Assignment-11

EE224BTECH11044 - Muthyala koushik

I. 2023-AE 53-65

53) If the energy of a continuous-time signal $x(t)$ is E and the energy of the signal $2x(2t-1)$ is cE, then c is _____ (rounded off to 1 decimal place).

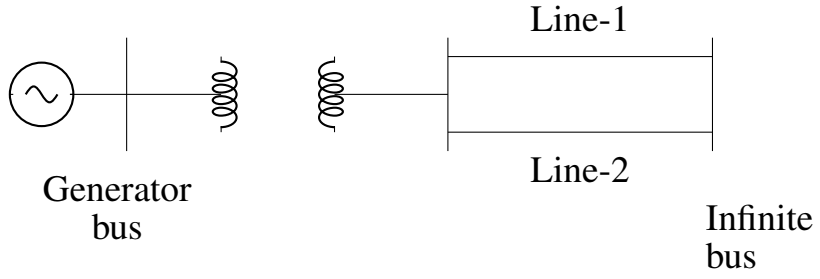
54) A 3-phase star connected slip ring induction motor has the following parameters referred to the stator:

$$R_s = 3\Omega, X_s = 2\Omega, X_r' = 2\Omega, R_r' = 2.5\Omega$$

The per phase stator to rotor effective turns ratio is 3 : 1. The rotor winding is also star connected. The magnetizing reactance and core loss of the motor can be neglected. To have maximum torque at starting, the value of the extra resistance in ohms (referred to the rotor side) to be connected in series with each phase of the rotor winding is _____ (rounded off to 2 decimal places).

55) A 5 kW, 220 V DC shunt motor has 0.5Ω armature resistance including brushes. The motor draws a no-load current of 3 A. The field current is constant at 1 A. Assuming that the core and rotational losses are constant and independent of the load, the current (in amperes) drawn by the motor while delivering the rated load, for the best possible efficiency, is _____ (rounded off to 2 decimal places).

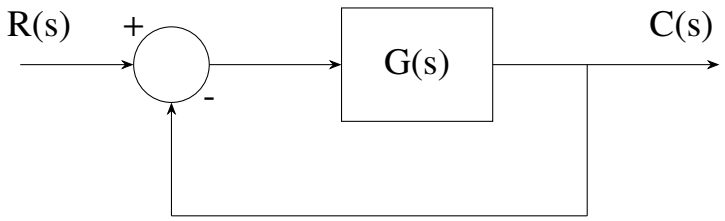
56) The single line diagram of a lossless system is shown in the figure. The system is operating in steady-state at a stable equilibrium point with the power output of the generator being $P_{max}\sin\delta$, where δ is the load angle and the mechanical power input is $0.5P_{max}$. A fault occurs on line 2 such that the power output of the generator is less than $0.5P_{max}$ during the fault. After the fault is cleared by opening line 2, the power output of the generator is $\left\{P_{max}/\sqrt{2}\right\}\sin\delta$. If the critical fault clearing angle is $\pi/2$ radians, the accelerating area on the power angle curve is _____ times P_{max} (rounded off to 2 decimal places).



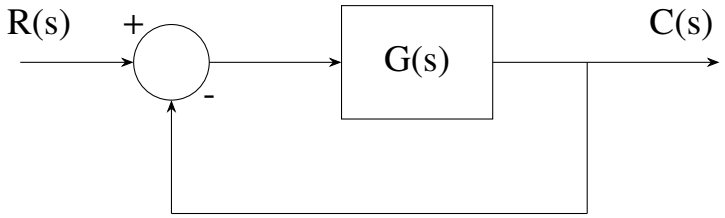
57) Consider the closed-loop system shown in the figure with

$$G(s) = \frac{k\left(s^2 - 2s + 2\right)}{s^2 + 2s + 5}$$

The root locus for the closed-loop system is to be drawn for $0 \le K < \infty$. The angle of departure (between 0° and 360°) of the root locus branch drawn from the pole $(-1 + j2)$, in degrees, is _____ (rounded off to the nearest integer).

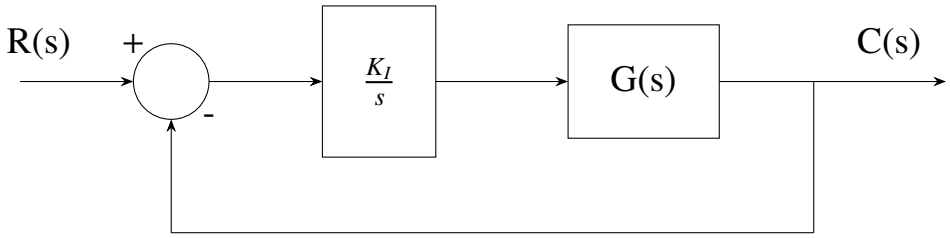


58) Consider the stable closed-loop system shown in the figure. The asymptotic Bode magnitude plot of $G(s)$ has a constant slope of -20 dB/decade at least till 100 rad/sec with the gain crossover frequency being 10 rad/sec. The asymptotic Bode phase plot remains constant at -90° at least till $\omega = 10$ rad/sec. The steady- state error of the closed-loop system for a unit ramp input is _____ (rounded off to 2 decimal places).

