

THE UNIVERSITY OF ZAMBIA

SCHOOL OF ENGINEERING

EXAM PAST PAPERS 2019/2020

1. AEN 2041 – Farm Power and Machinery
2. AGG 3832 – Forage Crop Production and Range Management
3. AGG 3842 – Introductory statistics for Agriculture
4. CEE 2219 – Statics and Introduction to Mechanics of Materials
5. EEE 2019 – Principles of Electrical and Electronic Engineering
6. ENG 4129 – Engineering Management and Entrepreneurship
7. ENG 5129 – Engineering Management and Society II
8. MAT 2110 – Engineering Mathematics I
9. MEC 2309 – Properties of Engineering Materials I

THE UNIVERSITY OF ZAMBIA
SCHOOL OF ENGINEERING
DEPARTMENT OF AGRICULTURAL ENGINEERING
UNIVERSITY EXAMINATIONS
AUGUST / SEPTEMBER 2020
BSc. AGRONOMY
AEN 2041: FARM POWER AND MACHINERY

TIME ALLOWED: THREE HOURS

INSTRUCTIONS:

1. READ ALL THE QUESTIONS CAREFULLY
2. THIS EXAMINATION PAPER HAS **FOUR SECTIONS, SECTION A, SECTION B, SECTION C AND SECTION D.**
3. **SECTION A HAS TEN “TRUE OR FALSE” QUESTIONS. ATTEMPT ALL QUESTIONS IN THIS SECTION. EACH QUESTION HAS **TWO MARKS.****
4. **SECTION B HAS TEN “FILL IN THE BLANKS” QUESTIONS. ATTEMPT ALL QUESTIONS FROM THIS SECTION. EACH QUESTION CARRIES **TWO MARKS.****
5. **SECTION C HAS TEN MULTIPLE CHOICE QUESTIONS. ATTEMPT ALL QUESTIONS IN THIS SECTION. EACH QUESTION HAS **TWO MARK.****
6. **SECTION D HAS **THREE QUESTIONS.** ATTEMPT **TWO** QUESTIONS ONLY FROM THIS SECTION. EACH QUESTION CARRIES **20 MARKS.****
7. MARKS ALLOCATED FOR EACH SUB-QUESTION IN SECTION D ARE INDICATED IN BRACKETS.
8. START EACH QUESTION **IN SECTION D** ON A NEW PAGE.
9. CLEARLY INDICATE THE SECTIONS IN THE ANSWER BOOKLET AND NUMBER THE ANSWERS CORRECTLY ACCORDING TO THE NUMBERING SYSTEM USED IN THIS QUESTION PAPER.
10. SHOW ALL CALCULATIONS AND UNITS. ROUND OFF FINAL ANSWERS TO TWO DECIMAL PLACES.
11. WRITE NEATLY AND LEGIBLY.
12. WRITTEN MATERIALS, CELL PHONES AND PROGRAMMABLE CALCULATORS ARE **NOT ALLOWED** IN THE EXAMINATION ROOM.

SECTION A (20 MARKS): ATTEMPT ALL QUESTIONS IN THIS SECTION

For each statement in the questions below, indicate in the answer booklet (T) if the statement is True or (F) if the statement is False.

1. Power is the amount of work done per unit time.
2. Technically, the use of a hoe to till the soil is considered as mechanization.
3. As you go up the levels of mechanization, human physical effort to perform a task reduces while the skill required to perform the task increases.
4. Conversion of glucose to glycogen is called glycolysis.
5. Anaerobic reactions only take place in the absence of oxygen.
6. 1 kW is equivalent to 3.6 MJ of energy.
7. Crankshaft crank throw is half the stroke.
8. A steer (castrated male cattle) is preferred over a young bull of the same age and weight for draught power training because it provides greater pull.
9. The proportion of digestible energy of a feed that is converted into metabolisable energy is independent on the type of feed consumed by an ox.
10. The position of the piston at the end of its travel when moving towards the cylinder head is called the Bottom Dead Centre (BDC).

SECTION B (20 MARKS): ATTEMPT ALL QUESTIONS IN THIS SECTION

For each question below, write in the answer booklet the word(s) that best complete(s) the sentence.

1. The power output beyond which lactic acid begins to accumulate in the muscle cells is called _____.
2. The general term for muscles that bend a joint _____.
3. The term used to describe all chemical reactions involved in maintaining the living state of the cells and the organism _____.
4. Conversion of glycogen back to glucose is called _____.
5. Where in the muscle cell does glycolysis take place during cellular respiration?
_____.
6. A device used to connect draught animal(s) to an implement _____.
7. A machine or device that converts chemical energy (in the fuel) into mechanical energy is called _____.
8. The maximum distance of travel of the piston in the engine cylinder from one extreme position to the other, in one direction is called _____.
9. _____ is the volume of gas in the cylinder when the piston is at Top Dead Centre (TDC).
10. The volume swept out by the piston as it moves from Bottom Dead Centre (BDC) to Top Dead Centre (TDC) is called _____.

SECTION C (20 MARKS): ATTEMPT ALL QUESTIONS IN THIS SECTION

For each of the following questions, choose the BEST answer and write in the answer booklet, in capital letters, the letter corresponding to your answer.

1. Three of the following are primary objectives for mechanisation. Which one is not?
- to reduce the drudgery of farm work.
 - to increase the productivity of farm worker.
 - to increase the timeliness and quality of work.
 - to reduce the cost of production.

2. Glucose is converted to _____ for short-term storage and _____ for long-term storage.

- pyruvic acid, fat
- protein, glycogen
- fat, pyruvic acid
- glycogen, fat

3. Given these phases of aerobic respiration:

- acetyl-coenzyme A formation
- citric acid cycle
- electron-transport chain
- glycolysis

List the phases in the order they occur, as a molecule of glucose is broken down during energy metabolism in the body.

- 1,4,2,3
- 2,1,4,3
- 3,2,4,1
- 4,1,2,3

4. What part of the engine converts reciprocating motion into a rotational motion?

- camshaft
- piston
- valve cover
- crankshaft

5. Anaerobic energy metabolism refers to the generation of ATP _____

- without the use of oxygen
- without the use of glycogen
- in the absence of oxygen
- by the conversion of pyruvate to lactic acid

6. Chemical reactions that break down complex molecules into simpler ones are called _____
- Catabolism
 - Metabolism
 - Anabolism
 - Oxidation reactions
7. Creatine Phosphate is a high-energy phosphate compound that is used in the cell _____
- to transport ATP to the mitochondria.
 - to resynthesize ATP from ADP.
 - as a direct source of energy for the cell.
 - as a rate-limiting enzyme in the metabolism of fat and carbohydrate.
8. The correct sequence of events in a four-stroke cycle engine is
- Intake, Power, Compression, Exhaust
 - Intake, Compression, Power, Exhaust
 - Exhaust, Power, Compression, Intake
 - Compression, Power, Intake, Exhaust
9. What event is characterised by closed intake and exhaust valves and the movement of the piston from BDC to TDC in a four stroke cycle engine?
- Induction stroke
 - Power stroke
 - Compression stroke
 - Exhaust stroke
10. Which one of the following implements is best suited for conservation tillage?
- Mouldboard plough
 - Disc plough
 - Chisel plough
 - Rotary cultivator

SECTION D: THIS SECTION HAS THREE QUESTIONS. ATTEMPT ANY TWO QUESTIONS. EACH QUESTION HAS 20 MARKS.

QUESTION 1

a) Define the following terms:

- i) Digestible energy
- ii) Appetite Limit.

[4 marks]

b) A pair of oxen, each weighing 600kg is used to plough a field. The force required to pull the plough is 1.2 kN at a speed of 3.6 km/h. The oxen work for 5 hours per day and they are fed on Napier grass which has a gross energy of 17.0 MJ/kg of dry matter and DE/GE ratio of 0.75. Given the following additional information:

- Maintenance Energy = $8.3 + (0.091W)$ MJ/day, Where W is the mass of the draft animal
 - Appetite Limit = $0.025W$ kg of dry matter
 - Metabolisable Energy (ME) = 0.8 of Digestible Energy (DE)
 - Energy Conversion Efficiency of Draft Animals = 20%
- i) Calculate the power, P, required to pull the plough.

[2 marks]

ii) Calculate the amount of energy, E, (in MJ) needed to plough the field per day.

