

LOCATION: SWANSEA

LLEOLIAD: ABERTAWE

LEVEL 4

LEFEL 4

EXAMINATION PERIOD
MAY 2026

CYFNOD ARHOLIADAU
MAI 2026

MODULE CODE: GOEE4003

ELECTRICAL AND ELECTRONICS PRINCIPLES

TIME: 2 HOURS

ANSWER ALL QUESTIONS

Show all workings clearly

Equipment or materials required – calculators & formula book

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Question One (20 marks)

- a. A 20 V DC supply is connected to a network of six resistors arranged in a combination of series and parallel, as shown in Figure 1. The resistor values are: $R_1 = 24\ \Omega$, $R_2 = 12\ \Omega$, $R_3 = 8\ \Omega$, $R_4 = 2\ \Omega$, $R_5 = 6\ \Omega$, and $R_6 = 10\ \Omega$. Calculate the following:

1. equivalent resistance of the circuit [5]
2. The total current supplied by the source [1]
3. The total power dissipated in the circuit [1]
4. The voltage across the $10\ \Omega$ resistor [1]
5. Determine the voltage across terminals a–b [2]
6. The current through the $2\ \Omega$ resistor [1]
7. The voltage across the $6\ \Omega$ resistor [1]
8. The voltage across the $8\ \Omega$ resistor [2]
9. The current through the $24\ \Omega$ resistor [2]

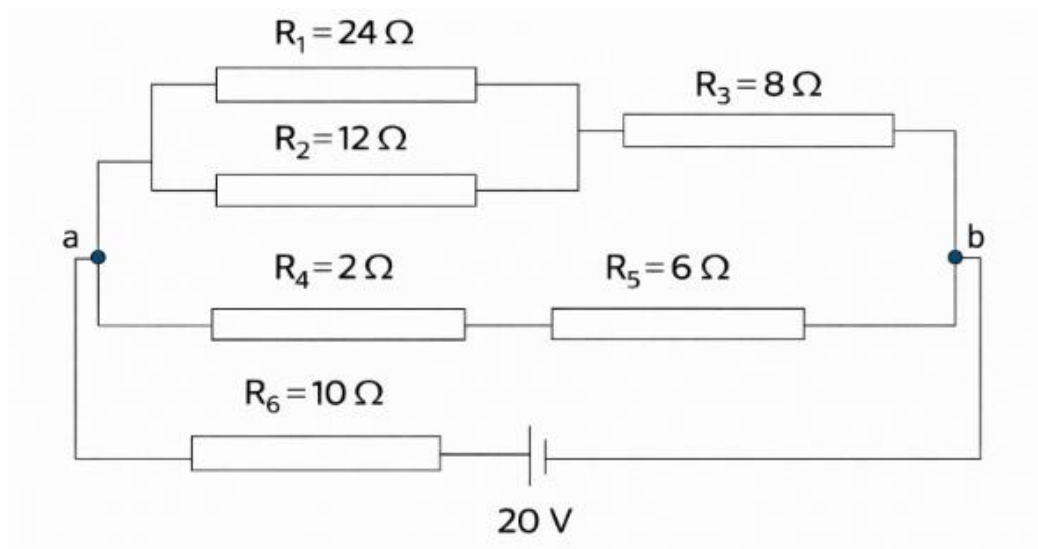


Figure 1

- b. In the circuit shown in Figure 2, the current through the $1\ \Omega$ resistor is 4 A . Assuming the battery has negligible internal resistance, determine the terminal voltage V .

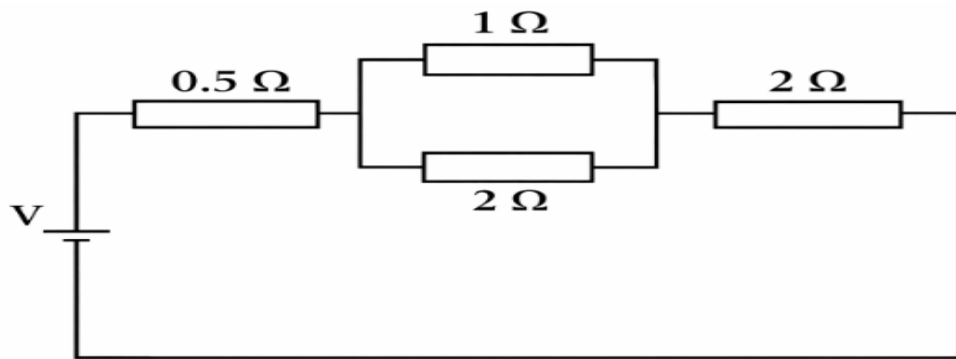


Figure 2

[4]

