



ZIMBABWE

**MINISTRY OF HIGHER AND TERTIARY EDUCATION,
INNOVATION, SCIENCE AND TECHNOLOGY
DEVELOPMENT**

**HIGHER EDUCATION EXAMINATIONS COUNCIL
(HEXCO)**

NATIONAL CERTIFICATE

IN

ELECTRICAL POWER ENGINEERING

MODULE: Electrical and Electronic Principles 2 PAPER NO: 321/22/M05/2

DURATION: 3 Hours

NOVEMBER/ DECEMBER 2025 EXAMINATION

REQUIREMENTS

Non programmable scientific calculator

INSTRUCTIONS TO CANDIDATE

- 1) Answer all questions.**
- 2) All questions carry equal marks.**
- 3) Show sufficient steps to justify your answer.**
- 4) Each question starts on a new page.**

QUESTION 1

State the following theorems

- a) Kirchhoff's laws (4 marks)
- b) Superposition theorem (2 marks)
- c) Maximum power transfer theorem (2 marks)
- d) Thevenin's theorem (2 marks)

QUESTION 2

Determine using Kirchhoff's law each branch current for the network shown in fig 1. (10 marks)

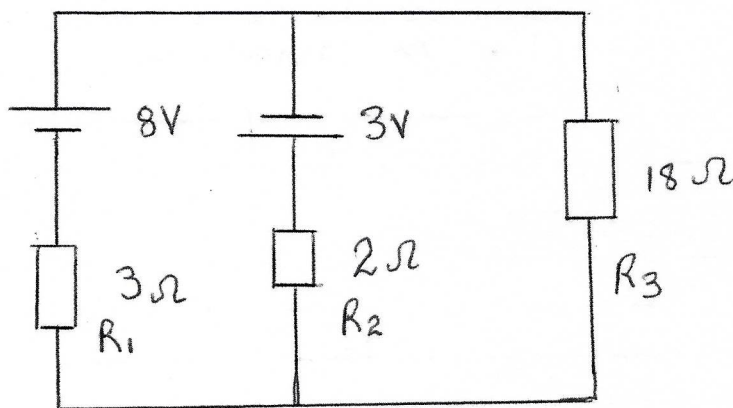


Fig 1

QUESTION 3

Capacitor of $0.1\mu F$ is charged from a 100V dc supply through a resistance of $1k\Omega$. Determine:

- a) Voltage across the capacitor at $t = 1$ time constant. (4 marks)
- b) The circuit current at $t=1$ time constant. (3 marks)
- c) The transfer of energy rate at $t=1$ time constant. (3 marks)

QUESTION 4

An inductive coil is connected to a 250V, 50Hz supply and takes a current of 5A. the coil dissipates 750W:

Calculate

- a) Power factor (3 marks)

- b) Resistance of coil (3 marks)
- c) Inductance of coil (4 marks)

QUESTION 5

Draw the following waves:

- a)
 - i) Saw tooth wave (1 mark)
 - ii) Triangular wave (1 mark)
 - iii) Rectangular wave (1 mark)
- b) An alternating voltage is given by $V=75 \sin (200\pi t - 0,25)$ volts. Find
 - i) Amplitude (1 mark)
 - ii) Periodic time (1 mark)
 - iii) Peak to peak value (1 mark)
 - iv) Frequency (1 mark)
 - v) RMS value (1 mark)
 - vi) The phase angle (2 marks)

QUESTION 6

The circuit shown fig 2 consist of three impedances which are connected in series across a 40V, 20kHz supply: calculate

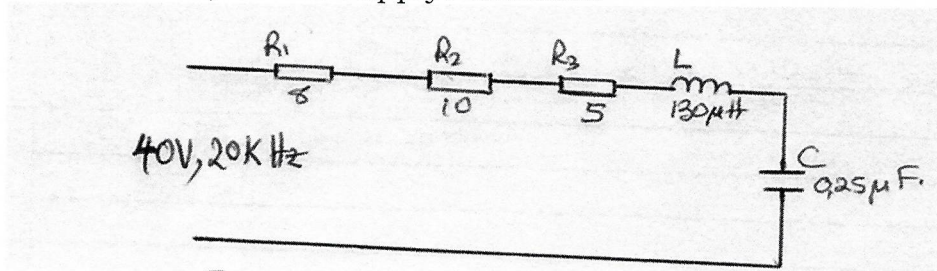


Fig 2

- a) The circuit current (4 marks)
- b) The circuit phase angle (3 marks)
- c) The voltage drop across each impedance (3 marks)

QUESTION 7

- a) Define the Q factor of a circuit. (2 marks)

- b) A coil of inductance $0,2H$ and resistance of 60Ω is connected in parallel with $20\mu F$ capacitor across a $20v$ variable frequency supply. Calculate:
- i) The resonant frequency (3 marks)
 - ii) The dynamic resistance (2 marks)
 - iii) The current at resonance (1 mark)
 - iv) The circuit Q factor (2 marks)

QUESTION 8

- a) State four (4) ideal characteristics of an Op amp. (4 marks)
- b) Calculate the common mode rejection ratio of an op amp with the following circuit measurements:
 $V_d = 1mV$
 $V_o = 120mV$
 $V_c = 1mV$
 $V_o = 120\mu V$ (6 marks)

QUESTION 9

- a) A multi input inverter op amp has an output equal to $(-4v_1 + 1V_2)$ given that the feedback resistor has a value of $100k\Omega$. Calculate the value of R_1, R_2 . (6 marks)
- b) Draw the circuit diagram representing the above (a). (4 marks)

QUESTION 10

- a) Draw the logic symbol and the truth table of a three input NAND gate. (5 marks)
- b) Simplify the following Boolean expression.
$$y = (\bar{A} + B)(A + B)$$
 (5 marks)

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