THE UNIVERSITY OF ZAMBIA

SCHOOL OF ENGINEERING

2017/2018 ACADEMIC YEAR

1. AEN 3331 FARM POWER AND MACHINERY
2. CEE 2219 STATICS AND INTRODUCTION TO MECHANICS OF MATERIALS
3. EEE 2019 PRINCIPLES OF ELECTRICAL AND ELECTRONIC ENGINEERING
4. ENG 2139 INTRODUCTION TO INFORMATION AND COMMUNICATIONS TECHNOLOGY
5. ENG 5129 ENGINEERING, MANAGEMENT AND SOCIETY II
6. MEC 2309 PROPERTIES OF ENGINEERING MATERIALS I

THE UNIVERSITY OF ZAMBIA
SCHOOL OF ENGINEERING
2017 / 2018 ACADEMIC YEAR
UNIVERSITY EXAMINATIONS
DEFERRED EXAMINATION – DECEMBER 2018
AEN 3331: FARM POWER AND MACHINERY

TIME ALLOWED: **THREE** HOURS.

INSTRUCTIONS:

1. THIS EXAMINATION PAPER HAS TWO SECTIONS, **SECTION A** AND **SECTION B**.
2. **SECTION A** HAS 25 MULTIPLE CHOICE QUESTIONS. ATTEMPT **ALL** OF THEM. EACH QUESTION HAS **ONE MARK.**
3. **SECTION B** HAS **FIVE QUESTIONS**. ATTEMPT **THREE** QUESTIONS ONLY. EACH QUESTION CARRIES **25 MARKS**.
4. CALCULATED **FINAL** FIGURES MUST BE ROUNDED OFF TO TWO (2) DECIMAL PLACES.
5. WRITTEN MATERIALS, CELL PHONES AND PROGRAMMABLE CALCULATORS ARE **NOT ALLOWED** IN THE EXAMINATION ROOM.

DO NOT TURN THE PAGE UNTIL YOU ARE TOLD TO

SECTION A (25 MARKS): ATTEMPT **ALL** QUESTIONS IN THIS SECTION

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

1. Three of the following are primary objectives for mechanisation. Which one is not?
   a) To reduce drudgery of farm work.
   b) To increase the productivity of farm worker.
   c) To increase the timeliness and quality of work.
   d) To reduce the cost of production.

2. Which of the following is not a simple machine.
   a) Wedge
   b) Lever
   c) Pulley
   d) Wheelbarrow

3. The process by which small molecules are joined to form larger molecules is called ...
   a) metabolism
   b) anabolism
   c) catabolism
   d) enzymatic reactions

4. The energy currency of the cell is
   a) Starch
   b) Glycogen
   c) Glucose
   d) ATP

5. Excess glucose after a meal will first form glycogen in a process called
   a) Glycolysis
   b) Glycogenesis
   c) Glycogenolysis
   d) Lipogenesis

6. How efficient is a human body in converting energy contained in glucose into ATP that can readily be used in muscle cells.
   a) 15%
   b) 25 to 30%
   c) 35 to 40%
   d) 66%

7. In compression ignition (CI) engine, the compression ratio is
   a) Cylinder volume / Clearance volume
   b) Swept Volume / Cylinder Volume
   c) Clearance volume / Cylinder volume
   d) Cylinder volume / Swept volume

8. Which of the following component(s) is not found in a four stroke compression-ignition (CI) engines?
   a) Fuel pump
   b) Spark plug
   c) Fuel injector
   d) Intake and exhaust valves

9. In a single cylinder four stroke cycle engine there is one power stroke in every _____ of crankshaft rotation.
   a) 180°
   b) 360°
   c) 540°
   d) 720°

10. In two stroke cycle engine, which of the following functions take place at the same time?
   a) Compression and exhaust
   b) Intake and power
   c) Intake and exhaust
   d) Intake and compression

11. Which of the following is not true for a two stroke cycle engine as compared to a four stroke cycle engine?
   a) Less cooling is required
   b) Greater lubrication is required
   c) More uniform torque on crankshaft
   d) Complete exhaust of products of combustion

12. All of the following are land levelling objectives except for
   a) provision of a smooth surface for the movement of farm machinery
   b) reduction of erosion and water logging
   c) promotion of uniform distribution of irrigation / rain water in the root zone
   d) management of cleared vegetation

13. Which one of the following implements is best suited for conservation tillage?
   a) Chisel plough
   b) Mouldboard plough
   c) Disc plough
   d) Rotary cultivator

14. Which one of the following adjustments would result in production of a very fine tilth when working the soil using a rotary cultivator?
   a) Increasing tractor forward speed
   b) Increasing rotor rotational speed
   c) Reducing rotor rotational speed
   d) Raising the hood of the rotary cultivator

15. What influence does doubling the planter forward travel speed have on the seed rate of a precision planter with land wheel driven metering mechanism.
   a) Seed rate doubles
   b) Seed rate reduces to half
   c) Seed rate remains the same
   d) Seed rate increases four times

16. Given that a 100g sample of maize contained 200 seeds and the desired seed rate is 50,000 seeds per hectare. The amount of seed required (in kg) per hectare would be:
   a) 40.0 kg/ha
   b) 12.5 kg/ha
   c) 25 kg/ha
   d) 37.5 kg/ha

17. The metering mechanism most commonly used in seed drills is the:
    a) cell plate
    b) finger pickup
    c) fluted feed roller
    d) vacuum metering disc

18. Which one of the following has no effect on boom sprayer pesticide application rate (l/ha).
    a) Sprayer forward speed
    b) Sprayer operating pressure
    c) Number of nozzles on a sprayer boom
    d) Nozzle spacing on the sprayer boom

19. Which one of the following is not a cultural pest control method?
    a) Sterile male technique
    b) Crop rotation
    c) Phyto-sanitation
    d) Use of pest free propagation material

20. During the field calibration of a seed drill with 20 rows spaced 250 mm apart, a farmer collected an average weight of 150 grams of wheat seed from each seed tube after covering 100 m. The seed rate achieved is …
    a) 60 kg/ha
    b) 70 kg/ha
    c) 75 kg/ha
    d) 80 kg/ha

21. Which of the following statements is not true about organic fertilizers?
    a) It acts as a slow release source of nutrients to the plant.
    b) It's insoluble in water.
    c) It's derived from plant and animal remains.
    d) It stimulates microbial activity in the soil

22. Which one of the following is not a plant macronutrient?
    a) Nitrogen
    b) Phosphorus
    c) Manganese
    d) Magnesium

23. Which one of the following pesticide formulations cannot be applied using a sprayer
    a) Emulsifiable Concentrate (EC)
    b) Solution (S)
    c) Wettable Powder (WP)
    d) Dustable Powder (DP)

24. In an 6 cylinder, in-line, four-stroke cycle engine, when cylinder number 3 is on power stroke, then cylinder number 4 must be on ...
    a) Power stroke
    b) Compression stroke
    c) Induction stroke
    d) Exhaust stroke

25. Which one of the following harvesting losses cannot be directly attributed to the combine harvester.

a) cutterbar losses
b) shatter losses
c) threshing losses
d) cleaning losses

SECTION B: ATTEMPT ANY **THREE** QUESTIONS FROM THIS SECTION **(75 MARKS)**

QUESTION 1

a) List **five** draft animal characteristics that are used as a basis to eliminate cattle that do not meet minimum requirements for draft power training.

[5 marks]

b) Briefly explain the following terms in relation to energy conversion in draft animals:

i) Digestible energy

ii) Appetite limit

[4 marks]

c) A farmer has a pair of oxen, each weighing 750 kg that he uses for ploughing. The plough cuts furrow slices that are 35 cm wide by 30 cm deep. The soil specific resistance is 15 kN/m^2 and the oxen have a working speed of 3.24 km/h. They work for 5 hours a day. Assume sustainable pull of the oxen is 12.5% of their total body weight when working as a pair.

i) Show that the oxen can pull the plough.

[3 marks]

ii) If the oxen are fed on Sudan grass, calculate the quantity of feed needed to meet the total daily feed requirement.

[8 marks]

iii) Will the oxen need any supplementary feed? Explain your answer.