[2 marks]

iii) Calculate the maintenance energy, ME_{MR} , for a pair of oxen.

[2 marks]

iv) Calculate the amount of metabolisable energy, ME_{WD} , needed to plough the field per day.

[2 marks]

v) Calculate the total daily metabolisable energy, ME_{Tot} , requirement (for maintenance and work) for a pair of oxen.

[2 marks]

vi) Calculate the quantity of Napier grass (in kg) needed to meet the total daily energy requirement for a pair of oxen.

[2 marks]

vii) Calculate the appetite limit for a pair of oxen.

[2 marks]

viii) Do the oxen need any supplementary feed? Explain your answer.

[2 marks]

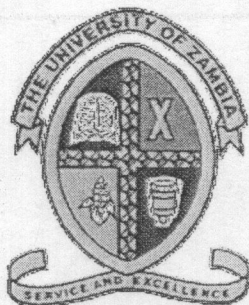
QUESTION 2

- a) What are the functions of the following components of an engine
- i) Crankshaft [2 marks]
 - ii) Valves [2 marks]
 - iii) Flywheel [2 marks]
- b) A four cylinder four stroke cycle engine has an 8.6 cm bore and 8.6 cm stroke. The clearance volume is 55.5 cm^3
- i) Calculate the crank throw [2 marks]
 - ii) Calculate the cylinder displacement [4 marks]
 - iii) Calculate the engine displacement [2 marks]
 - iv) Calculate the total cylinder volume [2 marks]
 - v) Determine the compression ratio of the engine [4 marks]
 - vi) State whether this is a diesel or petrol engine. Justify your answer. [5 marks]

QUESTION 3

- a) Outline **five** functions performed by a seed drill [5 marks]
- b) State **two** objectives for calibrating a seed drill [5 marks]
- c) A seed drill has 10 furrow openers and covers a width of 2000 mm in one pass. It has a wheel diameter of 0.796 m. In order to calibrate the seed drill, calculate the following:
- i) the spacing between any two adjacent furrow openers. [2 marks]
 - ii) the length of travel necessary to cover 0.10 ha [2 marks]
 - iii) the number of wheel revolutions necessary to cover 0.10 ha. [2 marks]
 - iv) the amount of seed expected from each seed tube to provide a seed rate of 80 kg/ha [4 marks]

END OF EXAMINATION



**THE UNIVERSITY OF ZAMBIA
SCHOOL OF AGRICULTURAL SCIENCES**

2019/2020 FINAL EXAMINATIONS

**COURSE : AGG 3832 FORAGE CROP PRODUCTION AND RANGE
MANAGEMENT**

DATE : FRIDAY 27TH NOVEMBER 2020 14:00 HOURS

DURATION : 1 HOUR 30 MINUTES

INSTRUCTIONS : ANSWER ANY THREE QUESTIONS

1. Hay is the oldest, and still the most important, conserved fodder, despite its dependence on suitable weather at harvest time. Meeting the feed requirements of each class of cattle is important in producing productive and healthy livestock. To do this, you need to understand both the feed requirements of your cattle as well as the value of the available feed.
 - a) List down the important steps involved in the production of good quality hay (8 marks).
 - b) What are the characteristics of good quality hay (12 marks).

2. Rangeland degradation consists of a reduction in the quantity or nutritional quality of the vegetation available for grazing. The prospect of increased rangeland degradation is common to all dryland areas. In particular, the deterioration is more advanced in semi-arid and sub-humid areas than in arid areas.
 - a) What are the characteristics of range lands? (4 marks).
 - b) Outline the importance of rangelands in Zambia (6 marks).
 - c) What measures should be carried out to improve the productivity of rangelands in Zambia? (10 marks).

3.
 - a) Define an ecosystem (5 marks).
 - b) What are the components of an ecosystem in rangelands (9 marks).
 - c) What are ecosystem goods and services. Explain and give examples (6 marks).

4. Pasture grasses and legumes are an importance component of the ecosystem in grazing lands.

- a) Give examples of any three pasture grasses and two pasture legumes. Please indicate their scientific names as well. (5 marks).
- b) Mention and explain five differences between pasture grasses and legumes (10 marks).

5. A farmer in Choma has the following herd of cattle 6 Tonga bulls, 150 Angoni Cows and 10 Angoni heifers. He has 10 hectares of field crops, 30 hectares of citrus fruits, 900 hectares of natural grazing land. **Take 1 Livestock Unit to 5 hectares**

- a) Define stocking rate (5 marks).
- b) Comment on the stocking rate (10 marks). Please show all calculations.
- c) What would be your advice to this farmer (5 marks).

Livestock Units of Different Breeds of Cattle

Breed	Cow	Bull	2-3 Years	1-2 Years	5-11 Months	0-5 Months
Brahman, Simmental	1.5	1.8	1.5	0.8	0.4	0.2
Hereford, Sussex, South Devon	1.3	1.6	1.3	0.7	0.3	0.2
Africander, Boran, Friesian	1.2	1.4	1.2	0.6	0.3	0.2
Barotse, Gurnsey	1.0	1.2	1.0	0.5	0.3	0.1
Tonga, Angoni, Jersey	0.9	1.1	0.9	0.5	0.2	0.1

END OF EXAMINATION



THE UNIVERSITY OF ZAMBIA
UNIVERSITY EXAMINATIONS – NOVEMBER 2020

AGG 3842
INTRODUCTORY STATISTICS FOR AGRICULTURE

TIME: 1 Hr. 30 min

Marks: 100

INSTRUCTIONS: ANSWER ANY TWO (2) QUESTIONS AND WRITE LEGIBLY
ANY STATISTICAL TEST SHOULD BE AT 5% SIGNIFICANCY LEVEL

Question One (1)

- Distinguish clearly between Discrete Random Variables and Continuous Random Variables (6 Marks)
- List and describe the 5 steps involved in carrying out a statistical investigation (10 Marks)
- Distinguish between Probability sampling methods and Non-probability sampling methods (6 Marks)
- List and describe the four probability sampling methods (8 Marks)

Question Two (2)

The average yield of a maize variety in one ha field in Kaoma is 100 tonnes. You believe this may not be the case currently.. You pick a random sample of 5 fields and record the following yields:

119	100	125	89	70
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- Is there enough evidence to suggest the average yield in Kaoma has changed? (20 Marks)
- What does the Central Limit Theorem state and why is it important in the field of Statistics? (10 Marks)

Question Three (3)

A student in Animal Science wanted to compare four sources of diet protein. He selected day old chicks and divided them into four groups: A, B. Group A was fed a diet which had fish meal as a source of protein, Group B was fed a diet which had cotton seed cake, Group C had soya bean cake and Group D had sunflower cake as a source of protein. Weight gain was recorded as shown below:

Fish meal	Cotton seed cake	Soya bean cake	Sunflower cake
8	2	3	2
9	4	5	2
6	3	4	-1
7	5	2	0
3	1	3	3

- a) Are there significant differences among the four diets? **(17Marks)**
b) Which diet would you likely recommend and why?**(3 Marks)**

Question Four (4)

The following data represents the average weight (Kg) of piglets over a period of eight weeks.:

Week	0	1	2	3	4	5	6	7	8
Weight gain	0.75	1.2	1.75	2.5	3.45	4.7	6.2	8.25	11.5

- a) Calculate a suitable linear prediction function for the gain in weight**(20 Marks)**
b) Predict what the weight gain would be at 6.5 weeks**(10 Marks)**

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

School of Engineering

Department of Civil & Environmental Engineering

CEE 2219 - Statics and Introduction to Mechanics of Materials

FINAL EXAMINATIONS 2019/2020

December 2020

Time allowed: Three (3) hours

CLOSED BOOK Examination

Instructions to candidates:

- 1) Candidates must ensure that their computer numbers are clearly written on each answer sheet used
- 2) ANSWER: Any THREE (3) from SECTION A, and Any TWO (2) from SECTION B. All questions carry equal marks (20 marks)
- 3) Additional marks will be gained by use of clear labelled sketches

