11. (a) What are the various methods of neutral grounding. 7

(b) A 33 kV, 3 phase, 50 Hz overhead line of 45 km length has a capacitance to earth of each line of 0.012 μF/km. Determine inductance and kVA rating of arc suppression coil suitable for this system. 4

(c) Explain types of compensation. 3

OR

12. (a) Derive the expression for reactance of Peterson coil in terms of capacitance of the protected line. 5

(b) Explain the following :

(i) Zig-Zag transformer

(ii) Arcing grounding and its method

(iii) Different types of compensating devices. 9

Faculty of Engineering & Technology
Seventh Semester B.E. (Electrical Engg.) (C.B.S.) Examination
ELECTRICAL POWER—II

Time—Three Hours] [Maximum Marks—80

INSTRUCTIONS TO CANDIDATES

(1) All questions carry marks as indicated.

(2) Solve Question No. **1 OR** Question No. **2**.

(3) Solve Question No. **3 OR** Question No. **4**.

(4) Solve Question No. **5 OR** Question No. **6**.

(5) Solve Question No. **7 OR** Question No. **8**.

(6) Solve Question No. **9 OR** Question No. **10**.

(7) Solve Question No. **11 OR** Question No. **12**.

(8) Due credit will be given to neatness and adequate dimensions.

(9) Assume suitable data wherever necessary.

(10) Illustrate your answers wherever necessary with the help of neat sketches.

(11) Use of non programmable calculator is permitted.

7. (a) Explain the methods for improvement of transient stability of power system. 7

(b) A 50 Hz four pole turbogenerator rated 100 MVA, 11 kV has an inertia constant of 8.0 MJ/MVA.

(i) Find the stored energy in the rotor at synchronous speed.

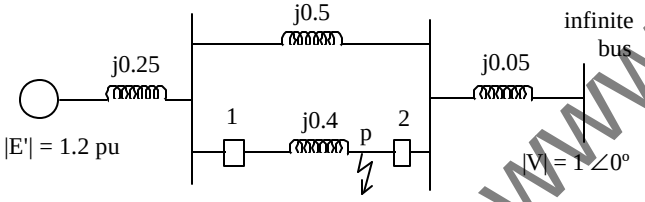
(ii) If the mechanical input is suddenly raised to 80 MW for an electrical load of 50 MW.

Find rotor acceleration, neglecting mechanical and electrical losses. 6

OR

8. (a) Derive the swing equation for synchronous machine connected to infinite bus. List all the assumptions made. 6

(b) For the given power system a three phase fault is applied at the point P as shown in figure :



Find the critical clearing angle for clearing the fault with simultaneous opening of the breakers 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. 7

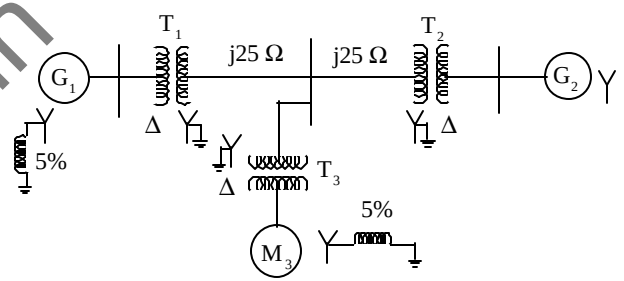
Synchronous motor M_3 = 25 MVA, 11 kV, X_0 = 0.2 pu

T_1 : 25 MVA 11/120 kV X = 10%

T_2 : 12.5 MVA 120/11 kV X = 10%

T_3 : 10 MVA 120/11 kV X = 10%

Choose a base of 50 MVA, 11 kV in generator circuit. Assume zero sequence impedance of line to be 250% of its positive sequence impedance.



6

3. (a) Explain the following :

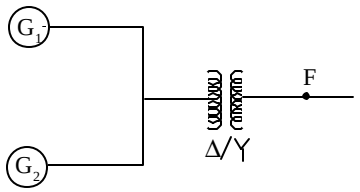
(i) Circuit breaker ratings 3

(ii) Necessity of current limiting reactors and their types. 4

(b) Two generating stations having short circuit capacities of 1500 MVA and 1000 MVA respectively and operating at 11 kV are interconnected by cable of reactance 0.6 Ω/ph. Determine the S.C. capacities of each station. 6

OR

4. (a) Two generators are connected in parallel to the low voltage side of 3 phase Δ-Y transformer as shown in Fig.