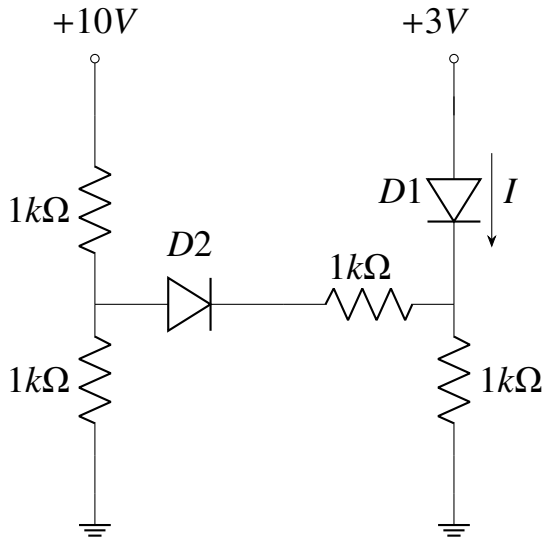


59) Consider the stable closed-loop system shown in the figure. The magnitude and phase values of the frequency response of $G(s)$ are given in the table. The value of the gain $K_I\,(>0)$ for a 50° phase margin is _____ (rounded off to 2 decimal places).

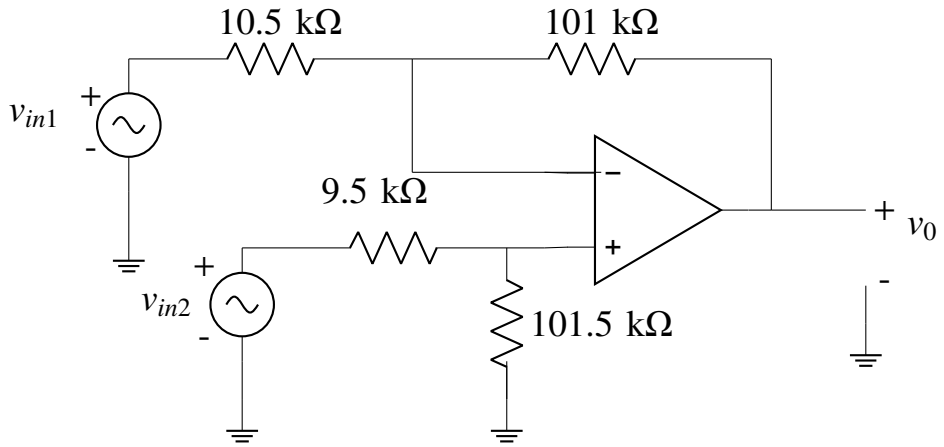
ω in rad/sec	Magnitude in dB	Phase in degrees
0.5	-7	-40
1.0	-10	-80
2.0	-18	-130
10.0	-40	-200



60) In the given circuit, the diodes are ideal. The current I through the diode $D1$ in milliamperes is _____ (rounded off to two decimal places).



61) A difference amplifier is shown in the figure. Assume the op-amp to be ideal. The CMRR (in dB) of the difference amplifier is _____ (rounded off to 2 decimal places).

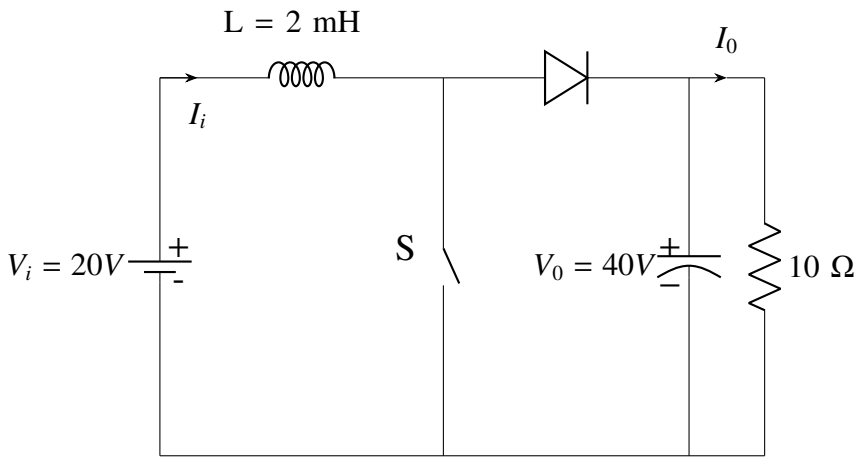


62) A single-phase half-controlled bridge converter supplies an inductive load with ripple free load current. The triggering angle of the converter is 60°. The ratio of the rms value of the fundamental component of the input current to the rms value of the total input current of the bridge is _____ (rounded off to 3 decimal places).

63) A single-phase full bridge voltage source inverter (VSI) feeds a purely inductive load. The inverter output voltage is a square wave in 180° conduction mode. The fundamental frequency of the output voltage is 50 Hz. If the DC input voltage of the inverter is 100 V and the value of the load inductance is 20 mH, the peak-to- peak load current in amperes is _____ (rounded off to the nearest integer).

64) In the DC-DC converter shown in the figure, the current through the inductor is continuous. The switching frequency is 500 Hz. The voltage (V_0) across the load is assumed to be constant and ripple

free. The peak inductor current in amperes is _____ (rounded off to the nearest integer).



65) A single-phase full-controlled thyristor converter bridge is used for regenerative braking of a separately excited DC motor with the following specifications:

Rated armature voltage	210 V
Rated armature current	10 A
Rated speed	1200 rpm
Armature resistance	1 Ω
Input to the converter bridge	240 V at 50 Hz
The armature of the DC motor is fed from the full-controlled bridge and the field current is kept constant.	

Assume that the motor is running at 600 rpm and the armature terminals of the motor are suitably reversed for regenerative braking. If the armature current of the motor is to be maintained at the rated value, the triggering angle of the converter bridge in degrees should be _____ (rounded off to 2 decimal places).