

Gate Assignment 5

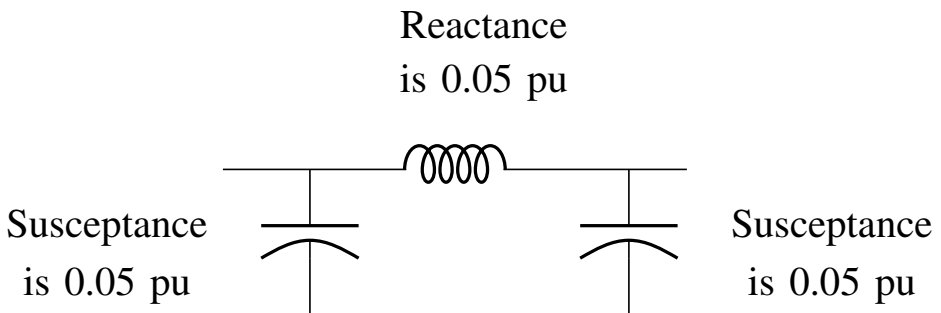
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- 1) The bus admittance for a power system network is

$$\begin{pmatrix} -j39.9 & j20 & j20 \\ j20 & -j39.9 & j20 \\ j20 & j20 & -j39.9 \end{pmatrix} pu.$$

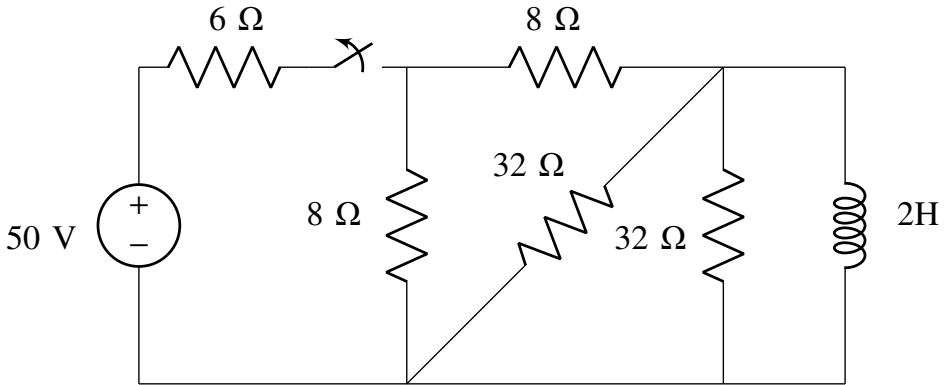
There is a transmission line, connected between buses 1 and 3, which is represented by the circuit shown in figure.



If this transmission line is removed from service, what is the modified bus admittance matrix?

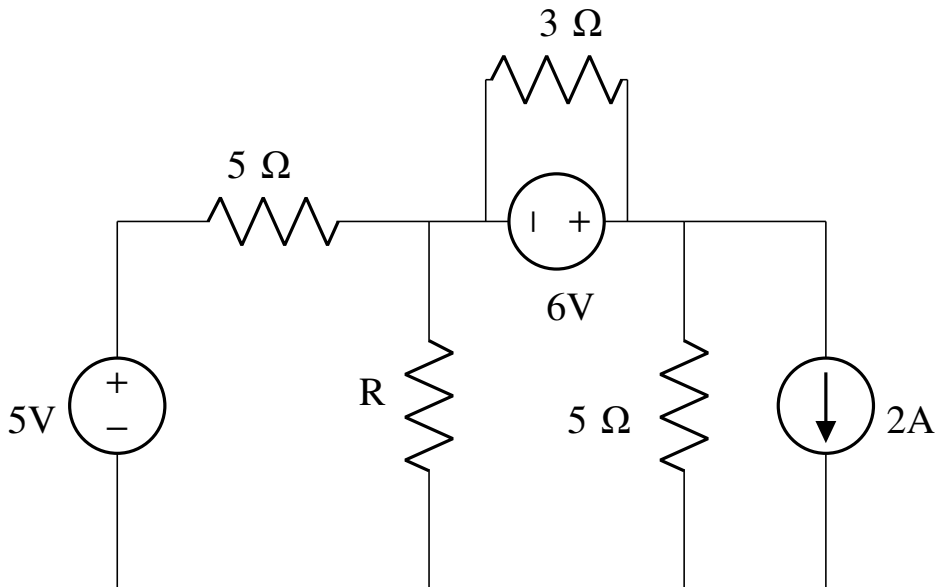
- a) $\begin{pmatrix} -j19.9 & j20 & 0 \\ j20 & -j39.9 & j20 \\ 0 & j20 & -j19.9 \end{pmatrix} pu$
- b) $\begin{pmatrix} -j39.95 & j20 & 0 \\ j20 & -j39.9 & j20 \\ 0 & j20 & -j39.95 \end{pmatrix} pu$
- c) $\begin{pmatrix} -j19.95 & j20 & 0 \\ j20 & -j39.9 & j20 \\ 0 & j20 & -j19.95 \end{pmatrix} pu$
- d) $\begin{pmatrix} -j19.95 & j20 & j20 \\ j20 & -j39.9 & j20 \\ j20 & j20 & -j19.95 \end{pmatrix} pu$