Rating of the generators are :

$G_1 \rightarrow$ 50 MVA, 13.8 kV x^{11} = 25%

$G_2 \rightarrow$ 25 MVA, 13.8 kV x^{11} = 25%

$T_1 \rightarrow$ 75 MVA, 13.8 Δ/69 Y kV with leakage reactance of 10%

Before the fault occurs the voltage on high tension side of the transformer is 66 kV at F. The transformer is unloaded and there is no circulating current between the generators. Find the subtransient current in each generator when a 3 phase short circuit occurs on the high tension side of the transformer. 8

(b) Explain the phenomenon of transient in transmission line if a synchronous generator is subjected to sudden three phase short circuit. Draw the circuit for subtransient period and show the periods and oscillogram. 5

5. (a) Derive an expression for fault current if LLG fault is occurred with a-fault impedance z_f. Also draw the sequence network. 7

(b) Two 11 kV, 20 MVA three phase star connected generators operate in parallel. The +ve, –ve and zero reactances of each being respectively j0.18, j0.15 and j0.10 pu. The star point of one of the generators is isolated and that of the other is earthed through 2 Ω resistor. A single line to ground fault occurs at the terminals of one of the generators. Estimate :

(i) The fault current

(ii) Current in the grounding resistor

(iii) Voltage across the grounding resistor. 6

OR

6. (a) A 10 MVA, 13.8 kV alternator has +ve, –ve and zero sequence reactances of 30%, 40% and 5% respectively :

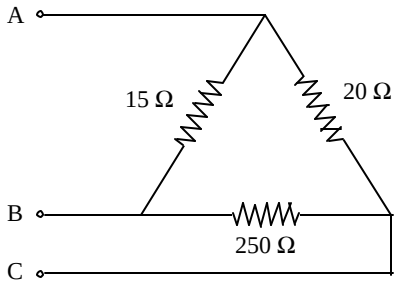
(i) What reactance must be put in the generator neutral so that the fault current for a line to ground fault of zero fault impedance will not exceed the rated line current.

(ii) What value of resistance in the neutral will serve the same purpose. 7

(b) Justify the statement "L-G fault may be more severe that 3 phase fault". 6

1. (a) Describe positive, negative and zero sequence impedances of a synchronous generator. 6

(b) A delta connected load consisting of resistances 15, 20 and 250 Ω is fed from a balanced supply of 400 volts. Find the symmetrical components of line and delta currents. 7



OR

2. (a) Explain the phase shift in positive and negative sequence voltage and current in a star/delta transformer by drawing phasor diagram. 7

(b) For the power system shown in fig. draw the zero sequence network. The rating of various components are as follows :

Gen 1 25 MVA, 11 kV, X_0 = 0.03 pu

Gen 2 30 MVA, 11 kV, X_0 = 0.01 pu

9. (a) Derive the necessary condition for optimal generation scheduling neglecting losses. 7

(b) The incremental fuel cost of two units are

$dc_1/dp_1 = 0.15p_1 + 50$ Rs/MWhr.

$dc_2/dp_2 = 0.3p_2 + 45$ Rs/MWhr.

Determine the economic operating schedule and the corresponding cost of generation if the rating of each unit is 150 MW and 225 MW. The demand is 200 MW. If the load is equally shared by both units, determine the saving obtained by loading the units as per equal incremental production cost. 7

OR

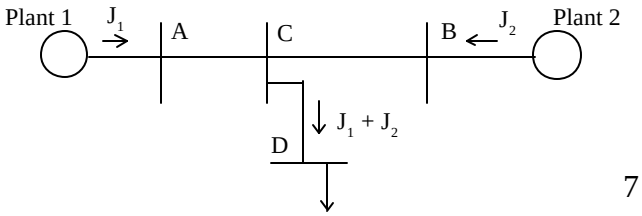
10. (a) Discuss the following :

(i) Equality and inequality constraints

(ii) Penalty factor

(iii) Loss coefficients. 7

(b) For the given system the voltage at bus C is VC = 1.0 pu. The currents in lines AC and BC are 1.05 pu and 0.9 pu. The line impedances are z_a = 0.05 + j0.20 pu, z_b = 0.04 + j0.16 pu and z_c = 0.03 + j0.12 pu. Find loss coefficient and transmission losses :



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