53 (IE 301) NWTH

2017

NETWORK THEORY

Paper : IE 301

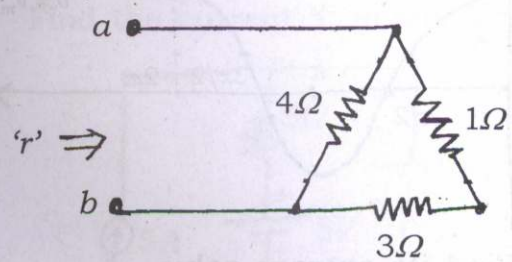
Full Marks : 100

Time : Three hours

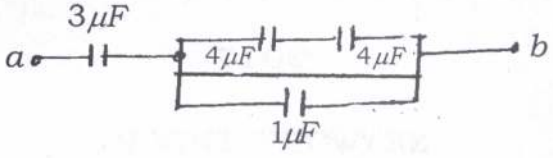
The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

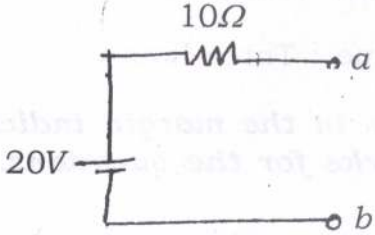
1. *(a)* Find the resistance '*r*' across $a-b$ in the following figure : 2



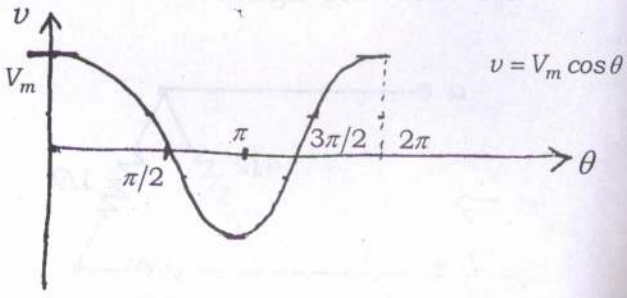
(b) Find the equivalent capacitance of the combination below across $a-b$: 2



(c) Convert the following into current source: 4



(d) A voltage waveform is shown below: 4

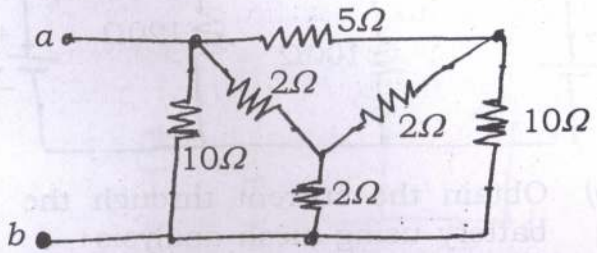


Find its average value.

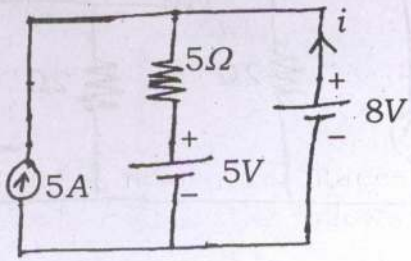
(e) In an a.c. circuit containing pure inductance, the voltage applied is $220V$, $50Hz$; while the current is $10A$. Find the value of inductive reactance (X_2) and inductance (L). 5

(f) The voltage and current through an a.c. circuit are given by — $v = v_m \sin wt$ and $i = I_m \cos wt$. What is the phase difference between these two variables? 3

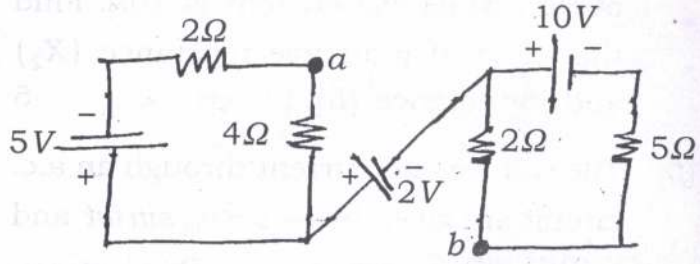
2. (a) Find the equivalent resistance between terminals $a-b$ in the following: 7



