GREAT ZIMBABWE UNIVERSITY

FACULTY OF EDUCATION

DEPARTMENT OF TEACHER DEVELOPMENT

SUPPLEMENTARY EXAMINATION PAPER

BACHELOR OF EDUCATION HONOURS PART II SEMESTER II

COURSE TITLE	ELECTRICAL CIRCUITS AND ELECTRONICS
COURSE CODE	HPH 124
TIME	3 HOURS

INSTRUCTIONS

Answer **all** questions from Section A and **any three** from Section B.

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SECTION A (40 Marks)

Question 1

(a) Explain the difference between the following:

i. Voltage source and current source. [2]

ii. Open circuit and short circuit. [2]

iii. Branch current and mesh current. [2]

(b) Explain why the emitter region of transistor is more heavily doped than the base and the collector regions. [3]

(c) Sketch the I-V characteristics of a germanium diode in the region -3V to +3V and explain briefly how the forward characteristics arise. [5]

(d) (i) Calculate the total current drawn from the battery in the circuit shown Fig 1. [4]

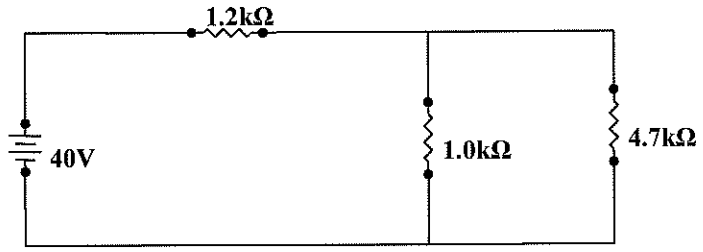

Fig 1

(ii) What is the current in the 4.7 kΩ resistor? [2]

(e) Given the potential drop across some circuit as $v = 250 \sin 300t$ for a current

$i = 15 \sin (300t + 60)$; calculate

i. The frequency of the electric signal. [3]

ii. The RMS voltage. [2]

iii. The power factor. [2]

iv. The apparent power. [2]

(f) Using superposition theorem, calculate the current through 2Ω resistor in the network in Fig 2. [5]

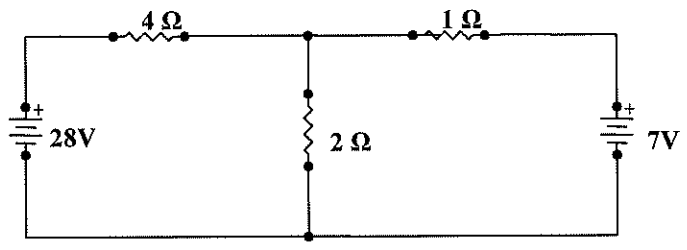

Fig 2

(g) Show that the effective value of a varying electric current i is given by $I_e = \sqrt{\frac{1}{T}\int_0^T i^2 dt}$, where symbols have their usual meanings. [6]

SECTION B (60 Marks)

Answer any three (3) questions from this section.

Question 2

(a) When using the method of mesh analysis, explain how one would define the polarity of potential drops across source and the passive components. [3]

(b) Using the method of mesh current analysis, calculate the currents in the 10Ω resistor and the 4Ω resistor in Fig 3. [10]

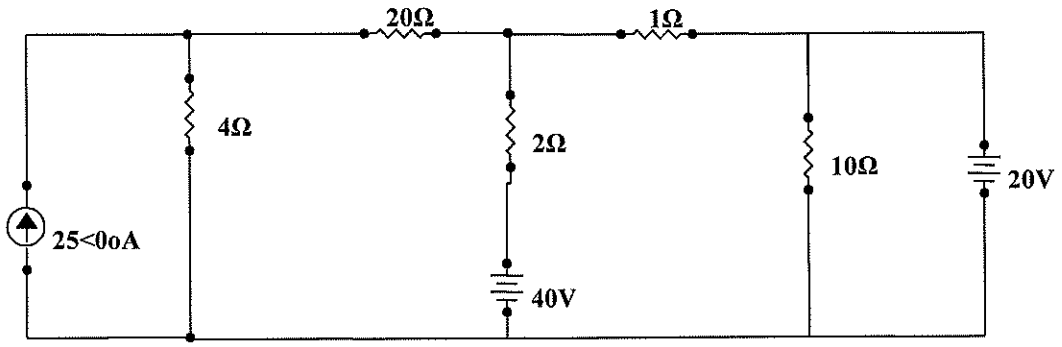

Fig 3

(c) What is the voltage drop across the current source? [3]

