

Nnamdi Azikiwe University, Faculty of Engineering

First Semester 2021/2022 Session

Course Title: Engineering Mathematics IV; Course Code: FEG 404

(Time: 1:30mins) Date: 12/12/2022; Instruction: Answer Any Five Questions

1. Solve the partial differential equation of  $\frac{\partial^3 y}{\partial v^3} = 24v^3(Q + P)$  with direct integration, given that at  $v = 0, y = \cos 4Q, \frac{\partial y}{\partial v} = \sin Q$ , and  $\frac{\partial^2 y}{\partial v^2} = Q^2$ . Note that the boundary conditions are functions of Q and not just constants.
- 2i. A particle moves along the curve  $r = (t^3 - 4t)\mathbf{i} + (t^2 + 4t)\mathbf{j} + (9t^2 - 3t^3)\mathbf{k}$ . where t is the time. Find the magnitude of the tangential components of its acceleration at  $t = 1$
- 2ii. Find the angle between these surfaces  $x^2 + y^2 + z^2 = 12$  and  $z = x^2 + y^2 + 9$  at  $(4, -2, 2)$
3. Consider the following LP problems  
Maximize  $P = 3x + 4y + 5z$   
Subject to  $2x + 4y + 3z \leq 80$   
$$\begin{aligned} & 4x + 2y + z \leq 48 \\ & x + y + 2z \leq 40 \\ & x, y, z \geq 0 \end{aligned}$$
- 4a. Find the transformation equations in rectangular coordinates and polar coordinates if  $w = f(z) = \frac{1}{z}$ .
- 4b. If  $w = z^2$ , find the transformation which corresponds to  $z = x + jy$ . What is the image of a point  $(1, 2)$  in  $z$  plane, in  $w$  plane.
- 5a. Using the steps in Leibnitz-Maclaurin approach, find the power series solution to the equation

$$\frac{d^2y}{dx^2} + 2x \frac{dy}{dx} + y = 0$$

5b. If  $y = \sin x$ ; Show that  $y^n = \sin \left[ x + \frac{n\pi}{2} \right]$  for the nth derivative of y.

6. Estimate the first derivative of  $f(x) = -0.1x^4 - 0.15x^3 - 0.5x^2 - 0.25x + 1.2$  at  $x = 0.5$  using a step size  $\Delta = 0.5$ .

7a. Solve the equation  $\frac{dx}{dt} - 2x = 4$  given that at  $t = 0, x = 1$

7b. Determine the transform  $L^{-1} \frac{5s+1}{(s^2-s-12)}$

1. Solve the partial differential equation of  $\frac{\partial^3 y}{\partial v^3} = 24v^3(Q + P)$  with direct integration, given that at  $v = 0, y = \cos 4Q, \frac{\partial y}{\partial v} = \sin Q$ , and  $\frac{\partial^2 y}{\partial v^2} = Q^2$ . Note that the boundary conditions are functions of Q and not just constants.

2i. A particle moves along the curve  $r = (t^3 - 4t)\mathbf{i} + (t^2 + 4t)\mathbf{j} + (9t^2 - 3t^3)\mathbf{k}$ , where t is the time. Find the magnitude of the tangential components of its acceleration at  $t = 1$

2ii. Find the angle between these surfaces  $x^2 + y^2 + z^2 = 12$  and  $z = x^2 + y^2 + 9$  at  $(4, -2, 2)$

3. Consider the following LP problems

$$\begin{aligned} &\text{Maximize } P = 3x + 4y + 5z \\ &\text{Subject to } 2x + 4y + 3z \leq 80 \end{aligned}$$

$$\begin{aligned} &4x + 2y + z \leq 48 \\ &x + y + 2z \leq 40 \\ &x, y, z \geq 0 \end{aligned}$$

4a. Find the transformation equations in rectangular coordinates and polar coordinates if  $w = f(z) = \frac{1}{z}$ .

4b. If  $w = z^2$ , find the transformation which corresponds to  $z = x + iy$ . What is the image of a point  $(1, 2)$  in  $z$  plane, in  $w$  plane.

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NNAMDI AZIKIWE UNIVERSITY, AWKA  
FACULTY OF ENGINEERING

DEPT. OF ELECTRONIC & COMPUTER ENGINEERING

Course title: Advanced Circuit Techniques Course code: ECE 427. Session: 2021/2022  
Semester: 1<sup>st</sup> Semester. Date: , 17<sup>th</sup> Dec , 2022. Time allowed: 1½hrs (12.00pm – 1.30pm)

Instruction: Answer all Questions in SECTION A and any other two (2) Questions from SECTION B

Cell phones are prohibited in the Examination Hall.

SECTION A

Q1 ai. What is an Integrator?

ii. With an appropriate circuitry, show that the output of a Differentiator is;

$$V_o = -RC \frac{\partial V_1}{\partial t}$$

b. With the aid of a detailed diagram, explain the pin configurations and internal block diagram of a typical Operational Amplifier type.

