B.E. Electronics & Communication / Telecommunication Engineering (Model Curriculum)
Semester - III

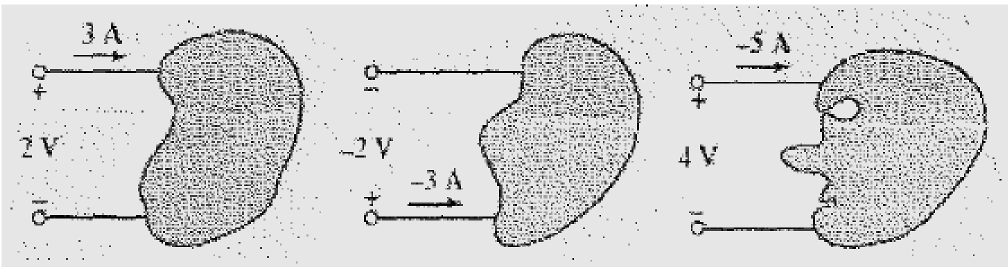
005 - Network Theory

P. Pages : 4 **GUG/S/23/13910**

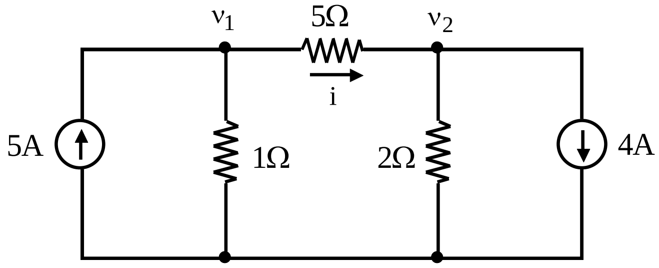
Time : Three Hours Max. Marks : 80

Notes : 1. All questions carry as indicated marks.
2. Assume suitable data wherever necessary.
3. Illustrate your answers wherever necessary with the help of neat sketches.

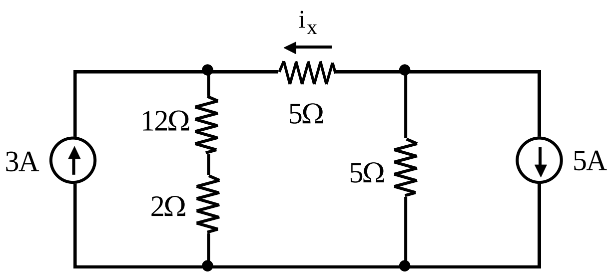
1. a) Compute the power absorbed by the circuit element in the Fig. **6**



b) In the circuit of Fig., determine the current labeled i with the assistance of nodal analysis techniques. **4**

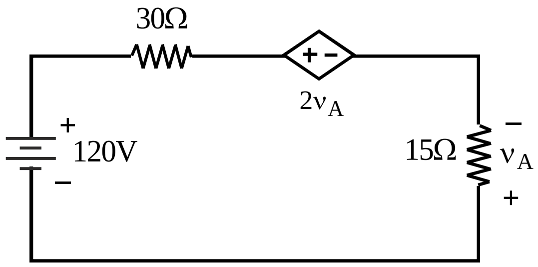


c) Employ superposition to obtain the individual contributions each of the two sources in Fig. makes to the current labeled i_x. **6**

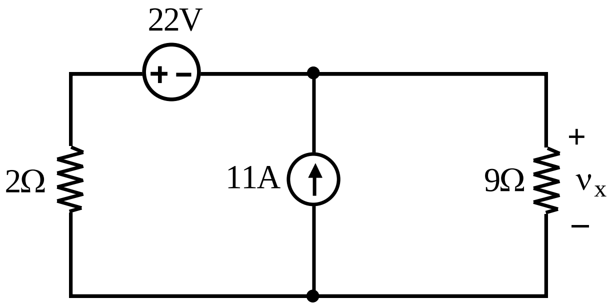


OR

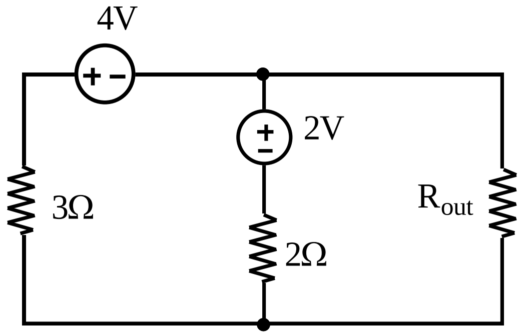
2. a) Compute the power absorbed in each element for the circuit shown in Fig, **4**



b) Solve for the voltage V_x as labeled in the circuit of Fig. using (a) mesh analysis. (b) Repeat using nodal analysis. (c) Which approach was easier, and why? **5**

