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GAILLIMH

NATIONAL UNIVERSITY OF IRELAND,
GALWAY

SEMESTER 1 (WINTER) EXAMINATIONS 2000-2001

3rd year B.Sc.Unit CS308 : Computer Modelling

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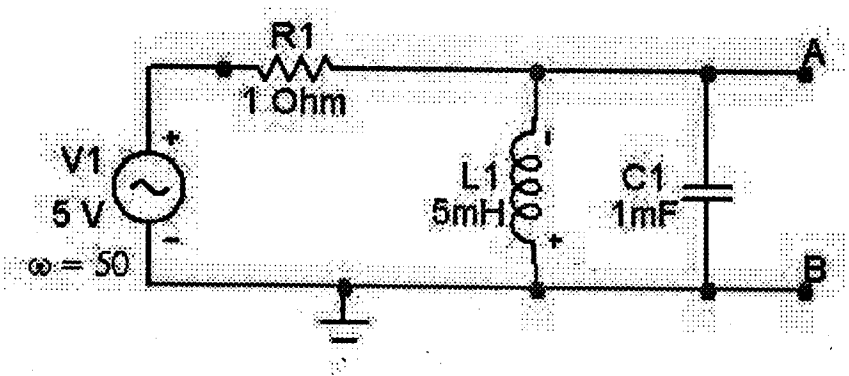
Time allowed : ONE and a HALF hours.	Answer TWO questions

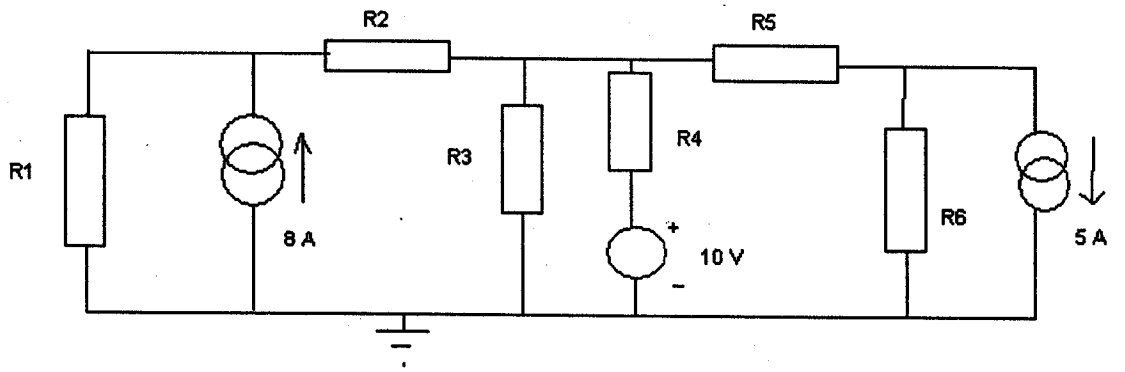
Q.1 In relation to electronic circuits state and explain the following:
Kirchhoff's Laws, Thevenin's theorem, Norton's theorem.

Using complex representation find the Thevenin and Norton equivalent circuits at the terminals A, B, for the circuit shown below



P.T.O.

Q.2 Explain what are meant by the *Complete* and *Reduced Incidence Matrices* in general Nodal Analysis circuit theory, and give the rules for their construction.
Draw up a carefully labelled (showing the nodes and branches) directed graph for the circuit shown below and construct its Incidence Matrix, [A]. Write down the numerical values of the Source Vectors, [E] and [J], for the circuit.



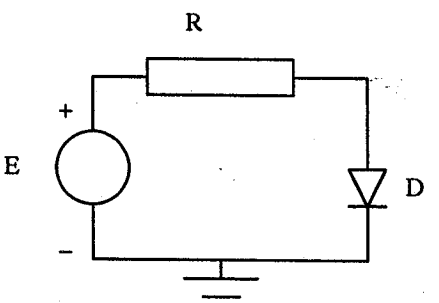
Do NOT attempt to solve for numerical values, but explain what other matrices would be required to solve for the unknown node voltages. Name the new matrices you introduce, and state the general matrix equations which would be used to obtain the complete nodal analysis solution.

Q.3 Answer parts (a) and (b)

(a) Use Gaussian Elimination and Back Substitution to solve the following system of simultaneous equations:

$$x_1 + 2x_2 + 2x_3 = 1$$
$$x_1 + 2x_2 + x_3 = 4$$
$$2x_1 + x_2 + 4x_3 = 2$$

(b)



In the circuit above, D is a Diode with characteristic equation $i = I_s \exp(40V)$, where $I_s = 10^{-12}$ A, R = 800Ω and E = 5V DC.
Explain how Newton Iteration can be used to find the diode bias.
Assuming an initial voltage of 0.75 V across the diode, calculate the initial diode current.
Calculate the diode voltage and current after one iteration of the Newton procedure.