Question Two (30 marks)

- a. For the circuit shown in Figure 3, determine the current flowing through the $12\ \Omega$ resistor and the power dissipated in this resistor.

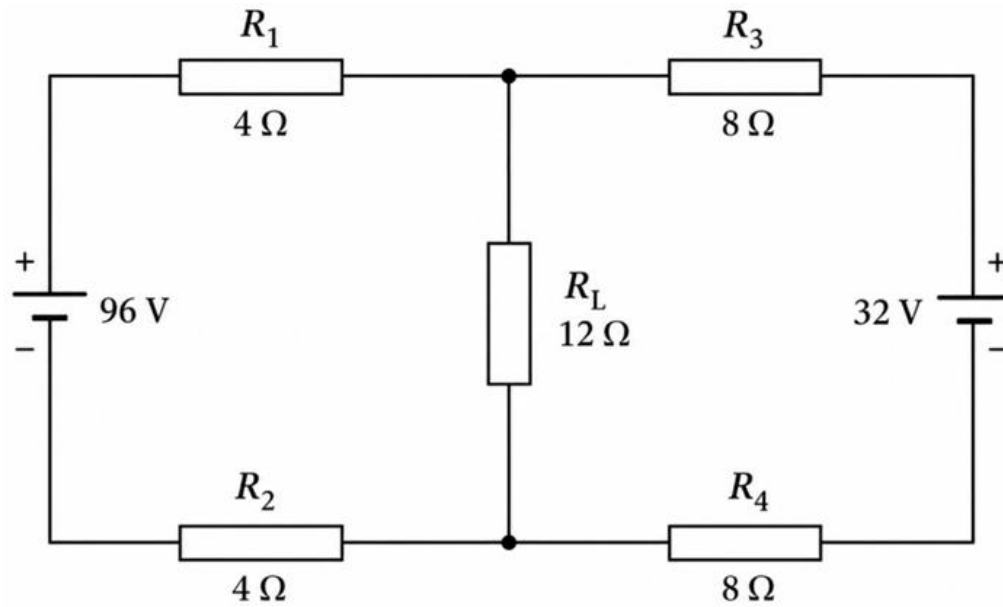


Figure 3

[15]

b. For the circuit shown in Figure 4, find:

1. The Thevenin equivalent circuit for the network [8]
2. The value of the resistance R that results in maximum power transfer across the terminals AB [2]
3. The maximum power transferred in the load [2]
4. Find Norton's equivalent circuit for the network. [3]

