



**UGANDA INSTITUTE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
END OF SEMESTER ONE EXAMINATIONS**

ACADEMIC YEAR 2024/2025

DEPARTMENT: ICT

SEMESTER: ONE

**PROGRAMME(S): DIPLOMA IN ELECTRICAL AND ELECTRONICS ENGINEERING (DEEE)
DIPLOMA IN ELECTRONICS COMMUNICATIONS ENGINEERING (DECE)**

YEAR OF STUDY: ONE

COURSE: PRINCIPLE OF ELECTRICITY AND MAGNETISM

COURSE CODE : ELT1101

DATE: SUNDAY 15TH, DECEMBER 2024

TIME: 9:00 AM – 12:00 NOON

DURATION: 3 HOURS

INSTRUCTIONS:

- (i) This paper contains two Sections: A (40 marks) & B (60 marks).**
- (ii) Attempt ALL questions in Section A, and ONLY THREE questions in Section B.**
- (iii) All questions in Section B carry equal marks.**
- (iv) Credit will be given for use of relevant examples and illustrations.**
- (v) Begin each number in Section B on a new page of the answer sheet.**
- (vi) DO NOT write on this question paper.**

PRINCIPLES OF ELECTRICITY AND MAGNETISM

SECTION A (20 Marks)

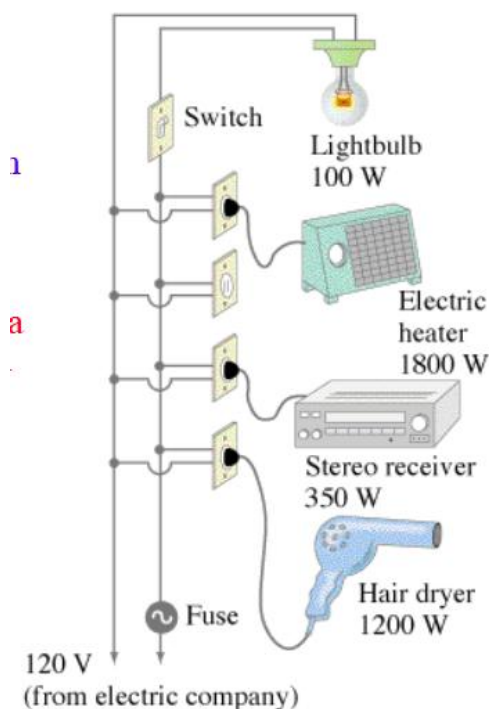
Attempt **ALL** the Questions in this section.

(2 marks @)

1. An electromagnet exerts a force of 12 N and moves a soft iron armature through a distance of 1.5 cm in 40 ms. Find the power consumed
2. An electric heater consumes 1.8MJ when connected to a 250 V supply for 30 minutes. Find the power rating of the heater and the current taken from the supply.
3. A conductor has a conductance of $50\mu\text{S}$. What is its resistance?
4. How long must a current of 100 mA flow so as to transfer a charge of 80 C?
5. Determine the p.d. which must be applied to a 2 k resistor in order that a current of 10 mA may flow.

Consider the household circuit in Figure 1 below, and answer the following

6. If each power outlet has 110V what will be the voltage for each Device
7. What will be the ending result of such a circuit and why?

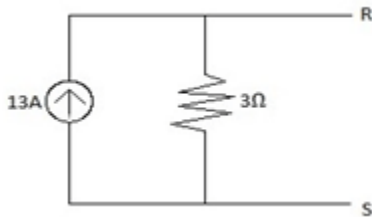


8. An aluminium cable has a resistance of 27 Ω at a temperature of 35°C . Determine its resistance at 0°C . Take the temperature coefficient of resistance at 0°C to be $0.0038/^\circ\text{C}$.
9. The p.d. at the terminals of a battery is 25 V when no load is connected and 24 V when a load taking 10 A is connected. Determine the internal resistance of the battery
10. At a temperature of 40°C , an aluminium cable has a resistance of 25 Ω . If the

