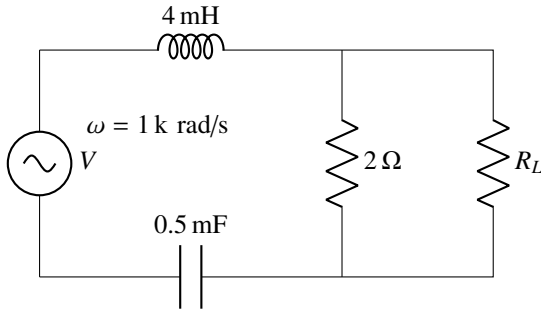
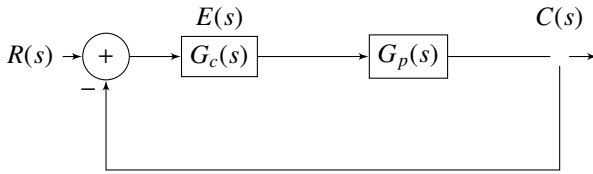


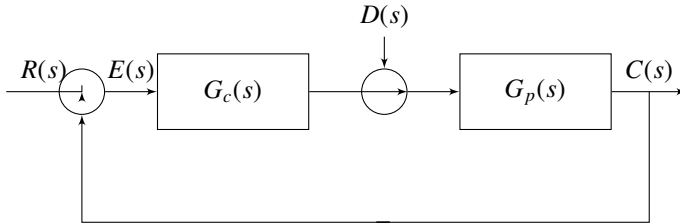
- 1) In the given circuit, for the maximum power to be delivered to  $R_L$ , its value should be  $\dots \Omega$



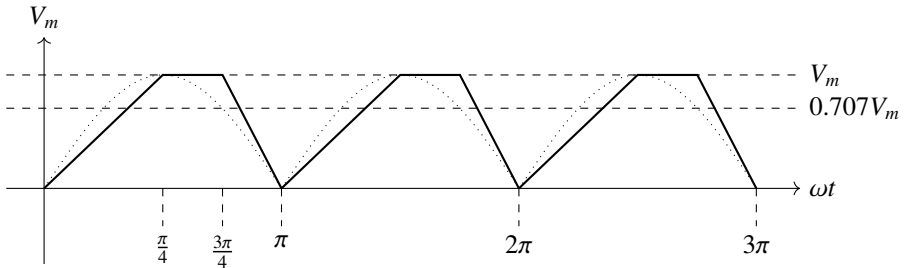
- 2) One coulomb of point charge moving with a uniform velocity  $10 \hat{x} \frac{m}{s^2}$  enters the region  $x \geq 0$  having a magnetic flux density  $\vec{B} = 10y\hat{x} + 10x\hat{y} + 10z\hat{z} \text{ T}$ . The magnitude of force on the charge at  $x=0^+$  is  $\dots \text{N}$ .  
 $\hat{x}, \hat{y}$  and  $\hat{z}$  are the unit vectors along x-axis, y-axis and z-axis respectively
- 3) Consider a large parallel plate capacitor. The gap  $d$  between the two plates is filled entirely with a dielectric slab of relative permittivity 5. The plates are initially charged to a potential difference of  $V$  volts and then disconnected from the source. If the dielectric slab is pulled out completely, then the ratio of the new electric field  $E_2$  in the gap to the original electric field  $E_1$  is  $\dots$
- 4) Consider a continuous-time signal  $X(t)$  defined by  $X(t) = 0$  for  $|t| > 0$ , 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  $\dots$
- 5) A belt-driven DC shunt generator running at 300 RPM delivers 100 kW to a 200 V. Ignoring armature reaction, the speed of the motor is  $\dots \text{RPM}$ .
- 6) An 8-pole 50 Hz, three-phase, slip-ring induction motor has an effective rotor resistance of  $0.08 \Omega$  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  $\dots \Omega$ . Neglect magnetizing current and stator leakage impedance. Consider equivalent circuit parameters referred to stator.
- 7) Consider a closed-loop system as shown.  $G_p(s) = \frac{14.4}{s(1+0.1s)}$  is the plant transfer function and  $G_e(s) = 1$  is the compensator. For a unit-step input, the output response has damped oscillations. The damped natural frequency is  $\dots \frac{\text{rad}}{s}$ .



- 8) In the given figure, plant  $G_p(s) = \frac{2.2}{(1+0.1s)(1+0.4s)(1+1.2s)}$  and compensator  $G_e(s) = k \left( \frac{1+T_1s}{1+T_2s} \right)$ . 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...



- 9) The waveform shown in the solid line is obtained by clipping a full-wave rectified sinusoidal. The ratio of the RMS value of the full-wave rectified waveform to the RMS value of the clipped waveform is ...



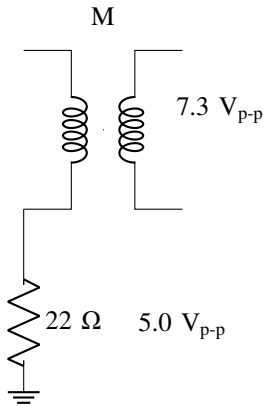
- 10) The state space representation of a first-order system is given as

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

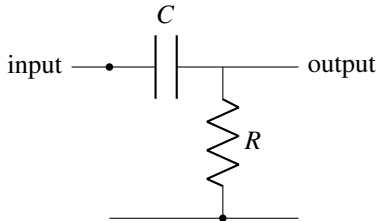
$$y = x$$

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...

- 11) An air-core radio-frequency transformer as shown has a primary winding and a secondary winding and connect an AC source across the transformer and connect other end to the resistor. The mutual inductance  $M$  between the windings of the transformer is ...  $\mu\text{H}$ .



- 12) A 100Hz square wave, switching between 0V and 5V, is applied to a CR high-pass filter circuit as shown. The output voltage waveform across the resistor is 6.2V peak-to-peak. If the resistance  $R$  is 820Ω, then the value of  $C$  is ...μF.



- 13) A CMOS schmitt-trigger inverter has a low output level of 0V and a high output level of 5V. It has input thresholds of 1.6V and 2.4V. The input capacitance and output resistance of the schmitt-trigger are negligible. The frequency of the oscillator shown in ...Hz.

