NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

APPLIED PHSYICS DEPARTMENT

SPH 1206 – ELECTRICAL CIRCUITS AND ELECTRONICS

BSc HONOURS PART I: *JANUARY 2003* *DURATION: 3 HOURS*

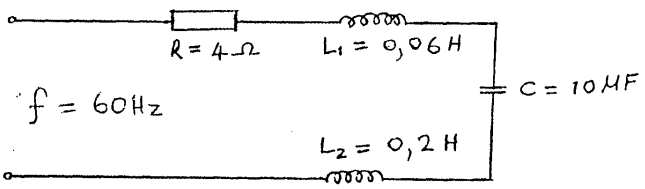
ANSWER **ALL** PARTS OF QUESTION 1-IN SECTION A AND ANY **THREE** QUESTIONS FROM SECTION B. SECTION A CARRIES 40 MARKS AND SECTION B 60 MARKS

SECTION A

1. (a) Find the effective values of the following waveforms:

   (i) $v = 20 \sin (754t + 30°C)$,
   (ii) $i = 1.76 \cos (377t - 10°)$. [5]

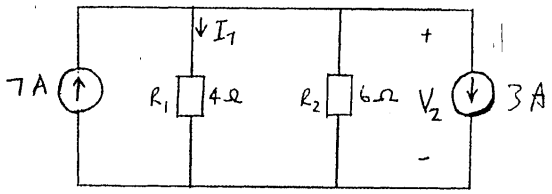
   (b) Calculate the impedance of the following circuit. Express your answer in both rectangular and polar form. [6]



   (c) Describe two functions of a transformer. [4]

   (d) In context to a semiconductor, define each of the following terms:
   (i) depletion region, [1]
   (ii) doping, [1]
   (iii) forward bias, [1]
   (iv) mobility. [1]

(e) Find the voltage V_2 and current I_1 for the network in the figure below.

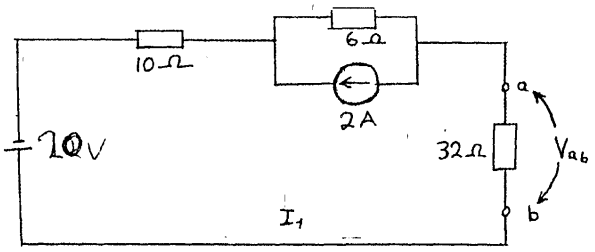


[6]

(f) Give the colour coding of the following resistors:

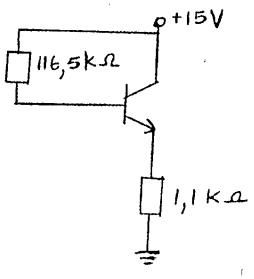
(i) $37k\Omega$,
(ii) 0.11Ω,
(iii) $98M\Omega$,
(iv) $2.2k\Omega$. [4]

(g)



In the network given above convert the current source and the 6 Ω resistor to a voltage source. Find I_1, V_{ab} and the polarity of points '*a*' and 'b'. [6]

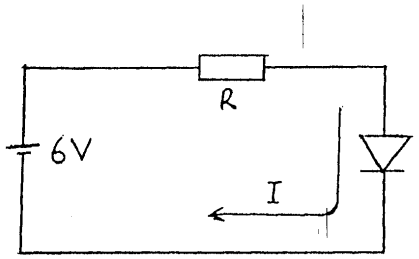
(h) Find I_B, I_E and V_{CE} for the germanium transistor in the following circuit. Assume $\beta = 120$.



[5]

SECTION B

2.

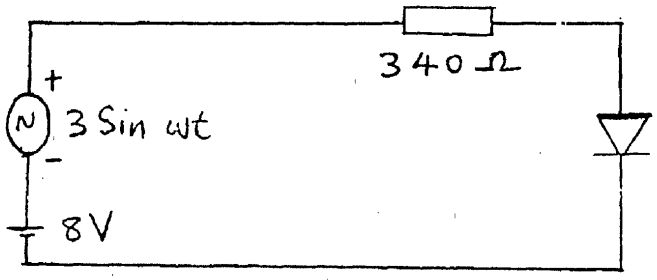


(a) Assuming that the Si diode requires a minimum current of 1mA to be above the knee of its I – V characteristic,

