UNIVERSITY OF ZAMBIA

SCHOOL OF ENGINEERING

END OF YEAR EXAMINATIONS

2018/2019 ACADEMIC YEAR

1. CEE 5122 – Construction Contract and Management
2. ENG 2139 – Introduction to Information and Communication Technology (ICT)
3. ENG 5129 – Engineering Management and Society II
4. MEC 2309 – Properties of Engineering Material I
5. MEC 4402 – Thermodynamics II and Heat Engines

THE UNIVERSITY OF ZAMBIA

SCHOOL OF ENGINEERING

2019 ACADEMIC YEAR

FINAL EXAMINATION

Cee
~~SES~~ 5122: CONSTRUCTION CONTRACT MANAGEMENT

TIME: THREE (3) HOURS

DATE: 22 NOVEMBER 2019

INSTRUCTIONS:

1. THIS EXAMINATION PAPER CONTAINS THREE SECTIONS AND SEVEN QUESTIONS. YOU ARE EXPECTED TO ANSWER FIVE QUESTIONS.
2. IT IS COMPULSORY THAT YOU ANSWER ATLEAST ONE QUESTION FROM EACH SECTION **A**, **B** AND **C**.
3. EACH SECTION SHOULD BE ANSWERED IN A **SEPARATE ANSWER BOOKLET**.
4. EACH QUESTION CONTAINS 20 MARKS.
5. MAKE SURE THE STUDENT NUMBER IS CLEARLY INDICATED ON ALL BOOKLETS TOGETHER WITH THE **SECTION AND QUESTIONS** ATTEMPTED.
6. THE ANSWER FOR EACH QUESTION SHOULD BEGIN ON A NEW SHEET
7. WHERE SPECIFIC INFORMATION IS NOT GIVEN, MAKE AND STATE YOUR ASSUMPTIONS
8. MARKS WILL BE LOST FOR <u>ILLEGIBLE</u>, <u>UNTIDY</u> AND <u>UNORGANISED</u> PRESENTATION
9. THE EXAMINATION IS STRICTLY CLOSED BOOK
10. TOTAL <u>MARKS</u> FOR THIS EXAMINATION IS **100 BUT CONTRIBUTES 60% TOWARD THE FINAL ASSESSMENT FOR THIS COURSE.**

SECTION A

Question One

1. In the month of October, 2019 as a trader we had the following transactions:

2019

Oct 1	Started the firm with capital in cash of K2,500
Oct 2	Bought goods on credit from the following persons: D. Ellis K540; C. Mendez K870; K. Gibson K250; D. Booth K760; L. Lowe K640
Oct 4	Sold goods on credit to: C. Bailey K430; B. Hughes K620; H. Spencer K1,760
Oct 6	Paid rent by Cash K120
Oct 9	C. Bailey paid us his account by cheque K430
Oct 10	H. Spencer paid us K1, 500 by cheque.
Oct 12	We paid the following by cheque: K. Gibson K250; D. Ellis K540
Oct 15	Paid carriage by cash K230
Oct 18	Bought goods on credit from C Mendez K430; D. Booth K1,100;
Oct 21	Sold goods on credit to B. Hughes K670
Oct 31	Paid rent by cheque K180

Required:

1.1   Define a trial balance (TB).   *(1 mark)*

1.2   Enter up the necessary accounts for the month of October, 2019 from the above details, and then balance off the accounts and extract the trial balance as at October 31, 2019.   *(13marks)*

1.3   State the information found in three (3) of the basic financial statements found in the final accounts of any business undertaking.

(6 marks)

(Total: 20 marks)

Question two

2. Forest Mushitu has been self-employed since January 2018 when she retired from the Ministry of Home Affairs. Her sales from the date of commencement of trade to September 30, 2018 had been K60, 000 per month. On October 1, 2018, she increased her sales prices and the monthly sales figures went up to K88, 160. All her sales are standard rated supplies for value added tax (VAT) purposes and both of these figures are VAT exclusive.

Forest Mushitu is required to register for VAT from January 1, 2019 as a result of the price increase. Since all her customers are members of the general public, Forest Mushitu is unable to increase the prices further as a result of VAT registration. She therefore continued earning a monthly turnover of K88, 160; but now inclusive of VAT. Her VAT inclusive standard rated expenses are K17, 400 per month.