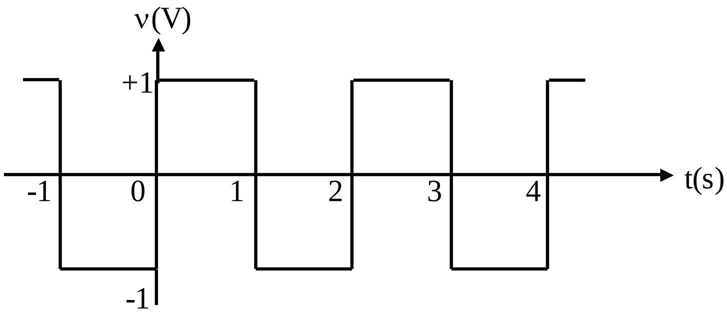


c) For the circuit drawn in Fig., (a) determine the Thevenin equivalent connected to R_{out}. (b) Choose Rout such that maximum power is delivered to it. **7**



3. a) Define Fourier series. Write the Trigonometric and exponential Fourier series. Also write the equations for their coefficients. **8**

b) Write the Fourier series for the voltage waveform shown in fig. **8**



OR

4. a) Explain even symmetry, odd symmetry and half wave symmetry. Also elaborate their effects on Fourier series coefficients. **8**

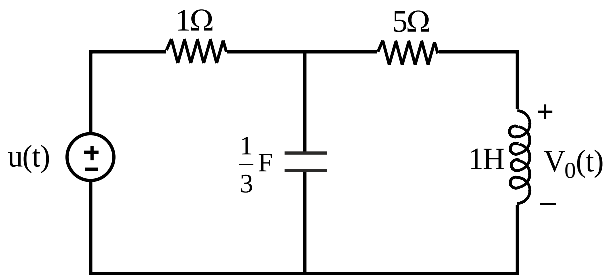
b) A balanced three-phase three-wire system has a Y-connected load. Each phase contains three loads in parallel: $-j100\,\Omega$, $100\,\Omega$ and $50 + j50\,\Omega$. Assume positive phase sequence with Vab = $400/0^{o}\,V$. Find (a) Van; (b) laA; (c) the total power drawn by the load. **8**

5. a) Determine the Laplace transform of each of the following functions: **8**

i) $u(t)$ ii) $e^{-at}u(t)$

iii) $\delta(t)$ iv) $\sin(\omega t)\,u(t)$

b) Find $v_0(t)$ in the circuit of Fig., assuming zero initial conditions. **8**



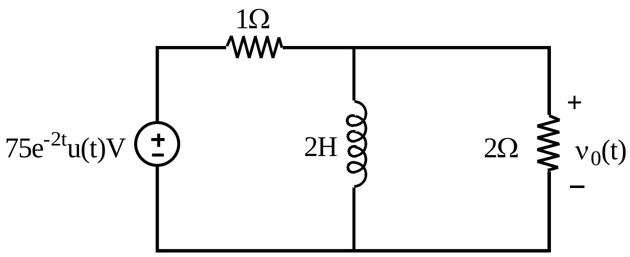
OR

6. a) Determine the inverse Laplace transform of **8**

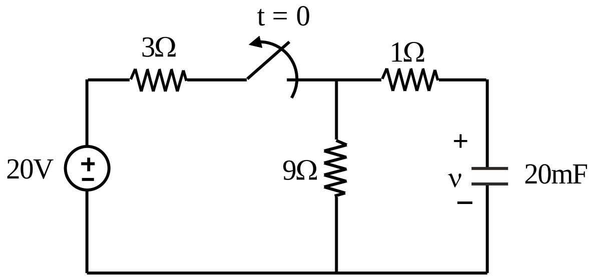
i) $F(s) = 5 + \dfrac{6}{s+4} - \dfrac{7s}{s^2+25}$ ii) $F(s) = \dfrac{s^2+12}{s(s+2)\,(s+3)}$

