2018-EE-53-65

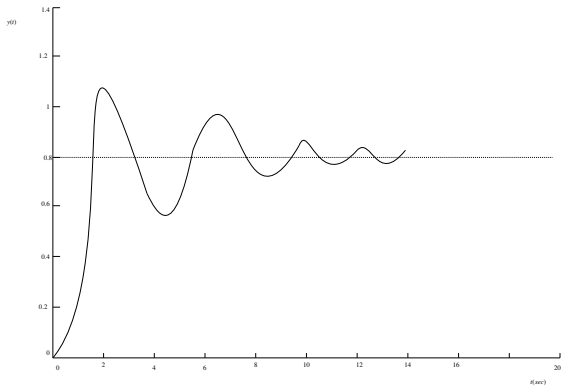
AI24BTEC11027 - R Sumanth

1) Let $f(x) = 3X^3 - 7x^2 + 5x + 6$. The maximum value of $f(x)$ over the interval $[0, 2]$ is _____ (up to 1 decimal place).

2) Let $A = \begin{pmatrix} 1 & 0 & -1 \\ -1 & 2 & 0 \\ 0 & 0 & -2 \end{pmatrix}$ and $B = A^3 - A^2 - 4A + 5I$, where I is the 3×3 identity determinant of B is _____ (up to 1 decimal place).

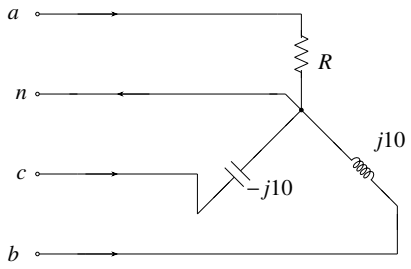
3) The capacitance of an air-filled parallel-plate capacitor is $60pF$. When a dielectric slab whose thickness is half the distance between the plates, is placed on one of the plates covering it entirely, the capacitance becomes $86pF$. Neglecting the fringing effects, the relative permittivity of the dielectric is _____ (up to 2 decimal place).

4) The unit step response $y(t)$ of a unity feedback system with open loop transfer function $G(s)H(s) = \frac{K}{(s+1)^2(s+2)}$ is shown in the figure. The value of k is _____ (up to 2 decimal place).

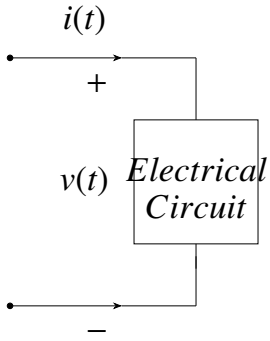


18

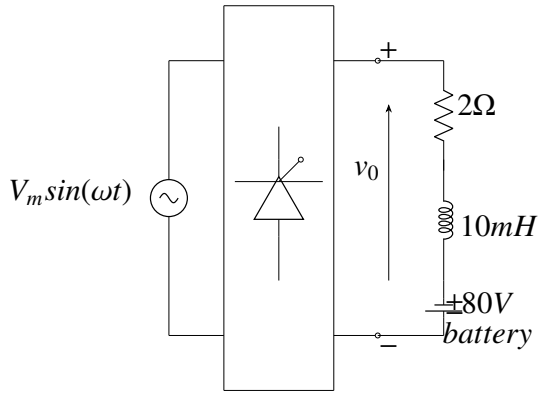
5) A three-phased load is connected to a three-phase balanced supply as shown in the figure. If $v_{an} = 100\angle 0°V, b_{bn} = 100\angle -120°V$ and $V_{cn} = 100\angle -240°V$ (angle are considered positive in the anti-clockwise direction), the value of R for zero current in the neutral wire is _____Ω (up to 2 decimal places).



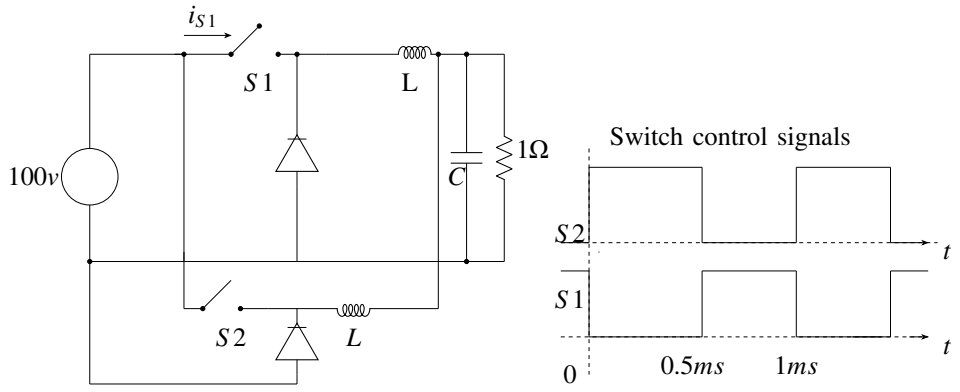
6) The voltage across the circuit in the figure, and the current through it, are given by the following expressions:
$v(t) = 5 - 10\cos\omega t + 60°V$
$i(t) = 5 + X\cos\omega tA$
where $\omega = 100\pi$ radian/s. If the average power delivered to the circuit is zero, then the value of X (in Ampere) if _____ (up to 2 decimal place).



