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

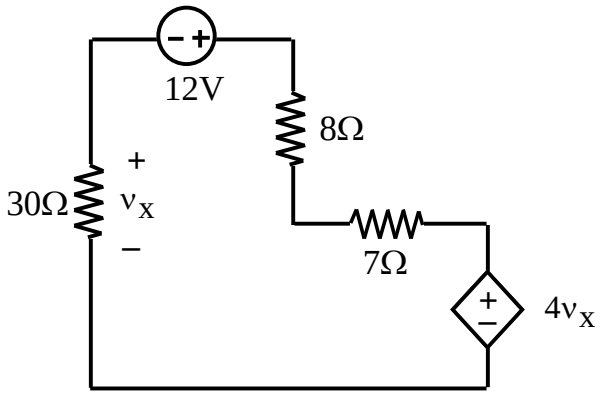
005 : Network Theory

P. Pages : 4 **GUG/W/22/13910**

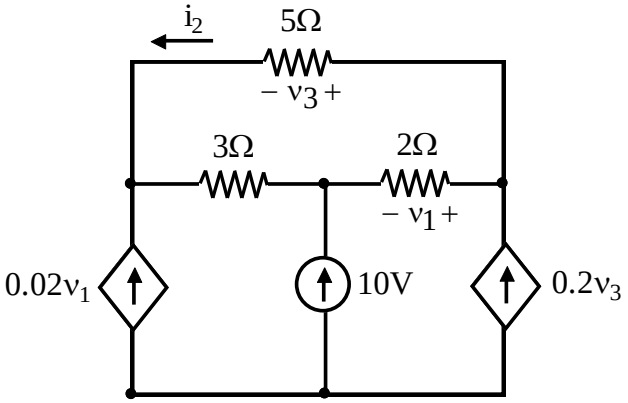
Time : Three Hours * 3 1 3 9 * Max. Marks : 80

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

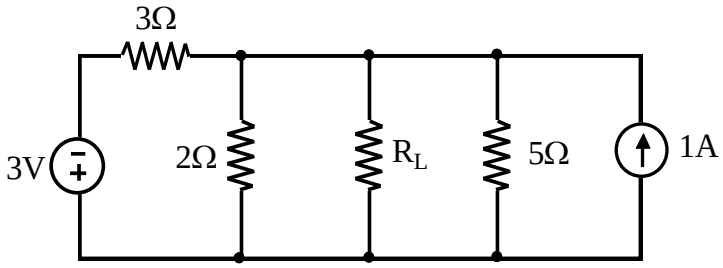
1. a) In the circuit of Fig. Find the power absorbed by each of the five elements in the circuit. **5**



b) Determine the current i2 as labeled in the circuit of Fig., with the assistance of nodal analysis. **6**

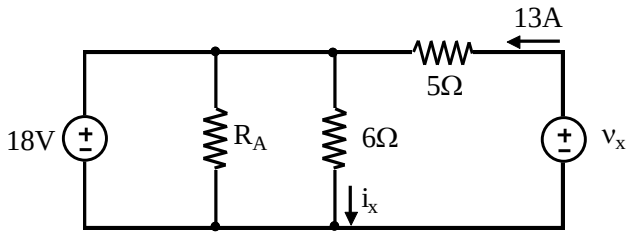


c) For the circuit of Fig., what value of R_L will ensure it absorbs the maximum possible amount of power? **5**

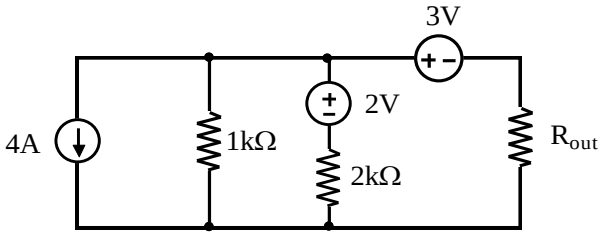


OR

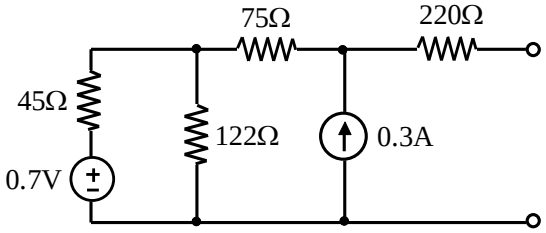
2. a) Count the number of branches and nodes in the circuit in Fig. if $i_X = 3$ A and the 18 V source delivers 8 A of current, what is the value of R_A ? **4**



