



UNIVERSITI KUALA LUMPUR
KAMPUS CAWANGAN MALAYSIAN SPANISH INSTITUTE

FINAL EXAMINATION
OCTOBER 2025 SEMESTER

COURSE CODE : SAB 23103
COURSE NAME : ANALOG CIRCUIT APPLICATION 1
PROGRAMME NAME : BACHELOR OF ENGINEERING TECHNOLOGY IN
APPLIED ELECTRONICS
DATE : 26 JANUARY 2026
TIME : 9.00 AM – 12.00 PM
DURATION : 3 HOURS

INSTRUCTIONS TO CANDIDATES

1. Please CAREFULLY read the instructions given in the question paper.
2. This question paper consists of FIVE (5) QUESTIONS..
3. Answer ANY FOUR (4) questions.
4. Answer all questions in English language ONLY.

INSTRUCTION: Answer ANY FOUR (4) questions.

Please use the answer booklet provided.

Question 1

- (a) State Kirchhoff's Current Law and write the general KCL equation.

(5 marks)

- (b) Figure 1 illustrates a circuit consisting of an independent current source, an independent voltage source, and several resistive elements including the load resistor R_L . Using the assigned source values $I_A = 0.052$ A and $V_B = 8$ V, calculate the current I_{RL} flowing through the load resistor.

(20 marks)

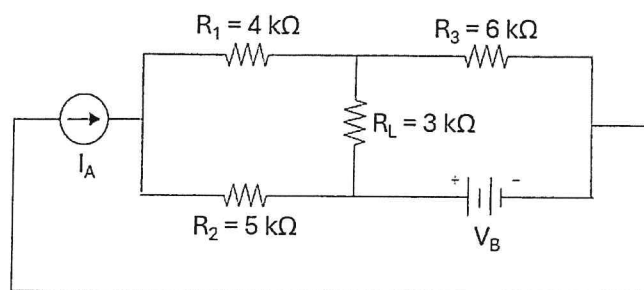


Figure 1: Circuit with independent sources and resistive elements.

Question 2

(a) Define the Superposition Theorem.

(3 marks)

(b) The current I_o flows through the $5\ \Omega$ resistor in the direction shown in Figure 2. By applying the Superposition Theorem, calculate the value of I_o for the given circuit that includes independent sources and a dependent voltage source of $5I_o$.

(10 marks)

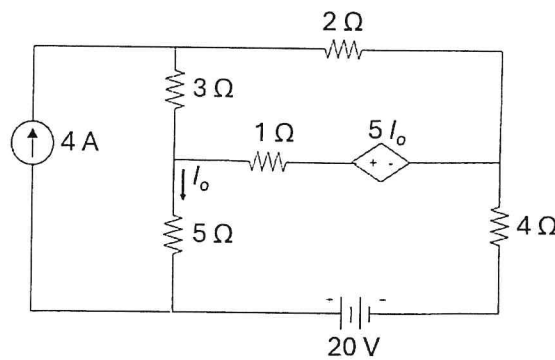


Figure 2: Circuit used for analysis using the Superposition Theorem.

(c) Apply Norton's Theorem to the circuit shown in Figure 3 below to find the Norton equivalent seen at the load resistor R_L . Assume all components are ideal and the circuit operates under steady-state DC conditions.

i. Calculate the Norton current, I_N .

(6 marks)

ii. Determine the Norton equivalent resistance, R_N .

(4 marks)

iii. Draw the Norton equivalent circuit for the network.

(2 marks)

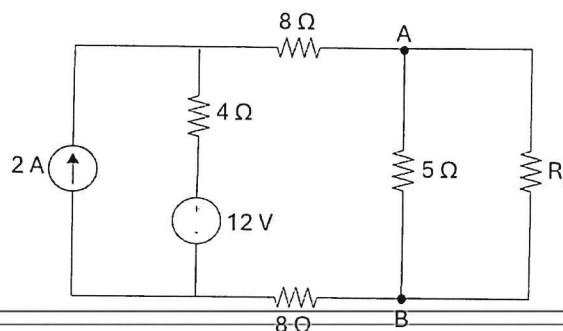


Figure 3: Circuit for Norton equivalent analysis at the load resistor.

