



MACHAKOS UNIVERSITY

University Examinations for 2016/2017

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

THIRD YEAR SECOND SEMESTER EXAMINATION FOR DEGREE IN
BACHELOR OF SCIENCE IN ELECTRICAL AND ELECTRONICS
ENGINEERING

EEE 307: NEWTORK ANALYSIS AND SYNTHESIS

DATE: 20/6/2017

TIME: 8:30 – 10:30 AM

INSTRUCTIONS:

- (i) There is a total of Five questions.
- (ii) Select any Three questions.
- (iii) Define all symbols used.
- (iv) Marks will be awarded for procedure, methodologies used and not necessarily the final answer.

1. Consider the circuit given in Fig. Q1.

(a) Obtain:-

- (i) Branch inductance matrix, Z_L . (3 marks)
- (ii) Branch capacitance matrix, Z_C . (2 marks)
- (iii) Branch resistance matrix, Z_R . (2 marks)
- (iv) The branch impedance matrix, Z_b . (3 marks)
- (v) Source potential matrix. (2 marks)
- (vi) Current source matrix. (2 marks)

(b) Derive:-

- (i) The Generalised Ohm's Law using impedance and admittance matrices. (2 marks)
- (ii) Kirchhoff's equilibrium equation on loop basis. (2 marks)
- (iii) Kirchhoff's equilibrium on node pair basis. (2 marks)

2. For the circuit given in Fig. Q2:-
- (a) Draw:-
- (i) The directed graph. (2 marks)
 - (ii) Its tree indicating the links. (2 marks)
- (b) (i) Write the Tie set Matrix. (10 marks)
- (ii) Calculate the loop currents. (6 marks)
3. (a) Consider the network depicted in Fig Q3a.
- (i) Find its h -parameters in terms of admittances Y_A , Y_B , and Y_C . (5 marks)
 - (ii) Determine its $ABCD$ -parameters in terms of the given admittances. (5 marks)
- (b) Find the Y parameters of the network shown in Fig. Q3b. (10 marks)
4. (a) (i) Using relevant schematic diagrams, explain what is meant by *image* and *iterative* cascading. (3 marks)
- (ii) Regarding networks with terminating impedances, demonstrate the circumstances under which the *image* and *iterative* impedances are equal. (3 marks)
- (iii) Write a brief essay on the “Lattice” Filter. (4 marks)
- (b) (i) Obtain the characteristic impedance Z_π of Π section shown in Fig. Q4 (5 marks)
- (ii) Find the Image Transfer Constant for the Π section in (i) above (5 marks)
5. (a) Compare and contrast the following network synthesis techniques:-
- (i) First and second Foster Forms. (5 marks)
 - (ii) First and second Caure Forms. (5 marks)
- (b) If the driving point impedance Z_D of a network is:-

$$Z_D = \frac{2s^2 + 2}{s^3 + 2s^2 + 3s + 2}$$

Synthesize the network in first Caue Form. (10 marks)