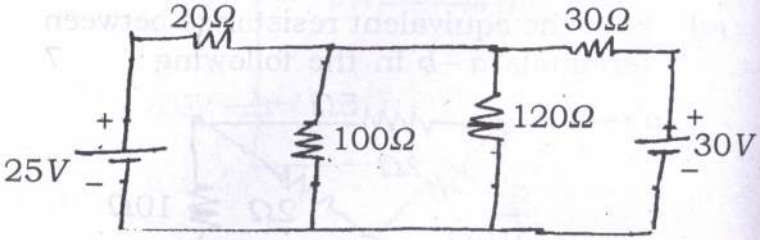
(b) Find the current 'i' in the figure: 6



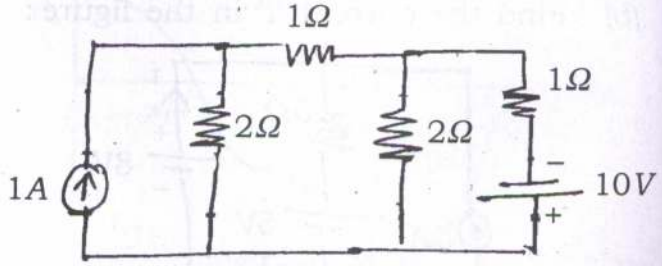
(c) Find the voltage drop across the terminals $a-b$: 7



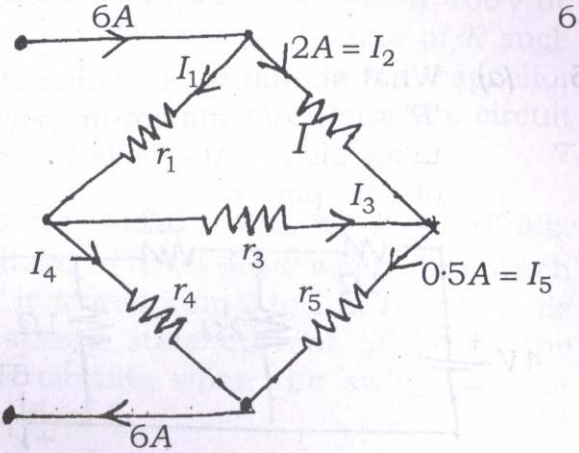
3. (a) Using Nodal analysis find the current through 100Ω resistance : 7



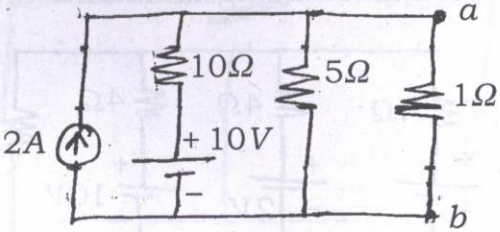
(b) Obtain the current through the 10V battery using mesh analysis : 7



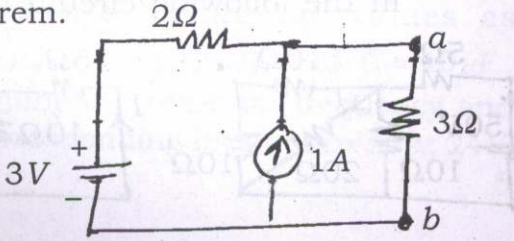
(c) Using KCL, obtain the values of unknown currents in the following: 6



4. (a) Find the power loss in the 1Ω resistance by Thevenin's theorem: 7

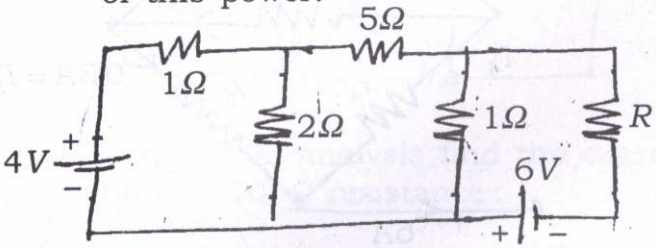


(b) Prove that the current flowing through 3Ω resistance is 1A ; using Norton's theorem. 7