Question 3

- (a) Differentiate between a first-order and a second-order circuit in terms of number of energy storage elements and transient behaviour. (4 marks)
- (b) State the three damping cases in a second-order RLC circuit and the condition for each case using the damping ratio (ζ). (6 marks)
- (c) The switch in the circuit in Figure 4 has been closed for a long time, and it is opened at $t = 0$. Calculate;
- The voltage across capacitor when $t < 0$. (5 marks)
 - The voltage across capacitor when $t > 0$. (6 marks)
 - The initial energy stored in the capacitor. (4 marks)

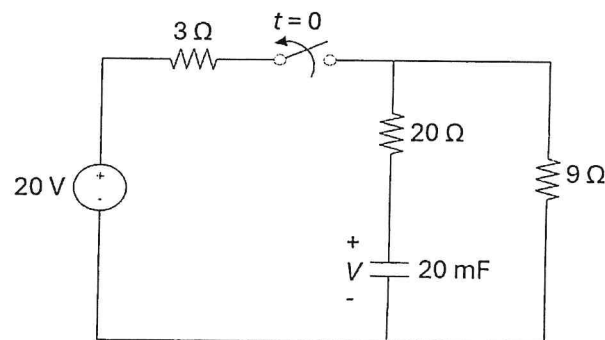


Figure 4: RC circuit with a switching operation for transient analysis.

Question 4

- (a) Define Quality Factor (Q) and bandwidth in a resonant circuit and state the formulas for Q and its relationship with bandwidth. (4 marks)
- (b) Resonance occurs in RLC circuits when the inductive and capacitive reactance become equal in magnitude, resulting in purely resistive impedance. Referring to the RLC configurations shown in Figure 5.
- i. Derive an expression for the resonant frequency of parallel circuit. (14 marks)
- ii. Using the expression derived in (i), calculate the resonant frequency if $R = 1 \text{ k}\Omega$, $L = 22 \text{ mH}$, $C = 1 \text{ }\mu\text{F}$. (7 marks)

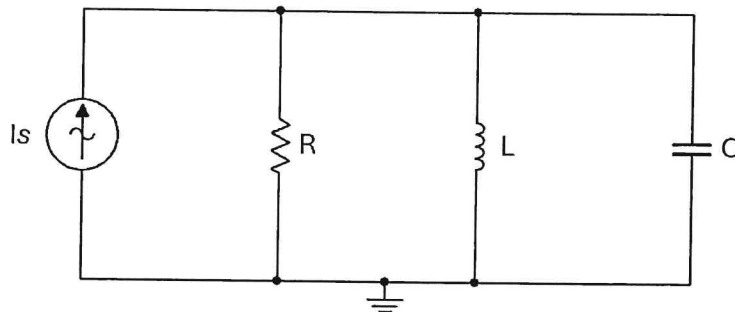


Figure 5: Parallel RLC circuit used for resonance analysis.

Question 5

Design a band-pass filter using an RLC circuit such that it achieves a center (resonant) frequency of 20 kHz and a bandwidth of 5 kHz, based on the circuit shown in Figure 6. Assume the capacitor value is $C = 5 \mu F$.

- i. Determine the suitable values of R and L to satisfy the specified filter characteristics.

(10 marks)

- ii. Derive the transfer function of the designed RLC band-pass filter in terms of R, L and C.

(15 marks)

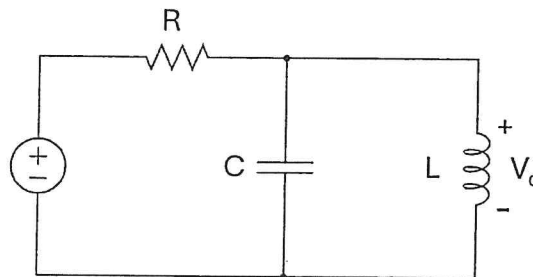


Figure 6: RLC band-pass filter circuit for frequency response design.

END OF EXAMINATION PAPER