Section A

Question 1

- a) Thermal stress is caused, when the temperature of a body
(I) is increased (II) is decreased (III) remains constant (IV) either 'I' or 'II'
- b) The maximum thermal stress in a circular tapering section is
(I) directly proportional to the bigger diameter
(II) directly proportional to the smaller diameter
(III) inversely proportional to the bigger diameter
(IV) both 'II' and 'III'
- c) If the ends of a body yield, the magnitude of thermal stress will
(I) increase (II) decrease (III) remain the same (IV) none of these
- d) When a body is subjected to a direct tensile stress (σ) in one plane, then normal stress on an oblique section of body inclined at an angle to the normal of the section is equal to
(I) $\sigma \sin \theta$ (II) $\sigma \cos \theta$ (III) $\sigma \sin^2 \theta$ (IV) $\sigma \cos^2 \theta$
- e) When a body is subjected to a direct tensile stress (σ) in one plane, then the tangential stress on an oblique section of the body inclined at an angle (θ) to normal of the section is equal to
(I) $p \sin 2\theta$ (II) $p \cos 2\theta$ (III) $P/2 \sin 2\theta$ (IV) $P/2 \cos 2\theta$
- f) When a body is subjected to the mutually perpendicular stress (σ_x and σ_y) then the centre of the Mohr's circle from y-axis is taken as
I) $(\sigma_x + \sigma_y)/2$ (II) $(\sigma_x - \sigma_y)/2$ (III) $(\sigma_x + \sigma_y)/2 + \tau_{xy}$ (IV) $(\sigma_x - \sigma_y)/2 - \tau_{xy}$

[6 Marks]

- g) Find the moment of inertia of the rectangular cross section shown in Fig. 1.1 with respect to the x-axis. [7 Marks]

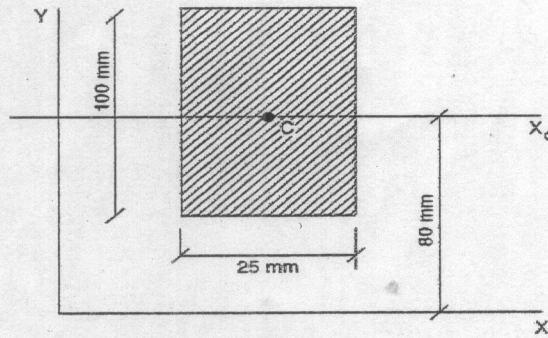


Figure 1.1

- h) Determine the moment of inertia of the composite area shown in Fig 1.2 with respect to the y-axis. Take $a = 600$, $b = 300$, $c = 200$ and $r = 150$. [7 Marks]

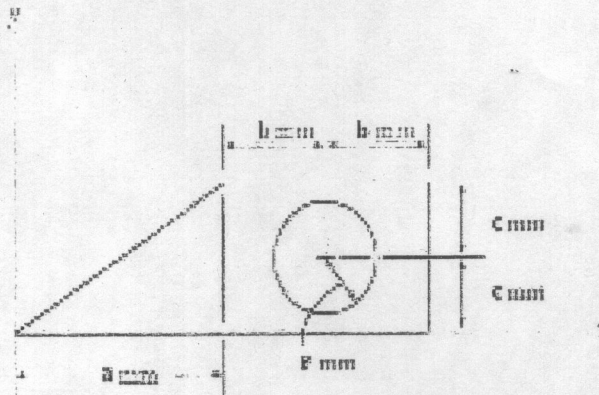


Figure 1.2

Question 2

- a) What is a beam? [1 Marks]
- b) Beams are often classified as to how they are supported. Give any two types of beams according to how they are supported. [1 Marks]
- c) Give two types of loads that are applied to a beam. [1 Marks]
- d) Explain how a shear diagram and a bending moment diagram together would help a designer come up with the best solution for beam design. [2 Marks]
- e) The beam AC is simply supported at A and C and subject to the uniformly distributed load w of 300 N/m plus the couple of magnitude M_c of $2700 \text{ N} \cdot \text{m}$ as shown in Fig 2.1. Find the following:
- i. The reactions R_A and R_C . [2 Marks]

- ii. Write equations for shear force V_1 for $0 < x < 3\text{m}$, V_2 for $3 < x < 6\text{m}$ and V_3 for $6 < x < 9\text{m}$, [3 Marks]
- iii. Write equations for bending moment M_1 for $0 < x < 3\text{m}$, M_2 for $3 < x < 6\text{m}$ and M_3 for $6 < x < 9\text{m}$. [3 Marks]
- iv. Draw the shear force and the bending moment diagrams. [5 Marks]
- v. The maximum moment M_{BC} between B and C [2 Marks]

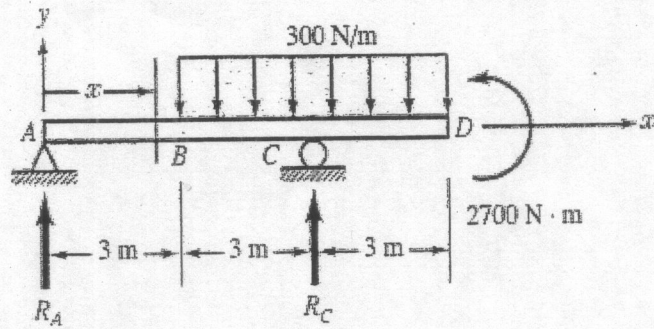


Figure 2.1

Question 3

- a) Locate the centroids of the areas shown in Fig. 3.1. [6 Marks]

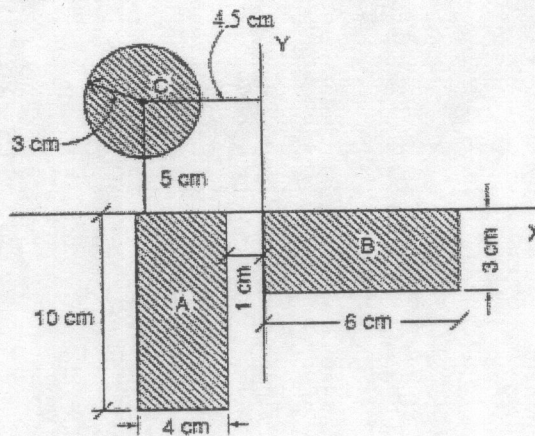


Figure 3.1

- b) A plane element is subjected to the stresses shown in Fig. 3.2. Using Mohr's circle, determine the following: [10 Marks]
 - i. The principal stresses and their directions. [4 Marks]
 - ii. The maximum shearing stresses and the directions of the planes on which they occur. [4 Marks]

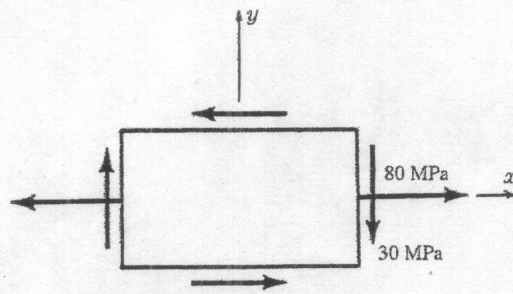


Figure 3.2

Question 4

A mild steel rod of 20 mm diameter and 300 mm long is enclosed centrally inside a hollow copper tube of external diameter 30 mm and internal diameter 25 mm. The ends of the rod and tube are tightly brazed together, and the composite bar is subjected to an axial pull of P as shown in Fig. 4.1.