- 2) The switch in the figure below was closed for a long time. It is opened at $t = 0$. The current in the inductor of 2H for $t \geq 0$, is



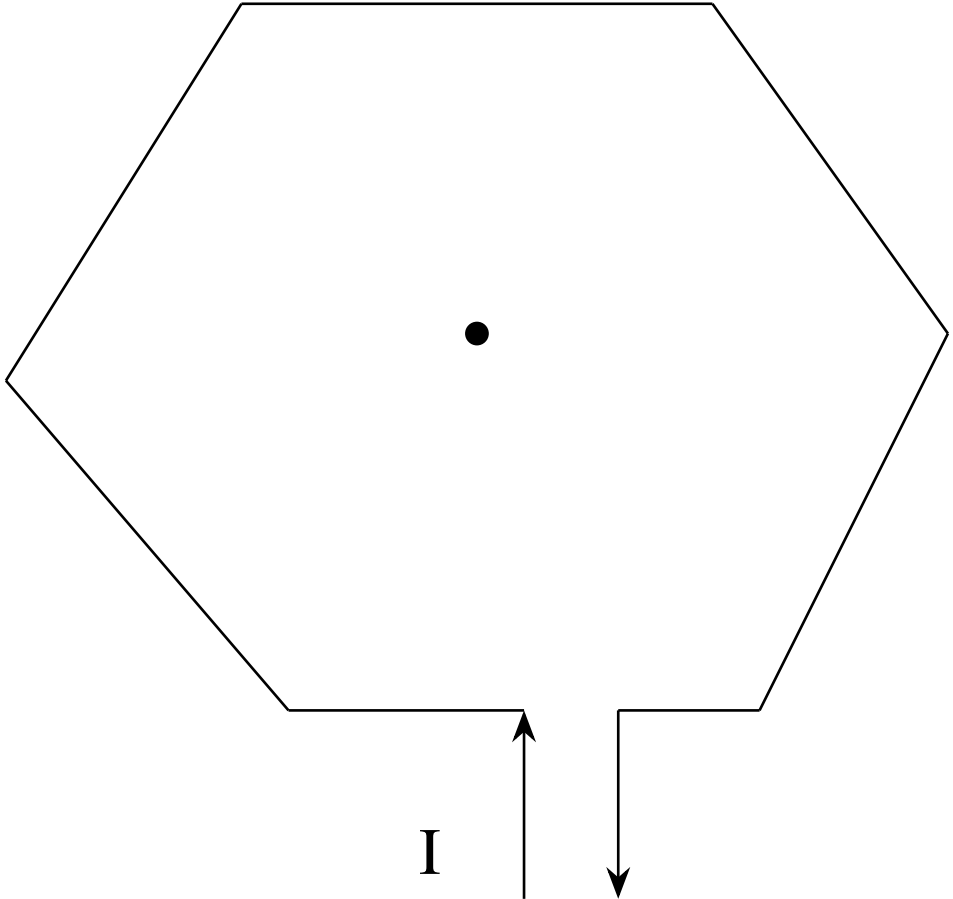
- a) $2.5e^{-4t}$
- b) $5e^{-4t}$
- c) $2.5e^{-0.25t}$
- d) $5e^{-0.25t}$