Q2 .a Explain in details any five figure of merit (FOM) for specifying performance in analog to digital converters

b. List Five methods of analog to digital converter and with a well labeled circuit diagram explicitly discuss anyone of the methods

✓ Q3

a. With an appropriate circuit diagram, show that the closed loop voltage gain for an ideal, non-inverting feedback Operational Amplifier is;

$$A = 1 + \frac{R_f}{R_i}$$

b. Briefly describe the following Operational Amplifier terms:

- i. Common Mode Rejection Ratio
- ii. Slew Rate

## SECTION B

Q4 a. A 10 bits ADC is used to sample over the range of 0 to 5 volts ( $V_{ref+} = 5V$ ,  $V_{ref-} = 0V$ )

- i. What is the step size?
- ii. How would 2.1V be encoded
- iii. What voltage would correspond to 321 being returned by ADC?

4b. State Five Applications of ADC in an industry

Q5 With the aid of circuit diagrams and mathematical analysis, briefly differentiate the operating principle of an Operational Amplifier as a Voltage Follower and as Inverter.

a. State the characteristics of an ideal Operational Amplifier.

✓ \* Q6i. A 8-bit is used to sample over the range of 0 to 2 volts ( $V_{ref+} = 2V$ ,  $V_{ref-} = 0V$ )

- a. How would 0.75v be encoded ?
- b. How would 2V be encoded ?
- c. What voltage would a code of 5 belong to ?
- d. What voltage would a code of 190 belong to ?

6ii. What do you understand by dynamic range

Good Luck

2 10  
1011111111

3 credit

NNAMDI AZIKIWE UNIVERSITY, AWKA  
FACULTY OF ENGINEERING

DEPARTMENT OF ELECTRONIC & COMPUTER ENGINEERING

**COURSE TITLE:** Advanced Circuit Techniques      **COURSE CODE:** ECE 427.  
**SESSION:** 2022/2023      **SEMESTER:** First Semester.      **DATE:** 17th August, 2023.  
**INSTRUCTIONS:** (i) Answer ALL Questions in SECTION A and any other two (2)  
Questions from SECTION B.

(ii) Possession of phones and other extraneous materials in the examination hall is tantamount to examination malpractice.

(iii) Time Allowed: 2 Hours

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**SECTION A**

Q1. i. Why is the term "Operational" used in Op-Amplifier?

ii. Show with the aid of a circuit diagram that the gain of a Voltage Follower is unity.

iii. With an appropriate circuit diagram using input resistor  $R_2$  and feedback resistor  $R_F$ , show and prove that the close loop voltage gain for an ideal inverting Operational Amplifier is;

$$A_v = \left[ -\frac{R_F}{R_2} \right]$$

Q2 .i. A 8-bit is used to sample over the range of 0 to 2 volts ( $V_{ref+} = 2V$ ,  $V_{ref-} = 0V$ )

- How would 0.75v be encoded?
- How would 2V be encoded?
- What voltage would a code of 5 belong to?
- What voltage would a code of 190 belong to?

2ii. List five methods of analog to digital converter and with a well labeled circuit diagram explicitly discuss anyone of the methods

## SECTION B

Q3 a. A 10 bits ADC is used to sample over the range of 0 to 5 volts ( $V_{ref+} = 5v$ ,  $V_{ref-} = 0v$ )

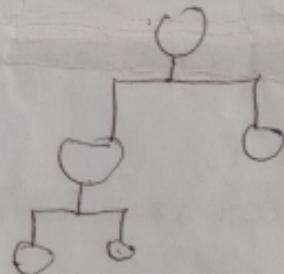
- i. What is the step size?
- ii. How would 2.1V be encoded
- iii. What voltage would correspond to 321 being returned by ADC?

3b. State five applications of ADC in an industry

Q4 a. With an appropriate circuit diagram using input resistor  $R_X$  and feedback resistor  $R_F$ , show and prove that the close loop voltage gain for an idle non-inverting Operational Amplifier is;

$$A_v = \left[ \frac{R_X + R_F}{R_X} \right]$$

- b. List and explain four parameters of an Operational Amplifier.
- c. What is the meaning of 741 in a typical 741Op-Amp?



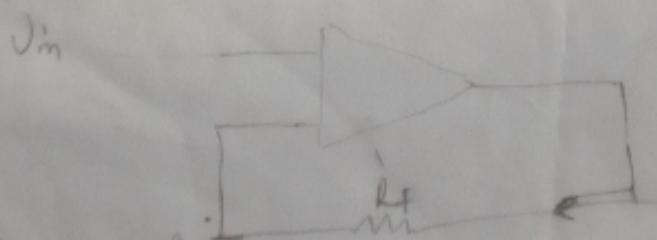
Q5 a. Show with the aid of a detailed circuit diagram and equations how a practical inverting Op-Amp can operate as an ideal inverting Op-Amp.

- b. State at least five electrical characteristics of an ideal Op-Amp.
- c. Explain the term, Output Offset Voltage.