[5 marks]

Table Q1:Animal feed characteristics

Feed	Dry Matter (%)	Gross Energy of Dry Matter (MJ/kg)	$\frac{DE}{GE}$
Guinea grass	26	7.4	0.50
Sudan grass	31	17	0.65
Hay (average quality)	85	17	0.55
Maize silage	27	18.8	0.75
Maize grain	86	19	0.80
Groundnut cake	90	20.7	0.85

Additional Information

- Maintenance Energy = 8.3 + (0.091W) MJ/day
- Appetite Limit = 0.025W kg of dry matter
- Metabolisable Energy (ME) = 0.8 of Digestible Energy (DE)
- Energy Conversion Efficiency of Draft Animals = 20%

QUESTION 2

a) Briefly explain the following terms:

i) Glycogenolysis

ii) aerobic limit

[4 marks]

b) A farm worker was tasked to clear virgin land consisting of shrubs and small to medium size trees. The worker could sustain the task without rest for 7.5 minutes only. He was expected to work for 6 hours per day. Continuous physical power output of a normal healthy human being varies with time according to the following equation:

$$P = (68 + 932e^{-0.908t^{0.16}})$$

where: P = power output [W]

t = time [s]

Assume energy conversion efficiency of human beings is 25%.

i) Calculate the average power output of the farm worker

[5 marks]

ii) What is the rate of energy consumption when clearing the field

[4 marks]

iii) Calculate the rest period needed.

[4 marks]

iv) Briefly explain why the farm worker needs rest during the land clearing operation.

[4 marks]

v) Determine the total time (in hours) that the worker needs to rest during the 6 hour work day.

[4 marks]

QUESTION 3

a) Briefly explain the following terms:

i) Integrated pest management

ii) Phyto-sanitation

[6 marks]

b) A farmer would like to apply 121 l/ha of Malathion, an organophosphate pesticide, using a tractor-mounted boom sprayer. Only one set of nozzles is available and each nozzle is rated at 2.27 litres/minute when operating at a pressure of 4 bars. If the sprayer has 40 nozzles spaced 75 cm apart, what tractor speed is required to apply the correct amount of the pesticide?

[7 marks]

THE UNIVERSITY OF ZAMBIA

SCHOOL OF ENGINEERING

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

UNIVERSITY EXAMINATIONS

TERM II – 2017 ACADEMIC YEAR – 13 DECEMBER, 2018

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) The current i_0 in Figure Q1(a) is 4A.

i) Find i_1. **[3 Marks]**

ii) Determine the power dissipated in each resistor. **[2 Marks]**

iii) Verify that the total power dissipated in the circuit equals the power developed by the 180V source. **[1 Mark]**

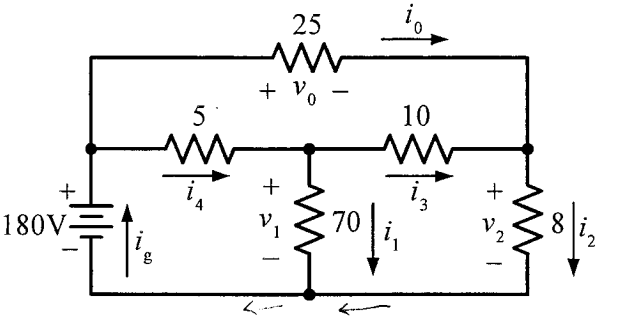


Figure Q1(a)

b) Find V_0 in the network shown in Figure Q1(b) using superposition. **[8 Marks]**

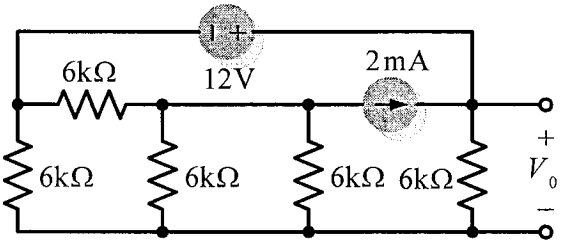


Figure Q1(b)

c) Use source transformation to find I_0 in the circuit shown in Figure Q1(c). **[6 Marks]**

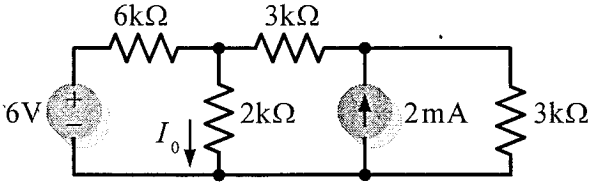


Figure Q1(c)

[Total 20 Marks]

QUESTION 2

a) Using source transformation determine V_0 in the network of Figure Q2(a). **[10 Marks]**

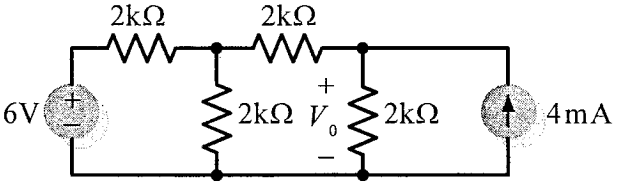


Figure Q2(a)

b) Use Thevenin's Theorem to find V_0 in the circuit shown in Figure Q2(b). **[10 Marks]**

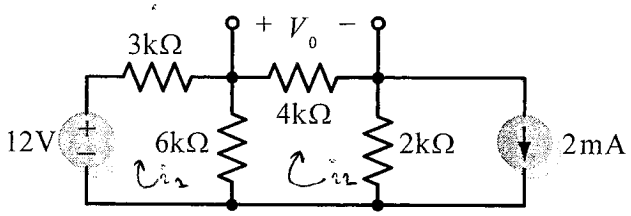


Figure Q2(b)

[Total 20 Marks]

QUESTION 3

a) Use Norton's Theorem to find V_0 in the network depicted in Figure Q3(a). **[12 Marks]**

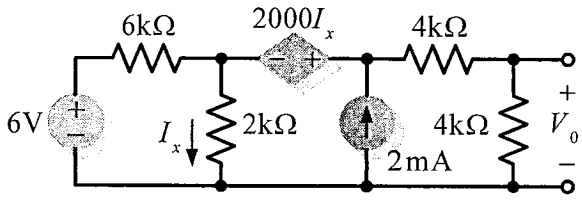


Figure Q3(a)

b) Determine the equivalent resistance across terminals a-b in the circuit of Figure Q3(b).
[8 Marks]

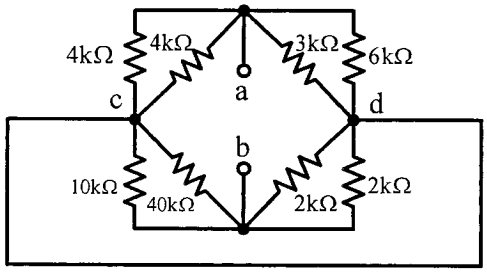


Figure Q3(b)

[Total 20 Marks]

QUESTION 4

a) Given the linear circuit shown in Figure Q4(a), it is known that when a $2\text{k}\Omega$ load is connected to the terminals A-B, the load current is 10mA. If a $10\text{k}\Omega$ load is connected to the terminals the load current is 6mA. Find the current in a $20\text{k}\Omega$ load. **[6 Marks]**

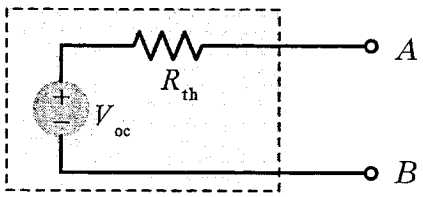


Figure Q4(a)

b) Consider the circuit of Figure Q4(b), find V_0 using Nodal Analysis. **[8 Marks]**

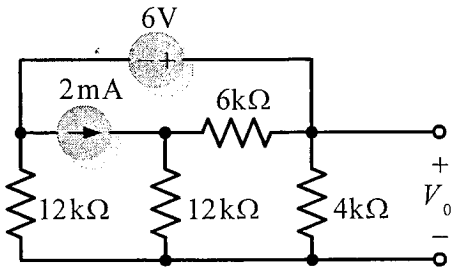


Figure Q4(b)

c) Name the elements labeled (a-f) in the Figure Q4(c) below. **[6 Marks]**

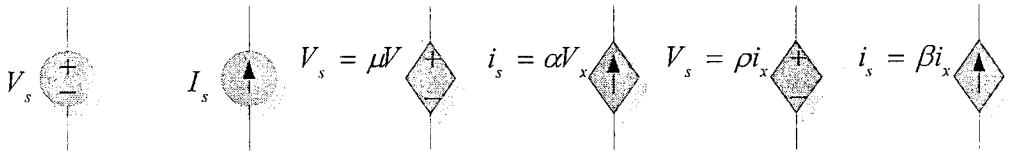


Figure Q4(c)

[Total 20 Marks]

SECTION B

QUESTION 5

a) Determine $i(t)$ and $v_x(t)$ in the circuit of Figure Q5(a) for $t > 0$. Let $i(0) = 8\,\text{A}$.

