

COLLEGE OF ENGINEERING, PUNE -411005

(An Autonomous Institute of Government of Maharashtra)

End- Semester Examination EE 302/EE-09004: Power Systems - 1

Programme: Third Year B. Tech - Electrical

Year: 20013-14

Date: 17th Nov. 2013

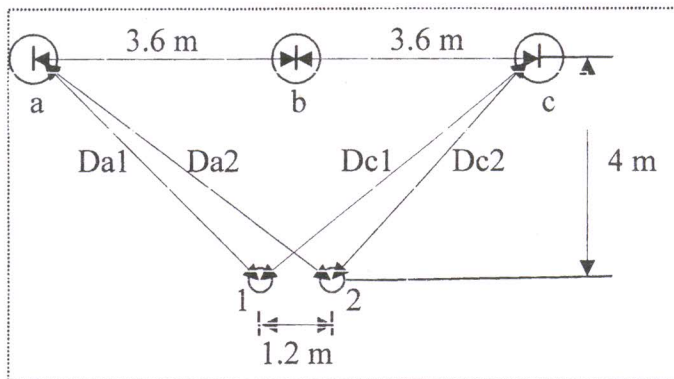
Duration: 3 Hours

Max. Marks: 60

Instructions: 1. All questions are compulsory.

2. Assume suitable data if necessary. Justify assumptions.

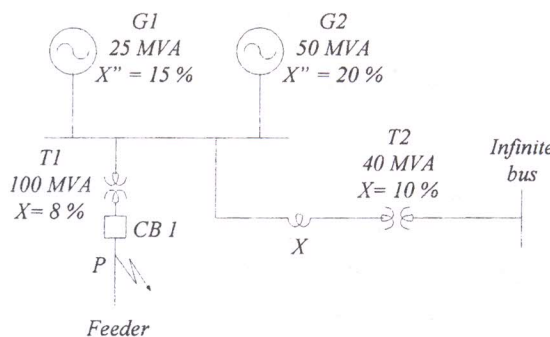
Que 1 a) Consider a three phase **un-transposed** transmission line in USA as shown in Figure 1, carrying balance current of 200 A per phase. Two wire telephone line is also located on the same tower directly below phase *b*. Find the voltage per km induced in telephone line. (07)



b) Consider a three phase, transposed transmission line with the length of 200km and 50 Hz frequency. The line has one conductor per phase and the spacing between the conductors is 4m, 5m and 6m. Radius of each conductor is 2 cm. Find the ABCD constants. (04)

c) How bundled conductor affects the line inductance and capacitance? (02)

Que 2 a) For the power system shown in following figure, find the value of current limiting reactance, *X*, if the short circuit capacity of circuit breaker-1 (CB 1) is to be restricted to 333 MVA. Consider fault at point 'P'. Assume same voltage base throughout. (04)



b) A three phase synchronous generator has positive, negative and zero sequence reactances per phase respectively, of 0.1, 0.8 and 0.4 ohm. The winding resistances are negligible. The phase sequence of generator is RYB with no load voltage of 11 kV

between lines. A short circuit occurs between lines Y and B and earth at the generator terminal. Calculate the sequence currents in phase R and the current in the earth return circuit, (i) if the generator neutral is solidly earthed; and (ii) if the generator neutral is isolated. (04)

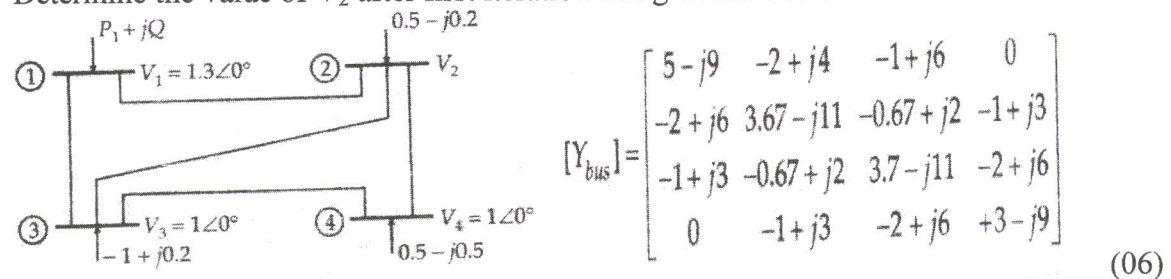
c) List (no description) the methods of voltage control. (02)

Que 3 a) A balanced delta connected resistive load is fed from unbalanced three phase supply. The current in two lines are $10\angle 30^\circ$ and $15\angle -60^\circ$. Find the symmetrical components of line and delta currents. (05)

b) Show that the symmetrical component transformation is power invariant. (03)

Que 4 a) Formulate the load flow problem for the power system having all PQ buses. Develop the algorithm for its solution using Newton-Raphson method. State the assumptions. (07)

b) The following figure shows a four bus network. The Y bus is also given below. Determine the value of V_2 after first iteration using Gauss-Seidal method.



c) Differentiate between decoupled and fast decoupled load flow method. (03)

Que 5 a) Derive the swing equation of synchronous machine connected to infinite bus. State the assumptions made. (05)

b) A synchronous motor of negligible resistance is receiving 25% of power that is capable of receiving from an infinite bus. If the load on the motor is suddenly doubled, calculate the maximum value of power angle during the swinging of the motor around its new equilibrium position. (04)

c) A 50 Hz, 4 pole turbo-generator rated at 20 MVA and 11.3 kV has an inertia constant of 9KW-sec/kVA. What will be the kinetic energy stored by rotor at synchronous speed. If the input power less rotational losses is 20 MW and the output power is 15 MW find the acceleration in degrees per sec² and in rpm per sec. (04)

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