11b wslm

6 diff ways

Good Luck



Nnamdi Azikiwe University Awka,  
Electrical Engineering Department

First Semester Examination 2022/2023

Course: Circuit Theory IV, Course Code: ELE 403, Time allowed: 2 hrs, Date: 18/08/2023

Instruction: Attempt 4 Questions in all at least one from each section

**SECTION A**

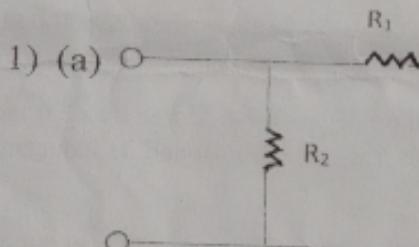


Fig 1

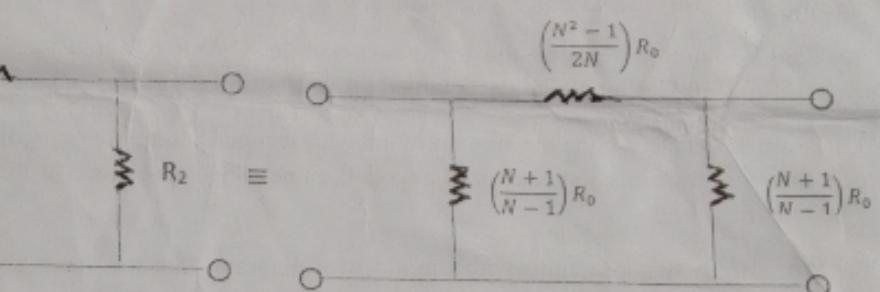


Fig 2

For the symmetrical  $\pi$  attenuator having the series and shunt arms resistances  $R_1$  and  $R_2$  respectively, as in fig 1, show that it is equivalent to fig 2.

Where,  $N$  = Insertion loss ratio,  $R_0$  = characteristic resistance.

1) (b) Design a symmetrical  $\pi$  – attenuator that offers a gain of  $0.25N_p$  when the load is  $500\Omega$

2) (a) Consider a symmetrical bridge T-type attenuator shown below

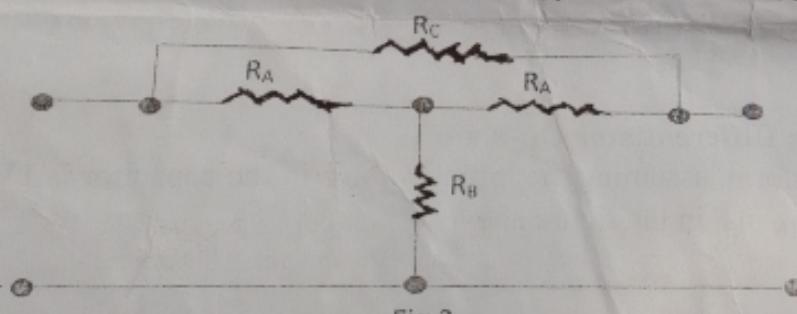


Fig 3

$$(R_0 \parallel R_A) + (R_B \parallel R_A)$$

Show that the characteristic resistance  $R_0$  of the network can be given as;

$$R_0 = \sqrt{R_C R_B}$$

(NB: For a symmetrical bridge T attenuator,  $R_0 = R_A$ )

(b) Given that the design impedance and attenuation of a symmetric bridge T – attenuator is  $700\Omega$  and  $50\text{dB}$  respectively, design the symmetrical bridge T-attenuator

$$R_A + \left( \frac{R_A R_B}{R_A + R_B} \right) = 700$$

$$+ R_A R_B + R_A R_B$$

### SECTION B

\* Question 3: (a) Prove from first principle, that characteristics impedance ( $Z_0$ ) of a  $3\pi$  section transmission line is equal to  $\sqrt{L/C}$ .

(b) Determine the characteristic impedance  $Z_0$  of (i) A parallel wire line with  $D/d$  ratio = 4.5 with air dielectric. (ii) An air dielectric coaxial line with  $D/d$  ratio = 2.25. (iii) RG-9A/U coaxial cable with  $D = 0.485$  inches, and  $d = 0.29$  inches. This cable uses a Polyethylene dielectric.

(c) Find the input impedance, the admittance and the VSWR of a transmission line  $4.5\lambda$  long when  $Z_0 = 100 \Omega$  and  $Z_L = 150 + j110 \Omega$ . Plot all values obtained on your Smith Chart and submit it alongside your answer script.

\* Question 4: (a) Determine the amount of delay in seconds and the velocity of propagation introduced by a 2 ft section of a two wire transmission line, used as a delay line. The capacitance of this line is 28.3 pF/ft and its inductance is 70.23 nH/ft.