7) A phase controlled single rectifier, supplied by an AC source, feeds power to an R-L-E load as shown in the figure. The rectifier output voltage has an average value gven by$v_0 = \frac{v_m}{2\pi}(3 + \cos\alpha)$, where $v_m = 80\pi$ volts and α is the firing angle. If the power delivered to the lossless battery is $1600W, \alpha$ in degree is _____ (up to 2 decimal place).



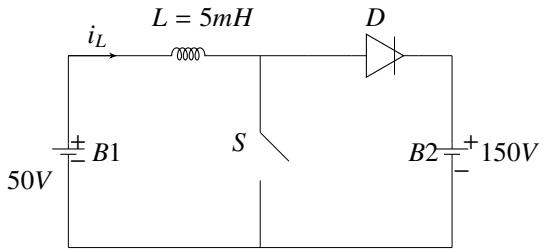
8) The load resistance is 1Ω. The capacitor voltage has negligible ripple. Both converters operate in the continuous conduction mode. The switching frequency is $1kHz$, and the switch control signals arc as shown. The circuit operates in the steady state. Assuming that the converters share the load equally, the average value $i_S 1$, the current of switch $S1$ (in Ampere), is _____ (up to 2 decimal place).



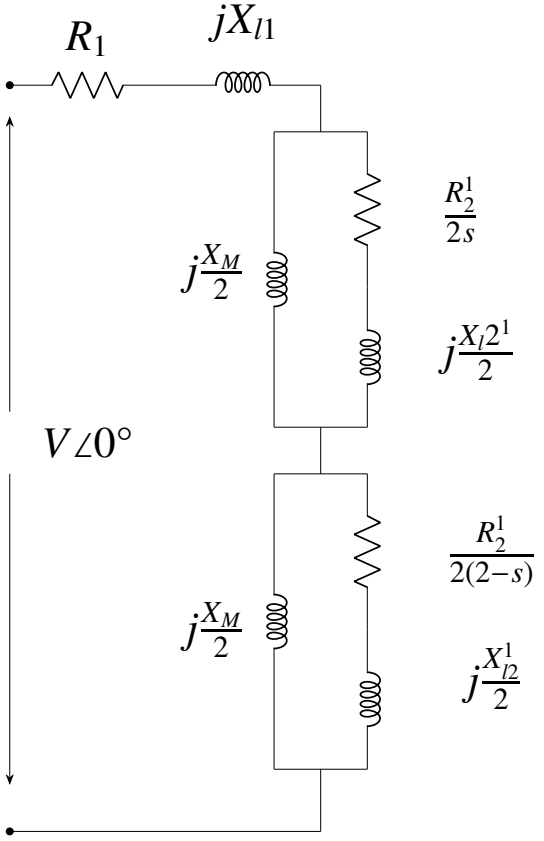
9) A 3-phase 900 kVA, 3 $kV/\sqrt{3}$k V (Δ/Y) 50 Hz transformer has primary (high voltage side) resistance per phase of 0.3Ω and secondary (low voltage side) resistance per phase of 0.02Ω. Iron loss of the transformer is 10 kW. The full load % efficiency of the transformer operated at unity power factor is _____ (up to 2 decimal place).

10) A 200 V DC series motor, when operating from voltage while driving a certain load, draws 10A current and runs 1000 r.p.m. The total series resistance is 1Ω. The magnetic circuit is assumed to be linear. At the same voltage, the load torque is increased by 44%. The speed of the motor in r.p.m. (rounded to the nearest integer) is _____

11) A dc to dc converter shown in the figure is charging a batery bank, B2 whose voltage is constant at 150 V. B1 is another battery bank whose voltage is constant at 50 V. The value of the inductor, L is 5mH and the ideal switch, S is operated with a switching frequency of 5 kHz with a duty ratio of 0.4. Once the circuit has attained steady state and assuming the diode D to be ideal, The power transferred from B1 to B2 (in watt) is _____ (up to 2 decimal place).



12) The equivalent circuit of a single phase induction motor is sown in the figure, where the parameters are $R_1 = R_2^1 = X_{l1}^1 = X_{l2}^1 = 12\Omega, X_M = 240\Omega$ and S is the slip. At no-load, the motor speed can be approximated to be the synchronous speed. The no-load lagging power factor of the motor is _____ (up to 3 decimal place).



13) The voltage $v(t)$ across the terminals a and b as shown in the figure, is a sinusoidal voltage having a frequency ω = 100 radian/s. when the inductor current $i(t)$ is in phase with the voltage $v(t)$, the magnitude of the impedance Z(in Ω) seen between the terminals a and b is _____ (up to 2 decimal place).