(d) Calculate the power supplied by 20V source in the circuit above. [4]

QUESTION 3

(a) State Norton's theorem for a.c. circuits and explain how one would determine the Norton coefficients. [4]

(b) (i) Determine I_N and R_N at port XY in Fig 4. [5]

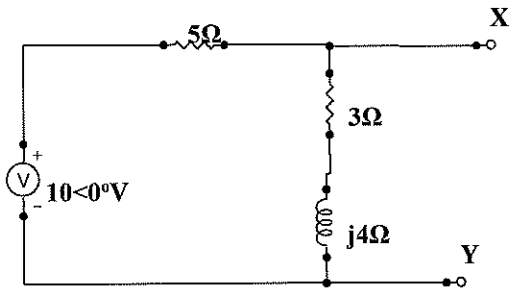

Fig 4

(ii) Hence or otherwise deduce the Thevenin voltage for the network at XY. [3]

(c) (i) Explain the conditions under which the superposition theorem can be applied in circuit analysis. [2]

(ii) Use the superposition theorem to determine the current through the 15 Ω resistor in network shown in Fig 5. [6]

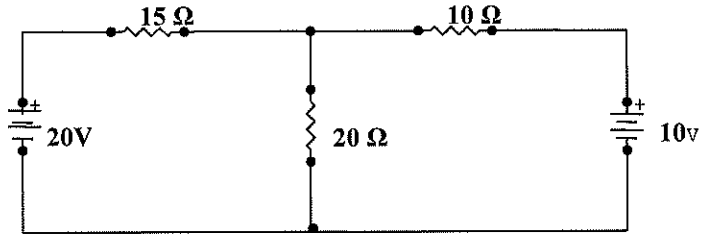

Fig 5

QUESTION 4

(a)

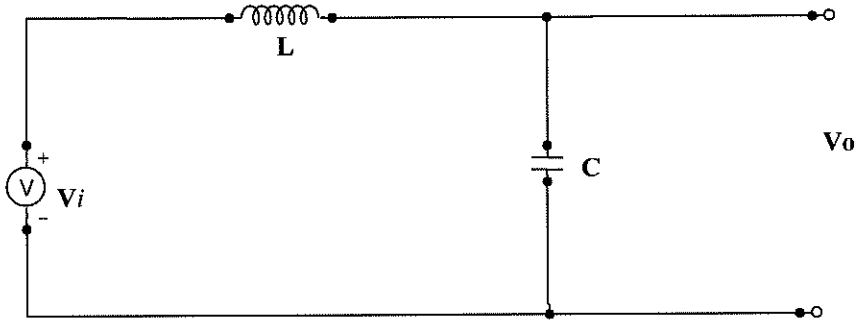

Fig 6

(i) Identify the type of filter shown in Fig 6. [1]

(ii) Deduce an expression for the cut-off frequency in terms of L and C. [2]

(iii) Sketch the frequency response curve of the circuit. [2]

(b) Using the circuit in Fig 7 below:

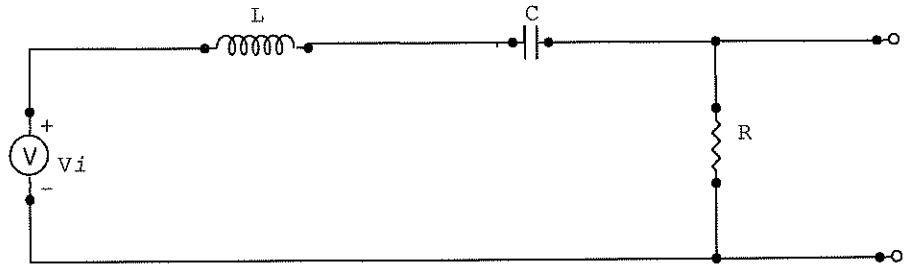

Fig 7

i. Derive expressions for the output voltage V_o, the voltage gain $|A|$ and the phase angle ϕ in terms of the given components; [5]

ii. Use expression obtained in (i) above to show that the circuit is a band pass filter. [3]

iii. Sketch also the variation of the phase angle ϕ with the ω. [2]

