Name : .....

Roll No. : .....

Invigilator's Signature : .....

2010-11

CIRCUIT THEORY & NETWORKS

Time Allotted : 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) The Laplace transform of a shifted unit step $f(t) = U(t - a)$ is

a) e^{-as} b) $e^{-as/s}$

c) se^{-as} d) $s\left(1-e^{-as}\right)$.

ii) A tie-set matrix has 3 rows and 7 branches. The number of twigs is

a) 3 b) 5

c) 2 d) 4.

iii) Unit step function is fist derivative of

a) Ramp function b) Impulse function

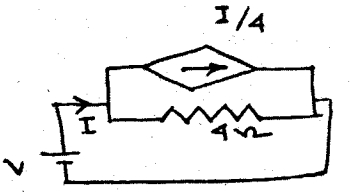
c) Gate function d) Parabolic function.

iv) A circuit having neither an e.m.f. source nor any energy source is

a) active circuit b) passive circuit

c) unilateral circuit d) bilateral circuit.

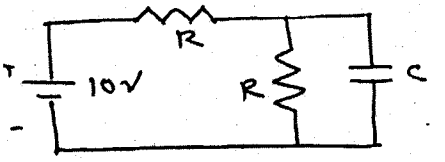
v) In the network shown in the figure, the effective resistance faced by the voltage source is



a) 4Ω b) 3Ω

c) 2Ω d) 1Ω.

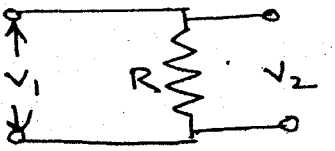
vi) The time constant of the network show in the figure is



a) 2 RC b) 3 RC

c) $\frac{RC}{2}$ d) $\frac{2RC}{3}$.

vii) The Z parameter of the following network is



a) $\begin{bmatrix} R & R \\ R & R \end{bmatrix}$

b) $\begin{bmatrix} R & 0 \\ 0 & R \end{bmatrix}$

c) $\begin{bmatrix} R & -R \\ -R & R \end{bmatrix}$

d) Cannot be determined.

viii) Two equal impedances $10\angle 60^\circ$ are connected in parallel. The equivalent impedance will be

a) $20\angle 60^\circ$ b) $10\angle 120^\circ$

c) $15\angle 120^\circ$ d) $5\angle 60^\circ$.

ix) A series resonant circuit at resonance is called

a) an acceptor circuit b) a rejector circuit

c) an oscillator circuit d) a damped circuit.

x) The average power delivered to a reactive load is

a) zero b) VI sin ϕ

c) $v(t) + i(t)$ d) $1\frac{1}{2} V_m I_m \sin \phi$.

xi) The output Y and input X of a system are related by the equation $Y = mX + c$, where m, c are constants. The system is

a) linear b) non-linear

c) bilateral d) unilateral.

xii) The Fourier transform can be used to represent

a) any signal

b) all periodic signals

c) all non-periodic signals

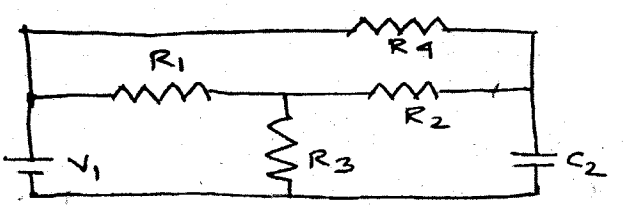
d) all periodic signals that obey Dirichlet's condition.

GROUP – B

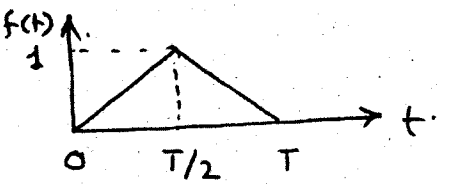
(Short Answer Type Questions)

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

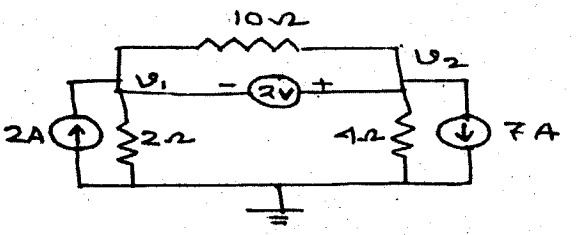
2. Draw the oriented graph of the figure shown and find the incidence matrix.



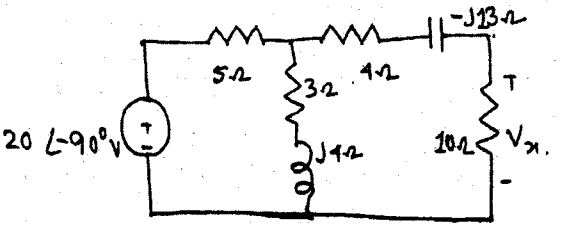
3. Find the Laplace transform of the triangular waveform shown.