(b) Prove from first principle with the aid of a diagram, that the amount of delay associated with a given signal travelling through a transmission line depends on the square root of its inductance and capacitance, that is  $t = \sqrt{LC}$

### SECTION C

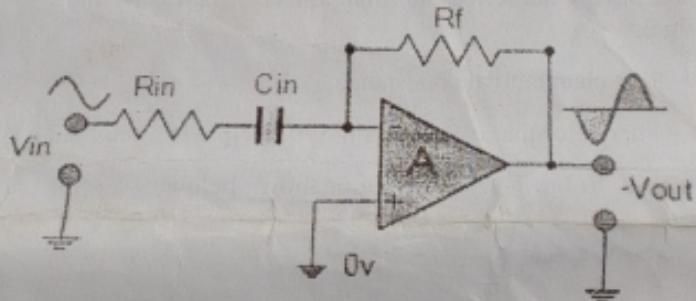


Figure 4: Differentiator Op-Amp

- \* 5) Obtain  $V_{OUT}$  using Laplace transform, assuming the initial voltage in the capacitor is 1V,  $V_{IN} = \sin t$ ,  $R_{IN} = 1\Omega$ ,  $R_F = 1\Omega$  and  $C_{IN} = 1F$  in the figure above?
- 6) The network shown below is under steady state condition. The switch K is closed at  $t = 0$ . Using Laplace transform, determine the current through  $R_L$ ?

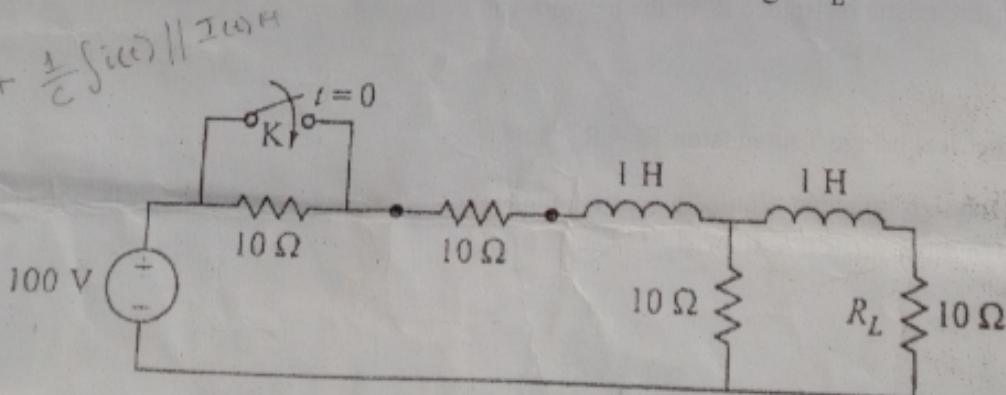


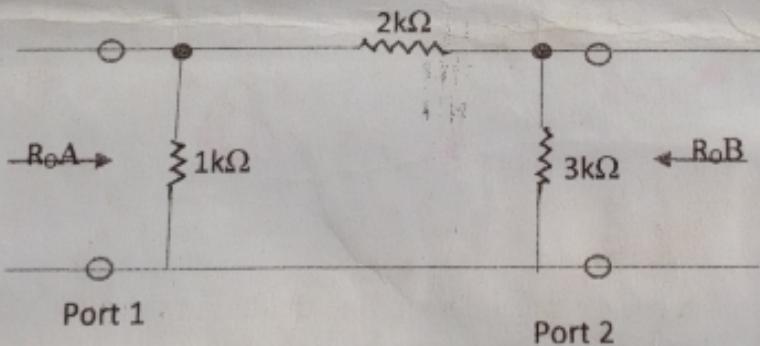
Figure 5: RL Network

NNAMDI AZIKIWE UNIVERSITY, AWKA  
 FACULTY OF ENGINEERING  
 DEPARTMENT OF ELECTRICAL ENGINEERING  
 FIRST SEMESTER EXAMINATION  
 2021/22 ACADEMIC SESSION  
 COURSE TITLE: CIRCUIT THEORY IV  
 COURSE CODE: ELE 403

**INSTRUCTION: ATTEMPT FOUR (4) QUESTIONS IN ALL, A MINIMUM OF ONE (1) QUESTION FROM EACH SECTION**

**SECTION A**

- 1) (a) show that for a symmetrical  $\pi$  – attenuator network terminated in a resistance  $R_o$ , that the characteristic resistance  $R_o = \sqrt{\left[ \frac{R_A R_B^2}{2R_A + R_B} \right]}$
- Where  $R_A$  = the series arm resistance of the  $\pi$  symmetrical network  
 $R_B$  = the shunt arms resistances of the  $\pi$  symmetrical network
- (b) The current input of an attenuator is 50mA. If the current ratio of the attenuator is  $-1.32\text{NP}$ , determine the current ratio expressed in decibels, assume that the input and load resistances of the attenuator are equal.
- 2) (a) Define the following terms, as they are used in the study of attenuator network  
 (i) Iterative resistance (ii) Image resistance (iii) characteristic resistance  
 (b) An Asymmetrical  $\pi$  – section attenuator is shown below



