(d) A power system has two generating plants and the power is being dispatched economically with $P_1 = 150$ MW and $P_2 = 275$ MW. The loss coefficient are :

$B_{11} = 0{\cdot}10 \times 10^{-2}\ MW^{-1}$, $B_{12} = -0{\cdot}01 \times 10^{-2}\ MW^{-1}$, $B_{13} = 0{\cdot}13 \times 10^{-2}\ MW^{-1}$. To raise the total load on the system by 1 MW will cost an additional Rs. 200 per hour. Find (i) the penalty factor for plant 1. (ii) the additional cost per hour to increase the output of plant 1 by 1 MW.

Unit-V

5. (a) What do you understand by Steady State Stability limit?

(b) Derive the Swing equation.

(c) Derive the equal area criterion for stability.

(d) A generator is delivering 0·6 of maximum power to an infinite bus through a transmission line. A fault occurs such that the reactance between the generator and the infinite bus is increased to three times its prefault value. When the fault is cleared the maximum power that can be delivered is 0·8 of the original maximum value. Determine the critical clearing angle.

325651(25)

B. E. (Sixth Semester) Examination, Nov.-Dec. 2015

(New Scheme)

(EEE Engg.)

ELECTRICAL POWER SYSTEM-II

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : *Attempt all questions. Part (a) is compulsory and carry 2 marks. Solve any two parts from parts (b), (c) and (d) and carry 7 marks.*

Unit-I

1. (a) Define per unit value of any quantity.

(b) Derive an expression for per unit impedance of a given base MVA and base kV in terms new base MVA and base kV.

(c) The one line diagram of a $3-\phi$ power system is shown in figure 1. Select a common base of 100 MVA and 22 kV on the generator side. Draw an impedance diagram with all impedances marked in per unit.

G : 90 MVA	22 kV	X = 18%
T_1 : 50 MVA	22/220 kV	X = 10%
T_2 : 40 MVA	220/11 kV	X = 6%
T_3 : 40 MVA	22/110 kV	X = 6·4%
T_4 : 40 MVA	110/11 kV	X = 8%
M : 66·5 MVA	10·45 kV	X = 18·5%

The $3-\phi$ load at bus 4 absorbs 57 MVA, 0·6 Power factor lagging at 10·45 kV. Line 1 & 2 have reactances of 48·4 Ω and 65·43 Ω respectively.

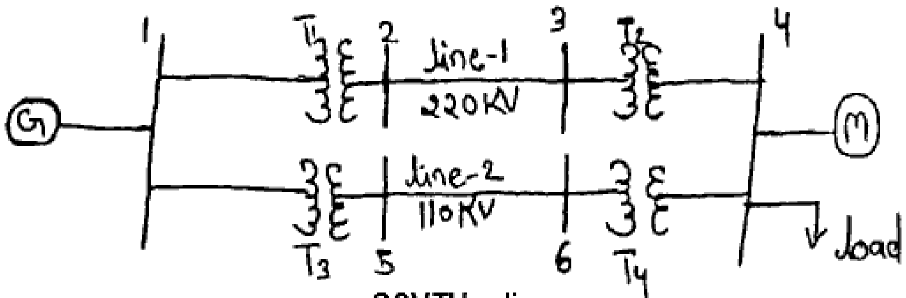

fig. 1

(d) The one line diagram of a 50 Hz power system is

shown in fig. (2).

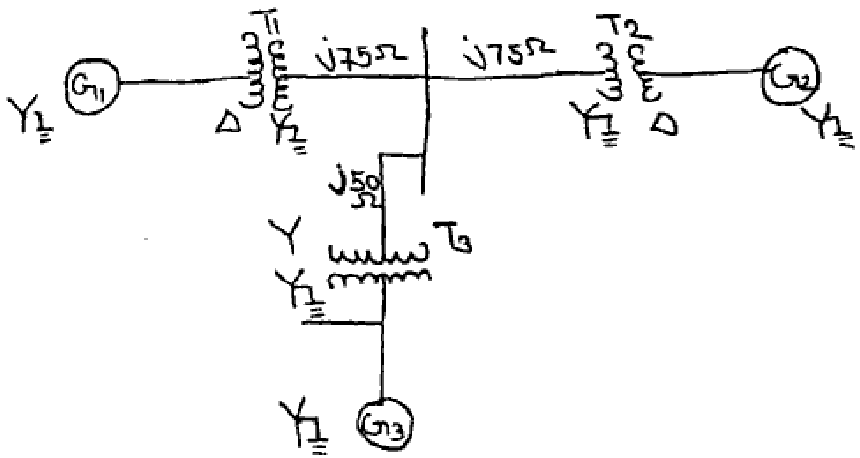

fig. 2

The system rating are :

Generator G_1 = 200 MVA, 20 kV, $X'' = 15\%$

G_2 = 300 MVA, 18 kV, $X'' = 20\%$

G_3 = 300 MVA, 20 kV, $X'' = 20\%$

Transformer T_1 = 300 MVA, 220/22 kV, $X = 10\%$

T_2 = 300 MVA, 220/22 kV, $X = 10\%$

T_3 = 300 MVA, 220/22 kV, $X = 10\%$

Transmission line reactances are indicated in fig. Draw reactance diagram choosing the generator G_3 circuit as the base.