- If modulus of elasticity E for steel and copper is 200 GPa and 100 GPa respectively and the axial pull $P = 40$ kN. Find the stresses developed in the copper tube and steel rod. [12 Marks]
- If modulus of elasticity E for steel and copper is 200 GPa and 100 GPa respectively and the axial pull $P = 0$ kN. Find the intensity of stress in each metal, when the common temperature rises by 200°F . Take coefficient of expansion for steel $= 6 \times 10^{-6}/^\circ\text{F}$ and for copper $= 10 \times 10^{-6}/^\circ\text{F}$. [8 Marks]

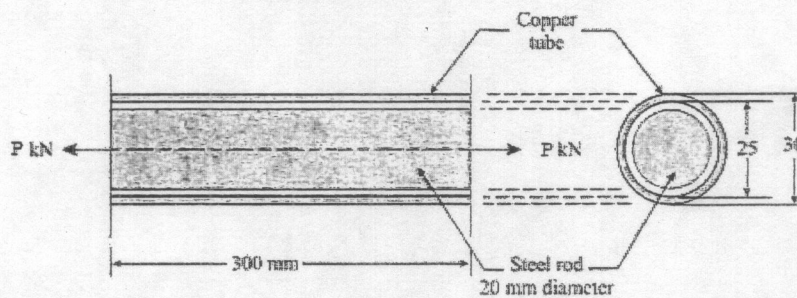


Figure 4.1

Section B

Question 5

- Frames and machines are different as compared to trusses since they have _____. [1 marks]

(I) only two-force members	(II) only multiforce members
(III) at least one multiforce member	(IV) at least one two-force member
- Forces common to any two contacting members act with _____ on the other member. [1 marks]

(I) equal magnitude but opposite sense	(II) equal magnitude and same sense
(III) different magnitude but opposite sense	(IV) different magnitude but the same sense
- Determine the force in member DC, CE, DE and BE of the truss shown in Fig. 5.1 and state if the members are in tension or compression. Take $P_1 = 10$ kN, $P_2 = 8$ kN. [10 Marks]

- d) The wedge shown in Fig. 5.2 is used to level the member. Determine the horizontal force P that must be applied to begin to push the wedge forward. The coefficient of static friction between the wedge and the two surfaces of contact is $\mu_s = 0.2$. Neglect the weight of the wedge. [8 Marks]

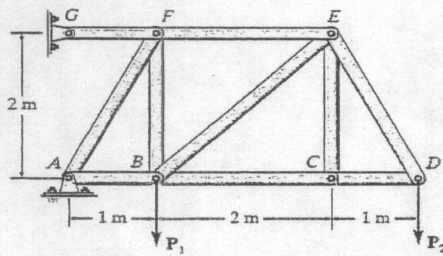


Figure 5.1

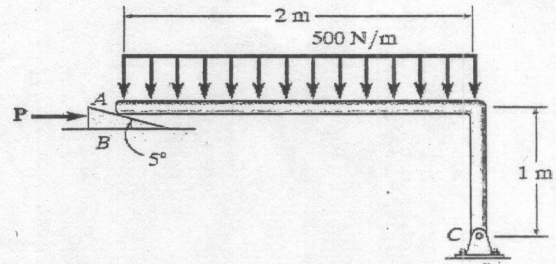


Figure 5.2

Question 6

- a) What is a major distinction between scalar and vector quantities? [1 Marks]
 b) Name some examples of scalar and vector quantities in mechanics of materials [1 Marks]
 c) The forces F_1 , F_2 , and F_3 shown in Fig. 6.1, all of which act on point A of the bracket, are specified in three different ways. Determine the x and y scalar components of each of the three forces and the magnitude of the force system shown in Fig. 6.1. [12 Marks]
 d) Express F_B and F_C in Cartesian vector form shown in Fig. 6.2. [6 Marks]

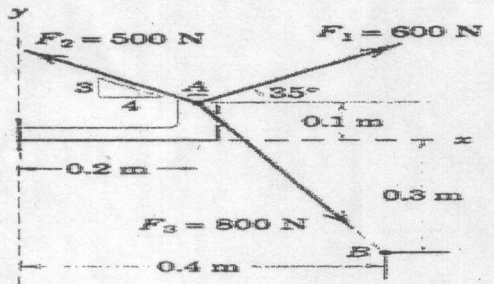


Figure 6.1

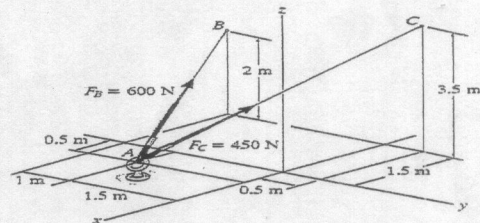


Figure 6.2

Question 7

- a) Determine the horizontal and vertical components of force that pins A and B exert on the frame shown in Fig. 7.1. [12 Marks]
 b) If a clamping force of 300 N is required at A as shown in Fig. 7.2, determine the amount of force F that must be applied to the handle of the toggle clamp. [8 marks]

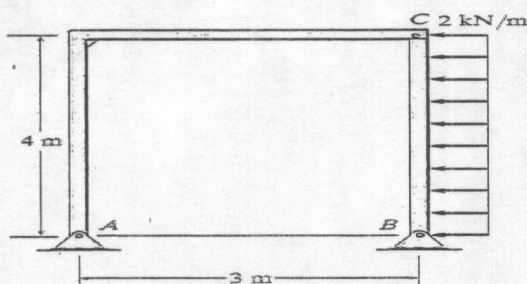


Figure 7.1

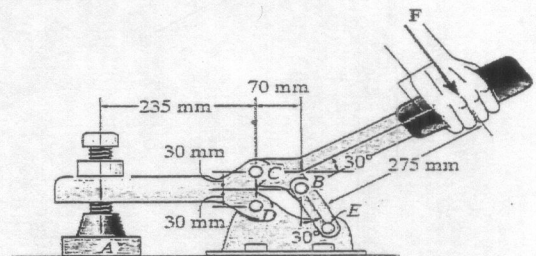
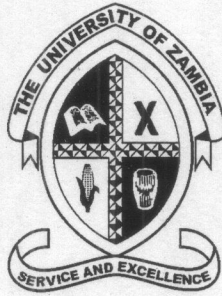


Figure 7.2



THE UNIVERSITY OF ZAMBIA

SCHOOL OF ENGINEERING

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

UNIVERSITY EXAMINATIONS

TERM II – 2019 ACADEMIC YEAR – 28 DECEMBER, 2020

EEE 2019

PRINCIPLES OF ELECTRICAL AND ELECTRONIC ENGINEERING

TIME	: Three (3) hours
INSTRUCTIONS	: Answer FIVE questions: AT LEAST TWO questions from EACH SECTION . Each section must be answered in a separate booklet.
ADDITIONAL INSTRUCTIONS	: Where not stated, resistances are in ohms. Each question carries [20 Marks], [Total 100 Marks].

SECTION A

QUESTION 1

a) Name the elements labeled (i) – (vi) in Figure Q1(a). [10 Marks]

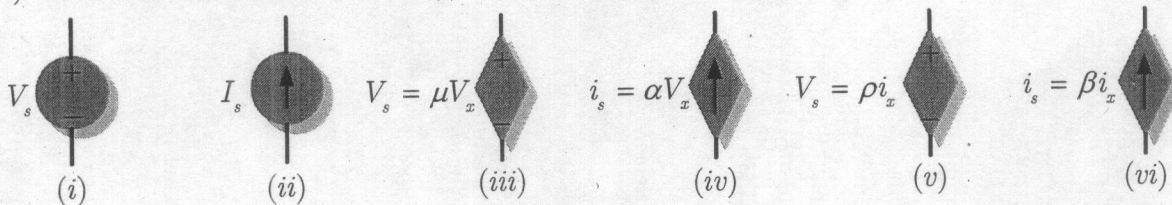


Figure Q1(a)

b) Using superposition, obtain the voltage v_0 in the circuit shown in Figure Q1(b). [10 Marks]

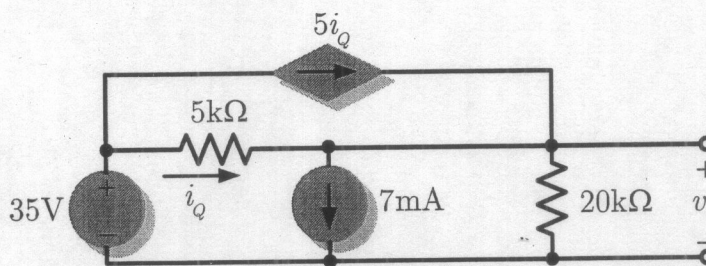


Figure Q1(b)

[Total 20 Marks]

QUESTION 2

a) For the circuit of Figure Q2(a), use nodal analysis to find v_1 , v_2 , and v_3 . [10 Marks]

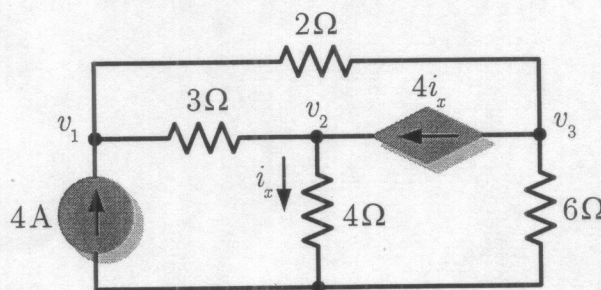


Figure Q2(a)

b) Consider a linear circuit whose Thevenin equivalent is shown in Figure Q2(b). It is known that when a $2k\Omega$ load resistor is connected across terminals $a-b$, the load current is $10mA$. If a $10k\Omega$ load resistor is connected to the terminals the load current is $6mA$. Obtain the current in a $20k\Omega$ load resistor. [10 Marks]