Determine, the iterative resistances

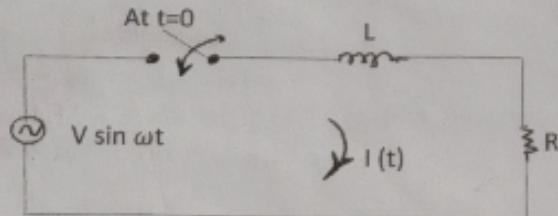
$$\frac{R_o}{R_A + R_B} + \frac{R_o^2}{2}$$

$$R_A R_o^2 + 2 R_o^2 R_B = R_A R_B^2$$

B

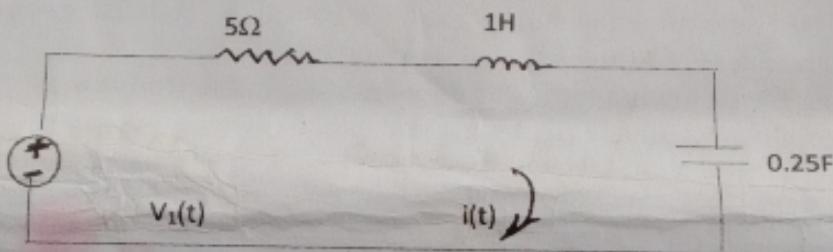
### Section B

- 3) Using the Laplace transform method, determine the current through R in the circuit below  
Assume the circuit to be initially relaxed.



- 4) Apply the Laplace transform method to determine the current  $i(t)$  in the series RLC circuit consisting of  $R = 5\Omega$ ,  $L = 1H$ ,  $C = 0.25F$ , when each of the following voltages is applied  
(i) Ramp voltage  $12r(t-2)$   
(ii) Step voltage  $3u(t-3)$

Assume the circuit was initially relaxed



### SECTION C

#### Question 5:

- (a) State and briefly explain 4 types of transmission line treated in this course, and write out the standard color coding for CAT6 signal transmission line.  
(b) Determine the characteristic impedance  $Z_0$  of  
(i) A parallel wire line with  $D/d$  ratio = 5 with air dielectric. (ii) An air dielectric coaxial line with  $D/d$  ration = 2.03 (iii) RG-9A/U coaxial cable with  $D = 0.5$  inches and  $d = 0.02$  inches. This cable uses a Teflon dielectric.

#### Question 6

- (a) For a  $3\pi$  section transmission line whose characteristics impedance is ( $Z_0$ ), calculate the value of the characteristics impedance, given that the inductance and the capacitance of the line are  $1.2 \text{ } 1H$  and  $0.5 \mu F$  respectively. The frequency of line is  $200\text{Hz}$ .  
(b) If the physical distance of a transmission line is equal to  $155\text{km}$ , calculate the velocity of propagation of wave down the line in kilometer per second given that the capacitive and the inductive reactance of the line are  $0.35 \Omega$  and  $0.02\Omega$  respectively. Take  $512\text{Hz}$  to be the frequency of the wave.

NNAMDI AZIKIWE UNIVERSITY, AWKA DEPARTMENT

OF CIVIL ENGINEERING 2022 / 2023

FIRST SEMESTER EXAMINATION

Code: CVE 421

TITLE: ENGINEERING CONTRACTS AND SPECIFICATIONS

Time:

Instruction: Answer Two Question from each section

**SECTION A**

1(a) Discuss ways in which a contract can be discharged? (10mks)

(b) What are remedies for breach of contract? (10mks)

(c) Is engineering contracts an entire contract? Discuss (5mks)

2(a) Assuming you are the engineer to a project, draft a "Form of contract" between your client, the promoter and the contractor. (15mks)

(b) Explain your understanding of the following terms common in the bill of engineering measurement and evaluation.

- i. Provisional sum
  - ii. Prime cost sum
  - iii. Schedule of basic rate
  - iv. Contingency allowance
  - v. Interim payment
- (2mks each)

3(a) Discuss your understanding of "Form of Tender" as a contract document. (12mks)

(b) Explain any five of the importance information covered by the appendix to the form of tender. (2mks each)

(c) What are the functions of "schedule of basic rates" in contract administration. (3mks)

**SECTION B**

4. Write a brief explanation of procedures for settlement of dispute between the employer and the contractor in an engineering contract (25mks)

5a. List and explain five advantages of choice of arbitration as opposed to going direct to the law. (15mks)

5b. Write a short note on Discovery of documents (10mks)

6a. What do you understand by condition of contract (5mks)?

