MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

EE-301

ELECTRIC CIRCUIT THEORY

Time Allotted: 3 Hours | Full Marks: 70

The questions are of equal value.
The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.
All symbols are of usual significance.

GROUP A
(Multiple Choice Type Questions)

1. Answer any *ten* questions. 10×1 = 10

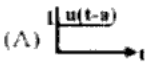
(i) A 10 μF capacitor is connected across a 10 V battery. The steady state current will be

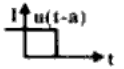
(A) 1×10^{7} A (B) 1×10^{-5} A
(C) 1×10^{4} A (D) 0

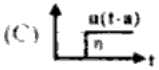
(ii) Unit step function is first derivative of

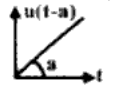
(A) ramp function (B) impulse function
(C) gate function (D) parabolic function

(iii) Graphical representation of u(t - a) is

(A) 

(B) 

(C) 

(D) 

(iv) The system characterized by the equation $y = mx + c$ with usual meaning of terms is

(A) linear (B) non linear
(C) oscillatory (D) discontinuous

(v) A high pass filler circuit is basically

(A) an integrating circuit with small time constant
(B) an integrating circuit with large time constant
(C) a differentiating circuit with large time constant
(D) a differentiating circuit with small time constant

(vi) Periodic signal that obey Dirichlet's condition can be represented by

(A) Fourier series (B) Fourier transform
(C) Laplace series (D) none of these

(vii) Condition of symmetry in ABCD parameters is

(A) A= B (B) A = D
(C) B = C (D) D = A

(viii) Millman's theorem treats circuit as a

(A) parallel set of series component branches
(B) parallel set of parallel component branches
(C) Series set of series-component branches.
(D) parallel set of parallel component branches

(ix) A network has 7 nodes and 5 independent loops. The number of branches in the network is

(A) 13 (B) 12
(C) 11 (D) 10

(x) A dependent source

(A) is always a current source
(B) is always a voltage source
(C) may be a current source or a voltage source
(D) is neither a current source nor a voltage source

(xi) A function in Laplace domain is given by $F(s)=\frac{2(s+4)}{(s+3)(s+8)}$.

The final value of $F(s)$ is

(A) 2 (B) 0
(C) 3 (D) 4

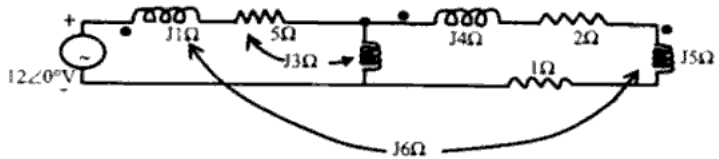
(xii) A complex wave is 5 + 5 sin *wt*. Its rms value is

(A) 6.12 V (B) 5 V
(C) 10 V (D) 7.07 V

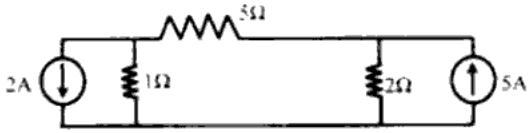
GROUP B
(Short Answer Type Questions)

Answer any *three* questions. 3×5 = 15

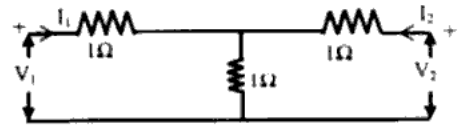
2. Write the mesh equations of the circuit shown in the following figure



3. Using mesh analyses obtain the current through the 5Ω resistor for the following circuit.



4. Find the ABCD parameters of the following circuit



5. (a) Find the Fourier transform of $\delta(t-t_0)$.
   (b) What do you mean by even symmetry and odd symmetry?

6. The reduced incidence matrix [Ar] of a network is given below:

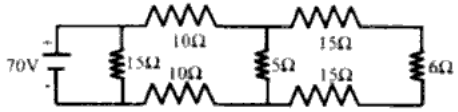
$$Ar=\begin{bmatrix} 1 & 0 & 0 & 0 & 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 & -1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 & 0 & -1 & 1 & -1 \\ 0 & 0 & 0 & 1 & 0 & 0 & -1 & 0 \end{bmatrix}$$

Draw the graph of the network.

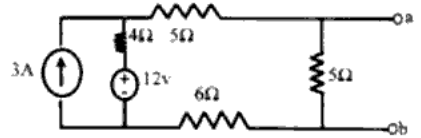
GROUP C
(Long Answer Type Questions)

Answer any *three* questions. $3 \times 15 = 45$

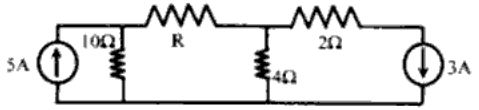
7. (a) Using Thevenin's theorem, find the current through the 6Ω resistor in the following circuit. 5



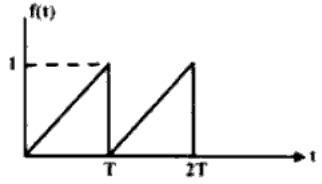
(b) Find the Norton's equivalent circuit of the figure shown below. 5



(c) Find the value of R such that maximum power transfer is possible from the source to the load R. 5



8. (a) Obtain the Fourier series of the waveform shown in the following figure. 9



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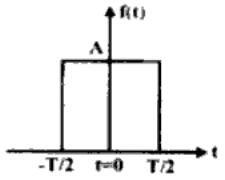
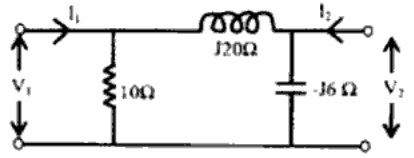
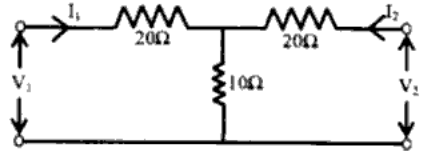
(b) Find the Fourier transform of a single rectangular pulse as shown below. 6



9. (a) Determine the Y parameter of the network shown below. 7

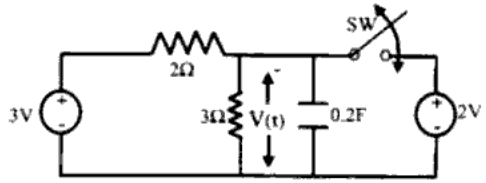


(b) Find the transmission parameters of the two port network shown below. 4



(c) Derive condition of symmetry in case of h-parameter. 4

10.(a) In the circuit shown below, the switch SW was closed for a long time. At $t = 0$, the switch is opened. Find $V(t)$ for $t > 0$. 8



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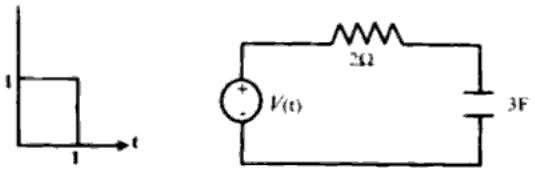
(b) The voltage pulse $V(t)$ is applied to the circuit shown with zero initial condition. Find $I(t)$ and sketch $I(t)$ vs t. 7



11.(a) Define an active filter. Mention the advantages of active filters over the passive filters. 5

(b) Draw the ideal and practical characteristics of a low pass filter and a band stop filter. 5

(b) Design a high pass filter with a corner frequency of 3 kHz and a high frequency gain of 4. 5