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Paper Code : EC-301

CIRCUIT THEORY AND NETWORKS

Time Allottea : 3 Hours | *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

   i) Three resistances each of R Ω are connected to form a triangle. The resistance between any two terminals will be

   a) R Ω b) $\frac{3}{2}$ R Ω

   c) 3 R Ω d) $\frac{2}{3}$ R Ω.

   ii) An ideal voltage source has

   a) large emf b) small emf

   c) zero resistance d) none of these.

   iii) An ammeter is connected in

   a) series b) parallel

   c) both (a) and (b) d) none of these.

   iv) Which of the following is an active element ?

   a) Resistance b) Inductance

   c) Capacitance d) Current source.

   v) Which of the following is true for symmetry ?

   a) Z11 = Z22 b) Z21 = Z11

   c) Z12 = Z21 d) Z21 = Z22.

   vi) Superposition theorem is applicable only to networks that are

   a) linear b) non-linear

   c) time-invariant d) passive.

   vii) If the impulse response is realisable by delaying it appropriately and is bounded for bounded excitation, then the system is said to be

   a) causal and stable

   b) causal but not stable

   c) non-causal but stable

   d) non-causal, but not stable.

viii) The rms value of the a-c voltage $v(t) = 200 \sin 314t$ is

a) 200 V b) 314 V

c) 157.23 V d) 141.42 V.

ix) Condition for reciprocity of y parameter is

a) $y_{11} = y_{22}$ b) $y_{12} = y_{21}$

c) $y_{11} = y_{12}$ d) $y_{22} = y_{21}$.

x) The Q factor for an inductor L in series with a resistance R is given by

a) wL/R b) R/wL

c) w/LR d) $1/wLR$.

xi) A rectangular pulse of duration t and magnitude I has the Laplace transform

a) I/s

b) $(I/s)e^{-st}$

c) $(I/s)e^{st}$

d) $(I/s)(1 - e^{-st})$.

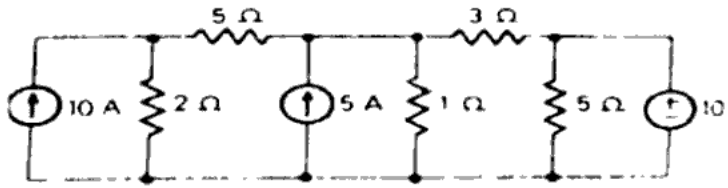
GROUP - B

(Short Answer Type Questions)

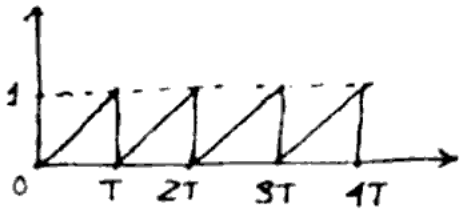
Answer any *three* of the following. $3 \times 5 = 15$

2. State maximum power transfer theorem. With the detailed explanation find out the expression of resistance at which maximum power transfer occurs. Can we apply Thevenin's theorem to a circuit having multisource ? 1 + 3 + 1

3. Find the current in the 3Ω resistor for the circuit shown below :



4. Find the laplace transform of the following waveform.



5. A 50 microfarad capacitor when connected in series with a coil having 40 ohm resistance, resonates at 1000 Hz. Find the inductance of the coil. Also obtain the circuit current if the applied voltage is 100 V. Also calculate the voltage across the capacitor and coil at resonance.

6. What is meant by band width of series resonating circuit and what is its relationship with Q factor ?

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. Obtain (a) Incidence matrix (b) Fundamental loop matrix and (c) Fundamental cut set matrix of the graph shown below :

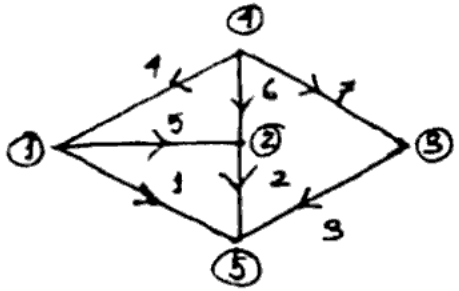


Fig. 1

8. A DC voltage of 100 valts is applied to a series RL circuit with R = 25 ohm. What will be the current in the circuit at twice the time constant ?