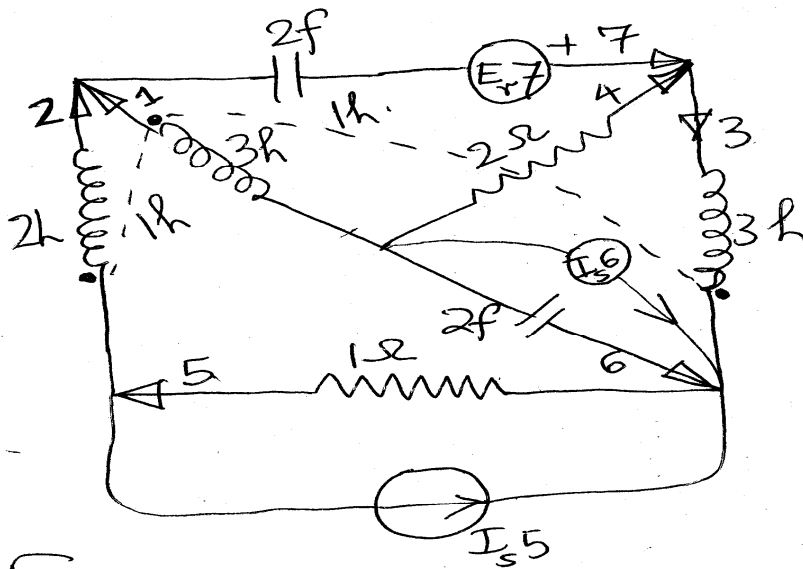
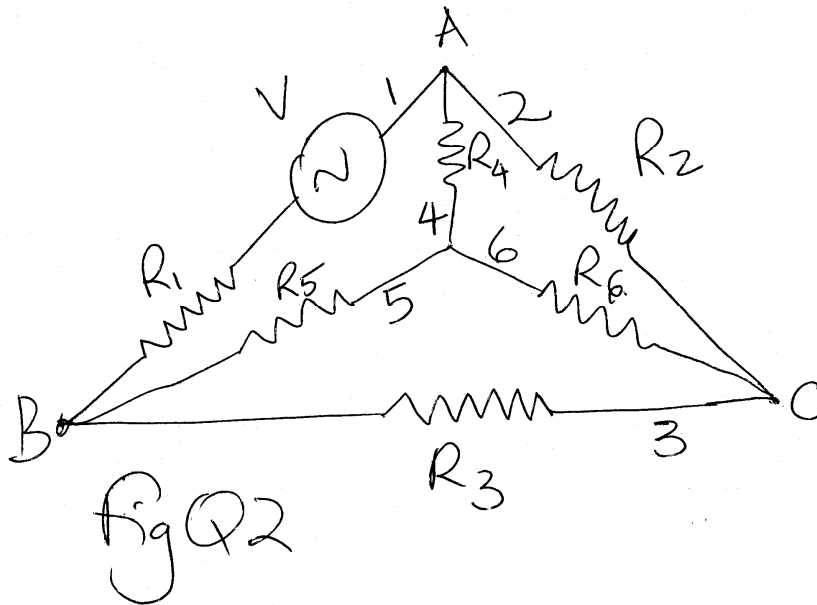


Fig Q1



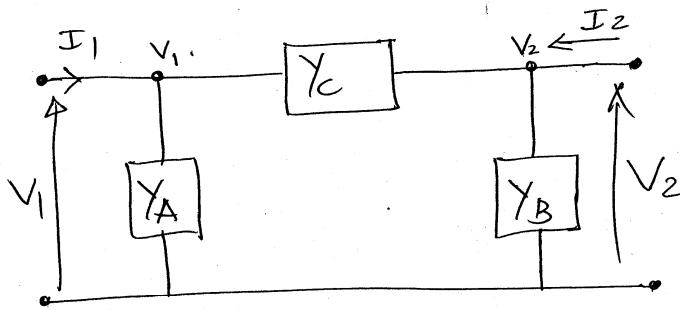


Fig Q3a.

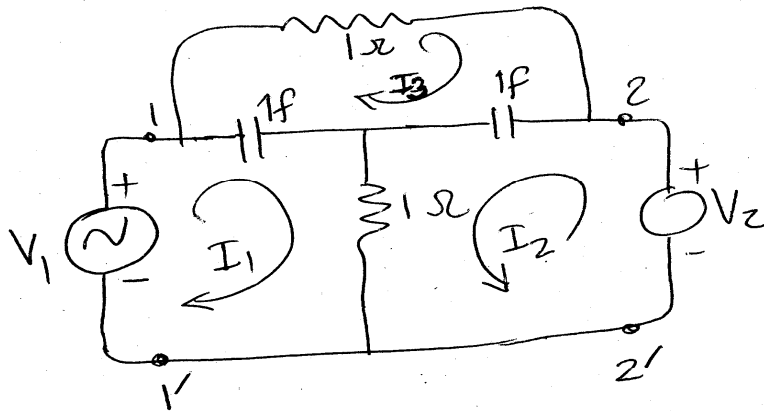


Fig Q3b

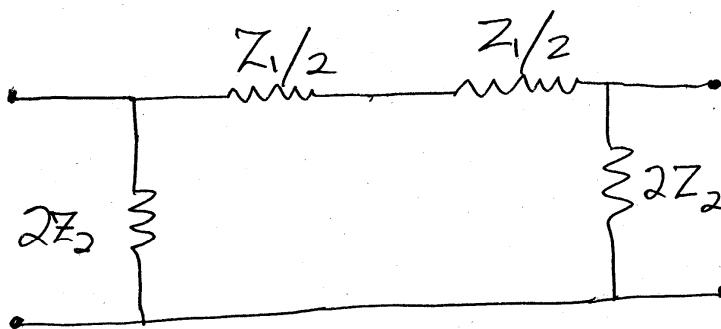


Fig Q4.