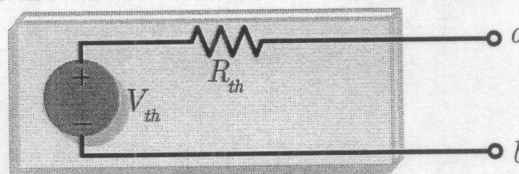


Figure Q2(b)

[Total 20 Marks]

QUESTION 3

- a) Find the Norton equivalent circuit at terminals $a-b$ for the transistor amplifier circuit depicted in Figure Q3(a). [10 Marks]

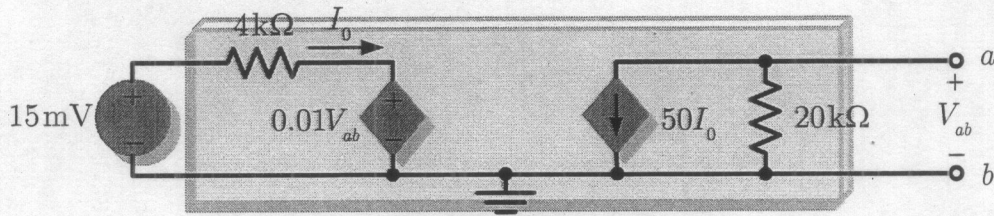


Figure Q3(a)

- b) For the circuit of Figure Q3(a), use source transformation to determine the current, i and power dissipated by the 4Ω resistor. [10 Marks]

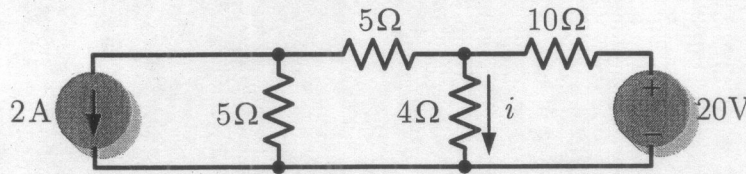


Figure Q3(b)

[Total 20 Marks]

QUESTION 4

- a) Determine the voltage gain $A_v = v_0/v_s$ for the transistor amplifier circuit in Figure Q4(a). [8 Marks]

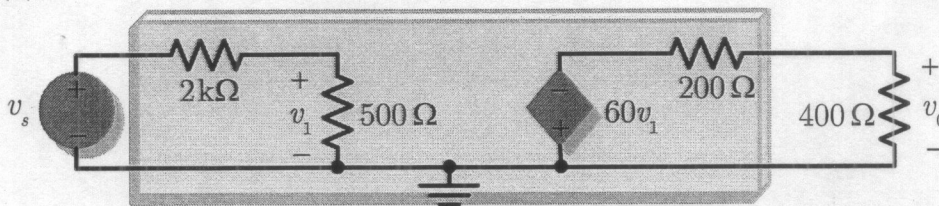


Figure Q4(a)

- b) Using mesh analysis, find i_1 , i_2 and i_3 in the circuit of Figure Q4(b). [12 Marks]

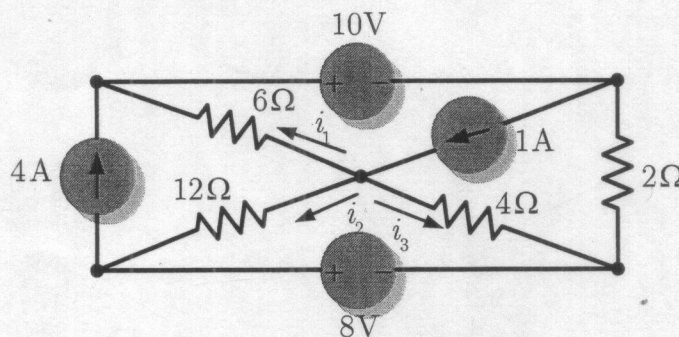


Figure Q4(b)

[Total 20 Marks]

SECTION B

QUESTION 5

- a) For the circuit depicted in Figure Q5(a) the switch is closed at $t = 0$ and $v_c(0) = 0$.
- i) Obtain the capacitor voltage $v_c(t)$, for $t > 0$. [6 Marks]
 - ii) Hence find $i(t)$, for $t > 0$. [2 Marks]

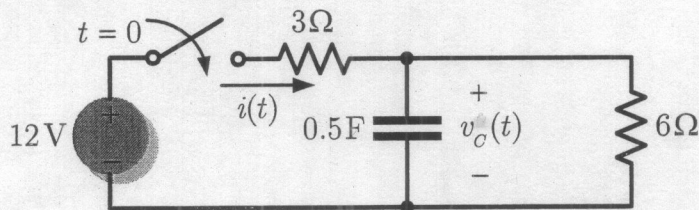


Figure Q5(a)

- b) Using mesh analysis, obtain I_0 in the circuit shown in Figure Q5(b). [12 Marks]

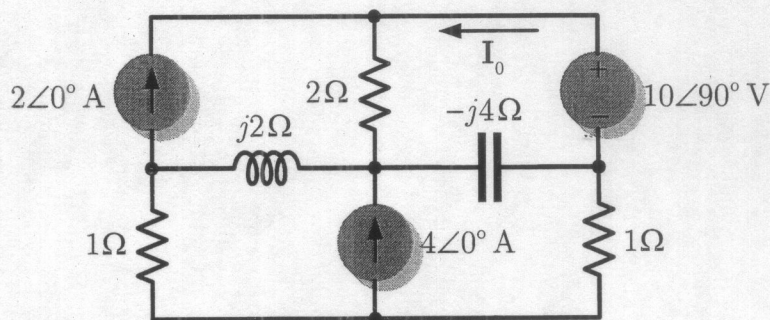


Figure Q5(b)

[Total 20 Marks]

QUESTION 6

- a) Find $v(t)$ and $i(t)$ for $t > 0$ in the circuit of Figure Q6(a). [10 Marks]

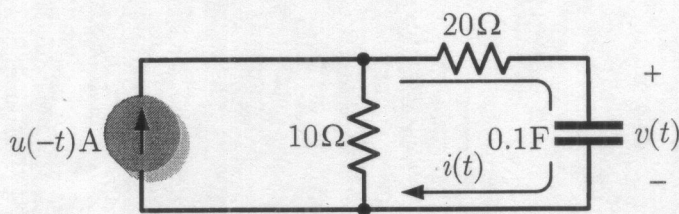


Figure Q6(a)

- b) Compute $v_0(t)$ in the circuit of Figure Q6(b) using nodal analysis. [10 Marks]

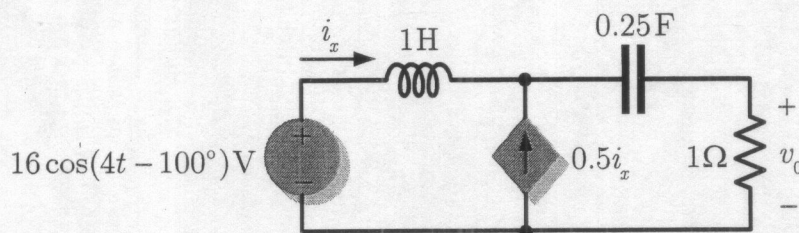


Figure Q6(b)

[Total 20 Marks]

QUESTION 7

- a) The switch in Figure Q7(a) has been closed for a long time. It opens at $t = 0$. Find $i(t)$ for $t > 0$. [10 Marks]

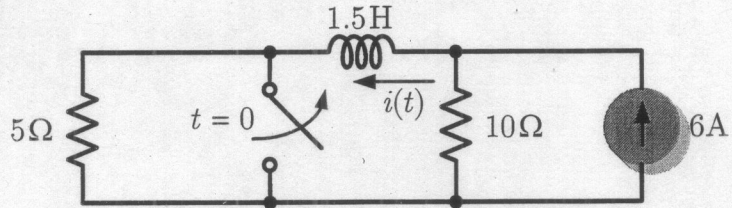


Figure Q7(a)

