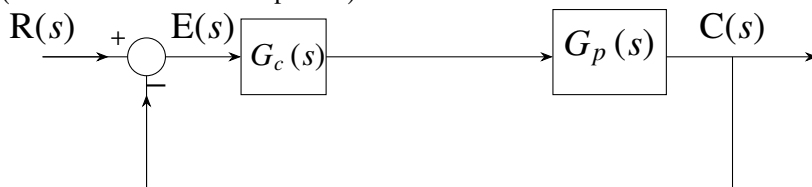
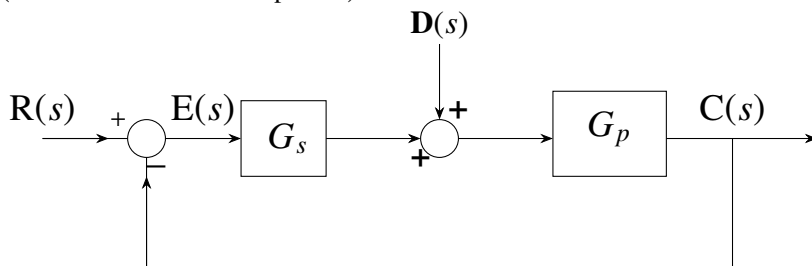


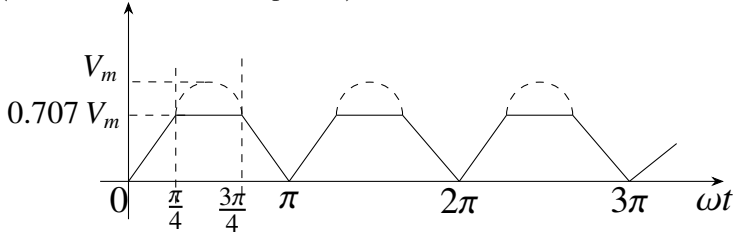
- 53) Consider a continuous-time signal $x(t)$ defined by $x(t) = 0$ for $|t| > 1$, and $x(t) = 1 - |t|$ for $|t| \leq 1$. Let the Fourier transform of $x(t)$ be defined as $X(\omega) = \int_{-\infty}^{\infty} x(t) e^{-j\omega t} dt$. The maximum magnitude of $X(\omega)$ is ...
- 54) A belt-driven DC shunt generator running at 300 RPM delivers 100 kW to a 200 V DC grid. It continues to run as a motor when the belt breaks, taking 10 kW from the DC grid. The armature resistance is 0.025Ω , field resistance is 50Ω , and brush drop is 2 V. Ignoring armature reaction, the speed of the motor is ... RPM. (Round off to 2 decimal places.)
- 55) An 8 - pole, 50 Hz, three-phase, slip-ring induction motor has an effective rotor resistance of 0.08Ω per phase. Its speed at maximum torque is 650 RPM. The additional resistance per phase that must be inserted in the rotor to achieve maximum torque at start is ... Ω . (Round off to 2 decimal places.) Neglect magnetizing current and stator leakage impedance. Consider equivalent circuit parameters referred to stator
- 56) Consider a closed-loop system as shown. $G_p(s) = \frac{14.4}{s(1+0.1s)}$ is the plant transfer function and $G_c(s) = 1$ is the compensator. For a unit-step input, the output response has damped oscillations. The damped natural frequency is ... $\frac{rad}{s}$. (Round off to 2 decimal places.)



- 57) In the given figure, plant $G_p(s) = \frac{2.2}{(1+0.1s)(1+0.4s)(1+1.2s)}$ and compensator $G_c(s) = K \left(\frac{1+T_1s}{1+T_2s} \right)$. The external disturbance input is $D(s)$. It is desired that when the disturbance is a unit step, the steady-state error should not exceed 0.1 unit. The minimum value of K is (Round off to 2 decimal places.)



- 58) The waveform shown in solid line is obtained by clipping a full-wave rectified sinusoid (shown dashed). The ratio of RMS value of the full-wave rectified waveform to the RMS value of the clipped waveform is
(Round off to 2 decimal places.)



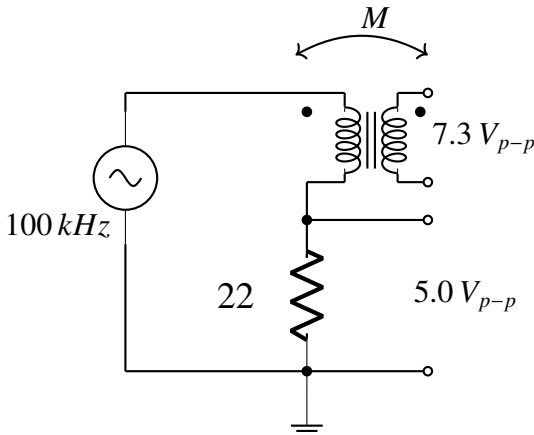
- 59) The state space representation of a first-order system is given by

$$\dot{x} = -x + u$$

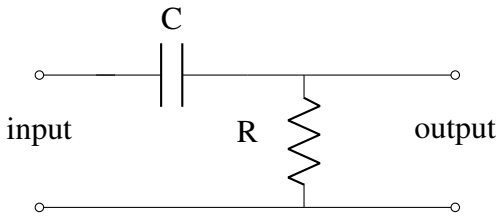
$$y = x$$

where, x is the state variable, u is the control input and y is the controlled output. Let $u = -Kx$ be the control law, where K is the controller gain. To place a closed-loop pole at -2 , the value of K is ...