[10 Marks]

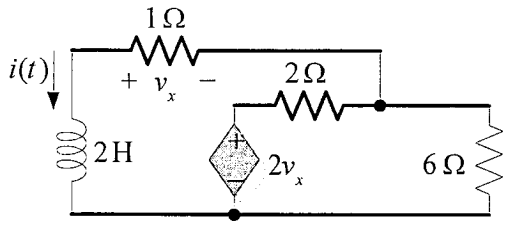


Figure Q5(a)

b) Use the superposition theorem to find $i_x(t)$ in the ac circuit of Figure Q5(b). Note that the two sources do not have the same frequency. **[10 Marks]**

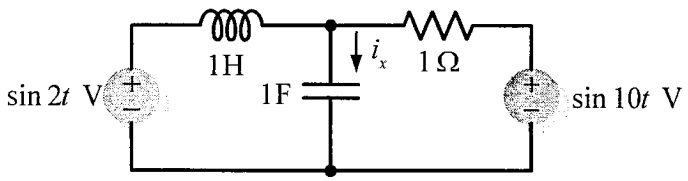


Figure Q5(b)

[Total 20 Marks]

QUESTION 6

a) Consider the circuit of Figure Q6(a), the switch is closed at $t = 0$. Let $v_C(0) = 0$,

i) Obtain the capacitor voltage $v_C(t)$ for $t > 0$. **[7 Marks]**

ii) Hence find $i(t)$ for $t > 0$. **[3 Marks]**

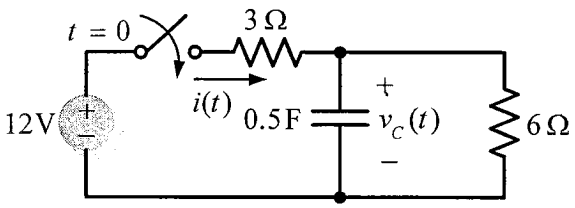


Figure Q6(a)

b) In the circuit of Figure Q6(b), $\mathbf{Z}_1 = 60\angle -30°\,\Omega$ and $\mathbf{Z}_2 = 40\angle 45°\,\Omega$. Calculate the total:

i) Apparent power supplied by the source. **[6 Marks]**

ii) Real power supplied by the source. **[1 Mark]**

iii) Reactive power seen by the source. **[1 Mark]**

iv) Power factor, pf seen by the source. **[2 Marks]**

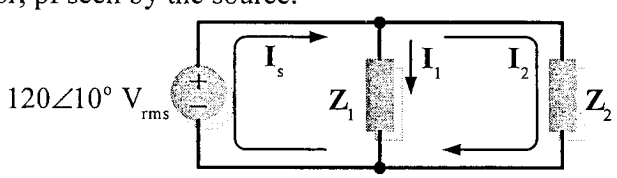


Figure Q6(b)

[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]**

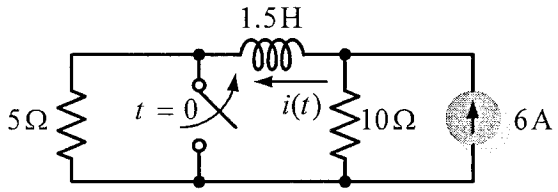


Figure Q7(a)

b) Consider the network of Figure Q7(b) in which the diodes are ideal.

i) Determine and sketch the output waveform $v_o(t)$. **[5 Marks]**

ii) Hence, calculate the output dc level. **[3 Marks]**

iii) Find the required peak inverse voltage (PIV) of each diode. **[2 Marks]**

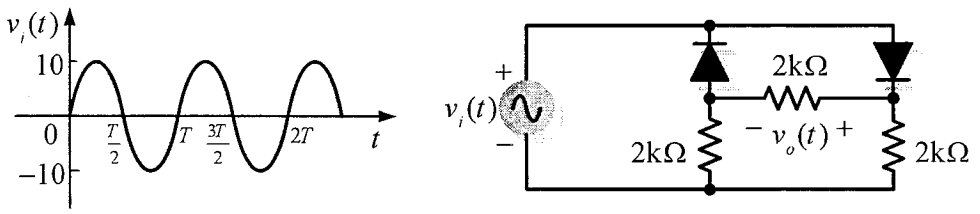


Figure Q7(b)

[Total 20 Marks]

QUESTION 8

a) Calculate the rms value, I_{rms} of the periodic ac saw-tooth current waveform of Figure Q8(a). **[6 Marks]**

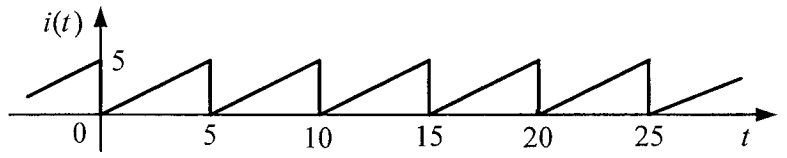


Figure Q8(a)

b) For the circuit of Figure Q8(b) find $\mathbf{V}_s$. **[14 Marks]**

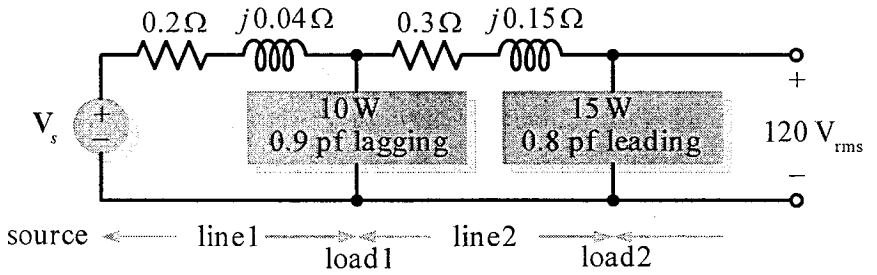


Figure Q8(b)

[Total 20 Marks]

END OF EEE 2019 EXAM

THE UNIVERSITY OF ZAMBIA

School of Engineering

Department of Civil & Environmental Engineering

CEE 2219-Statics and Introduction to Mechanics of Materials

FINAL EXAMINATIONS 2017/2018

November 2018 **Time allowed: Three hours**

CLOSED BOOK Examination

Instructions to candidates:

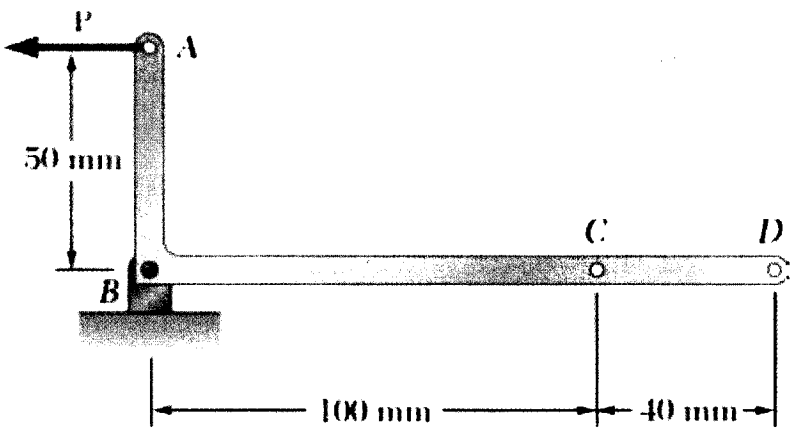
1. **Candidates must ensure that their computer numbers are clearly written on each answer sheet**
2. **Answer any FIVE questions. All questions carry equal marks (20%)**
3. **Additional marks will be gained by use of clear labelled sketches**

Question 1

The 80-N horizontal force P acts on a bell crank as shown.