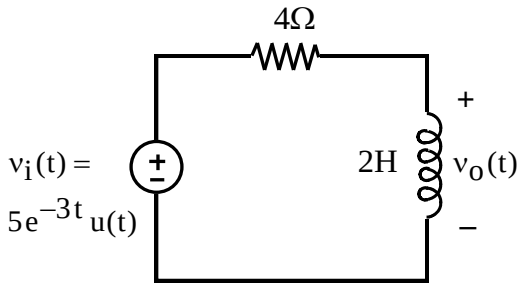
b) For the circuit of Fig. (a) Determine the Norton equivalent connected to resistor Rout. (b) Select a value for Rout such that maximum power will be delivered to it. **6**



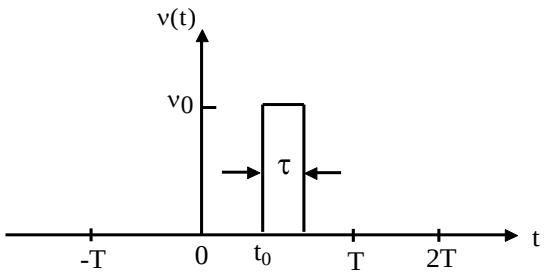
c) Employ Thevenin's theorem to obtain a simple two-component equivalent of the circuit shown in Fig. **6**



3. a) Find the voltage across the inductor of the circuit shown in Fig. when the input voltage is a simple exponentially decaying pulse, as indicated. **8**



b) Use the Fourier transform to obtain the continuous spectrum of the single rectangular pulse Fig. **8**



OR

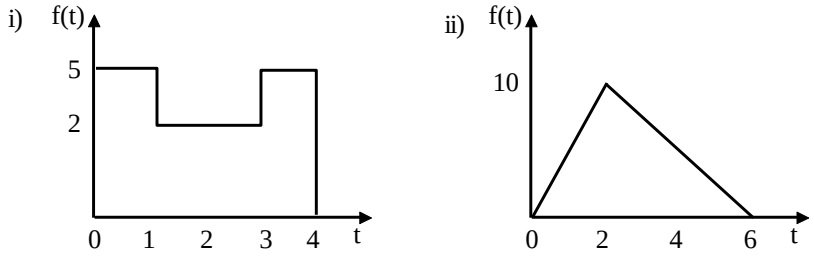
4. a) Determine the amplitude of the line current in a three-phase system with a line voltage of 300V that supplies 1200 W to a. **8**

i) Δ -connected load at a lagging PF of 0.8; then find the phase impedance.

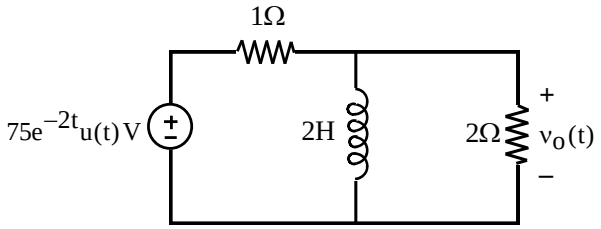
ii) Y-connected load at a lagging PF of 0.8; then find the phase impedance.