6b. Write down the Basic Expanded logic for an engineering contract and explain the content of the first three items. (20mks)

*2 credit*

NNAMDI AZIKIWE UNIVERSITY, AWKA  
DEPARTMENT OF CIVIL ENGINEERING

2021/2022 FIRST SEMESTER EXAMINATION

**CODE: CVE 421      TITLE: ENGINEERING CONTRACTS AND SPECIFICATIONS**  
**TIME: 2HRS INSTRUCTION: ANSWER 2 QUESTIONS FROM EACH SECTION**

**SECTION A**

- 1a. Explain briefly the different ways in which contracts may be made (6mks)
- 1b. What are the advantages in written contracts (9mks)
- 1c. Discuss the essentials for a valid contract (10mks)
- 2a. Who are the following parties to an engineering contract?
- i. The Employers (4mks)
  - ii. The various types of contractors (5mks)
  - iii. The Engineer (4mks)
  - iv. The Supervising Officer (4mks)
- 2b. What are the basic requirements of a "Form of Contract", in any engineering contract (8mks)
- 3a. Discuss the following types of contract
- i. Schedule contract (8mks)
  - ii. Target cost with variable fee contract (7mks)
- 3b. What are the means of selecting contractors for a project (10mks)

**SECTION B**

4. Write a brief explanation of procedures for settlement of dispute between the employer and the contractor in an engineering contract (25mks)
- 5a. List and explain five advantages of choice of arbitration as opposed to going direct to the law. (15mks)
- 5b. Write a short note on Discovery of Documents (10mks)
- 6a. What do you understand by condition of contract (5mks)
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NNAMDI AZIKIWE UNIVERSITY, AWKA  
ELECTRICAL ENGINEERING DEPARTMENT  
2022/2023 FIRST SEMESTER EXAMINATION  
INSTRUMENTATION AND MEASUREMENT II: ELE 473

INSTRUCTION: ANSWER ONLY 4 QUESTIONS  
TIME: 1 HOUR & 30 MINUTES

- \* 1) This example is an exercise in the use of thermocouple tables, but it also serves to illustrate the large errors that can arise if thermocouples are used incorrectly. In a particular industrial situation, a chromel-alumel thermocouple with chromel-alumel extension wires is used to measure the temperature of a fluid. In connecting up this measurement system, the instrumentation engineer responsible has inadvertently interchanged the extension wires from the thermocouple. The ends of the extension wires are held at a reference temperature of  $0^{\circ}\text{C}$  and the output emf measured is 14.1mV. If the junction between the thermocouple and extension wires is at a temperature of  $40^{\circ}\text{C}$ , what temperature of fluid is indicated and what is the true fluid temperature?
- \* 2) State 5 temperature measuring instruments and briefly discuss:  
i) Merits and demerits of any two?  
ii) Application of any two?  
iii) Selection criteria for the bimetallic thermometer?
- \* 3) An optical rotary encoder consists of an infrared LED, 12V supply, a Schmitt trigger and a PNP phototransistor in common emitter configuration.  
a) Explain the principle of operation with a well labelled diagram?  
b) Sketch the output of the Schmitt trigger, if the encoder pulse has a mark-space ratio of 3:1?
- \* 4) The pulses of the encoder of an electric motor's shaft, with a mark-space ratio of 3:1, are used to gate a 1MHz frequency clock into a counter.  
a) Determine the encoder resolution, if the smallest angle to be measured is 1.44degrees?  
b) Using the encoder resolution obtained in 5a above, calculate the count value, when the shaft rotates at 120RPM?
- \* 5) Discuss the following performance characteristics of an instrument with well labelled diagrams and/or graphs:  
Error analysis, Static sensitivity, Bias, Reliability, Accuracy and Precision?

**GOODLUCK!!!**

NNAMDI AZIKIWE UNIVERSITY, AWKA  
ELECTRICAL ENGINEERING DEPARTMENT  
2021/2022 FIRST SEMESTER EXAMINATION  
INSTRUMENTATION AND MEASUREMENT II: ELE 473

**INSTRUCTION: ANSWER 4 QUESTIONS ONLY**  
**TIME: 1 HOUR & 40 MINUTES**

- 1a) Discuss the optical encoder speed with respect to its mechanical and electrical speed limitations?
- 1b) A 200TRDA-45 encoder has a mechanical and electrical speed limits of 2000RPM and 30,000RPM respectively. Calculate its maximum frequency response?
- 2a) With the aid of a well labelled diagram, explain the operating principle of a Linear Variable Differential Transformer?
- 2b) An open loop force measurement system comprises a body of mass, a dash pot, a spring with spring constant 20N/M and a LVDT attached to the spring in order to measure its extension. The differential voltage of the LVDT is 1.2V for a displacement of 2mm, when a force is applied to the body of mass. Calculate the force exerted on the body of mass, if the LVDT gives a differential voltage of 3V?
- 3 An optical rotary encoder consists of an infrared LED, 9V supply, a Schmitt trigger and a PNP phototransistor in common emitter configuration.
- a) Explain the principle of operation with a well labelled diagram?
- b) Sketch the output of the Schmitt trigger, if the encoder pulse has a mark-space ratio of 3:1?
- 4a) With the aid of a suitable practical example of input signal filtering, explain the method of correcting interfering and modifying inputs?
- 4b) The operation of a strain gauge is interfered by a 60Hz A.C electromagnetic interference (EMI). Explain how you would address this interference with output signal filtering using appropriate diagrams and graphs?
- 5 The pulses of the encoder of an electric motor's shaft, with a mark-space ratio of 3:1, are used to gate a 1MHz frequency clock into a counter.
- a) Determine the encoder resolution, if the smallest angle to be measured is 0.72 degrees?
- b) Using the encoder resolution obtained in 5a above, calculate the count value, when the shaft rotates at 60RPM?