Unit-II

2. (a) Draw the zero sequence network of :

(i) $Y\ Y_{\overline{=}}$

(ii) $Y_{\overline{=}}\ \Delta$

(b) Determine the symmetrical component of current in a $3-\phi$ system the original phasor at which are :

$$I_a = 12 + j6\,A$$

$$I_b = 12 - j12\,A$$

$$I_c = -15 + j10\,A$$

(c) Derive the expression for positive, negative and zero sequence current in an unbalanced $3-\phi$ system. Draw necessary phasor diagram.

(d) A 25 MVA, 11 kV, $3-\phi$ generator has a subtransient reactance of 20% a generator supply 2 motor over a transmission line with transformer at both the end shown in fig.-3. The motors 1 and 2 have rated inputs of 15 MVA and 7·5 MVA, both 10

kV with 25% subtransient reactance. The $3-\phi$ transformers are both rated 30 MVA, 10·8/121 kV, connection $\Delta - Y_{\overline{=}}$ with leakage reactance of 10% each. The series reactance of the line is $100\,\Omega$. The zero sequence reactance for generator and motor of 0·06 p.u. current limiting reactor of $2\cdot5\,\Omega$ each are connected in the neutral of the generator and motor 2. The zero sequence reactance of transmission line is $300\,\Omega$. Draw the negative and zero sequence networks of the system with reactances mark in per unit. Choose generator rating is the base of the system.

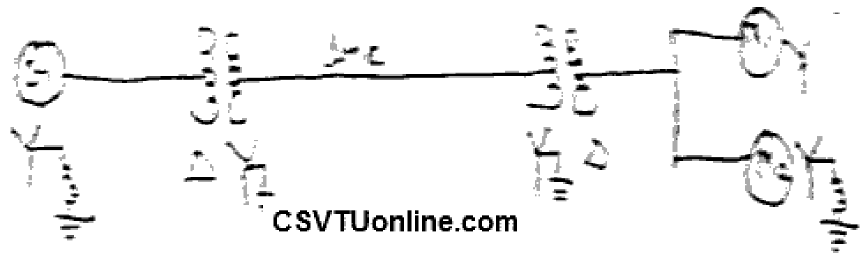

fig. 3

Unit-III

3. (a) Classify the fault occur in power system.

(b) Derive and develop the equivalent circuit for a LG fault through impedance.

(c) A synchronous generator & motor each rated 25 MVA, 11 kV 15% subtransient reactance are connected through transformer & the line as shown in figure (4). The transformers are rated 25 MVA, 11/66 kV with leakage reactance of 10% each the line has reactance of 10% on the base of 25 MVA, 66 kV. The motor is drawing 15 MW at 0·8 p.f. (leading) and a terminal voltage 10·6 kV when a symmetrical 3-ϕ fault occurs at the motor terminals. Find the subtransient current in generator, motor and fault. Draw pre fault equivalent circuit during fault.

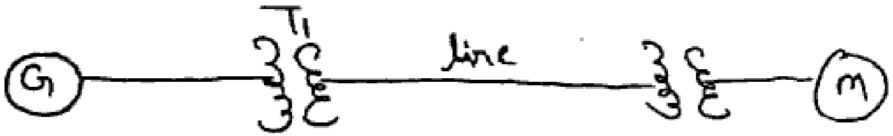

fig. 4

(d) Draw the sequence network for the system shown in fig. (5). Determine the fault current when (a) LLG and (b) LL fault occur at point F. The per unit reactances all referred to the same base are as follows :

	X_0	X_1	X_2
Generator 1	0·05	0·3	0·2
Generator 2	0·03	0·25	0·15
Line 1	0·7	0·3	0·3
Line 2	0·7	0·3	0·3
Transformer T_1	0·12	0·12	0·12
Transformer T_2	0·1	0·1	0·1

Bothe generations are generating 1 pu voltage.

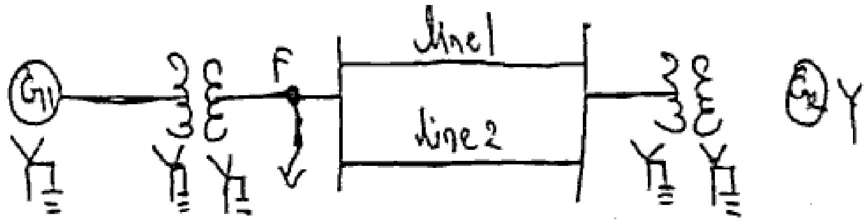

fig. 5

Unit-IV

4. (a) State the importance of the load flow studies.

(b) Write the interative algorithm for NR method for load flow solution.

(c) Draw an expression for transmission loss as a function of plant generation.