FACULTY OF ENGINEERING

END OF SEMESTER EXAMINATIONS - APRIL 2025

PROGRAMME: DIPLOMA IN ELECTRICAL AND CONTROL ENGINEERING

YEAR/SEM: YEAR 1/SEMESTER 2

COURSE CODE: DEE1202

NAME: ELECTRICAL ENGINEERING SCIENCE II

DATE: 2025-04-14

TIME: 2:00-5:00PM

INSTRUCTIONS TO CANDIDATES:

1. Read the instructions very carefully

2. The time allowed for this examination is STRICTLY three hours

3. Read each question carefully before you attempt and allocate your time equally between all the Sections

4. Write clearly and legibly. Illegible handwriting cannot be marked

5. Number the questions you have attempted

6. Use of appropriate workplace examples to illustrate your answers will earn you bonus marks

7. Any examination malpractice detected will lead to automatic disqualification.

DO NOT WRITE ANYTHING ON THE QUESTION PAPER

Section A Attempt any 2 questions in Section A

Question 1:

A circuit consists of a 10μF capacitor connected in series with a 25kΩ resistor with a switchable 100Vd.c. supply. When the supply is connected,
Calculate
    a. The time constant (03 marks)
    b. The maximum current (03 marks)
    c. The voltage across the capacitor after 0.5s (04 marks)
    d. The current flowing after one time constant (04 marks)
    e. The voltage across the resistor after 0.1s (05 marks)
    f. The time for the capacitor voltage to reach 45V (06 marks)

Question 2:

    a. Explain briefly what happens when a capacitor is connected in series with a resistor across a DC supply source. Write relevant equations to support your answer (09 marks)
    b. A capacitor is charged to 100V and then discharged through a 50kΩ resistor. If the time constant of the circuit is 0.8s, determine:
      i.   The value of the capacitor (04 marks)
     ii.   The time for the capacitor voltage to fall to 20V (04 marks)
    iii.   The current flowing when the capacitor has been discharging for 0.5s (04 marks)
    iv.   The voltage drop across the resistor when the capacitor has been discharging for one second. (04 marks)

Question 3:

    a. An alternating current completes 5 cycles in 8ms. What is its frequency? (04 marks)
    b. An alternating voltage v has a periodic time of 20ms and a maximum value of 200V. When time t=0, v=−75volts. Deduce a sinusoidal expression for v and sketch one cycle of the voltage showing important points. (05 marks)
    c. Plot a sine wave of peak value 10.0A. Show that the average value of the wave form is 6.37A over half a cycle, and that the r.m.s. value is 7.07A (10 marks)
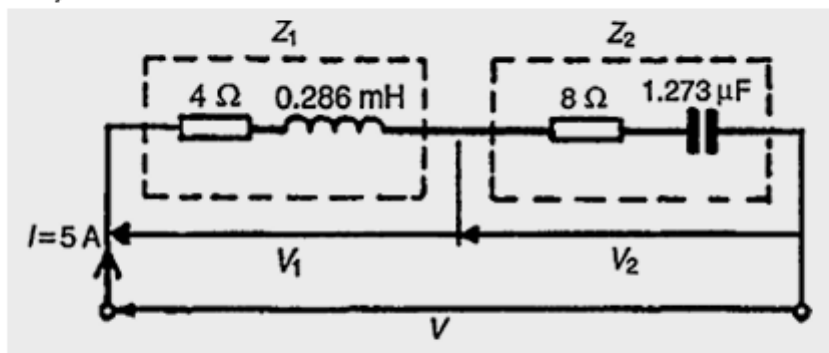   d. Determine the peak and mean values for a 240V mains supply. (05 marks)

Question 4:

a. Explain briefly what happens when a capacitor is connected in series with a resistor across a DC supply source. Write relevant equations to support your answer (09 marks)
b. A coil of inductance 0.04H and resistance 10Ω is connected to a 120V d.c. supply. Determine
    i.   The final value of current,
    ii.   The time constant of the circuit
    iii.   The value of current after a time equal to the time constant from the instant the supply voltage is connected

Section B Attempt any 2 questions in Section B

Question 1:

a. Define the term Resonance in an R-L-C circuit (02 marks)
b. Determine the p.d.s V_1 and V_2 for the circuit shown in Figure if the frequency of the supply is 5 kHz, determine the supply voltage V and the circuit phase angle. (13 marks)

b. The current at resonance in a series L–C–R circuit is 100µA. If the applied voltage is 2mV at a frequency of 200 kHz, and the circuit inductance is 50µH, find
    i.   The circuit resistance (05 marks)
    ii.   The circuit capacitance. (05 marks)

Question 2:

a. Explain briefly what happens when a capacitor is connected in series with a resistor across a DC supply source. Write relevant equations to support your answer (09 marks)
b. A coil of inductance 0.04H and resistance 10Ω is connected to a 120V d.c. supply. Determine
    i.   The final value of current,
    ii.   The time constant of the circuit
    iii.   The value of current after a time equal to the time constant from the instant the supply voltage is connected

Question 3:

A coil consists of a resistance of 100Ω and an inductance of 200 mH. If an alternating voltage, v, given by $v=200\sin500t$ volts is applied across the coil,
Calculate
    (a) The circuit impedance, (5 marks)
    (b) The current flowing, (5 marks)
    (c) The p.d. across the resistance, (5 marks)
    (d) The p.d. across the inductance (5 marks)
    (e) The phase angle between voltage and current. (5 marks)

Question 4:

a. A transformer has a rated output of 200kVA at a power factor of 0.8. Determine the rated power output and the corresponding reactive power. (05 marks)
b. A circuit consisting of a resistor in series with a capacitor takes 100 watts at a power factor of 0.5 from a 100V, 60Hz supply.
Find
    i.   The current flowing (05 marks)
    ii.   The phase angle (05 marks)
    iii.   The resistance, the impedance (05 marks)
    iv.   The capacitance. (05 marks)