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

5. a) Calculate the Laplace transform of the functions in Fig. **8**



b) Find $v_o(t)$ 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**



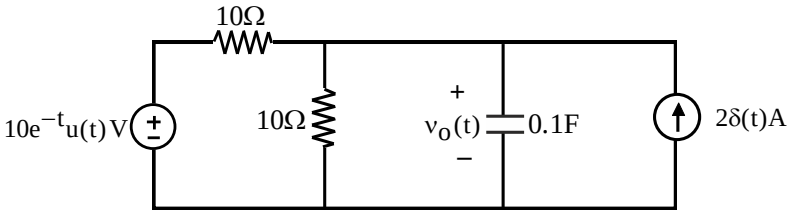
OR

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

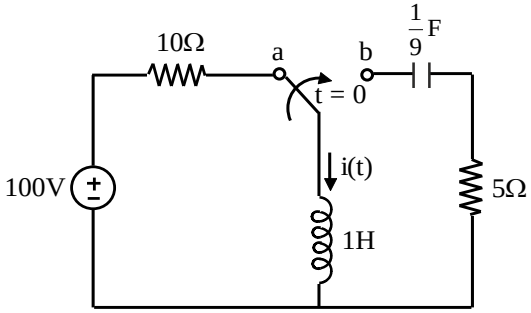
i) u(t) ii) $e^{-at}u(t)$

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

b) Find $v_o(t)$ in the circuit of Fig. Assume $v_o(0) = 5\,V$. **8**



7. a) The circuit in fig. has reached steady state at t = 0. If the make before-break switch moves to position b at t = 0, calculate i(t) for t > 0. **8**

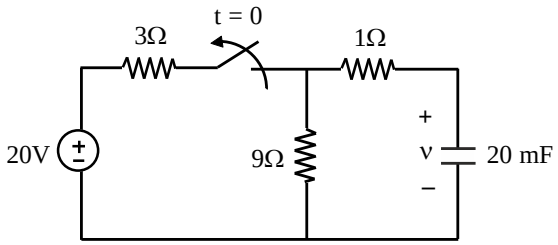


b) A parallel resonance circuit has a resistance of and half-power frequencies of 86 kHz and 90 kHz. Determine: **8**

a) The capacitance b) The inductance
c) The resonant frequency d) The bandwidth
e) The quality factor

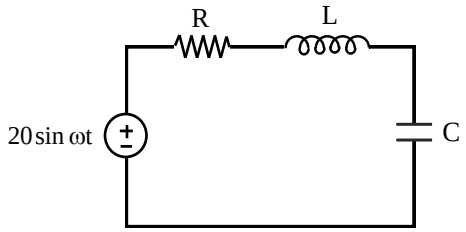
OR

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



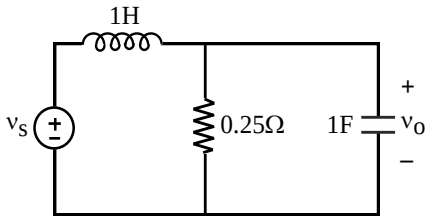
b) In the circuit of Fig., $R = 2\Omega$, L = 1mH and $C = 0.4\mu F$. **8**

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.



9. a) Determine the range of frequencies that will be passed by a series RLC band pass filter with $R = 10\Omega$, L = 25m H and $C = 0.4\mu F$. Find the quality factor. **8**

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

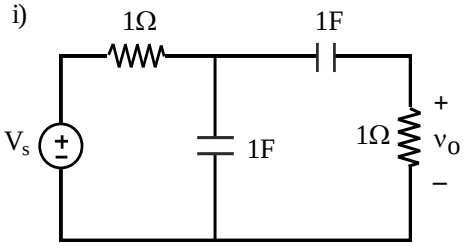


OR

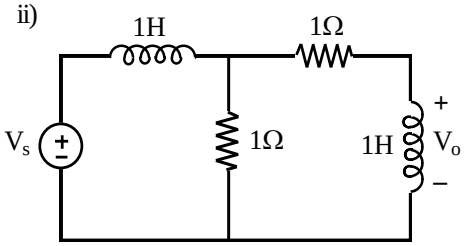
10. a) Show that a series LR circuit is a lowpass filter if the output is taken across the resistor. Calculate the corner or cutoff frequency f_c if L = 2 mH and $R = 10\,k\Omega$. **8**

b) Determine the center frequency and bandwidth of the bandpass filters in Fig. **8**

i)



ii)



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