Sketch the current given by $I(t) = 5 - 4\,e^{-20t}$

In the circuit shown in figure, switch S is in position 1 for a long time and brought to position 2 at time $t = 0$. Determine the circuit current. 6 + 3 + 6

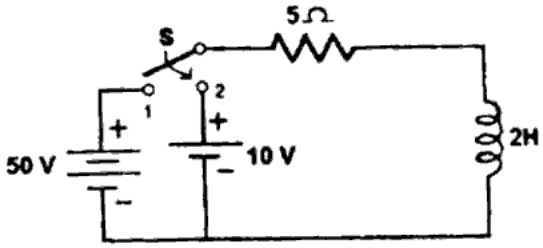


Fig. 2

9. a) A series RC circuit consists of 10 ohm resistor and a capacitor of 0.5 F. 20 volt is applied to the circuit at $t = 0$. Obtain the current equation. Determine the voltage across the resistor and capacitor.

   b) Define ABCD parameters of a two-port network

   c) State and prove maximum power transfer theorem for complex impedance circuit.

   d) Find the Thevenin equivalent circuit.

10. a) Find the transmission parameters for the two-port network shown.

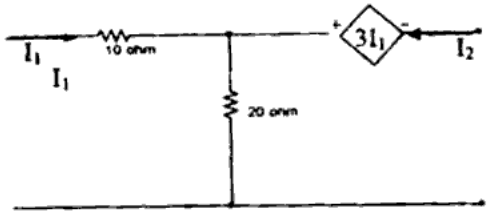


Fig. 3

b) Obtain Y parameter of the network :

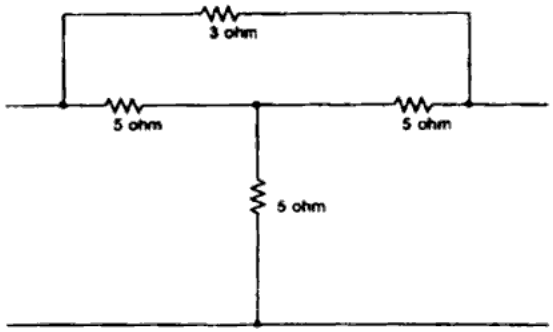


Fig. 4

c) The *h* parameters of a two-port network shown in the following figure are $h11=1k\Omega$, $h12=0.003$

$h21 = 100$, $h22=500\mu mho$. Find V2 of the network.

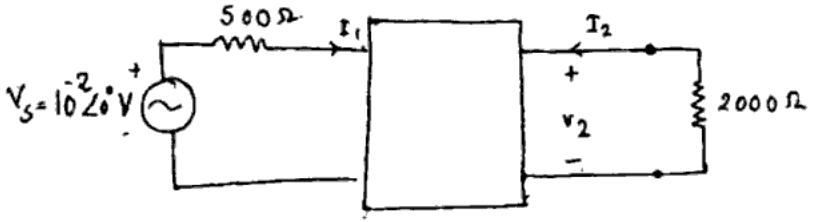


Fig. 5 5 + 5 + 5

11. a) Define Bandwidth and the half power points of a series resonance circuit.

b) The network of fig. 6 is to have a pure resistance of 11000 Ω across the terminals (*a*,*b*) at a frequency of 10kHz. Determine the values of R,L,C.

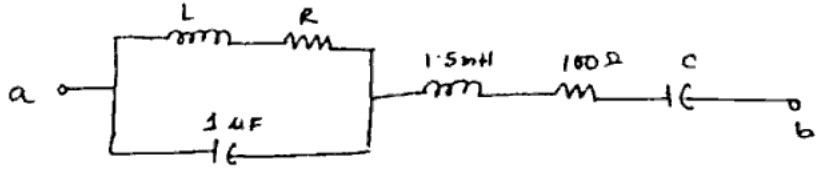


Fig. 6

c) Calculate the phasor currents I_1 and I_2 in the circuit of Fig. 7.

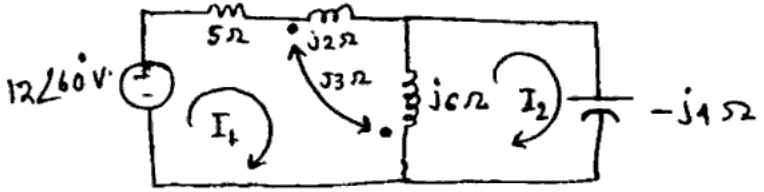


Fig. 7 2 + 7 + 6