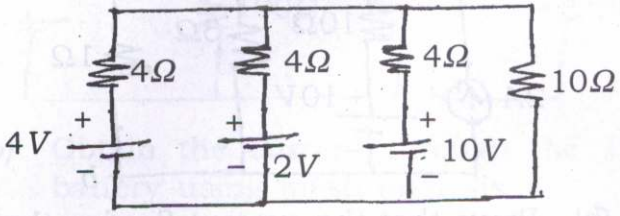


(c) State and prove the Superposition Theorem as applicable to d.c. circuits. 6

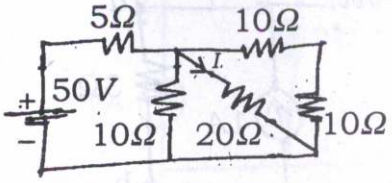
5. (a) What should be the value of resistance 'R' such that maximum power transfer takes place ? Also calculate the amount of this power. 8

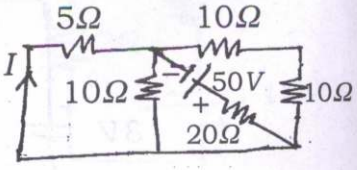


(b) Find the current through 10Ω resistance using Millman's theorem. 6



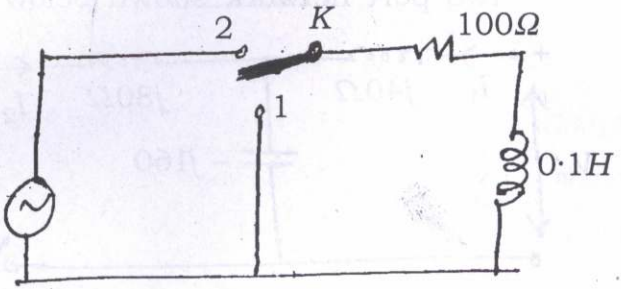
(c) Show the validity of Reciprocity theorem in the following circuits : 6





6. *(a)* A resistance 'R' and $5\mu F$ capacitor are connected in series across a $100V$ dc supply. Calculate the value of R such that the voltage across the capacitor becomes $50V$ in 5 *sec* after the circuit is switched on. 7

(b) Obtain the current at $t>0$; if a.c. voltage 'v' is applied when the switch 'K' is moved from 2 to 1 at $t=0$. Assume a steady state current of $1A$ in the L-R circuits when the switch was at position 1. 8



(c) A *R-L-C* tank circuit is composed of components having the values as $R=0{\cdot}3\Omega$; $L=120mH$ and $C=40\mu F$. Determine the resonant frequency and the corresponding input current at $24V$. 5

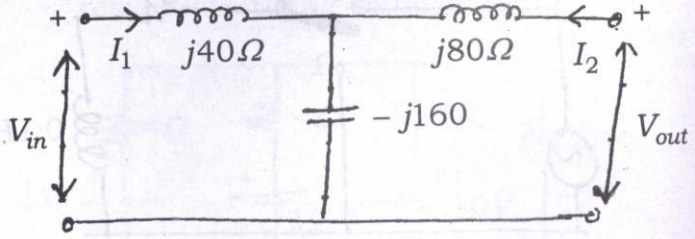
7. *(a)* Find the current in a series *R-L* circuit having $R = 2\Omega$ and $L = 10H$, while a dc voltage of $100V$ is applied. What is the value of this current after $5sec$ of switching on? 5

(b) A function in s-domain is given by — 5

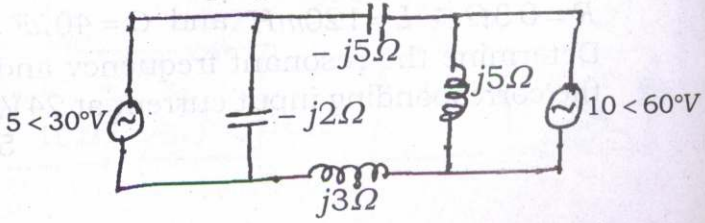
$$F(s) = \frac{50}{s^2 + 2s + 2}$$

Find the inverse Laplace transform.

(c) Find the open circuit parameter of the two port network shown below: 5



(d) Obtain the current through $j3\Omega$ inductive reactance using the principle of superposition. 5



8. Write short notes on : ***(any four)*** 5×4=20

(i) Initial and final value theorem

(ii) Q-factor

(iii) Reciprocity theorem

(iv) Poles and zeroes in network function

(v) Y-parameters.

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