(c) If components in the circuit in (b) above have the values L = 50 mH, C = 127 nF and R = 57 Ω, calculate the cut-off frequencies and the bandwidth of the filter. [5]

QUESTION 5

(a) Use the Δ - Y conversion to determine the currents in each resistor in the network shown in Fig 8. [10]

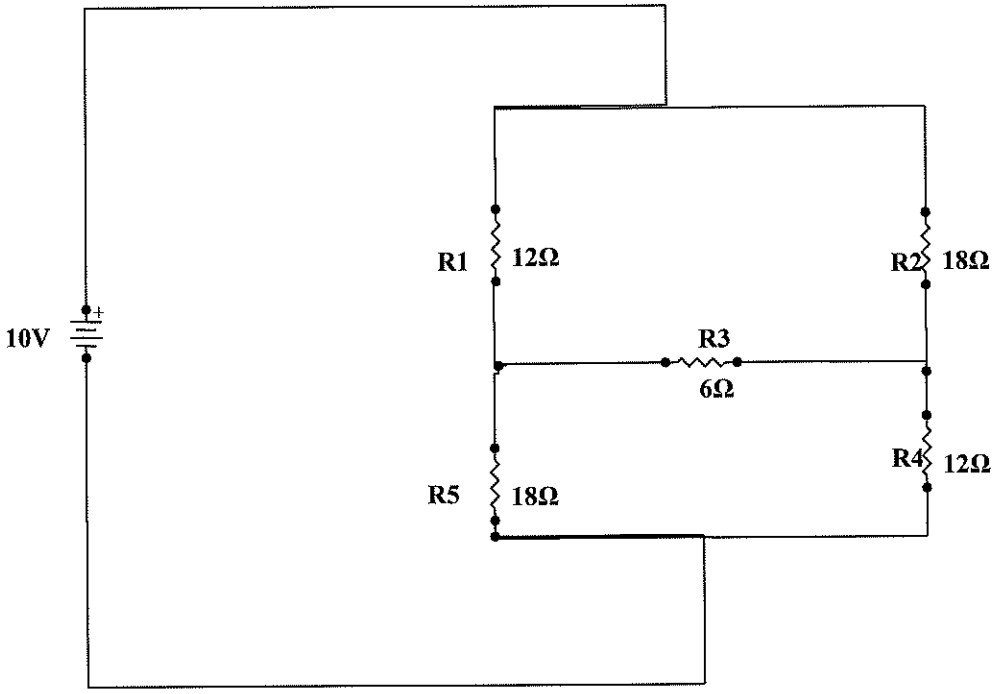

Fig 8

(b) Fig 9 below shows a Wheatstone Bridge circuit. Show that at balance $\frac{R_1}{R_2} = \frac{R_4}{R_3}$ [5]

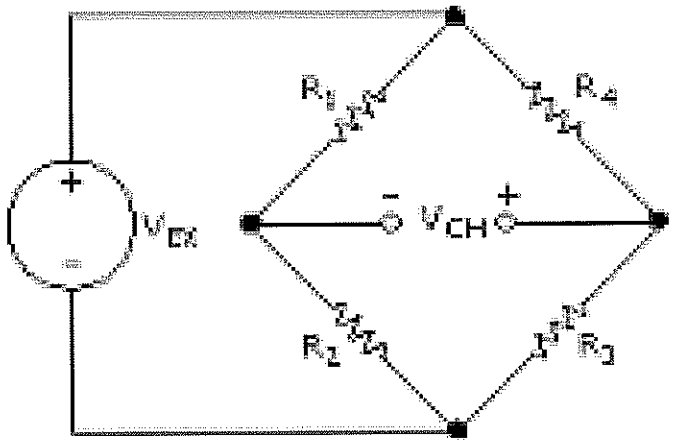

Fig 9

(c) Given that the Bridge in Fig 9 above is balanced, determine the value of R_3 if R_1 = 12kΩ, R_2 = 60 kΩ and R_4 = 10 kΩ, [5]

End Of Paper