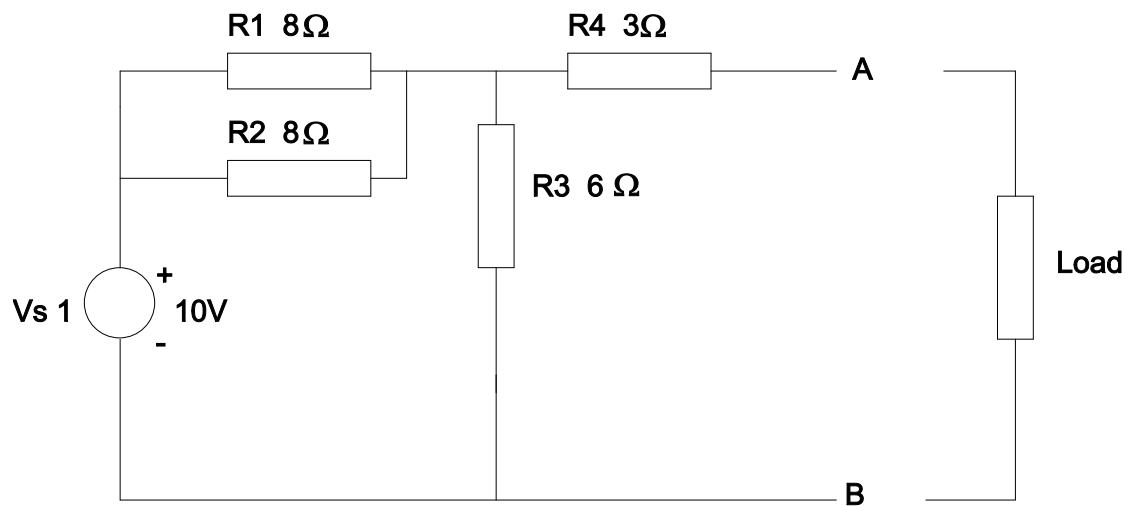


Figure 4

Question Three (20 marks)

A series RLC circuit is supplied from a 200 V rms, 50 Hz single-phase AC source, as shown in Figure 5. The circuit consists of a resistor of $8\ \Omega$, an inductor of 32 mH and a capacitor of $800\ \mu\text{F}$. Calculate:

1. The circuit impedance Z [7]
2. The current flowing in the circuit [1]
3. The voltage across each component [3]
4. The phase angle between voltage and current [2]
5. The value of the net reactance required for the magnitude of the circuit impedance to be $100\ \Omega$. [5]
6. State whether the circuit would be inductive, capacitive or at resonance for the condition found in part (5), giving a reason for your answer. [2]

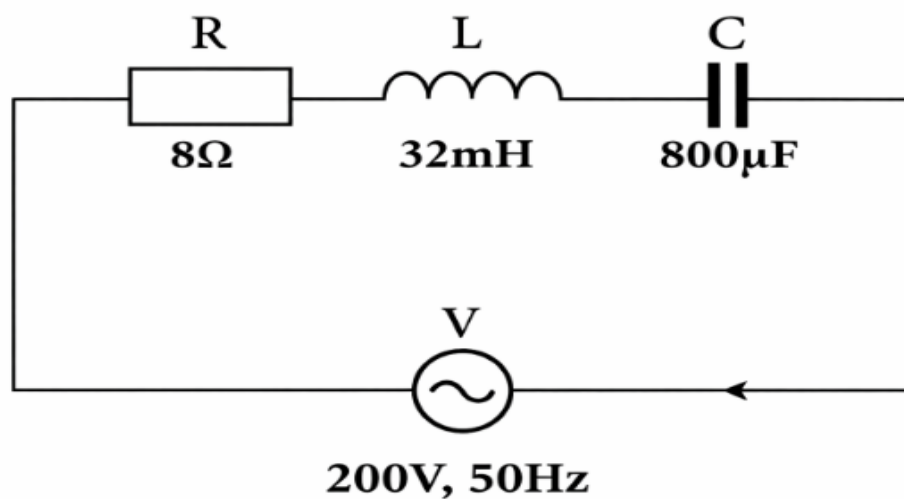


Figure 5

Question Four (30 marks)

- a. Figure 6 shows a single stage common emitter amplifier. Under DC operating conditions, the transistor has a collector current $I_C = 2mA$ and $V_{CE} = 10V$. Assume: $V_{BE} = 0.7V$, $I_E = I_C$ and the base current is negligible compared to the divider current. Calculate:

1. The emitter voltage V_E [2]
2. The base voltage V_B [2]
3. The voltage across R_1 [2]
4. The current going through R_2 [1]
5. The resistance value of R_1 [1]
6. The collector voltage V_C [2]
7. The resistance value of R_C [2]