Required:

2.1   Explain why Forest Mushitu was required to register for VAT on January 1, 2019 and state the action she had to take as regards VAT registration. You should ignore registration with reference to quarterly turnover.

(4 marks)

2.2   Calculate the total amount of VAT payable by Forest Mushitu for the year from April 1, 2018 to March 31, 2019, ignoring pre-registration input VAT.   (3 marks)

2.3 Calculate the increase or decrease in Forest Mushitu's net profit for the year ending December 31, 2019 as a result of the price increase and subsequent VAT registration. (4 marks)

2.4 VAT is one type of tax that the government through the Zambia Revenue Authority (ZRA) charges to raise funds for the treasury. Other than revenue generation, state three (3) other functions/roles of taxation; and describe how those roles are fulfilled. (9 marks)

(Total: 20 marks)

Question three

3. As you graduate and join industry; you will be involved in the implementation of various projects ranging from small to mega projects, some of which could be running for periods of over five years. Generally in Zambia, mega projects involve importation of plant and machinery and other materials. Furthermore, your colleague has mentioned to you that, as you implement your projects it will be important to be undertaking some audits.

Required:

In relation to the above statement:

3.1 Define technical audit and state four (4) objectives of a technical audit. (6 marks

3.2 Define contract costing. (2 marks)

3.3 It is clear from the above statements that some of the risks your projects will be exposed to is foreign exchange risk. State what foreign exchange risk is? *(2 marks)*

3.4 **Why** and **how** can the Government of the Republic of Zambia (GRZ) intervene in the foreign exchange market? *(5 marks)*

3.5 At the end of every financial year, you will be preparing financial statements for your institution. Among the elements in your financial statements will be depreciation and capital allowances when submitting your tax returns to the Zambia Revenue Authority (ZRA)

3.5.1 Define depreciation and capital allowances; and state the difference between the two. *(3 marks)*

3.5.2 Define bank reconciliations and state why they are an important tool in an accountant's tool box. *(2 marks)*

(Total: 20 marks)

SECTION B

Question Four

4.1 Domestic preference in Zambia is based on the provisions of the Public Procurement Act of 2008. The law provides for classification of beneficiary bidders into three categories for purposes of encouraging private sector participation.
What are the three categories and briefly explain what each entails?

(3marks)

4.2 What is the purpose of Bid evaluation and why is price adjustment necessary during the bid evaluation? *(3 marks)*

4.3 What is the purpose of specifying in the bidding document the provision of *Performance Security* and *Retention Money*?. *(3 marks)*

4.4   What are the determinants for the choice of procurement method?

(5 marks)

4.5   What is Open bidding and what are the advantages of this bidding process? (6 marks)

(Total: 20 marks)

Question Five

5.1   A prerequisite to executing the project is a basic understanding of the documents used in construction. Why is this important? *(2 marks)*

5.2   Identify the main types of records that need to be kept on construction site. *(½ x 6 = 3 Marks)*

5.3   Correspondence for the construction contract is used to convey messages and confirm verbal discussions held between the parties on site. Discuss the difference between the **Written notices** and **Site instructions**. *(½ x 4= 2marks)*

5.4   In Zambia, contraction industry still adopts the traditional methods of contracting. On a traditional, fully-designed project, what are the documents that would constitute a contract? *(½ x 6=3 marks)*

5.5   Identify key components that would constitute Contractor's mobilization. *(4 marks)*

5.6   What are the two main documents required to achieve quality on a project in the construction industry? Discuss the two documents relative to quality achievement. *(6 marks)*

(Total: 20 marks)

SECTION C

Question Six

6.1   Outline the two key concepts behind sustainable development

(4+4= Marks)

6.2   What is the primary objective of an Environmental Assessment exercise for a construction project?   (6 Marks)

6.3   Compare and contrast the primary objectives of both sustainable development and project specific environmental assessment and give any commonalities, if any.   (Marks:2+2+2 = Marks)
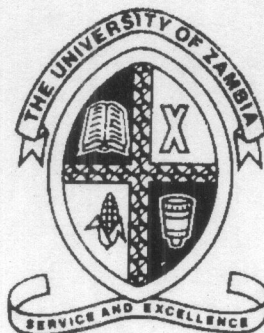
(Total: 20 marks)

Question Seven

7.1   Explain four (4) definitions of quality by which a product can described.
(8 Marks)

7.2   Use a diagram to identify the various stages in which quality assurance controls would be necessary in the life cycle of a construction project to address the problems that could arise.   *(12 Marks)*