(a) Replace P with an equivalent force-couple system at B.

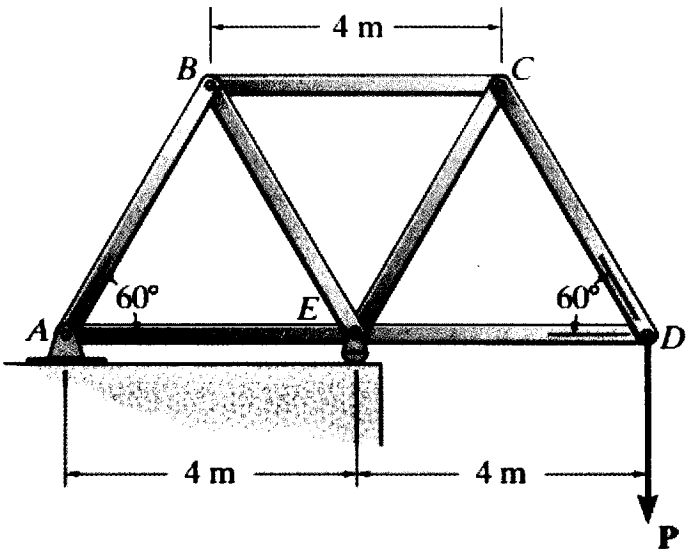
(b) Find the two vertical forces at C and D that are equivalent to the couple found in Part a.



[10+10] marks

Question 2

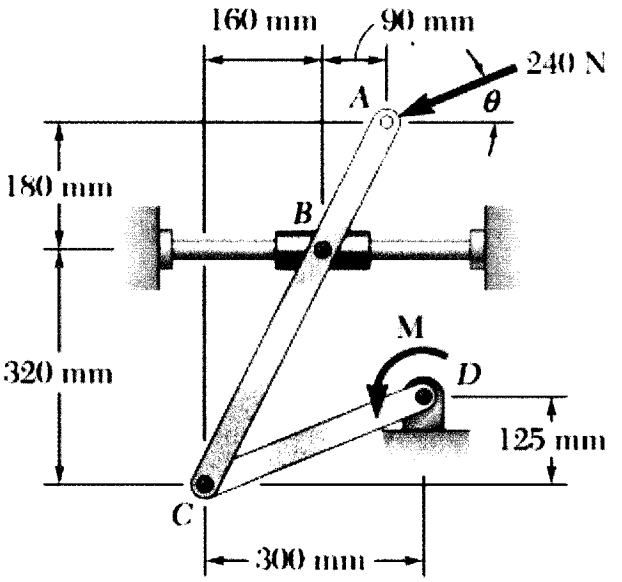
Q. Determine the force in each member of the truss given that P = 8 kN



[20] marks

Question 3

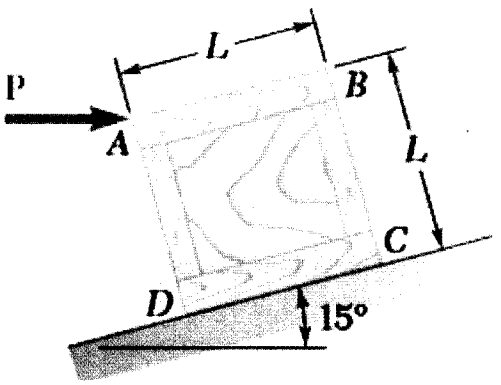
Arm ABC is connected by pins to a collar at B and to crank CD at C. Neglecting the effect of friction, determine the couple M required to hold the system in equilibrium when $\theta=0^{O}$.



[20] marks

Question 4

A uniform crate with a mass of 30kg must be moved along the 15^0 incline without tipping. Knowing that force **P** is horizontal, (determine the largest allowable coefficient of static friction between the crate and the incline, (b) the corresponding magnitude of force **P**.



[20] marks

Question 5

It is known that for a given area Iy=48 x10^6 mm^4 and Ixy =-20 x10^6 mm^4, where the x and y axes are rectangular centroidal axes. If the axis corresponding to the maximum product of inertia is obtained by rotating the x axis 67.5° counterclockwise about C, use Mohr's circle to determine

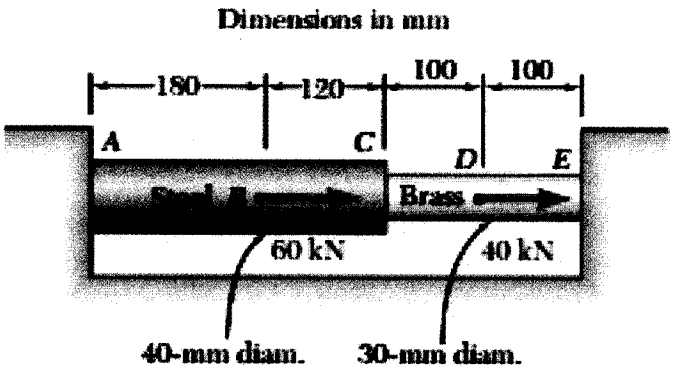
(a) the moment of inertia Ix of the area,

(b) the principal centroidal moments of inertia.

[8+12] marks

Question 6

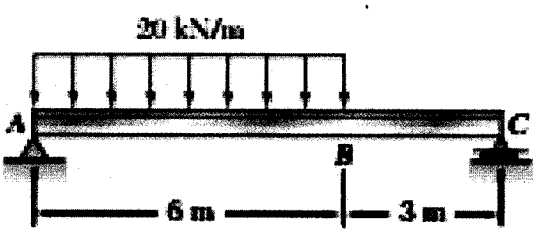
Two cylindrical rods, one of steel and the other of brass, are joined at C and restrained by rigid supports at A and E. For the loading shown and knowing that Es=200 GPa and Eb= 105 GPa, determine (a) the reactions at A and E, (b) the deflection of point C.



[20 marks]

Question 7

Draw the shear and bending-moment diagrams for a simple beam AC.



[20 marks]

THE END

THE UNIVERSITY OF ZAMBIA

SCHOOL OF ENGINEERING

DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

UNIVERSITY EXAMINATIONS
2017/2018

ENG 2139: INTRODUCION TO INFORMATION & COMMUNICATIONS TECHNOLOGY (ICT)

DATE: **10th December, 2018**

TIME	**:**	**Three (3) hours**
INSTRUCTIONS	**:**	**1. This exam paper has seven questions, divided into two parts (sections), Part I (Questions 1 – 4) and Part II (the rest).** **2. You should answer any five (5) questions.** **3. You can only attempt three questions maximum from one part (section).** **4. Show clearly all working ideas and processes, leading to the final answer.** **5. All questions carry equal marks.**

PART 1: FUNDAMENTALS OF HARDWARE ARCHITECTURE, DATA NETWORKS, DATABASES & APPLICATIONS

Question One

a) Define and explain a peripheral to a microprocessor from a computer hardware architecture perspective, and give two examples. **[5 Marks]**

b) Explain the word "Program Counter" from a computer hardware architecture perspective. **[5 Marks]**

c) During a start-up of a computer system, there is one phase known as POST; explain this phase as it occurs during a computer start-up or boot up. **[6 Marks]**

d) One of your friends went to a local computer shop and saw a laptop with Hard Disk Drive (HDD) of 750 MB (Terabytes) and an Intel i7-processor of 2.75GHz.
What are these two specifications (750 MB and 2.75 GHz) of that laptop as you would explain to your friend. **[4 Marks]**

Question Two

a) Analyse the diagram presented below:

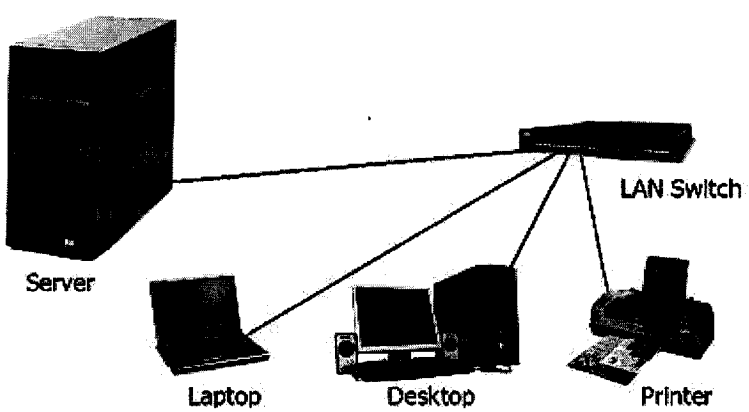


Figure 3.1.: A small Local Area Network (LAN)

Suppose the LAN Switch is brand new and the above local area network has just been set up. Explain how the Lan Switch will go about discovering all devices connected to it for an efficient communication to take place. **[10 Marks]**

b) Explain in details the Open Systems Interconnection (OSI) model for data network protocols. **[10 Marks]**

Question Three

The Operating System (OS) is very critical to the working a computer system. Among its main functionalities, two of these features could be said to play certain roles in the design and development of applications/computer programs, these are: Processor Management and Communication Services.

a) How does the operating system's memory management help the software engineer as they develop applications which will be running on a computer system?**[10.5 Marks]**

b) And how do the operating system's communication services ensure that the software engineer produces modern applications? **[7.5 Marks]**

c) Acrobat Reader, Microsoft PowerPoint and Mozilla Firefox, all share a common feature; what is this feature? **[2 Marks]**

Question Four

a) Define and explain the concept of No-SQL database management system. **[7 Marks]**

b) Define and explain what we mean when we say Relational Database Management Systems. **[7 Marks]**

c) Select all false statements about Database Management Systems (DBMS):**[6 Marks]**
   A. Cloud computing has made DBMS obsolete.
   B. E-commerce systems heavily rely on DBMS.
   C. DBMS are very important in today's Information age.
   D. In fact, DBMS systems are simply web sites.
   E. DBMS are used in Business Intelligence.
   F. DBMS were invented at the University of Cambridge (UK).

PART 2: FUNDAMENTALS OF C++ PROGRAMMING

Question Five

a) Find below a short C++ program:

```
1.  include <iostream>
2.  #using namepace standard;
3.
4.  int main()
5.  {
6.      string traineeName;
7.      int traineeAge;
8.      coat << Enter first your name and then your age " << endl
9.      cen >> traineeName>>traineAge;
10.     cuit << "Your name is: " <<traineename << "and you are: " << traineeAge << " old" ;
11.
12.    return 0;
13. }
```

Read through the above code, then list lines numbers, and find all associated syntax and other types of errors which violate C++ rules, and give corrected program elements which can then make this program free of syntax and typographic errors. **[12 Marks]**

b) Give short definitions of the following terms:

(1) Member variable; **[2 Marks]**

(2) Destructor; **[2 Marks]**

(3) Protected; **[2 Marks]**

(4) Inheritance **[2 Marks]**

Question Six

a) Find below a C++ code snippet:

```
// code snippet
1.  int totalScore = 0;
2.  int scores[] = {-8, 39, 72, -48, 22, 10, 7};
3.
4.  for (int j = 0; j < 7; j++) {
5.      totalScore += scores[j];
6.  }
```

Read carefully the code snippet above and explain in details what is happening in the following lines:

a. Line 1 **[2 Marks]**
b. Lines 2 **[3 Marks]**
c. Line 4 **[6 Marks]**
d. Line 5 **[1 Mark]**

b)

(1) Write a code snippet in which you declare an enumeration to denote the days of the week, name it as eWeekDay. **[1 Mark]**

(2) Define a function which returns a message (string) and take a parameter of type eWeekDay. In the body of this function, create a switch – case construct in which you return a different message for each day as "Today is Sunday" and so on. You should take care of the option where there is an invalid day as function parameter. **[7 Marks]**

Question Seven

Suppose that you have been given some details of sales at a small metal fabrication shop specialised in making door and window frames in your neighbourhood. Weekly sales are given in the form of the following arrays:

float week1Sales[6] = {7556.25, 3938.82, 4265.49, 8629.33}
float week2Sales[6] = {4237.45, 5837.92, 3250.23, 7375.89, 8742.68, 6492.58}
float week3Sales[6] = {3859.35, 7570.73, 9265.49, 6492.58, 5629.33}
float week4Sales[6] = {8556.25,7 938.82, 8265.49}

a) Come up with design ideas which will help you develop a program which will compute the total monthly sales for this small metal fabrication shop. Your design ideas should include details on how you will go about implementing such a solution with C++ control flow constructs which will be more appropriate to use in such a computation. **[10 Marks]**

b) Write a short C++ program to calculate the total monthly sales for the given small metal fabrication shop in Zambian Kwacha [ZMW]. **[10 Marks]**

------- *END OF EXAM & GOOD LUCK!*-------

THE UNIVERSITY OF ZAMBIA

SCHOOL OF ENGINEERING

UNIVERSITY EXAMINATIONS

FINAL EXAMINATIONS: NOVEMBER-DECEMBER 2018

ENG 5129

ENGINEERING, MANAGEMENT AND SOCIETY II

TIME	:	**Three (3) Hours PLUS 5 Minutes Reading Time**
INSTRUCTIONS	:	**This paper consists of a total of Seven (7) Questions**
	:	**You shall Answer a total of Five (5) Questions**
		i.e. At least Two (2) Questions from Section A and Two (2) Questions from Section B

SECTION A: Answer at least 2 Questions from this Section

QUESTION ONE

(a) To create a corporation where stockholders' interests are looked after, many companies have implemented a two-tier corporate hierarchy. Name and briefly describe the two-tier of a corporate hierarchy and how individuals in the hierarchy are appointed. **(4 marks)**

(b) Which people in an organization typically should be included in the planning process? And explain why? **(4 marks)**

(c) Discuss the steps of strategy management process, highlighting the main components of each step. **(6 marks)**

(d) Name and discuss the three managerial skills. **(6 marks)**

(TOTAL 20 MARKS)

QUESTION TWO

(a) State and briefly explain the four-marketing mix. **(4 marks)**

(b) What is the role of a job description for **(i)** employer, **(ii)** employee? **(4 marks)**

(c) Name and briefly describe the four basic functions of Management that make up the management process. **(8 marks)**

(d) Why are personnel specifications prepared when planning recruitment? **(4 marks)**

(TOTAL 20 MARKS)

QUESTION THREE

(a) Name and explain briefly the four areas of difference between strategic planning and tactical planning. **(8 marks)**

(b) Management need to fine tune projects toward the most commercially successful outcome, by highlighting the 3 competing priorities in every project. State and briefly describe these three (3) competing priorities. **(3 marks)**

(c) What is delegation of authority? **(2 marks)**

(d) What are the three duties of planners? **(3 marks)**

(e) Managers are required to have two qualities in their use of company resources. Describe these two qualities. **(4 marks)**

(TOTAL 20 MARKS)

SECTION B: Answer <u>at least 2 Questions</u> from this Section

<u>QUESTION FOUR</u>

You are the head of the project selection team at Zam Roots records. Your team is considering three different recording projects. Based on past history, Zam Roots expects at least a rate of return of 9 percent. Given the following information for each project, which one should be Zam Roots first priority? Should Zam Roots fund any of the other projects?
If so, what should be the order of priority based on return on investment?

Recording Project: **Katyetye**

Year	Investment	Revenue Stream
0	K 600,000	
1		600,000
2		75,000
3		20,000
4		15,000
5		10,000

Recording Project: **Chilimwibala**

Year	Investment	Revenue Stream
0	K 400,000	0
1		400,000
2		100,000
3		25,000
4		20,000
5		10,000

Recording Project: **Lelo Ni Lelo**

Year	Investment	Revenue Stream
0	K 200,000	0
1		200,000
2		125,000
3		75,000
4		20,000
5		10,000

(TOTAL 20 MARKS)

QUESTION FIVE

You are working as a project manager to build an access control system for the University of Kafue.

(a) Draw a network diagram for the project and calculate the fastest time in which the following project may be completed.