iii) $\dfrac{10s^2+4}{s(s+1)\,(s+2)^2}$

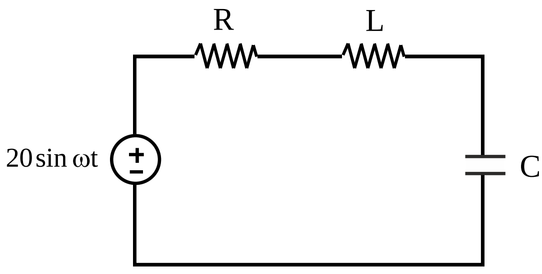
b) Find $v_0(t)$ in the circuit shown in Fig. Note that, since the voltage input is multiplied by u(t), the voltage source is a short for all $t > 0$ and $i_L(0) = 0$. **8**



7. a) The switch in the circuit in Fig. has been closed for a long time, and it is opened at t = 0. Find $v_0(t)$ for $t \geq 0$. Calculate the initial energy stored in the capacitor. **8**

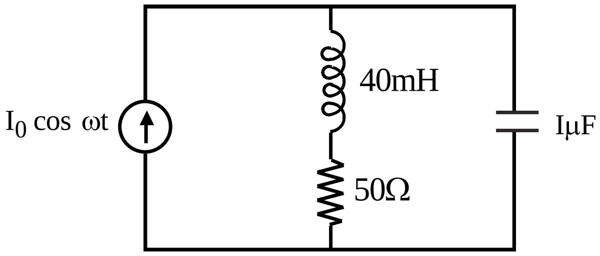


b) In the series resonance circuit of Fig., $R = 2\Omega, L = 1\text{mH}$ and $C = 0.4\,\mu\text{F}$. (i) Find the resonant frequency and the half-power frequencies. (ii) Calculate the quality factor and bandwidth. (iii) Determine the amplitude of the current at ω_0, ω_1 and ω_2. **8**

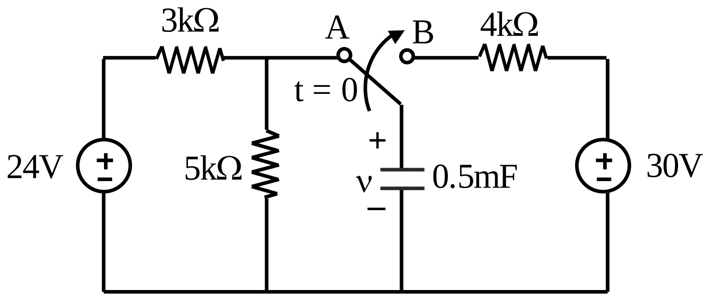


OR

8. a) For the "tank" circuit in Fig., Find the resonant frequency. **8**

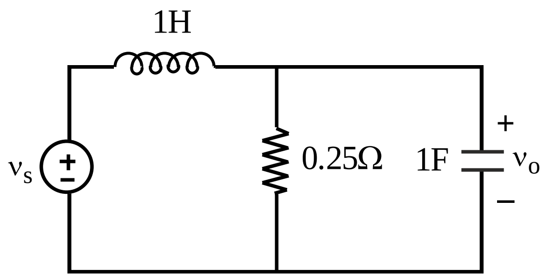


b) The switch in Fig. has been in position A for a long time. At t = 0 the switch moves to B. Determine v(t) for t > 0 and calculate its value at t = 1 s and 4s. **8**



9. a) Show that a series LR circuit is a lowpass filter if the output is taken across the resistor. Calculate the corner or cutoff frequency f_c if L = 2 mH and $R = 10k\Omega$. **8**

b) Find the transfer function V_0 / V_s of the circuit in Fig. Show that the circuit is a low pass filter. **8**



OR

10. a) Show that for a bandpass filter, $H(s) = \dfrac{sB}{s^2 + sB + \omega_0^2}$, $s = j\omega$ **8**

Where B = bandwidth of the filter and ω_0 is the center frequency.

b) Show that for a bandstop filter, $H(s) = \dfrac{s^2 + \omega_0^2}{s^2 + sB + \omega_0^2}$, $s = j\omega$ **8**

Where B = bandwidth of the filter and ω_0 is the center frequency.

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