(Total: 20 marks)

THE UNIVERSITY OF ZAMBIA
SCHOOL OF ENGINEERING
DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

UNIVERSITY EXAMINATIONS
2018/2019

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

DATE: 25th November, 2019

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 (Questions 5 – 7). 2. You should answer any five (5) questions. 3. You can only attempt three questions at **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) Explain the word "Stack Pointer" from a computer hardware architecture perspective.
[4 Marks]

b) During a start-up of a computer system, there is one phase known as operating system (OS) loading; explain this phase as it occurs during a computer start-up. **[6 Marks]**

c) Why is it said that the hard disk drive (HDD) is both an input device and output device? Give illustrations to support your answer. **[10 Marks]**

Question Two

a) Define and explain the concept of No-SQL database management system. **[10 Marks]**

b) Name two examples of Relational Database Management Systems products which may be used as database systems in some sectors of the industry for data storage and management. **[4 Marks]**

c) Select all **true** statements about Relational Database Management Systems (RDBMS):
[6 Marks]

    A. RDBMS were invented at the University of Pennsylvania (USA).
    B. RDBMS are at the centre of Data mining and Business Intelligence.
    C. RDBMS systems and web sites are just the same.
    D. RDBMS are very important in today's Information age.
    E. Cloud computing has made RDBMS obsolete.
    F. E-commerce systems heavily rely on RDBMS.

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 or computer programs, as well as the usefulness of a computer as a whole; and these are: Processor Management and Device Management.

a) How does the operating system's processor management help the software engineer as they develop applications which will later be running on a computer system?**[10 Marks]**

b) Explain the importance of the operating system's device management in supplementing the usability of a computer system. **[10 Marks]**

Question Four

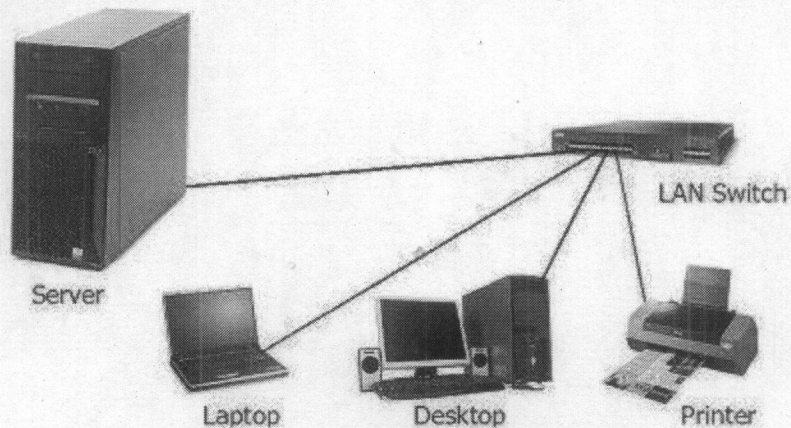a) Analyse the diagram presented below:

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

a) Explain in details the network switch, and how it helps in managing of LAN traffic as depicted in the figure above. **[12 Marks]**

b) Select all **false** statements about the Transmission Control Protocol/Internet Protocol (TCP/IP): **[8 Marks]**

1. TCP/IP does not have any role in the Cloud Computing.
2. TCP/IP was the brain-child of ARPANET project.
3. TCP/IP was the precursor of OSI (Open Systems Interconnections).
4. TCP/IP is very critical for the working of the Internet.
5. TCP/IP has become obsolete with the advent of wireless Internet.
6. TCP/IP is a pair of two data network protocols.
7. TCP/IP was invented by Bell Labs now owned by Nokia in New Jersey (USA).

PART 2: FUNDAMENTALS OF C++ PROGRAMMING

Question Five

a) Answer the following questions by simply making one correct choice:

    (1) *float* is a primitive data type: True or False.   **[2 Marks]**

    (2) *struct* is a primitive data type: True or False.   **[2 Marks]**

    (3) *enum* is a user-defined data type: True or False.   **[2 Marks]**

    (4) *unsigned long* is a primitive data type: True or False.   **[2 Marks]**

    (5) *array* is a derived data type: True or False.   **[2 Marks]**

b) Design a C++ program that implements a simple calculator (+: addition, -: subtraction, *: multiplication, and /: division). If user inputs (x and y) are valid, the program should compute the sum/product/difference/quotient of the two numbers and display the result with the following message: "You entered x = … and y = …. Therefore the sum/ product/ difference/ quotient of these two numbers is: …   **[10 Marks]**