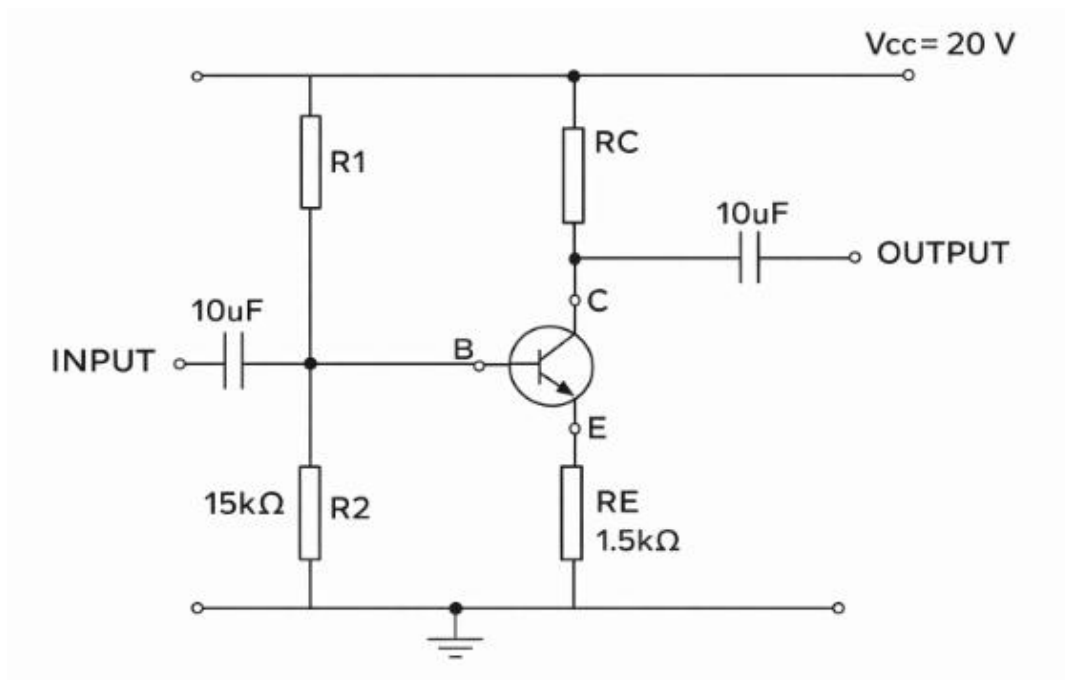


Figure 6

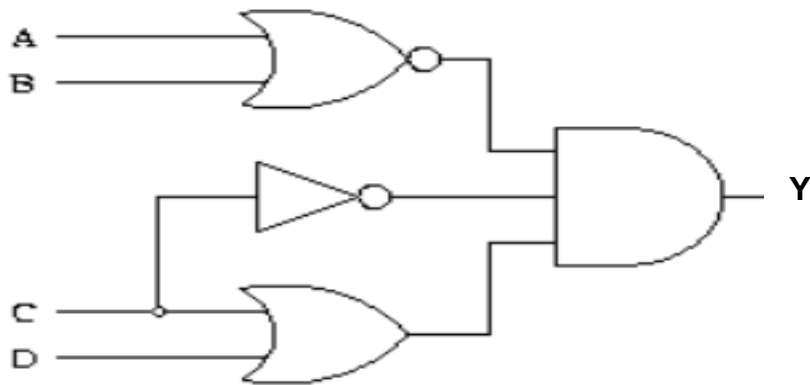
b. Draw the logic circuit design for the following Boolean equations below.

1. $output = A + BC + \bar{D}$ [3]

2. $output = (AB) + \overline{(AC)}$ [3]

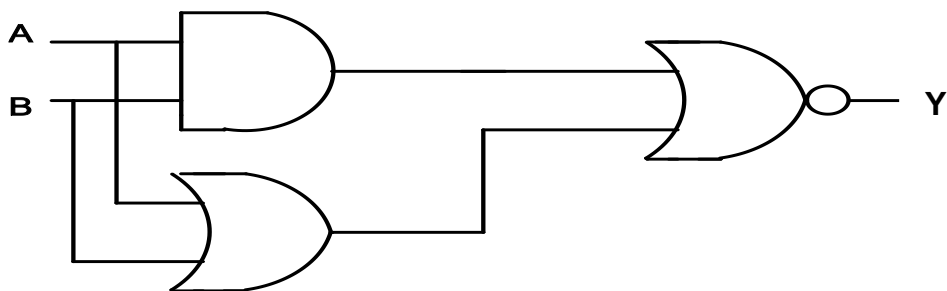
c. Write Boolean algebraic expressions for the circuits below.

1.



[3]

2.



[3]

d. Simplify the output function Y using DeMorgan's theorem.

$$Y = \overline{(\overline{A + B})(\overline{B + C})}$$

[6]

END