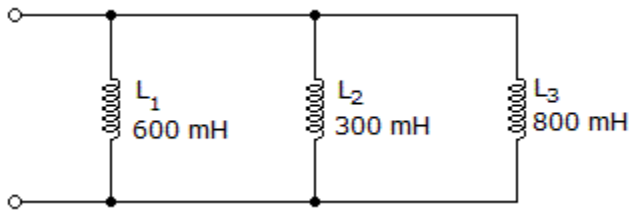
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temperature coefficient of resistance at 0°C is $0.0038/^{\circ}\text{C}$, calculate its resistance at 0°C

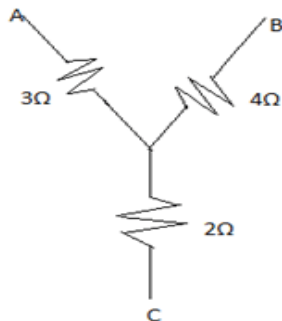
11. An arc lamp takes 9.6 A at 55 V. It is operated from a 120 V supply. Find the value of the stabilizing resistor to be connected in series.
12. A direct current of 10 A flows into a previously uncharged $5\mu\text{F}$ capacitor for 1 ms. Determine the p.d. between the plates.
13. What is the capacitance when $Q = 60\ \mu\text{C}$ and $V = 12\ \text{V}$?
14. Using source transformation, calculate the circuit voltage.



15. What is the total inductance in the given circuit?



16. Two impedances of $(7 + j5)\ \Omega$ and $(10 - j5)\ \Omega$ are connected in series across a 200 V 50 Hz supply. Find the power factor.
17. A radio receiver is tuned to 450kHz and consists of a coil of unknown inductance value and a $0.01\mu\text{F}$ capacitor in series. Calculate the inductance at resonance.
18. The r.m.s value of a sine wave is 9.0 Arms. Its amplitude value is:
19. What will be the resistance between B and C when the network given below is converted into delta?



20. A circuit has current of $2\angle 60^{\circ}$ Arms and at a voltage of 240 V. Find the average power consumed by the circuit.

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SECTION B [60 MARKS]

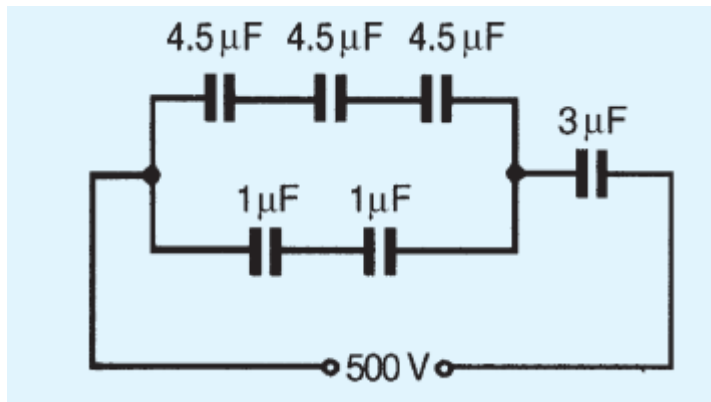
Attempt **ONLY THREE** Questions in this Section.

Question 1

- a) Define capacitance and state its SI unit **(2 marks)**
- b) Briefly explain 3 factors that affect the capacitance of a **(2 marks)**
- c) A parallel plate capacitor is made from 25 plates, each 70 mm by 120 mm, interleaved with mica of relative permittivity 5. If the capacitance of the capacitor is 3000 pF determine the thickness of the mica sheet. **(4 marks)**

For the arrangement shown in Fig. 6.11 find

- i) the equivalent circuit capacitance and **(6 marks)**
- ii) the voltage across a $4.5\mu\text{F}$ capacitor **(6 marks)**