Question Six

a) Find below a C++ code snippet:

```
// code snippet
1.  int totalMark = 0;
2.  int scores[] = {-8, 39, 72, -48, 22, 10, 7, 57, 83, 49, -31, 68};
3.
4.  for (int j = 0; j < 12; j++) {
5.      totalMark += scores[j];
6.  }
```

Read carefully the code snippet above and explain in details what is happening in the following:
    a. Line 1   **[2 Marks]**
    b. Lines 2   **[2 Marks]**
    c. Line 4   **[6 Marks]**
    d. Line 5   **[2 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 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

a) Suppose that you have been given some details of sales at a small grocery shop specialised in selling local food and other commodities 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}

   Write a short C++ program to calculate the total monthly sales for the given small metal fabrication shop in Zambian Kwacha [ZMW]. **[9 Marks]**

b) Given two integer numbers s and t, write a single line C++ statement that can display on the console a message such as – "The sum of these two numbers is: ", followed by the value of their sum. **[4 Marks]**

c) Declare a class named Employee with four member variables: first name, surname, NRC number and their age. It should have a constructor which initialises the four member variables, a destructor and four accessor member functions. **[7 Marks]**

------- *END OF EXAM & GOOD LUCK!*-------
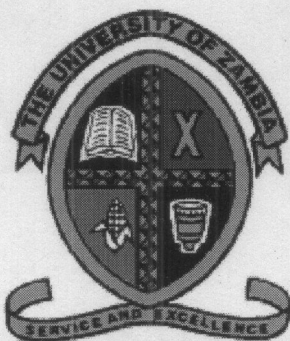
THE UNIVERSITY OF ZAMBIA

SCHOOL OF ENGINEERING

UNIVERSITY EXAMINATIONS

FINAL EXAMINATIONS: NOVEMBER-DECEMBER 2019

ENG 5129

ENGINEERING, MANAGEMENT AND SOCIETY II

TIME	:	**Three (3) Hours PLUS 5 Minutes Reading Time**
INSTRUCTIONS	:	**There are a total of Seven (7) Questions in this Exam**
	:	**You shall Answer <u>a total of Five (5)</u> Questions which should include AT LEAST TWO QUESTIONS from either section A or B**

SECTION A: <u>Answer at Least Two (2) Questions</u> from this Section

QUESTION ONE

(a) Briefly EXPLAIN what`s meant by the term 4-P in marketing. (4 marks)

(b) Briefly DESCRIBE the FOUR main organization structures. (4 marks)

(c) Name and briefly DESCRIBE the SIX steps of planning. (6 marks)

(d) DISCUSS the THREE managerial skills. (6 marks)

(TOTAL 20 MARKS)

QUESTION TWO

(a) Which people in a company are typically included in the planning process and EXPLAIN why? (4 marks)

(b) Name and briefly DESCRIBE TWO main areas of emphasis when managing Human Resources to ensure effective results (4 marks)

(c) EXPLAIN the importance why personnel specifications should be prepared when planning for recruitment? (4 marks)

(d) Briefly DESCRIBE the TWO elements of the strategy management process approach used in establishing organisational direction. (4 marks)

(e) Name and briefly DESCRIBE the FOUR basic functions of management that make up the management process. (4 marks)

(TOTAL 20 MARKS)

QUESTION THREE

(a) Planning is a process comprising SIX steps, DESCRIBE these steps. (6 marks)

(b) Briefly DESCRIBE the THREE duties of planners. (3 marks)

(c) NAME and briefly DESCRIBE the THREE competing priorities that need to be "fine-tuned" in order to derive the most commercially successful outcomes in projects. (3 marks)

(d) DESCRIBE the key roles of the Chief Executive Officer (CEO) with regard to his/her role as a company planner? (4 marks)

(e) In the use of company resources, managers are required to have TWO qualities. Briefly describe these TWO qualities. (4 marks)

(TOTAL 20 MARKS)

SECTION B: Answer at Least Two (2) Questions from this Section

QUESTION FOUR
Harold purchased two trucks for his warehouse for a total of $65,000. This investment saved him $13,500 every year for ten years. At the end of the tenth year, he sold both the trucks for a total of $10,000. COMPUTE the NPV and determine if this was a sound investment decision. The cost of capital is 15%.