- 3) Only one of the real roots of $f(x) = x^6 - x - 1$ lies in the interval $1 \leq x \leq 2$ and bisection method is used to find its value. For achieving an accuracy of 0.001, the required minimum number of iterations is _____.
- 4) In the circuit shown below, the maximum power transferred to the resistor R is _____ W.



- 5) The magnitude of flux density (B) in micro Teslas (μT), at the center of a

loop of wire wound as a regular hexagon of side length 1 m carrying a current ($I = 1 \text{ A}$), and placed in vacuum as shown in the figure is _____. (Give the answer upto two decimal places.)



- 6) A 375 W, 230 V, 50 Hz, capacitor start single-phase induction motor has the following constants for the main and auxillary windings (at starting): $Z_m = (12.50 + j15.75) \Omega$ (main winding), $Z_a = (24.50 + j12.75) \Omega$ (auxillary winding). Neglecting the magnetizing branch, the value of the capacitance (in μF) to be added in series with the auxillary winding to obtain maximum torque at starting is _____.
- 7) Two parallel connected, three-phase, 50 Hz, 11 kV, star-connected synchronous condensers. They together supply 50 MVAR to a 11 kV grid. Current supplied by both the machines are equal. Synchronous reactances of machine A and machine B are 1Ω and 3Ω , respectively. Assuming the magnetic circuit to be linear, the ratio of excitation current of machine A to machine B is _____.
- 8) A 220 V DC series motor runs drawing a current of 30 A from the supply.

Armature and field circuit resistances are 0.4Ω and 0.1Ω , respectively. The load torque varies as the square of the speed. The flux in the motor may be taken as being proportional to the armature current. To reduce the speed of the motor by 50%, the resistance in ohms that should be added in series with the armature is _____. (Give the answer upto two decimal places.)

- 9) A three-phase, three winding $\delta/\delta/Y$ (1.1kV/6.6kV/400V) transformer is energized from AC mains at the 1.1 kV side. It supplies 900 kVA load at 0.8 power factor lag from the 6.6 kV winding and 300 kVA load at 0.6 power factor lag from the 400 V winding. The RMS line current in ampere drawn by the 1.1 kV winding from the mains is _____. (Give the answer upto two decimal places.)
- 10) A separately excited DC generator supplies 150 A to a 145 V DC grid. The generator is running at 800 RPM. The armature resistance of the generator is 0.1Ω . If the speed of the generator is increased to 1000 RPM, the current in amperes supplied by the generator to the DC grid is _____. (Give the answer upto two decimal places.)
- 11) For a system having transfer function $G(s) = \frac{-s+1}{s+1}$, a unit step input is applied at time $t = 0$. The value of the response of the system at $t = 1.5$ sec (rounded off to three decimal places) is _____
- 12) Consider a causal and stable LTI system with rational transfer function $H(z)$, whose corresponding impulse response begins at $n = 0$. Furthermore, $H(1) = \frac{5}{4}$. The poles of $H(z)$ are $p_k = \frac{1}{\sqrt{2}} \exp\left(j\frac{(2k-1)\pi}{4}\right)$ for $k = 1, 2, 3, 4$. The zeros of $H(z)$ are all at $z = 0$. Let $g[n] = j^n h[n]$. The value of $g[8]$ equals _____. (Give the answer upto three decimal places.)
- 13) The circuit shown in the figure uses matched transistors with a thermal voltage $V_T = 25$ mV. The base currents of the transistors are negligible. The value of the resistance R in $k\Omega$ that is required to provide $1 \mu A$ bias current for the differential amplifier block shown is _____. (Give the answer upto one decimal place.)