Act	Description	Duration (days)	Predecessor
A	Develop project deliverables	15	-
B	Approval from stakeholders	5	A
C	Select site	4	B
D	Evaluate and select vendor	4	B
E	Purchase hardware	3	D
F	Design software	15	B
G	Write code	30	F
H	Test software	4	G
I	Test hardware	10	E
J	Integrate hardware and software	20	H, I
K	Install and final acceptance	5	C, J

(12 marks)

(b) Create a table showing each activity and the slack for each activity.

(5 marks)

(c) Which of the activities are on the critical path?

(3 marks)

(TOTAL 20 MARKS)

QUESTION SIX

(a) State **FOUR** mandatory insertions required in an **EMPLOYMENT CERTIFICATE** and for each explain the reason why it is essential.

(8 marks)

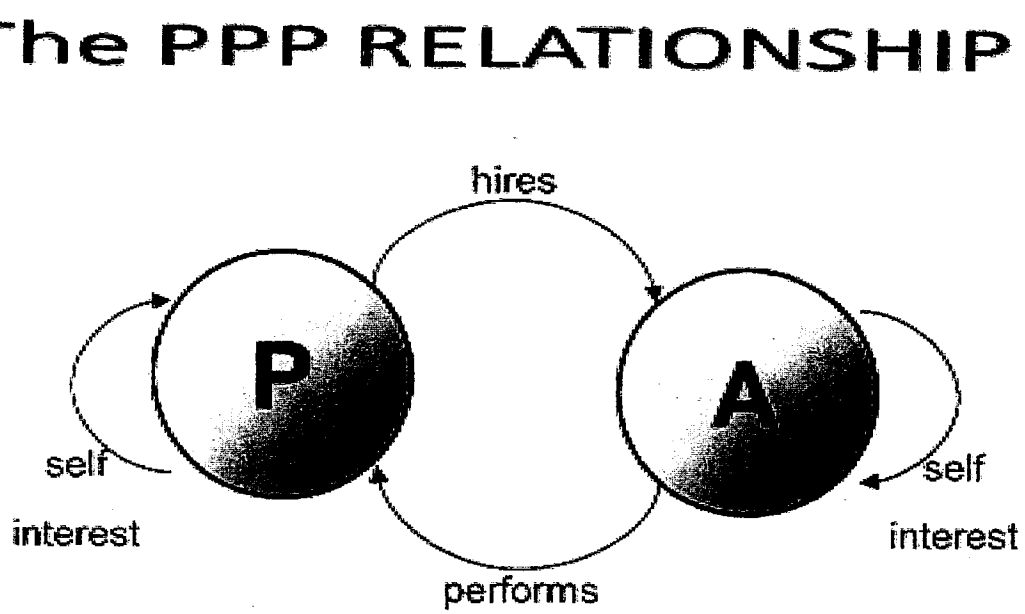
(b) Briefly explain the key differences between the **SHORT-TERM CONTRACT** of employment and **TEMPORARY CONTRACT** of employment.

(12 marks)

(TOTAL 20 MARKS)

QUESTION SEVEN

The figure below illustrates the Principal Agent Relationship which is used to explain the relationships between the Public and Private entities in a Public Private Partnership (PPP) formed to enhance delivery of public services.



The Manenekela Municipal Council (The Principal) has contracted a private company called BEng Waste Collectors Ltd (The Agent) to collect waste on their behalf from all residential and commercial properties within its area of jurisdiction using the MANAGEMENT CONTRACT type of PPP arrangement.

(a) Fully explain the term Management Contract as applied in PPPs.

(6 marks)

(b) Using the figure above as your reference explain what the term SELF INTEREST means from both the Principal and Agent's perspectives in the waste collection contract.

(14 marks)

(TOTAL 20 MARKS)

END OF EXAMINATION

(Dr-Eng. Simon Tembo; Dr-Eng. Ian Banda; Dr-Eng. Mwape Chileshe)

THE UNIVERSITY OF ZAMBIA
SCHOOL OF ENGINEERING
DEPARTMENT OF MECHANICAL ENGINEERING

UNIVERSITY EXAMINATIONS

END OF YEAR EXAMINATIONS, 2017

NOVEMBER/DECEMBER 2018

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: Question 1 and one other question from Section A and any two questions from Section B.*
4. *Hand in Sections A and B in Separate Answer Books.*
5. *Question 1 carries 40 marks. Other questions carry 20 marks each.*

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

SECTION A: ANSWER QUESTION 1 AND ONE OTHER QUESTION

Q1. This question is compulsory and carries 40 marks

(a) Two arbitrary elements *A* and *B* with melting points 800 °C and 700 °C, respectively, are insoluble in one another. Upon cooling the various mixtures of these elements, it was observed that they formed an intermetallic compound *C*, at 60% B by weight, with a melting point of 950 °C. There is a eutectic mixture e_1 between *A* and *C* at 500 °C at 60% *A* by weight and a second eutectic e_2 between *C* and *B* at 450 °C at 85% *B* by weight. Using the graph paper provided, draw the phase diagram to scale and label all its features. [20 marks]

(b) From your phase diagram, answer the following questions:

(i) What would be the formula for the intermetallic compound? [02 marks]

(ii) For a mixture containing 40% *B* cooled slowly from the liquid phase to room temperature, state the phase transformation that take place and the temperatures where these phase changes begin. [04 marks]

(iii) For a mixture containing 90% *B* at 550 °C, what phases are present? What are their relative proportions and compositions? [08 marks]

(iv) What is special about the eutectic points, e_1 and e_1? [06 marks]

Q2.

(a) (i) How is power lost in an electricity transmission line and how can this be minimised? [05 marks]

(ii) Discuss, with a specific example in each case, the cases where power loss in a conductor is desired and where it is not desired. [05 marks]

(b) Given a copper conductor 0.25mm diameter and 1.5m long, calculate the number of charge carriers in a 1mm diameter copper wire 1m long. Assume that copper has a density of copper is 8.93 Mg/m^3 and a valence of 1. [05 marks]

(c) What would be the drift velocity in the wire under an applied voltage of 24 V? Take the conductivity of copper as $\sigma = 5.98 \times 10^7\ \Omega^{-1}m^{-1}$. [05 marks]

Q3.

(a) Use the data in Table Q3 to determine which is denser between molybdenum and copper. [10 marks]

(b) Use a sketch to show that for the face-centred cubic (fcc) crystal structure the co-ordination number is 12. [05 marks]

(c) With a sketch, show that all atoms in the fcc crystal structure are lattice points. [05 marks]

Table Q3: Useful data for copper, iron and molybdenum

Element	Symbol	Structure	Atomic mass, m_a (kg)	Lattice constant, a (nm)
Copper	Cu	fcc	1.05359×10^{-25}	0.36147
Iron	Fe	bcc	9.26028×10^{-26}	0.28664
Molybdenum	Mg	cph	4.03720×10^{-26}	0.32094

SECTION B – ANSWER ANY TWO QUESTIONS

Q4.

(a) Using a well labelled stress-strain curve diagram, discuss the behaviour of ductile metallic materials when statically loaded in tension to the point of fracture. [12 marks]

(b) During a tensile test, the specimen having a diameter of 12.5 mm was loaded up to a load of 75 kN and its diameter was measured as 12 mm. By showing your calculations, compare the true stress and strain with engineering stress and strain. [08 marks]

Q5.

Discuss in detail the following terms as understood in engineering materials:

(a) Annealing

(b) Hardening

(c) Thermoplastics

(d) Cyaniding [4×05 marks]

Q6.

(a) (a) For metallic material with cubic system having a lattice parameter of 2.9×10^{-9} m and density of 7870 kg/m^3. Show that the number of atoms per unit cell of a metal is 2, given that the atomic weight of metal is 55.85 and the Avogadro's number as 6.023×10^{23}. [08 marks]

(b) Natural crystals always contain defects, often in abundance, due to the uncontrolled conditions under which they were formed. Briefly discuss the causes of the following defects in crystals.