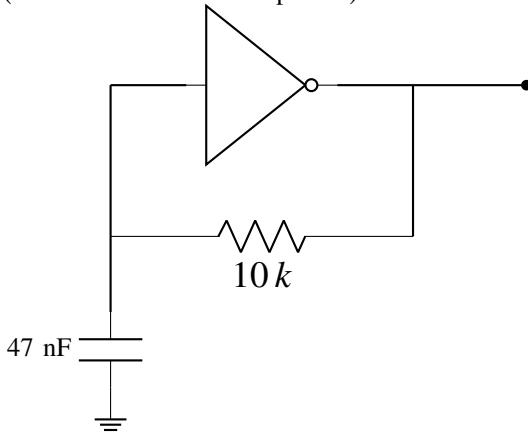
- 60) An air-core radio-frequency transformer as shown has a primary winding and a secondary winding. The mutual inductance M between the windings of the transformer is ... μH .
(Round off to 2 decimal places.)



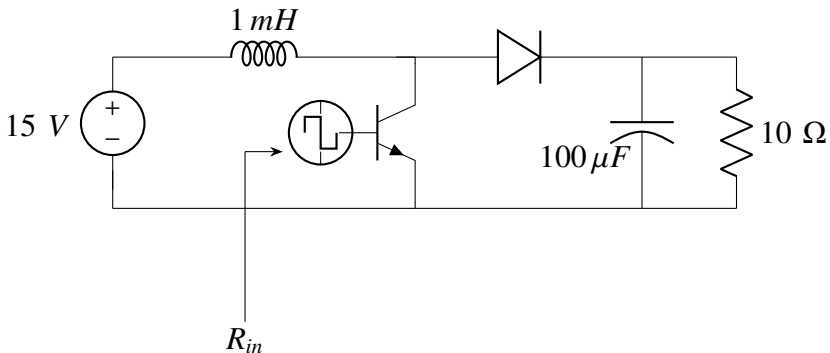
- 61) A 100 Hz square wave, switching between 0 V and 5 V , is applied to a CR high-pass filter circuit as shown. The output voltage waveform across the resistor is 6.2 V peak-to-peak. If the resistance R is 820 , then the value C is ... μF .
(Round off to 2 decimal places.)



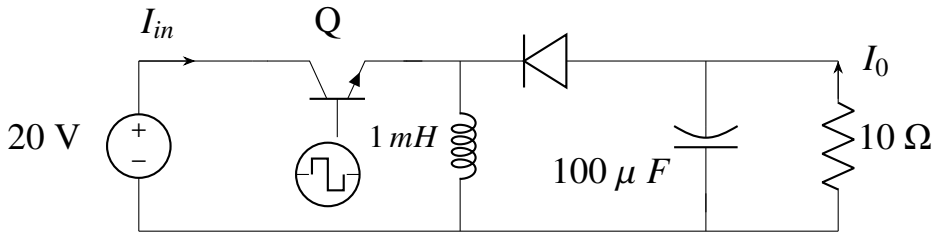
- 62) A CMOS Schmitt-trigger inverter has a low output level of 0 V and a high output level of 5 V . It has input thresholds of 1.6 V and 2.4 V . The input capacitance and output resistance of the Schmitt-trigger are negligible. The frequency of the oscillator shown is ... Hz.
(Round off to 2 decimal places.)



- 63) Consider the boost converter shown. Switch Q is operating at 25 kHz with a duty cycle of 0.6 . Assume the diode and switch to be ideal. Under steady-state condition, the average resistance R_{in} as seen by the source is
(Round off to 2 decimal places.)



- 64) Consider the buck-boost converter shown. Switch Q is operating at 25 kHz with a duty cycle of 0.75 . Assume the diode and switch to be ideal. Under steady-state condition, the average current flowing through the inductor is ... A.



- 65) A single-phase full-bridge inverter fed by a 325 V DC produces a symmetric quasi-square waveform across 'ab' as shown. To achieve a modulation index of 0.8 , the angle θ expressed in degrees should be
(Round off to 2 decimal places.)

(Modulation index is defined as the ratio of the peak of the fundamental component v_{ab} to the applied DC value.)