- b) For the ac circuit shown in Figure Q7(b), determine the current I_0 . [10 Marks]

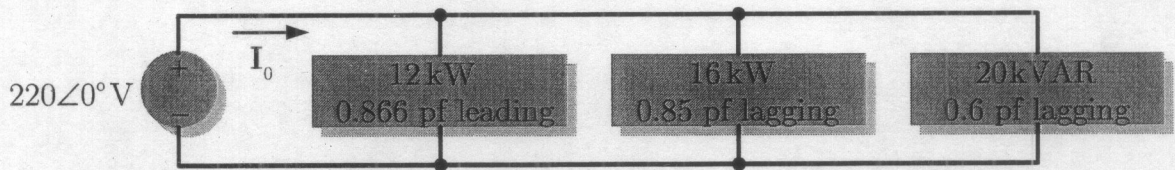


Figure Q7(b)

[Total 20 Marks]

QUESTION 8

- a) Calculate the rms value, V_{rms} of the periodic sawtooth ac voltage waveform of Figure Q8(a). [5 Marks]

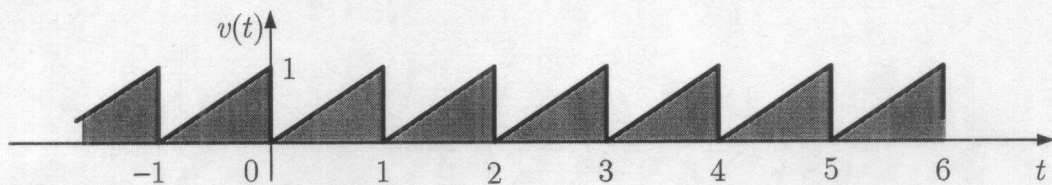


Figure Q8(a)

- b) A 240 V rms, 50Hz source supplies two loads in parallel, as shown in Figure Q8(b).
 i) Find the power factor of the parallel combination. [8 Marks]
 ii) Calculate the value of the capacitance connected in parallel that will raise the power factor to unity. [7 Marks]

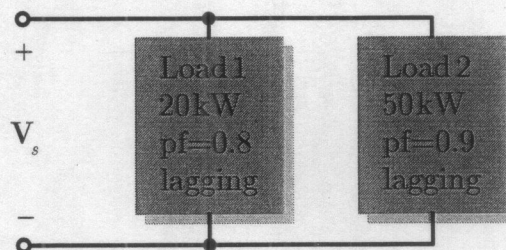


Figure Q8(b)

[Total 20 Marks]

END OF EEE 2019 EXAM

SCHOOL OF ENGINEERING**2020 ACADEMIC YEAR****FINAL EXAMINATION – FOURTH YEARS****BACHELOR OF ENGINEERING****ENG 4129: ENGINEERING MANAGEMENT AND ENTREPRENEURSHIP****TIME: THREE (3) HOURS****DATE: FRIDAY, 27th NOVEMBER 2020****INSTRUCTIONS:**

1. THIS EXAMINATION PAPER CONTAINS THREE SECTIONS (A & B [B1-B2]) AND A TOTAL OF SEVEN QUESTIONS.
2. SECTION A CONTAINS THREE QUESTIONS. QUESTION ONE IS **COMPULSORY** AND YOU ARE EXPECTED TO ANSWER ANY ONE QUESTION FROM THE OTHER TWO.
3. SECTION B CONTAINS TWO SUB-SECTIONS **B1** AND **B2**. **B1 IS COMPULSORY** AND YOU ARE EXPECTED TO ANSWER ANY OTHER TWO QUESTION FROM THE SUBSECTION **B2**.
4. EACH SECTION A AND B SHOULD BE ANSWERED IN A SEPARATE ANSWER SHEET.
5. EACH QUESTION CONTAINS 20 MARKS.
6. MAKE SURE THE STUDENT NUMBER IS CLEARLY INDICATED ON ALL BOOKLETS TOGETHER WITH THE QUESTIONS ATTEMPTED.
7. THE ANSWER FOR EACH QUESTION SHOULD BEGIN ON A NEW SHEET.
8. WHERE SPECIFIC INFORMATION IS NOT GIVEN, MAKE AND STATE YOUR ASSUMPTIONS.
9. MARKS WILL BE LOST FOR ILLEGIBLE, UNTIDY AND UNORGANISED PRESENTATION.
10. THE EXAMINATION IS STRICTLY CLOSED BOOK.
11. TOTAL MARKS FOR THIS EXAMINATION IS **100**.

Section A

Question One – (Compulsory Question)

In microeconomics, the concept of demand and supply are fundamental to the analysis of markets. Briefly explain the following:

- (a) What is the difference between a "change in demand" and a "change in quantity demanded"? Similarly, a "change in supply" and a "change in quantity supplied" Use graphs to explain your answers. [4 Marks]
- (b) Events listed below have an impact on the market for Maize. For each event, assuming the market is initially in equilibrium, state which curve is affected (supply or demand curve for Maize), what direction is it shifted, and what is the resulting impact on equilibrium price and quantity of Maize?
- (i) The price of inputs for Maize increases. [4 Marks]
- (ii) Consumers expect the price of Maize to fall in the future. [4 Marks]
- (iii) A technological advance in the production of Maize occurs. [4 Marks]
- (iv) Consumers' incomes decrease, if Maize is an inferior good [4 Marks]

(Total: 20 marks)

Question Two

Economists use the Production Possibilities Frontier to simplify reality in order to improve our understanding of the real world

- (i) State what the Production Possibilities Frontier is [2 Marks]
- (ii) With the aid of a graph explain the economic concepts that are illustrated by the Production Possibilities Frontier Model [8 Marks]
- (iii) Explain two ways in which an economy can push out its production possibilities frontier? [4 Marks]
- (iv) Briefly, explain the difference between Labour and Entrepreneurship as factors of production? [6 Marks]

(Total: 20 marks)

Question Three

The short run Phillips curve and the short-run aggregate supply curve are closely related, yet one slopes downward and the other slopes upward. With the aid of graphs, discuss this relationship using the aggregate demand and aggregate supply model and the resultant policy implications.

(Total: 20 marks)

Section B

Answer Section B1 (Multiple Choice and Compulsory) and Any Two (2) questions from Section B2.

Section B1 – Multiple Choice and Compulsory

1. Which of the following items would not fall under the definition of an asset?
 - a) Land
 - b) Machinery
 - c) Cash
 - d) Owners' Equity
 - e) Debtors

2. Which one of the following items would fall under the definition of a liability?
 - a) Cash
 - b) Debtors
 - c) Owners' equity
 - d) Tax owed
 - e) None of the above

3. Which of the following statements are false?
 - a) A liability is a debt for your business.
 - b) Debtors are a debt for your business.
 - c) The accounting equation shows how much of your assets belong to the owner, and how much 'belong' to people outside the business.
 - d) If you cannot work out a value for an item that will bring you future benefits, then you cannot keep this as an asset in your records.
 - e) None of the above.

4. A business has the following items in it:
 - Land ZMW1,000,000
 - Machinery ZMW20,000
 - Cash ZMW10,000
 - Debt ZMW0
 - Owner's equity _____?
 What is the value of the owner's equity?
 - a) ZMW1,000,000
 - b) ZMW1,020,000
 - c) ZMW1,010,000
 - d) ZMW1,030,000
 - e) None of the above

5. Which of the following statements are true?
- a) A business whose liabilities are greater than its assets has a bad financial position.
 - b) A business whose liabilities are greater than its owner's equity has a bad financial position.
 - c) A business whose assets are greater than its owner's equity has a bad financial position.
 - d) a) and b)
 - e) All the above
6. Company A used ZMW3, 000 worth of office supplies this year but the costs were not paid for until next year. Which of the following is not a result of this transaction?
- a) An expense of ZMW3,000 is recorded on this year's income statement
 - b) There is a ZMW3,000 credit in cash on the Statement of financial position (balance sheet).
 - c) An accrued expense of ZMW3,000 is recorded as current liabilities on the statement of financial position (balance sheet).
 - d) There is a ZMW3,000 credit in office supplies on the statement of financial position (balance sheet).
7. Which accounting assumption assumes that an enterprise will continue in operation long enough to carry out its existing objectives and commitments?
- a) Monetary unit assumption
 - b) Economic entity assumption
 - c) Time period assumption
 - d) Going concern assumption
 - e) None of the options listed
8. Chavuma's Car Repair Shop started the year with total assets of K60, 000 and total liabilities of K40, 000. During the year the business recorded K100, 000 in car repair revenues, K55, 000 in expenses, and dividends of K10, 000.