(i) Point imperfections

(ii) Line imperfections

(iii) Surface and grain boundary imperfections

(iv) Volume imperfections. [4×03 marks]

END OF MEC 2309 EXAMINATION
G M MUNAKAAMPE / E CHIBWE

THE UNIVERSITYOF ZAMBIA

SCHOOL OF ENGINEERING

DEPARTMENT OF MECHANICAL ENGINEERING

DEFERRED EXAMINATIONS FOR 2017 ACADEMIC YEAR

MEC 4105 - PRODUCTION TECHNOLOGY I

Time allowed: 3 HOURS plus 5 minutes reading time

Instructions to Candidates:

1. Check that you have the correct examination paper in front of you. There is one page excluding this cover page.
2. This is a **Closed Book** examination.
3. There are FIVE (5) Questions in this paper.
4. Attempt any FOUR (4) Questions only.
5. All questions must be answered in the answer booklet provided only.
6. Write down the question number of each question that you have answered in the provided boxes on the cover of the examination answer booklet.
7. Begin each new solution on a new page.
8. Non-programmable calculators and drawing instruments are allowed.
9. There shall be no form of communication between students during the examination. Any students caught doing this will be disqualified.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

Question 1

a) State the six basic factors in casting (6 marks)
b) What is the most suitable casting method for complex castings (3 marks)
c) Briefly describe with diagrams 4 common casting quality defects associated with sand casting. (16 marks)

Question 2

a) List the 7 codes used for classifying plastics and give examples of their application. (21 marks)
b) List 8 typical additives used in plastics (4 marks)

Question 3

Briefly describe the main 8 joining methods for plastic products (25 marks)

Question 4

a) What is Forging and its major operation types? (5 marks)
b) What is Rolling and its major operation types? (5 marks)
c) Describe with diagrams the 5 typical types of rolling mill classifications. (15 marks)

Question 5

a) State 4 drivers emphasizing the importance of Metrology to international trade? (4 marks)
b) Describe with diagram the traceability chain (9 marks)
c) A school ruler manufactured by a world class firm has a certified length of 30cm. Five groups of five students each are given the bearing to measure. The following are their results:

GROUP	Student 1	Student 2	Student 3	Student 4	Student 5
Group A	30.21	30.22	29.35	29.65	30.01
Group B	33.11	32.28	33.07	32.89	33.02
Group C	29.85	29.91	29.99	30.13	30.09
Group D	28.95	31.51	29.03	30.96	31.03
Group E	28.76	29.05	29.27	29.45	31.51

i) Which group is least accurate? (3 marks)
ii) Which group has smallest error? (3 marks)
iii) Which group is least precise? (3 marks)
iv) Which group has least uncertainty? (3 marks)

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

SCHOOL OF ENGINEERING

2017/8 ACADEMIC YEAR FIRST SEMESTER

FINAL EXAMINATION

BACHELOR OF ENGINEERING

ENG 4129: ENGINEERING MANAGEMENT AND ENTREPRENEURSHIP

TIME: **THREE (3) HOURS**

INSTRUCTIONS:

1. THE PAPER CONTAINS THREE SECTIONS A, B AND C. **EACH SECTIONS HAS ONE COMPULSORY QUESTION.**
2. THERE ARE SEVEN (7) QUESTIONS IN THIS PAPER. YOU ARE EXPECTED TO ANSWER FIVE IN TOTAL. **THREE ARE COMPUSORY QUESTIONS. CHOOSE ONE OTHER QUESTION IN EACH OF THE SECTIONS "B" AND "C".**
3. **EACH SECTION** SHOULD BE WRITTEN IN **SEPARATE ANSWER BOOKLET.**
4. MAKE SURE THE STUDENT NUMBER IS CLEARLY INDICATED ON ALL BOOKLETS TOGETHER WITH THE QUESTIONS ATTEMPTED
5. THE ANSWER FOR EACH QUESTION SHOULD BEGIN ON A NEW SHEET
6. WHERE SPECIFIC INFORMATION IS NOT GIVEN, MAKE AND STATE YOUR ASSUMPTIONS
7. MARKS WILL BE LOST FOR ILLEGIBLE, UNTIDY AND UNORGANISED PRESENTATION
8. THE EXAMINATION IS STRICTLY CLOSED BOOK
9. TOTAL MARKS FOR THIS EXAMINATION IS **100.**

SECTION A

Question 1 (Compulsory)

1.1 Assuming you have come together with three of your colleagues to develop a group business plan to manufacture an electronic gadget that has a potential of providing internet services. The licence to operate the gadget only provides for Data and not Voice. List what you would consider as relevant information in your business plan by filling out the following information:

(a) Business name: ($^1/_2$ Mark)

(b) Activity: ($^1/_2$ Mark)

(c) Product: ($^1/_2$ Mark)

(d) Target Customers: ($^1/_2$ Mark)

(e) Name Two of the competitors: ($^1/_2$ x2 = 1Mark)

(f) Why is being an entrepreneur encouraged in the modern education system?

(2 Marks)

1.2 An entrepreneur exhibits ***key*** characteristic and ***typical*** characteristic. Identify five of each of these characteristics. ($^1/_2$ x 10 =5 Marks)

1.3 Identify eight (8) traits that could lead to one's small business to fail. ($^1/_2$ x 8 = 4 Marks)

1.4 There are six (6) key steps to follow when registering a business with PACRA in Zambia. Identify all six. (6 Marks)

[20 Marks]

SECTION B

Question 2 (Compulsory)

2.1 The laws of supply and demand are central to analysis of the behaviour economic agents in competitive markets.

(a) Briefly, explain any four factors that would influence the demand for beef if it were a normal good. In each case indicated whether it will result in the increase in quantity demanded or a shift in demand? (4 Marks)

(b) Similarly, explain any four factors that would influence the supply for beef, if it were a normal good. In each case indicated whether it will result in the increase in quantity demanded or a shift in supply curve? (4 Marks)

(c) Describe the difference between average revenue and marginal revenue. Why are both revenue measures important to a profit-maximizing firm? (4 Marks)

(d) In a competitive market, what would happen if a firm doubles the quantity it sells to, the price of its output and its total revenue? (2 Marks)

(e) Briefly explain why, the price faced by a profit-maximizing firm is equal to its marginal cost. (2 Marks)

(f) Explain why the competitive firm's price equals the minimum of average total cost only in the long run and not in the short run. (4 Marks)

[20 Marks]

Question 3

3.1 Economist and policy makers use various macroeconomic indicators to gauge how quickly prices are rising overtime in the economy and some of the most commonly used parameters are the Gross Domestic Product (GDP deflator), the Consumer Price Index (CPI) and Unemployment rate. Briefly explain the following:

(a) When you draw a macro aggregate demand curve you have "Price Level" on the vertical axis. What is the price level and what is its relationship to the inflation rate? (2 Marks)

(b) What are the differences between the GDP deflator and CPI? (4 Marks)

(c) In an ideal labour market, wages would adjust to balance the supply and demand for labour, ensuring that all workers would be fully employed.

i. Explain why frictional unemployment, that is, the unemployment that results from the time that it takes to match workers with jobs, is inevitable? (4 Marks)

ii. How might the government reduce the amount of frictional unemployment? (2 Marks)

(d) Structural unemployment is the unemployment that results because the number of jobs available in some labour markets is insufficient to provide a job for everyone who wants one. It is often argued that one of the reasons that may cause this is government laws on minimum wage. This is a wage that is set above the level that balances supply and demand. It is argued that this wage creates unemployment. However, much as this might be the case, there are compelling reasons why firms may choose to hire workers at such a wage.

i. Outline four reasons that firms might find it profitable to pay wages above the level that balances the quantity of labour supplied and the quantity of labour demanded. (8 Marks)

[20 Marks]

Question 4

4.1 Using the aggregate demand and aggregate supply model explain the macroeconomic policy dilemma that is possible along the short-run Phillips curve. Clearly explain the policy dilemma in the presence of the following shocks (10 Marks)

4.2 Explain why the macroeconomic policy dilemma that may be experienced along the short run Phillips curve is not sustainable in the long run. (6 Marks)

4.3 In the midst of a supply shock, recommend two supply side policy-oriented measures that the government can implement to shift the long run supply curve (4 Marks)

[20 Marks]

SECTION C

Question 5 (Compulsory)

5.1 The trial balance of Chris Chan's business as at 15 October 2018 is shown below:

- The owner deposited capital as follows: Bank K10,000 & Cash balance K 5000
- Sales on credit to T Wilde K1,000.
- Purchases of goods on credit K500.
- Sold goods Cash K1200.
- Purchased Van K4,000 out of Bank.
- Paid wages K1,000 out of bank.
- Paid Advertising bill K200 out of Cash.
- Approved loan of K10,000 deposited into the bank.
- Paid rent K2,000 out of bank account.