(TOTAL 20 MARKS)

QUESTION FIVE
The chief surveyor of a firm that moves earth in preparation for the construction of roads has identified the activities and their durations for each stage of an operation to prepare a difficult stretch of motorway (see Table Q4.). The surveyor needs to know how long the project will take and which are the critical activities. DRAW a network diagram for the project and CALCULATE the fastest time in which the operation might be completed.

Table: Road construction activities

Activity	Duration in weeks	Activities that must be completed before it can start
A	5	–
B	10	–
C	1	–
D	8	B
E	10	B
F	9	B
G	3	A, D
H	7	A, D
I	4	F
J	3	F
K	5	C, J
L	8	H, E, I, K
M	4	C, J

(TOTAL 20 MARKS)

QUESTION SIX

Participation by the Private Sector in public service delivery can yield many benefits. You being a Senior Manager in a publicly owned company providing electricity to four districts in one region sourced from their locally based thermal power station have been tasked to make a detailed presentation to the Board of Directors on why inviting a potential private partner will derive benefits and improvements. EXPLAIN the **BENEFITS and IMPROVEMENTS** that will arise from FOUR perspectives namely:

(a) De-politicization of decisions

(b) Wider Share ownership

(c) Lowering of risk and costs

(d) Recapitalisation

(TOTAL 20 MARKS)

QUESTION SEVEN

The Employment Act Cap 281 of the laws of Zambia was in 2019 repealed and replaced with the Employment Code No 3 of 2019. The principle function of this statute is to provide regulations and general oversight on matters to do with employment of persons in Zambia. DISCUSS FOUR key issues that the law provides for and what the implications would be if these provisions were non existent

(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, 2018

NOVEMBER 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

Q1.

Given the Pb-Sn phase diagram, in Figure Q1, for an alloy of 40% Sn and 60% Pb at 250°C;

(a)   If an alloy of 40% Sn and 60% Pb is slowly cooled from 350oC to room temperature, explain the transformations that will take place.   [06 marks]

(b)   For the same alloy of 40% Sn and 60% Pb at 250°C

    (i)   What phases are present?   [02 marks]

    (ii)   What is the fraction of each phase?   [08 marks]

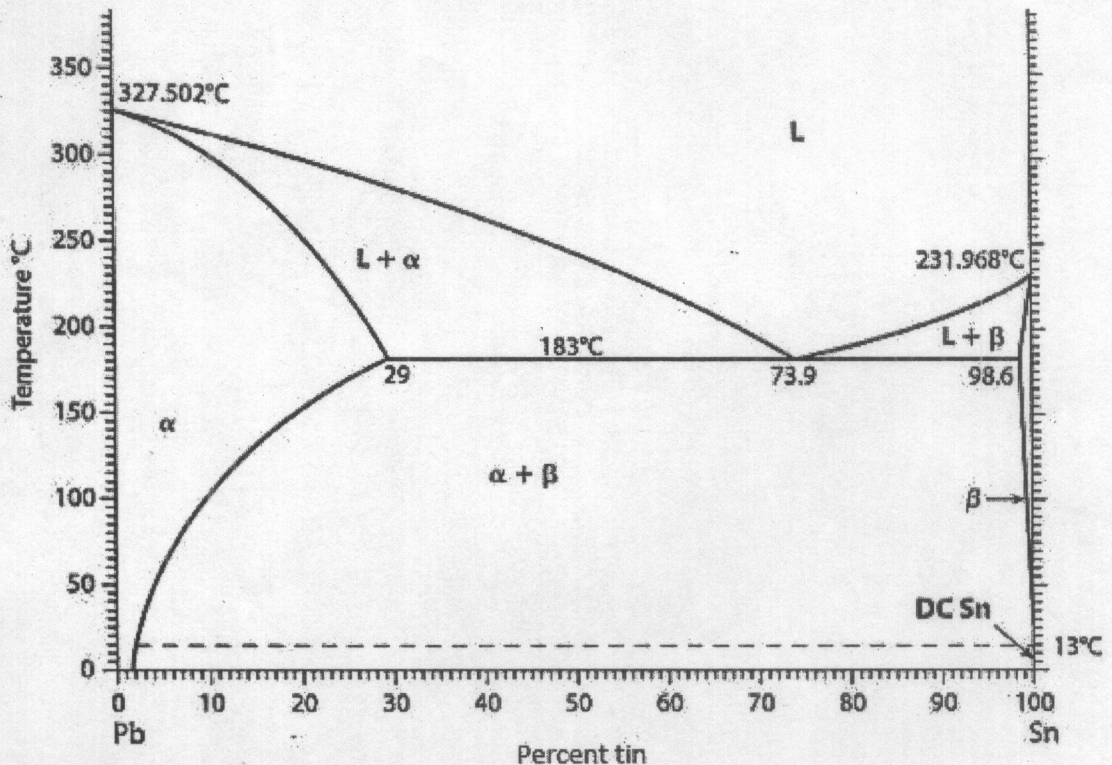   (iii)   What composition of each phase?   [04 marks]

