325651(25)

BE (6th Semester)
Examination, Nov.-Dec., 2017

(New Scheme)

Electrical Power System-II

Time Allowed : 3 hours | *Maximum Marks :* 80
Minimum Pass Marks : 28

Note : (*i*) Part (*a*) of each question is compulsory. Attempt any two parts from (*b*), (*c*) and (*d*).

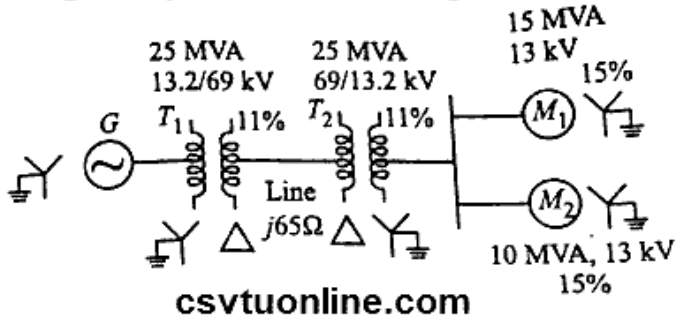
(*ii*) The figures in the right-hand margin indicate marks.

Unit-I

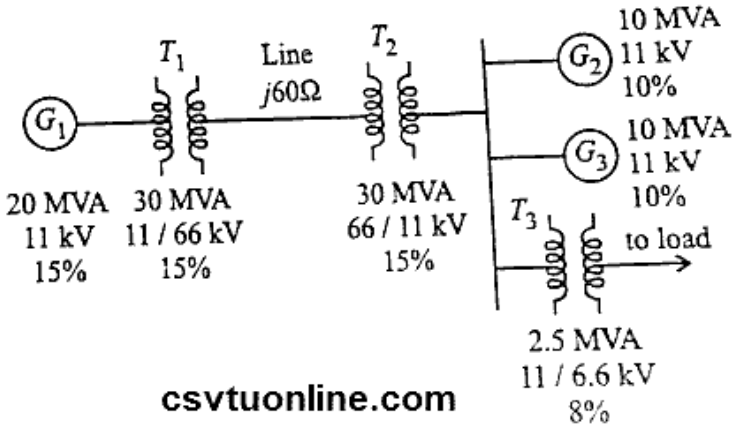
1. (*a*) Define p.u. system. [2]

(*b*) Show that the p.u. equivalent impedance of a two-winding transformer is the same whether the calculation is made from the high-voltage side or the low-voltage side. [7]

(*c*) One line diagram of a three-phase power system is given in figure below. Choose 13.8 kV, the generator voltage, as the base voltage and 25 MVA as the base MVA. Draw a per unit reactance diagram. [7]



(*d*) Draw per unit reactance diagram for the three-phase system shown on 200 MVA and 66 kV as base values. [7]



Unit-II

2. (*a*) Prove that [2]

$$|I_a|^2 + |I_b|^2 + |I_c|^2 = 3\left(|I_{a_0}|^2 + |I_{a_1}|^2 + |I_{a_2}|^2\right)$$

(*b*) Derive phase sequence impedances for transmission line. [7]

(*c*) A 3-phase 4-wire system supplying a balanced star connected load 150A. If the fuses in two of the lines are removed, then find the symmetrical components of the line currents before and after the fuses are removed. [7]

(*d*) Draw zero sequence network for various configuration of three-phase transformer. [7]

Unit-III

3. (*a*) Define short-circuit capacity. [2]

(*b*) Derive the expression for double line to ground fault current for an unloaded synchronous generator. [7]

(*c*) An 11 kV, 25 MVA synchronous generator has positive, negative and zero sequence reactances of 0.12, 0.12 and 0.08 per unit respectively. The generator neutral is grounded through a reactance of 0.03 per unit. A single line to ground fault occurs at the generator terminals. Determine the fault current assuming that the generator was unloaded before fault. [7]

(*d*) The 33 kV busbars of a station are in two sections *A* and *B* separated by a reactor. *A* is fed from four 10 MVA generators each having 0.20 per unit reactance and *B* is fed

(Turn Over)

from the grid through a 50 MVA. Find the reactance of the reactor to prevent the circuit breakers being overloaded, if a symmetrical short circuit occurs on an outgoing feeder connected to it. [7]

Unit-IV

4. (*a*) Give expression for general loss formula. [2]

(*b*) The fuel cost of a two-unit plant are given by

$$C_1 = 100 + 2P_1 + 0.005P_1^2$$

$$C_2 = 200 + 2P_2 + 0.01P_2^2$$

where P_1 and P_2 are in MW. The plant supplies a load of 450 MW. Find economic load scheduling of the two units and the incremental fuel cost. Neglect losses. [7]

(*c*) Derive the expression for transmission line loss in terms of loss formula coefficients. [7]

(*d*) Write down the flowchart of Newton-Raphson method. [7]

Unit-V

5. (*a*) Define stability. [2]

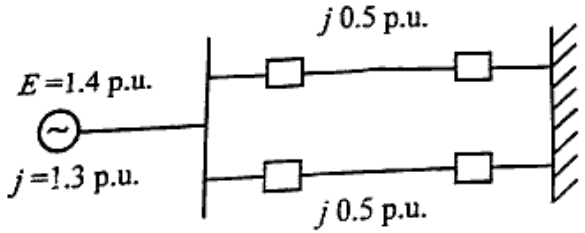
(*b*) Derive swing equation and define swing curve. [7]

(*c*) A loss-free generator supplies 50 MW to an infinite bus, the steady-state limit of the system being 100 MW. Determine whether the generator will remain in synchronism if the prime mover input is abruptly increased by 30 MW. [7]

(Continued)

 [5]

(*d*) A synchronous machine is delivering 1.0 p.u. power to an infinite bus through a double-circuit transmission line shown in figure below. The direct axis transient reactance of the generator is 0.3 p.u. The per unit reactance for each line is 0.5. All reactances are given to a base of the machine rating. One of the transmission lines experiences a solid three-phase fault to ground, during which occurrence the system reactances are shown in figure below. Determine the critical clearing angle before which the circuit breakers of the faulted line should operate if the stability is to be maintained. [7]



»–»–»