(a) Draw up T Accounts and balance off. (10 Marks)

(b) Prepare the trial balance of Chris Chan's business as at 15 October 2018. (10 Marks)

[20 Marks]

5.2 Write short notes on the characteristics and use of the following documents in an accounting department.

(a) Sales Invoice. (4 marks)

(b) Purchases invoices. (4 marks)

(c) Credit Note. (4 marks)

(d) Quotation. (4 marks)

(e) Remittance advice. (4 marks)

[20 Marks]

6 Describe in detail the flow of documentation from inception of the transaction to the finish of the transaction in the following departments;

(a) The Sales department. (10 marks)

(b) Purchases department. (10 marks)

[20 Marks]

THE UNIVERSITY OF ZAMBIA

SCHOOL OF ENGINEERING

UNIVERSITY EXAMINATIONS

FINAL EXAMINATIONS: NOVEMBER-DECEMBER 2018

ENG 5129

ENGINEERING, MANAGEMENT AND SOCIETY II

TIME	:	**Three (3) Hours PLUS 5 Minutes Reading Time**
INSTRUCTIONS	:	**This paper consists of a total of Seven (7) Questions**
	:	**You shall Answer a total of Five (5) Questions**
		i.e. At least Two (2) Questions from Section A and Two (2) Questions from Section B

SECTION A: Answer <u>at least 2 Questions</u> from this Section

QUESTION ONE

(a) To create a corporation where stockholders' interests are looked after, many companies have implemented a two-tier corporate hierarchy. Name and briefly describe the two-tier of a corporate hierarchy and how individuals in the hierarchy are appointed. **(4 marks)**

(b) Which people in an organization typically should be included in the planning process? And explain why? **(4 marks)**

(c) Discuss the steps of strategy management process, highlighting the main components of each step. **(6 marks)**

(d) Name and discuss the three managerial skills. **(6 marks)**

(TOTAL 20 MARKS)

QUESTION TWO

(a) State and briefly explain the four-marketing mix. **(4 marks)**

(b) What is the role of a job description for **(i)** employer, **(ii)** employee? **(4 marks)**

(c) Name and briefly describe the four basic functions of Management that make up the management process. **(8 marks)**

(d) Why are personnel specifications prepared when planning recruitment? **(4 marks)**

(TOTAL 20 MARKS)

QUESTION THREE

(a) Name and explain briefly the four areas of difference between strategic planning and tactical planning. **(8 marks)**

(b) Management need to fine tune projects toward the most commercially successful outcome, by highlighting the 3 competing priorities in every project. State and briefly describe these three (3) competing priorities. **(3 marks)**

(c) What is delegation of authority? **(2 marks)**

(d) What are the three duties of planners? **(3 marks)**

(e) Managers are required to have two qualities in their use of company resources. Describe these two qualities. **(4 marks)**

(TOTAL 20 MARKS)

SECTION B: Answer <u>at least 2 Questions</u> from this Section

<u>QUESTION FOUR</u>

You are the head of the project selection team at Zam Roots records. Your team is considering three different recording projects. Based on past history, Zam Roots expects at least a rate of return of 9 percent. Given the following information for each project, which one should be Zam Roots first priority? Should Zam Roots fund any of the other projects?
If so, what should be the order of priority based on return on investment?

Recording Project: **Katyetye**

Year	Investment	Revenue Stream
0	K 600,000	
1		600,000
2		75,000
3		20,000
4		15,000
5		10,000

Recording Project: **Chilimwibala**

Year	Investment	Revenue Stream
0	K 400,000	0
1		400,000
2		100,000
3		25,000
4		20,000
5		10,000

Recording Project: **Lelo Ni Lelo**

Year	Investment	Revenue Stream
0	K 200,000	0
1		200,000
2		125,000
3		75,000
4		20,000
5		10,000

(TOTAL 20 MARKS)

QUESTION FIVE

You are working as a project manager to build an access control system for the University of Kafue.

(a) Draw a network diagram for the project and calculate the fastest time in which the following project may be completed.

Act	Description	Duration (days)	Predecessor
A	Develop project deliverables	15	-
B	Approval from stakeholders	5	A
C	Select site	4	B
D	Evaluate and select vendor	4	B
E	Purchase hardware	3	D
F	Design software	15	B
G	Write code	30	F
H	Test software	4	G
I	Test hardware	10	E
J	Integrate hardware and software	20	H, I
K	Install and final acceptance	5	C, J

(12 marks)

(b) Create a table showing each activity and the slack for each activity.

(5 marks)

(c) Which of the activities are on the critical path?

(3 marks)

(TOTAL 20 MARKS)

QUESTION SIX

(a) State **FOUR** mandatory insertions required in an **EMPLOYMENT CERTIFICATE** and for each explain the reason why it is essential.

(8 marks)

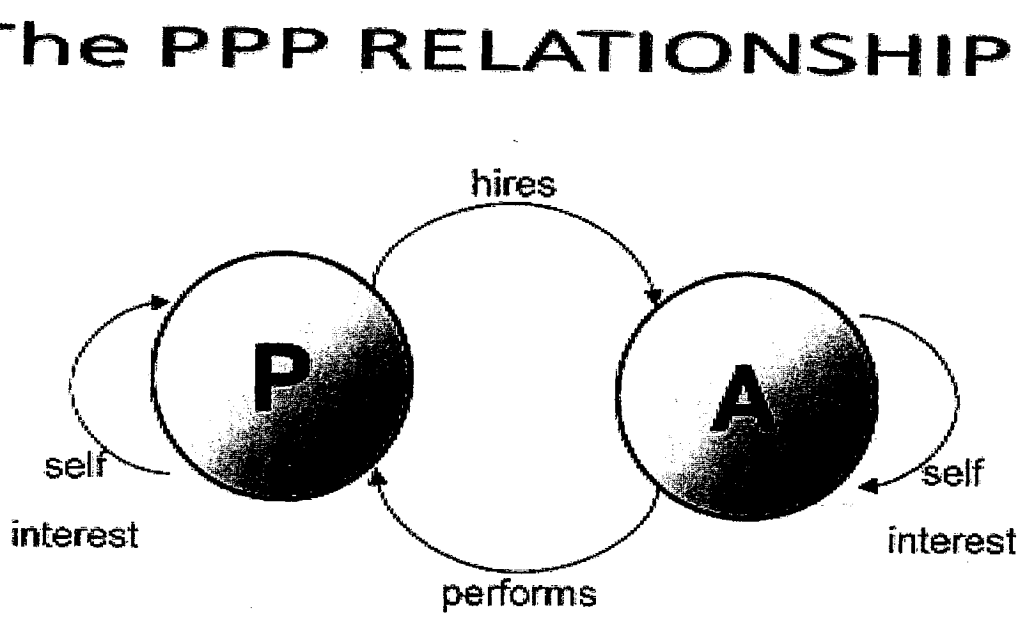
(b) Briefly explain the key differences between the **SHORT-TERM CONTRACT** of employment and **TEMPORARY CONTRACT** of employment.

(12 marks)

(TOTAL 20 MARKS)

QUESTION SEVEN

The figure below illustrates the Principal Agent Relationship which is used to explain the relationships between the Public and Private entities in a Public Private Partnership (PPP) formed to enhance delivery of public services.



The Manenekela Municipal Council (The Principal) has contracted a private company called BEng Waste Collectors Ltd (The Agent) to collect waste on their behalf from all residential and commercial properties within its area of jurisdiction using the MANAGEMENT CONTRACT type of PPP arrangement.

(a) Fully explain the term Management Contract as applied in PPPs.

(6 marks)

(b) Using the figure above as your reference explain what the term SELF INTEREST means from both the Principal and Agent's perspectives in the waste collection contract.

(14 marks)

(TOTAL 20 MARKS)

END OF EXAMINATION

(Dr-Eng. Simon Tembo; Dr-Eng. Ian Banda; Dr-Eng. Mwape Chileshe)