What was the net income reported by Chavuma's Car Repair Shop for the year?

- a) K35, 000.
- b) K45, 000.
- c) K20, 000.
- d) K90, 000.
- e) none of the options listed

9. If beginning capital was K25,000, ending capital is K37,000, and the owner's withdrawals were K23,000, the amount of net income or net loss for the period was:
- Net loss of K35,000
 - Net income of K35,000
 - Net income of K14,000
 - Net loss of K14,000
 - None of the options listed
10. Which of the following is not an activity listed in the statement of cash flows?
- Investing Activities
 - Funding Activities
 - Operating Activities
 - Financing Activities
 - None of the options listed

Section B2 – Answer any two Questions

Question One -

The following transactions took place in the month of March, 2020.

2020

- | | |
|----------|---|
| March 1 | Started business with K800 in the bank |
| March 2 | Bought goods on credit from the following persons: K. Henriques K76; M. Hyatt K27; T. Braham K56; |
| March 5 | Cash sales K87 |
| March 6 | Paid wages cash K14 |
| March 7 | Sold goods on credit to: H. Elliott K35; L. Lane K42; H. Carlton K72 |
| March 9 | Bought goods for cash K46 |
| March 10 | Bought goods on credit from: M. Hyatt K57; T; Braham K98 |
| March 12 | Paid wages in cash K14 |
| March 13 | Sold goods on credit to: L. Lane K32; H. Carlton K23 |
| March 15 | Bought shop fixtures on credit from Betta Limited K50 |
| March 17 | Paid M. Hyatt by cheque K84 |
| March 18 | We returned goods to T. Braham K20 |
| March 21 | Paid Betta Limited a cheque for K50 |
| March 24 | J. Carlton paid us his account by cheque K95 |
| March 27 | We returned goods to K. Henriques K24 |
| March 30 | J. King lent us K60 by cash |
| March 31 | Bought a motor van paying by cheque K400 |

Required

- a) Define the following: double entry system and the accounting equation, and trial balance. [6 marks]
- b) Enter up the books for the above transactions. [10 marks]
- c) Extract a trial balance as at March 31, 2020. [4 marks]

(Total: 20 marks)**Question Two**

Accounting is a very important function for any business undertaking. At the end of every financial year, every business organisation has to prepare final accounts which comprise four main or basic financial statements.

In relation to the above statement; you are:

Required:

- i) State four (4) accounting concepts. [6 marks]
- ii) What can motivate you to start your own business? [3 marks]
- iii) Define the four (4) basic financial statements and state the information found in each of them. [8 marks]
- iv) State three (3) users of financial statements of an organisation and state their information needs. [3 marks]

(Total: 20 marks)**Question Three**

1. Bookkeeping and accounting are very important functions in any organisation.

Required:

- i) Define bookkeeping and accounting? [2 marks]
- ii) Draw up Civil and Environmental Engineering Limited's statement of financial position as at October 31, 2020 from the details given in the table below.

Item	Amount (ZMW)
Capital	23,750
Debtors	4,950
Motor vehicles	5,700
Creditors	2,450
Fixtures	5,500
Stock of goods	8,800
Cash at the bank	1,250

[5 marks]

iii) Complete the columns in the table below to show the effects of each of the transactions.

S/N	Transaction	Effect upon		
		Assets	Capital	Liabilities
a)	We pay a creditor in cash			
b)	Bought fixtures paying by cheque			
c)	Bought goods on credit			
d)	The proprietor introduces capital in the business			
e)	Gogo Muchembele lends the firm cash			
f)	A debtor pays us by cheque			
g)	We return goods to a supplier whose bill we had not paid.			
h)	Bought additional shop premises paying by cheque			

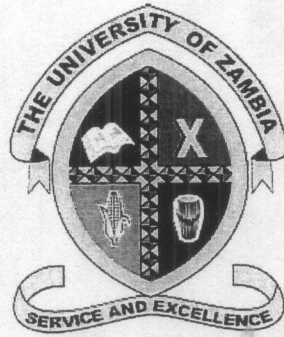
[8 marks]

iv) Complete the following table showing which accounts are to be credited and which ones are to be debited:

S/N	Transaction	Account to be debited	Account to be credited
a)	Bought motor vehicle for cash		
b)	Bought office equipment on credit from Eng. Forest Mushitu		
c)	Introduced capital in cash		
d)	A debtor, Lisa Lake pays us by cheque		
e)	Paid a creditor Night Busiku Bwacelanji, in cash		

[5 marks]

(Total: 20 marks)



THE UNIVERSITY OF ZAMBIA
SCHOOL OF ENGINEERING

ENG 5129 ENGINEERING MANAGEMENT AND SOCIETY II

FINAL EXAMINATION NOVEMBER-DECEMBER 2020

TIME ALLOWED: 3 HOURS

CLOSED BOOK

=====

INTRUCTIONS TO CANDIDATES

1. THIS QUESTION PAPER COMPRISES TWO SECTIONS: SECTION A AND SECTION B
2. **SECTION A HAS THREE QUESTIONS**
ANSWER ANY TWO QUESTIONS
3. **SECTION B HAS FOUR QUESTIONS**
ANSWER ANY THREE QUESTIONS

SECTION A: ANSWER ANY TWO QUESTIONS

QUESTION ONE

- (a) Using Figure 1 below W, X, Y and Z show the **FOUR** types of the Developing Growth Strategies. Name and describe the **FOUR** Developing Growth Strategies labelled W, X, Y and Z. **(4 marks)**

	Existing Products	New Products
Existing Markets	W	X
New Markets	Y	Z

Figure 1: Developing Growth Strategies

- (b) Draw a diagram of the SWOT Framework. **(3 marks)**
(c) Name and briefly describe the four main organization structures. **(4 marks)**
(d) Briefly explain the FIVE characteristics of a Strategic Plan. **(5 marks)**
(e) Name and describe the FOUR types of Pricing Strategies. **(4 marks)**

QUESTION TWO

- (a) Name the **THREE** stages of Managing the Marketing Effort and briefly explain the THREE processes involved in these stages. **(6 marks)**
(b) Name **TWO** groups of management that are involved in performing Tactical Planning and Operational Planning. **(2 marks)**
(c) Name and briefly describe **TWO** main areas to consider when managing Human Resource if they are to work effectively. **(2 marks)**
(d) Name and briefly explain the **FOUR** components that are critical in the preparations of personnel specifications when planning recruitment? **(4 marks)**
(e) Briefly describe the importance of job description to the:
i) Employer **(2 marks)**
ii) Employee **(2 marks)**
(f) Briefly describe the **TWO** main elements of strategy management process used in establishing organizational direction. **(2 marks)**

QUESTION THREE

- (a) There are **THREE** competing priorities in every project used to "fine-tune" projects toward the most commercially successful outcome.
i) Name and briefly describe these **THREE** competing priorities. **(3 marks)**
ii) With the help of a diagram explain the concept Behind-Time and Performance versus Cost and describe their tradeoffs. **(4 marks)**

- (b) Discuss the term "universality of management". (2 marks)
- (c) Briefly explain what the Commonwealth Association Corporate Governance's guidelines on corporate governance states regarding the duties of the Board Chairman and that of the Chief Executive Officer (CEO). (3 marks)
- (d) State and briefly discuss the **FOUR** basic functions of management that constitute the management process (8 marks)

SECTION B: ANSWER ANY FOUR QUESTIONS

QUESTION FOUR

The operations team at Jack and Bull Engineering Inc. was evaluating the feasibility of the following two projects that were required for the business:

- i) Milling Project: Investment of \$260,000 in an automatic milling machine that would reduce wastage by \$180,000 in the first year and \$120,000 in the second year.
- ii) Grinding Project: Investment of \$120,860 in an automatic grinding machine that would reduce wastage by \$85,000 in the first year and \$116,000 in the second year.

Compute the NPV of each project and determine if the team should accept or reject them if the cost of capital is 13%. (20 marks)

QUESTION FIVE

As part of the computer programming team making a project management software, you are requested to prepare a sample solution to be used for validating the project management software by doing the following assignment.