**GOODLUCK!!!**

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NNAMDI AZIKIWE UNIVERSITY  
FACULTY OF ENGINEERING  
ELECTRONIC AND COMPUTER ENGINEERING DEPARTMENT, AWKA  
FIRST SEMESTER EXAMINATION 2022/2023 SESSION  
MICROPROCESSOR AND MICROCOMPUTER (ECE 405)

**ANSWER QUESTIONS 1 AND ANY OTHER THREE QUESTIONS.**

- \* 1a. You are consulted as an IT expert to recommend a suitable micro-computer for a light weight user and an intensive user. List and explain the key parameters you would consider for this recommendation.
- 1b. Implement a decade counter using Atmega 16 microcontroller interfaced to a single common anode seven segment display. Draw the block diagram of the system, the circuit diagram and write the code in c language using Atmel/AVR studio as compiler
- \* 2a. With the aid of a diagram describe the architecture of a single board computer.
- 2b. Using an example, explain the concept of multi-threading in a micro-computer.
- 3a. You are given 3 piece of hardware to run artificial intelligence models namely: Recurrent Neural Network (RNN), Convolutional Neural Network (CNN) and fully-connected Neural Networks (FCNN). Each of the underlisted hardwares are best suited for a particular model. Identify the hardware's you will use for the models.
- i. Google Coral TPU
  - ii. NVIDIA GeForce RTX GPU
  - iii. AMD Ryzen™ 5 4500 6-Core, 12-Thread CPU
- 3b. Outline the steps involved in transferring program from your computer to a microcontroller
- 4a. Design an 8051 based bank door control system with bidirectional dc motor control such that the door opens when a button is pressed and closes back after 5 seconds. Draw the block diagram of the system, the circuit diagram and write the code in c language using Keil compiler.
- b. Explain briefly the flag of the 8085 microprocessor.
- c. Draw the 8085 flag register and show the values of the flag register as a result of the addition of 0XA7 and 0X24.
- 5a. Draw the 8085 bus organization and explain briefly the three address buses.
- b. what makes core i5 processor better than Pentium processor?
- 6a. Starting with block diagram, design a counter that counts from 0-100 and decode it with 8 LEDs connected to a port of 89C55 microcontroller in common cathode arrangement. Write a c language program with Keil c compiler to implement this.
- b. What is a hex file?
- c. The microcontroller is a single chip computer, Explain.

NNAMDI AZIKIWE UNIVERSITY, AWKA

FACULTY OF ENGINEERING

DEPARTMENT OF ELECTRONIC AND COMPUTER ENGINEERING

2021/2022 1ST SEMESTER EXAMINATION

### **Course Code: ECE 405**

**Time 1hrs 30minutes**

**INSTRUCTIONS:** 1. YOU MUST PRESENT AN ID CARD FOR IDENTIFICATION

- 1 R512  
4 RST5  
5 ST  
10 INTA

2. ANSWER FOUR QUESTIONS

it is an event which alters the normal program execution

Vector, now used for maskable/unmaskable, software/hardware

This is done by temporarily suspending its current execution, saving it and jumping to interrupt service routine to specify for interrupt source.

1. a. What is an interrupt and how are they classified?

b. Explain how a microprocessor services an interrupt.

c. List the software and hardware interrupts of 8085?

2. a. List and explain the 8085 system buses. ~~Data bus, Address bus, Control bus~~

b. Show by calculation the maximum byte a memory with 8 bit data bus and 16 bit address bus can store.  $\text{Byte } 2^n$  where  $n = \text{number of bit}$   
~~ex SSD & HDD~~

c. Differentiate between primary and secondary memory of a microcomputer <sup>(volatile), small capacity, more expensive, faster access time, used for temporary storage, example SRAM or DRAM</sup>

3. a. What are the addressing modes available in 8085? <sup>Intermediate, direct, indirect</sup>  
~~Register & implied address modes.~~

b. Write down the full interpretation of the following 8051 instructions

MOV R1, 60h

DJNZ R4,XX

ADD A, #25h

DEC R7

SETB P1.0

4. a. Design a microprocessor based bidirectional bank door control such that when you press a button the door opens in one direction and closes after some seconds. Draw the circuit properly and write the code. Assuming the size of the hex file is 18kbyte, what 8051 microcontroller will you use?

b. What do you understand by the term "Hex file"

$$\begin{aligned} 2^N &= 1024 \\ \log_2 N &= 10 \end{aligned}$$

5. a. How is microprocessor used in medical instrumentation field? 1
- b. How many address lines are needed to interface a memory chip of 1kilobytes to the 8085 microprocessor? Please show how you got your answer.
- c. Draw the interfacing diagram of the memory chip in question b above stating clearly the pins of the microprocessor used.