Figure Q1: Pb-Sn Phase Diagram

Q2.

(a)   Iron has bcc structure and its density is 7874 kg/m^3. Given that the mass of an iron atom is 9.26028 x 10^{-26} kg. Find the unit cell dimensions (lattice parameter) and atomic diameter.

                                                                                                  [10 marks]

(b)   In the cubic crystal system, planes are described using miller indices. Using clear diagrams, draw the following planes.

    (i)   (110)

    (ii)   (010)   [10 marks]

Q3.

Consider the iron carbon diagram shown in Figure Q3.

(a)   What compositions are at points 1, 2, 3, 4 and 5?   [05 marks]

(b)   What phases are represented by the numbers 6, 7, 8, 9 and 10?   [05 marks]

(c)   Give the name and values of temperatures 11 and 12?   [04 marks]
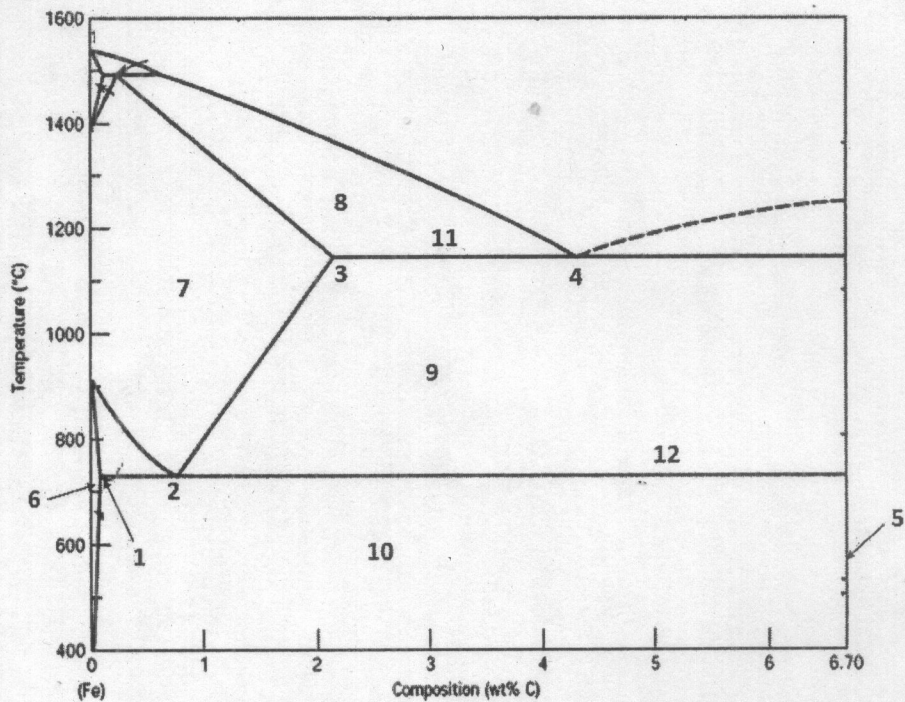

Figure Q3a: Unlabelled Fe-C Diagram

(d)   A 1 kg sample of hypereutectoid steel is heated to 722°C. Analysis of the sample reveals that it contains 760 g ferrite. Is this possible? If so what is the overall composition of the sample?

[06 marks]

Q4.