4. For the circuit shown below, find the mode voltages.



5. Compute V_x in the circuit shown below using the method of source transformation.



6. Find the rms value of the periodic current :

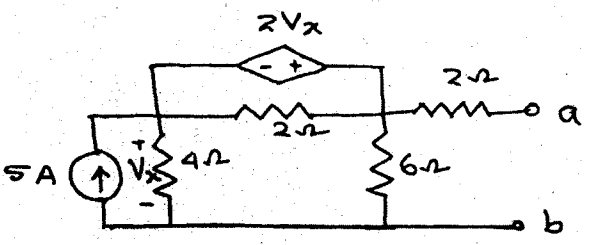
$i(t) = 8 + 30 \cos 2t - 20 \sin 2t + 15 \cos 4t - 10 \sin 4t$ A.

GROUP – C

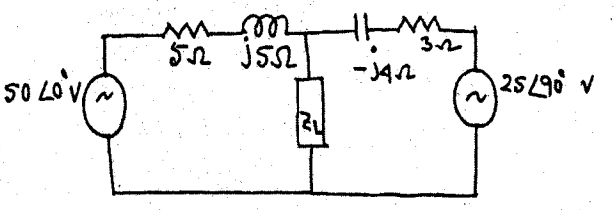
(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

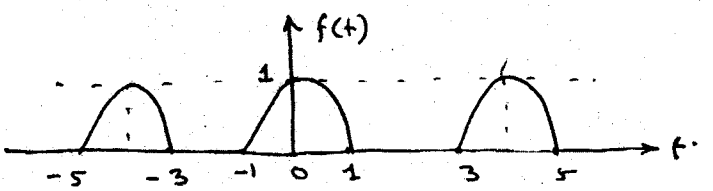
7. a) Find the Thevenin equivalent of circuit shown below :



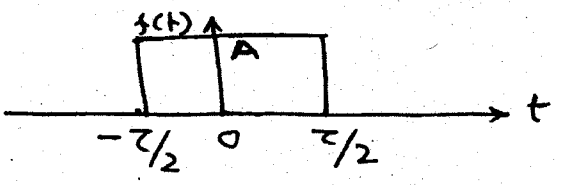
b) Find the load impedance Z_L to transfer maximum power in the circuit shown. Find also the value of power consumed by the load. 7 + 8



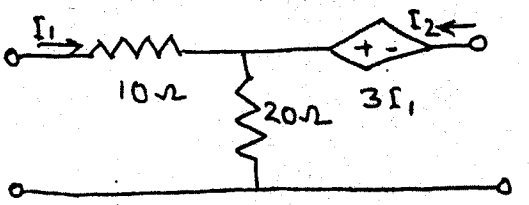
8. a) Determine the Fourier series for the half wave rectified consine function shown.



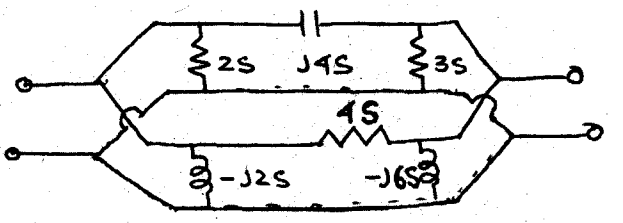
b) Derive the Fourier transform of a single rectangular pulse of width τ and height A shown below : 10 + 5



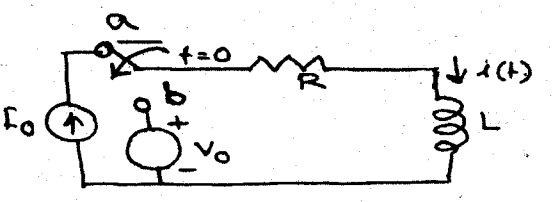
9. a) Find the transmission parameters for the two-part network shown below :



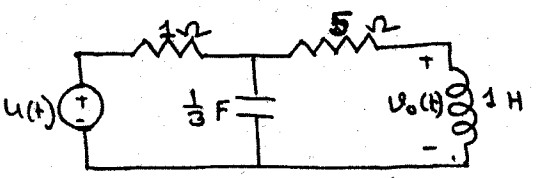
b) Find the *Y* parameters of the two-part network shown below : 8 + 7



10. a) In the circuit shown below, the switch moves from position *a* to position *b* at $t = 0$. Find $i(t)$ for $t > 0$.



b) Find $v_0(t)$ in the circuit shown below. Assume zero initial condition. 8 + 7



11. a) Draw the circuit diagram of a first order highpass filter & find out the expression of the cut-off frequency.

b) What do you mean by wide bandpass and narrow band-pass filters ? Draw the circuit diagram for the two types of filters.

c) Find the cut-off frequency of the following lowpass second order active filter shown below. 5 + 5 + 5