UNIVERSITY OF SWAZILAND

FACULTY OF SCIENCE & ENGINEERING

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

MAIN EXAMINATION DECEMBER 2014

TITLE OF PAPER: BASIC ELECTRICAL ENGINEERING	
COURSE CODE:	**EE251**
TIME ALLOWED:	**THREE** HOURS

INSTRUCTIONS:

1. Answer all questions
2. Each question carries 20 marks.
3. Marks for different sections are shown in the right-hand margin.

This paper has 5 pages including this page.

DO NOT OPEN THE PAPER UNTIL PERMISSION HAS BEEN GRANTED BY THE INVIGILATOR.

Question 1

a) Determine the nodal voltages for the network of Figure 1 (a) (10 marks)

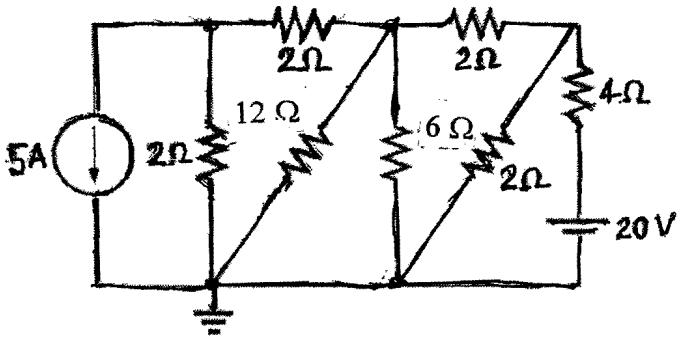

Figure 1(a)

b) For Figure 1(b) identify resistors which are connected in delta and then replace them with a Y equivalent. Redraw the circuit and then find the voltage across the current source marked 3A. (10 marks)

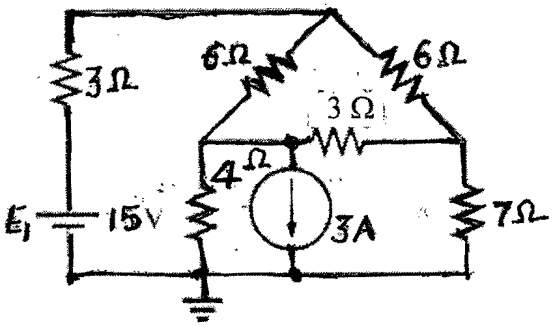

Figure 1(b)

Question 2

a) Find the equivalent capacitance between terminals x and y for the circuit shown in Figure 2(a). (4 marks)

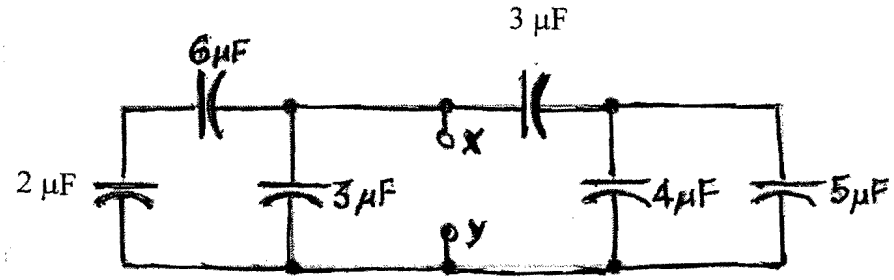

Figure 2(a)

Question 2 (continued)

b) For the series circuit shown in figure 2 (b):

i. The resonance frequency f_o, (3 marks)

ii. The quality factor Q_s, (3 marks)

iii. The bandwidth BW, (3 marks)

iv. The half power frequencies, (4 marks)

v. The total impedance of the circuit at resonance (3 marks)

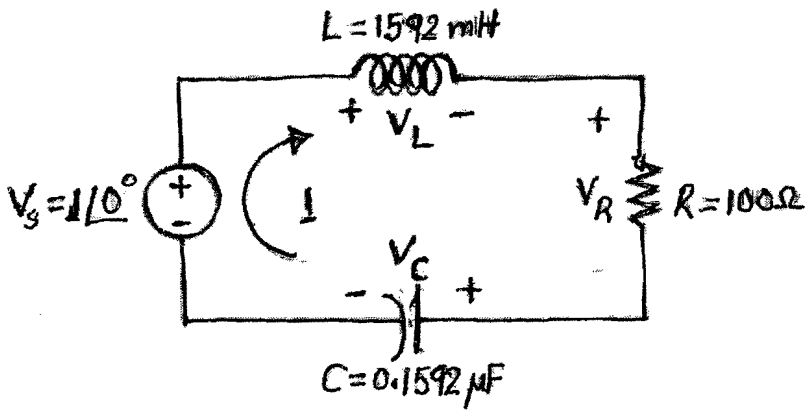

Figure 2(b)

Question 3

For the network of Figure 3:

a) Apply Thevenin's theorem the 80 mH inductor . (6 marks)

b) Find the expression for the transient of the current i_L and the voltage v_L after the closing of the switch ($I_L = 0$) (8 marks)

c) Draw the resultant waveforms for i_L and v_L on the same graph. (6 marks)

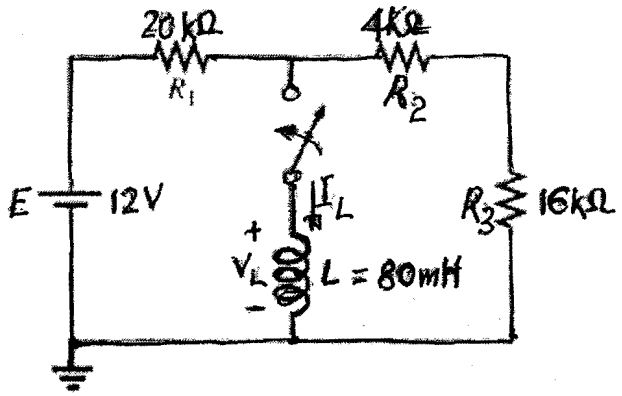

Figure 3

Question 4

For the series-parallel circuit shown in Figure 4

(a) Draw the magnetic circuit equivalent and label the flux densities (Φ_1, Φ_2) and the reluctances (6 marks)

(b) If $\mu = 6 \times 10^{-5}$ find H_{bcde} (3 marks)

(c) Use Ampere's circuital law to find H_{be} (3 marks)

(d) Find the total flux density Φ_T (3 marks)

(e) Find the current I (5 marks)

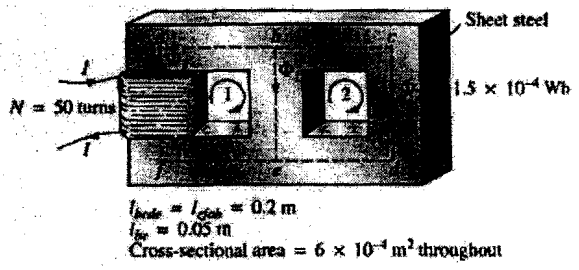

Figure 4

Question 5

A DC machine having the armature resistance of 0.30 Ω and the field resistance of $R_F = 500\ \Omega$ operates as a motor at a speed of 1200 rpm with induced armature voltage $E_A = 145$ V. If the speed is changed to 600 rpm the armature current $I_A = 30$A and field current $I_F = 2.5$ A. Find

a) the voltage applied to the field circuit (3 marks)

b) the voltage V_T applied to the armature (8 marks)

c) the developed torque, and (6 marks)

d) the developed power. (3 marks)