(i) Calculate the value of R to establish 5mA in the circuit. [3]

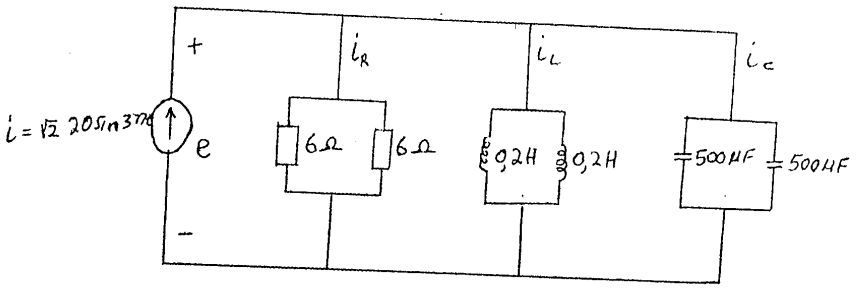
(ii) For the value of R calculated in (i), find the minimum value to which the voltage E could be reduced and which still maintain the diode above the knee? [5]

(b) Assuming that the Silicon diode in the circuit below is biased above the knee and has a bulk resistance of 2.0Ω; find the total current in and total voltage across the diode.



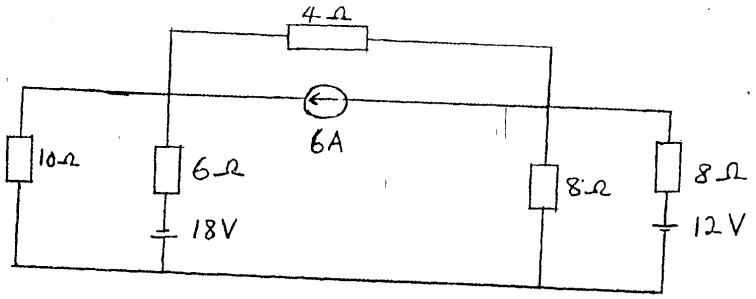
[12]

3.



(a) Compute e, i_R, i_L, and i_c in phasor form. [16]
(b) Compute the total power factor. [4]

4. (a)

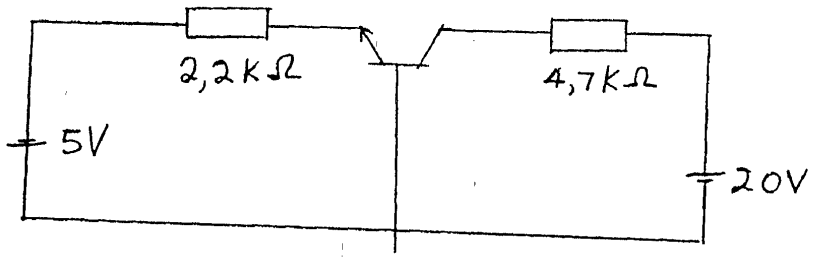


Using Superposition Theorem, find the current through the 10Ω resistor. [20]

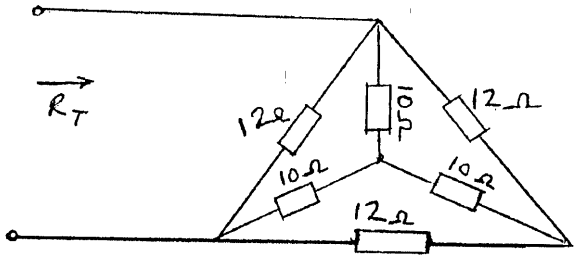
5. (a) Determine the equation of load line for the circuit shown below.

(b) Sketch the line.

[20]

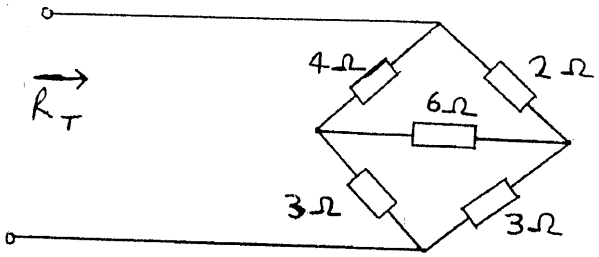


6. (a) Find the total resistance of the network in the figure below.



[10]

(b) Find the total resistance of the network in the figure below.



[10]

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