*used for general purpose, high clock speed, consume more power, complex, used in PC and laptops*

- 6a. Differentiate between a microprocessor and microcontroller *used in embedded systems*
- b. Design a microprocessor based up counter using AT89C51 microcontroller interfaced to a common anode seven segment display and a button. Program the circuit to increase its count by 1 whenever the button is pressed and when it gets to 9, let it go back to 0. Note: let your circuit be complete including all the basic components that will make it work in real life.

1st

ECE 331

EE 311

ECE 333

EEG 303

EE 343

EE 353

GS 301 - B

EE 341

~~ECE~~ 323

ECE 321

2nd

ECE 334

EE 344

ECE 322

ECE 328 - F

EE 342

EE 372

EE 382

EE 312 - F

ECE 326

2 credit

NNAMDI AZIKIWE UNIVERSITY, AWKA

DEPT. OF ELECTRONIC & COMPUTER ENGINEERING

1<sup>ST</sup> SEMESTER EXAMINATION 2021/2022 SESSION

ECE 421: ASSEMBLY LANGUAGE PROGRAMMING TIME: 1<sup>1/2</sup>HRS

**Instruction:** Answer question no. (1) in section A and any other two questions from section B.

### SECTION A

- 1) A microcontroller-based system is to be installed at the entrance gate of a crusade field, such that when someone passes through the gate, there will be an LCD display of **LORD, UNTO THEE I CRY FOR HELP**. The system is to be designed using AT89C52 microcontroller, LM016L, 12MHz crystal oscillator, and other electronic components. Use your knowledge of LCD programming to write an Assembly Language sub-program for the LCD display only. (20 Marks)

### SECTION B

- 2a) What are addressing modes and why do we need multiple addressing modes?
- b) List 5 addressing modes you were taught, explain one of them and give an example of its use.
- c) Write the structure of the assembly language statement, explain what each component is and give appropriate example.
- d) With an appropriate illustration, show the four units into which the internal memory of a typical 8051 microcontroller is organized. (25 Marks)
- 3) (a) (i) Distinguish between an Assembler and a Compiler.  
(ii) Give their examples and the programming language associated with each of them.
- (b) (i) Differentiate between single-pass assembler and two-pass assembler. (ii) State the steps in achieving single-pass and multi-pass respectively.
- (c) (i) Discuss succinctly the three-major statement format of an assembly language and write any single statement in assembly language to illustrate this.  
(ii) Which statement format should be ignored in assembly language program execution?
- (d) Show the steps of how an assembly language program for a PIC16F84A Microcontroller can be implemented in Proteus VSM to switch ON a security alarm system. (25 Marks)
- 4) Write an Assembly Language program for AT89C52 microcontroller to display the word **FOLE** in a Common Cathode Seven Segment Display. Use 10 MHz crystal oscillator. (25 Marks)

PS  
RW  
E

**NNAMDI AZIKIWE UNIVERSITY, AWKA**  
**DEPT. OF ELECTRONIC & COMPUTER ENGINEERING**  
**1<sup>ST</sup> SEMESTER EXAMINATION 2020/2021 SESSION**  
**ECE 421: ASSEMBLY LANGUAGE PROGRAMMING TIME: 2HRS**

**Instruction:** Answer all the questions in Section A, and any other one in Section B

**SECTION A**

- 1) In a concert hall, 24 LEDs are connected in a circular format. Use a Set Bit programming technique to write an Assembly Language program which will make AT89C52 microcontroller to display the 24 LEDs in a swap dance form of 4 LEDs at a time. Use 12MHz crystal oscillator, with a delay of half second.
- 2a) When we say Assembly language is not "portable", what do we mean? Exhaustively explain.  
b) What is another name for the term "pseudo operators?" Define this term. How are they different from Instruction set? List 5 different groups of this term and give an example of each group.
- 3a) An assembly language program file must have three sections, name them.  
(b) Differentiate between single pass assembler and two pass assembler  
(c) List the three-statement format of an assembly language, write any single statement in assembly language to illustrate this.  
(d) (i) Write an assembly language program for a PIC16F84A Microcontroller that turns on a single LED.  
(ii) Show the steps of how this can be implemented in Proteus VSM to simulate the working of the Microcontroller-controlled LED.

**SECTION B**

- 4) Write an Assembly Language program for AT89C52 microcontroller to scroll the word **Edun** in a Common Anode Seven Segment Display. Use 10 MHz crystal oscillator.
- 5a) List the four different divisions of the internal memory of a typical 8051 microcontroller and state the function of each.  
b) What are the major differences between a simulator and an emulator? Give an example of each
- 6a) Develop an Assembly Language control program for a 3-Way Traffic Lights in a T-Road Junction using AT89C51 microcontroller. State your assumptions, and develop a Code Table for the control. Use 12 MHz crystal oscillator.  
b) (i) What is an Assembler?  
(ii) Explain briefly "Cross Assembler".