

2025

M.Sc. 1st Semester Examination

ELECTRONICS

Paper : ELCC404X0

[Modern Communication and Network Theory]

Full Marks : 50

Time : Two Hours

*The figures in the margin indicate full marks.
Candidates are required to give their answers
in their own words as far as practicable.*

Unit - I

Group - A

Answer any two questions : $2 \times 2 = 4$

1. Define the terms noise figure and noise temperature.
2. What do you mean by VSB-SC-AM? Write down its one application. 1+1
3. Explain the advantages of graded index fiber over step index fiber.
4. Give at least two technical differences between the Wi-Fi and the GPS system.

P.T.O.

(2)

Group - B

Answer any *two* questions : $4 \times 2 = 8$

5. Explain the principle of operation of ASK and FSK system with suitable sketch and diagram. $2+2$
6. State and prove the Nyquist sampling theorem. $1+3$
7. An optical fibre has a loss of 0.1 dB/km. Calculate the sensitivity of the receiver needed if the laser source is pumping a power of 13 dBm?
8. An analog waveform is to be quantised with a uniform quantiser. The quantisation error should not exceed 1% of the peak-to-peak level of the signal. Determine the minimum number of bits needed to encode the signal.

Group - C

Answer any *one* question : $8 \times 1 = 8$

9. With a neat sketch, explain the phase-shift method of SSB-SC AM generator. Indicate some of its limitations. With a proper circuit diagram, discuss how you can demodulate an AM wave using envelope detector. How can you select the values of R and C? $3+1+3+1$
10. Write a short note on IOT. Explain how light is guided by an optical fibre. $4+4$

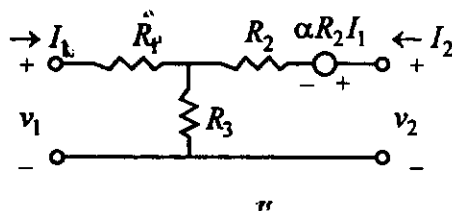
(3)

Unit - II

Group - A

Answer any *two* questions : $2 \times 2 = 4$

11. Define the terms Branch, Link, Twigs and Tree.
12. State and explain superposition theorem.
13. Write down the design equation for a low pass constant k filter.
14. Determine the Z matrix of the following circuit :



Group - B

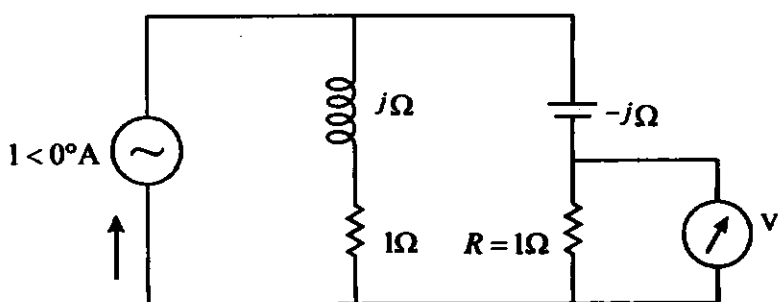
Answer any *two* questions : $4 \times 2 = 8$

15. Prove that for a reciprocal Network $AD - BC = 1$.
16. Design a constant k low pass T-section filter with a nominal resistance of 50Ω to produce cut-off at a frequency of 1.2 kHz. Find also the attenuation in dB at 2 kHz.

P.T.O.

(4)

17. In the following circuit find the reading of the voltmeter V. Inter change the current source and voltmeter and verify the reciprocity theorem.



18. The reduced incidence matrix of an oriented graph is

$$A = \begin{bmatrix} 0 & -1 & 1 & 1 & 0 \\ 0 & 0 & -1 & -1 & -1 \\ -1 & 0 & 0 & 0 & 1 \end{bmatrix}, \text{ Draw the graph.}$$

Group - C

Answer any *one* question :

$8 \times 1 = 8$

19. (a) Two Networks N_a and N_b are connected in cascade to form Network N, show that

$$\begin{bmatrix} A & B \\ C & D \end{bmatrix} = \begin{bmatrix} A_a & B_a \\ C_a & D_a \end{bmatrix} \begin{bmatrix} A_b & B_b \\ C_b & D_b \end{bmatrix}$$

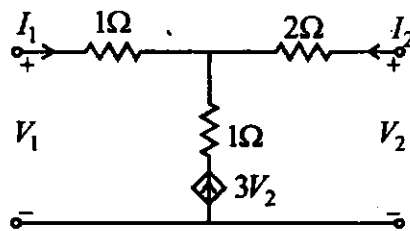
where the symbols have their usual meaning.

(5)

- (b) Verify if the following impedance function is realizable or not :

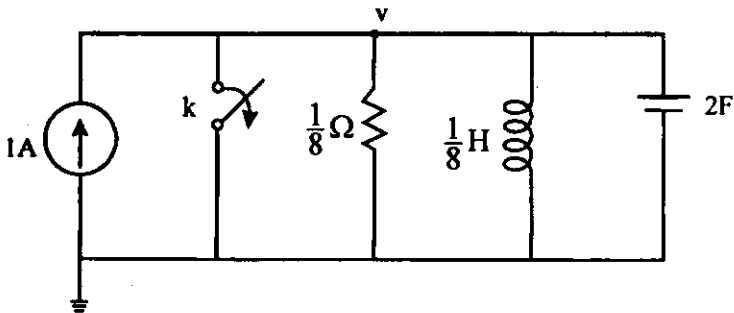
$$Z(s) = \frac{4s^4 + s^2 - 3s + 1}{s^3 + 2s^2 + 2s + 40}$$

- (c) Find y_{21} of the network shown in Figure. 5 :



4+2+2

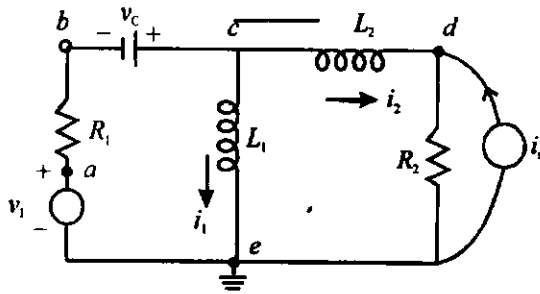
20. (a) In the following Network the switch k is open at $t = 0$. Calculate $v(t)$.



P.T.O.

(6)

- (b) For the following circuits, write down the state equation and derive Bashkow A matrix and constant B matrix.



4+4

Internal Assessment : 10 marks
