Summer Examinations 2015

ENG100515N

Module Title: Electrical Principles
Level: Four
Time Allowed: Two hours

Instructions to students:

- Enter your student number **not** your name on all answer books.
- Answer **all** questions.
- All questions carry equal marks. Where a question has more than one part the division of marks is stated.
- Begin each answer on a separate page; label each page clearly with the number of the question you are answering.
- Neither books nor notes can be taken into the examination.
- The use of a non-programmable scientific calculator is permitted.
- Graph paper and a formula booklet will be provided.
- Students are permitted to remove this examination paper at the end of the examination.

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Answer all questions.

Question 1

Considering the circuit in Figure Q1:

a. Find the power dissipated in the load (75 Ω resistor) using Thevenin’s Theorem. (15 marks)

b. Find the value of the load resistance that will dissipate the highest power. (5 marks)

Figure Q1

Total: 20 marks

Question 2

Considering the circuit shown below in Figure Q2:

a. Determine the currents flowing through all of the resistors using Mesh Analysis. (15 marks)

b. Calculate the value of the potential difference between a and b. (5 marks)

Figure Q2

Total: 20 marks
Question 3

Refer to the circuits shown in Figure Q3:

a. When \( t=0 \text{s} \), \( S_1 \) is open and the initial capacitor voltage is 2.5 V. Find the voltage drop across the capacitor 50ms after the switch \( S_1 \) is closed.  

\( \text{(10 marks)} \)

b. When \( t=50 \text{ms} \) \( S_2 \) switches to position 2 and the capacitor discharges through a resistor. Determine the final capacitor voltage one second after \( S_2 \) moves to position 2. 

\( \text{(10 marks)} \)

**Figure Q3**

Total: 20 marks
Question 4

Compute the average, peak-peak and rms values for the following periodic waveform in Figure Q4 below:

\[ y(t) = a_0 + a_1 \sin(\omega t) \]

Figure Q4

(20 marks)

Question 5

a. For each of the following, determine the impedance of the circuit element and state whether it is resistive, inductive or capacitive:

i. \( V = 300 \angle -30^\circ \ \text{[V]}, \ \ I = 50 \angle 60^\circ \ \text{[A]} \)

(5 marks)

ii. \( V = 100 \angle 30^\circ \ \text{[V]}, \ \ I = 2 \angle 30^\circ \ \text{[mA]} \)

(5 marks)

b. Find the impedance \( Z_T \) of the circuit shown in Figure Q5. Assume the operating frequency is 100Hz.

Figure Q5

(10 marks)

Total: 20 marks

End of Paper