Question 2

- a) Define inductance and state its SI unit **(2 marks)**
- b) Explain what you understand by
 - i) an electromagnet **(2 marks)**
 - ii) electromagnetic induction and mention one area where we find its application in homes. **(4 marks)**
- c) A magnetizing force of 8000A/m is applied to a circular magnetic circuit of mean diameter 30 cm by passing a current through a coil wound on the circuit. If the coil is made up of pure iron of relative permeability 8000 uniformly wound around the circuit and has 750 turns, find the
 - i) magnetic flux density in the coil **(5 marks)**

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- ii) current in the coil. **(3 marks)**
- iii) Energy stored by the coil **(4 marks)**

Question 3

- a) With the aid of simple illustrations, state Thevenin's and Norton's theorems **(6 marks)**
- b) i) State the Maximum Power Transfer Theorem for resistive networks (circuits). **(2 marks)**
 - ii) In the circuit of Figure below, find the value of R_L for which maximum power is transferred from the circuit to R_L . **(6 marks)**

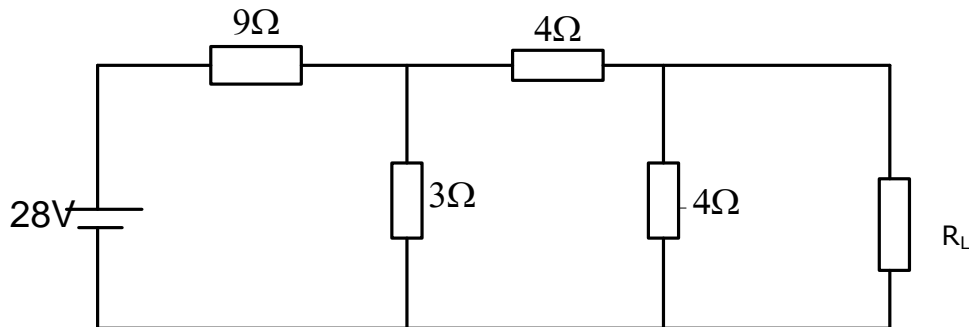


fig. 3

- iii) Hence find the maximum power absorbed by R_L . **(6 marks)**

Question 4

- a) Briefly explain four factors that affect the resistance of a material **(4 marks)**
- b) Your relative in senior four opened a scrap radio and found a resistor. He was able to identify that the resistor had four colour bands. Given that he identified the four colour bands as yellow – blue – Brown – Gold, please guide him on how to determine
 - i) the resistance **(3 marks)**
 - ii) the minimum resistance **(2 marks)**
 - iii) the maximum resistance. **(2 marks)**
- c) State the Principle of Superposition as it applies to linear electric circuits. Illustrate your answer with a simple circuit. **(3 marks)**
- d) Two batteries A with e.m.f of 6V and internal resistance of 2Ω and B with e.m.f 4 V and internal resistance of 1Ω are connected in parallel across a 5Ω resistor. Calculate the current in each branch of the network using Superposition Principle. **(6 marks)**

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Question 5

- a) A series circuit consists of a resistance of 10Ω , an inductance of 4mH and a capacitance of $30\mu\text{F}$ connected to a 240V supply source. Calculate:
- i) the frequency at resonance; **(3 marks)**
 - ii) the current at this frequency; **(2 marks)**
 - iii) the quality factor; **(3 marks)**

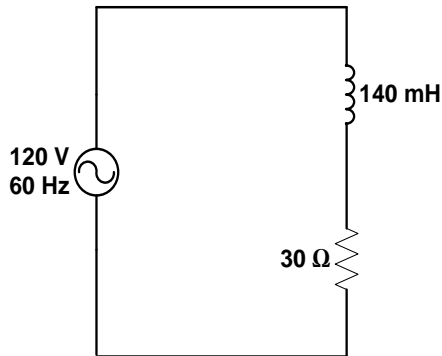


Fig. 2

- b) Using the figure above, calculate the circuit current hence, find **(4 marks)**
- i) the amplitude, **(1 mark)**
 - ii) the peak-to-peak value, **(2 marks)**
 - iii) the rms value, **(2 marks)**
 - iv) the frequency, and **(1 mark)**
 - v) the periodic time **(1 mark)**
 - vi) the phase angle **(1 mark)**