Draw the network and identify the critical path for the information in table 1 below. Also calculate the earliest–latest starting and finishing times for each activity:

Table 1

Activity	Preceding activity	Time (weeks)
A	-	4
B	-	10
C	A, B	11
D	B	16
E	B	13
F	C	5
G	D	11
H	D, E	9
I	F, G, H	4

(20 marks)

QUESTION SIX

- (a) Define comprehensively the term Public Private Partnership (PPP) as applied in public service delivery **(5 marks)**
- (b) With the aid of an example, explain the concept "self-interest" in a Public Private Partnership relationship between the government and a private company engaged to collect and safely dispose all solid waste generated in a city **(7 marks)**
- (c) Compare the level of risk between a "service contract" and a "lease contract" in Public Private Partnerships **(8 marks)**

QUESTION SEVEN

Fully explain (with the aid of supporting examples) the following concepts in contractual relationships:

- (a) Parties competent to contract **(5 marks)**
- (b) Certainty of Meaning **(5 marks)**
- (c) Lawful Object **(5 marks)**
- (d) Possibility of performance **(5 marks)**

The University of Zambia
Department of Mathematics & Statistics
2019/2020 Academic Year Final Examinations
MAT2110 - Engineering Mathematics I

Time allowed : Three (3) hours

Full marks : 100

Instructions: • There are **six (6)** questions in this paper. Attempt **any five (5)** questions.

All questions carry **equal** marks.

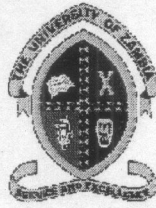
- **Full credit** will only be given when **necessary work** is shown.
- Indicate your **computer number** on all answer booklets.

This paper consists of two pages of questions.

1. a) Define each of the following:
 - i) Parabola [2 marks]
 - ii) Ellipse [2 marks]
- b) Find the xy -coordinates for the vertices of the conic section $4x^2 - 4xy + 7y^2 = 24$. [10 marks]
- c) Given that $r = \frac{3}{2+2\cos\theta}$ represents a conic section.
 - i) Identify this conic section. [4 marks]
 - ii) Sketch its graph. [2 marks]
2. a) Find all the critical points of $f(x, y) = x^3 - 3x + xy^2$ and classify them using the second derivative test. [12 marks]
- b)
 - i) Find the Taylor series of e^x about $x = c$. [3 marks]
 - ii) Find the radius of convergence for the series found in i). [3 marks]
- c) From b)i) or otherwise, obtain the Maclaurin series for e^x . [2 marks]

3. a) Find the area of the finite region bounded by the curve $y = x^2 - 2$ and the line $y = 2$. [5 marks]
- b) Find the volume of a solid obtained by rotating the finite region bounded by $y = x^2 - 2x$ and $y = x$ about the line $y = 4$. [5 marks]
- c) A leaky water tank is in the shape of an inverted right circular cone with depth $5m$ and top radius $2m$. When the water in the tank is $4m$ deep, it is leaking at a rate of $\frac{1}{10}m^2/min$. How fast is the water level dropping at that time. [5 marks]
- d) Find the centroid of the region bounded above by $y = 1$ and below by $y = \frac{x^2}{4}$. [5 marks]
4. a) Evaluate the following integrals:
- i) $\int \frac{1}{x^3} dx$ [2 marks]
- ii) $\int \frac{x}{x^2+1} dx$ [3 marks]
- iii) $\int \frac{1}{(4-x^2)^{3/2}} dx$ [5 marks]
- b) Find the arc length of the cardioid $r = 2 + 2 \cos \theta, 0 \leq \theta \leq 2\pi$. [5 marks]
- c) Given that $f(x, y, z) = e^{xy} \sin z$, $x = r + s$, $y = r - s$ and $z = 2rs$. Find $\frac{\partial f}{\partial r}$ at the point $(r, s) = (1, -1)$. [5 marks]
5. a) Show that $\lim_{(x,y) \rightarrow (0,0)} \frac{y^2 - x^2}{x^2 + y^2}$ does not exist. [4 marks]
- b) Find the absolute minimum and absolute maximum values of $f(x, y) = x \sin y$ within the rectangular plate $x = 0, x = 2, y = 0, y = 2\pi$. [8 marks]
- c) Use total differential to estimate the value of $\sqrt{(2.98)^2 + (4.03)^2}$. [5 marks]
- d) Find $\frac{dy}{dx}$ if $xy - y^2 = 2x$. [3 marks]
6. a) i) Find the reduction formula for $\int x^n e^{-x} dx$. [4 marks]
- ii) Use the formula found in i) to evaluate $\int x e^{-x} dx$. [2 marks]
- b) Evaluate $\lim_{x \rightarrow 0} \frac{x - \sin x}{x^3}$ [4 marks]
- c) Use the method of Lagrange multipliers to find the maximum and the minimum of $f(x, y) = 4xy$ subject to the constraint $\frac{x^2}{9} + \frac{y^2}{16} = 1$. [10 marks]

END OF EXAMINATION!



**THE UNIVERSITY OF ZAMBIA
SCHOOL OF ENGINEERING
DEPARTMENT OF MECHANICAL ENGINEERING**

**UNIVERSITY EXAMINATIONS
END OF YEAR EXAMINATIONS, 2019**

**MEC 2309 – PROPERTIES OF ENGINEERING MATERIALS I
QUESTION PAPER**

Read the following instructions carefully before you start writing:

-
- 1. This Examination is Closed Book.***
 - 2. Time Allowed: Three (3) Hours.***
 - 3. Answer: Five (5) questions, with at least two from Section A and two from Section B.***
 - 4. Hand in Sections A and B in Separate Answer Books.***
 - 5. All questions carry 20 marks each.***
-

[DO NOT TURN THE PAGE OVER UNTIL YOU ARE TOLD TO DO SO]

SECTION A: ANSWER A MINIMUM OF TWO QUESTIONS IN THIS SECTION

Question One

- a) Draw a fully labelled Fe-C phase diagram up to 6.7% Carbon, indicating the important points. [12 marks]
- b) With reference to your Fe-C phase diagram, for two plain carbon steels of 0.4% and 1.0% Carbon;
 - i) Calculate the amount of austenite present in each of these steels at 723°C, assuming the transformation is complete. [02 marks]
 - ii) Calculate the amount of pearlite present in each of these steels at 25°C, assuming slow cooling. [02 marks]
 - iii) Suggest a typical application for each steel in its fully hardened and tempered conditions, and justify your choice. [04 marks]

Question Two

Assuming that metal atoms can be considered as hard spheres in contact, determine the coordination numbers and packing fractions for the following crystal structures:

- a) Body-centred cubic [06 marks]
- b) Face-centred cubic [07 marks]
- c) Hexagonal close-packed. [07 marks]

[Hints: Packing fraction = (volume of atoms in unit cell)/ (volume of unit cell) and the volume of a sphere is $4\pi R^3/3$.]

Question Three

- a) Sketch a unit cell of the face-centred cubic crystal system and show the positions of the following (100), (110) and (111) planes. [06 marks]
- b) Show by calculation that the (111) planes in the face-centred cubic crystal system possess a greater density of atomic packing and a smaller inter-planar spacing than either the (100) or (110) planes. [14 marks]

Question Four

- a) Using suitable sketches, differentiate between tetrahedral and octahedral interstitial solid solutions. [05 marks]
- b) Name the three types of intermetallic compounds. Discuss how they are formed and mention some of their important properties. [15 marks]

SECTION B: ANSWER A MINIMUM OF TWO QUESTIONS IN THIS SECTION

Question Five

- a) With the aid of sketches, describe in detail ionic, covalent and metallic bonds. [09 marks]
- b) State and describe the two polymer classifications in relation to polymerisation mechanisms [06 marks]
- c) What are composite materials? Give examples? [05 marks]

Question Six

Briefly discuss the following:

- a) Annealing [05 marks]
- b) Hardening [05 marks]
- c) Cyaniding [05 marks]
- d) Normalising [05 marks]

Question Seven

- a) Briefly discuss how you would test a composite material's hardness using the Rockwell test. [12 marks]
- d) List four advantages and four disadvantages of polymer materials [08 marks]

**END OF MEC 2309 EXAMINATION
G M MUNAKAAMPE / F K CHITALU
DECEMBER 2020**