(a)   Calculate the planer density and planer packing fraction for the (010) and (020) planes in simple cubic polonium (Po), which has a lattice parameter of 0.3340 nm.   [12 marks]

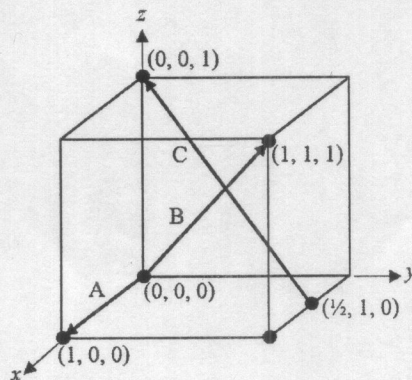(b)   Determine the Miller indices of the directions A, B and C in Figure Q4.   [08 marks]

Figure Q4: Crystallographic directions and coordinates

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

Q5.

(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.   [08 marks]

(b)   During a laboratory test, a steel rod loaded in compression measured 0.40 m in diameter just before its yield point. Given that the material yields at 350 MPa, calculate;
   (i)   the radial strain at yield,
   (ii)   the initial diameter of the steel rode,
   (iii) the material's resilience.
   Take: $E = 205$ GPa; $v = 0.33$ [12 marks]

Q6.

(a)   What are thermoplastic materials?   [05 marks]

(b)   A cylindrical connecting rod 120 mm long and a diameter of 10 mm is subjected to a maximum tensile load of 30 kN. If the connecting rod is not to experience either plastic deformation or a diameter reduction of more than 7×10^{-2} mm, recommend the material(s) suitable for this operation from the list of materials provided in Table Q6.
   [15 marks]

Table Q6: Mechanical properties of selected alloys

Material	Modulus of Elasticity (GPa)	Yield Strength (MPa)	Poisson's Ratio
Aluminium alloy	70	200	0.33
Brass alloy	101	300	0.35
Steel alloy	207	400	0.27
Titanium alloy	107	650	0.36

Q7.

(a)   Discuss the following terms in relation to heat treatment of materials;
   (i)   Hardening
   (ii)   Tempering
   (iii) Cyaniding   [12 marks]

(b)   For a stress of 50 MPa applied at an incline of 45°, calculate the normal and shear stress components.   [08 marks]

Q8.

(a)   What are composite materials? Give examples?   [04 marks]

(b)   Briefly discuss how you would test a composite material's hardness using the Rockwell test.   [12 marks]

(c)   What are four properties of a polymer which are useful in engineering applications?   [04 marks]

END OF MEC 2309 EXAMINATION
G M MUNAKAAMPE / E CHIBWE

THE UNIVERSITY OF ZAMBIA
SCHOOL OF ENGINEERING
DEPARTMENT OF MECHANICAL ENGINEERING

FINAL EXAMINATIONS-2019

MEC 4402: THERMODYNAMICS II & HEAT ENGINES

INSTRUCTIONS

1. Answer Five (5) questions that is Two (2) from Section A and Three (3) from Section B.
2. Please note that Question Four (4) in Section B is <u>Compulsory.</u>
3. State all assumptions and clearly show all analytical steps leading to you solution metrically.
4. Underline your final answer for all analytical questions.
5. Where necessary give fully labelled sketches and illustrations to support your work.
6. Comment on your final solution where appropriate.
7. Marks distribution is as indicated at the end of each question.

SECTION A

There are three (3) questions in this section. Answer <u>Two (2)</u> questions only.

QUESTION 1

    A. Briefly discuss the essential components of a Spark Ignition (SI) Engine with your listing following the logical order of operation from the source of energy to the end. **[7.5 Marks].**

    B. Give an outline of any SI ignition system you know **[7.5 Marks].**

QUESTION 2

    A. Explain why lubrication is required in the operation of a heat engine. Your solution must include four (4) major functions of lubrication oil.

[7.5 Marks].

    B. Discuss the need for the cooling system for an automotive engine. Include in your solution Two (2) characteristics of an efficient cooling system.

[7.5 Marks].

QUESTION 3

    A. Discuss the important elements influencing the rating of an SI Engine

       Fuels. **[7.5 Marks].**

    B. Explain the laboratory method used to determine the fuel rating of

       CI Engine. **[7.5 Marks].**

SECTION B

QUESTION 4: COMPULSORY

An eight-cylinder, Four-stroke engine of 9cm bore and 8cm stroke with a compression ratio of 7 is tested at 4500 rpm on a dynamometer which has 54cm arm. During a 10 minutes test the dynamometer scale beam reading was 42 kg and the engine consumed 4.4kg of gasoline having a calorific value of 44000kj/kg. Air at 27°C and 1 bar was supplied to the carburetor at the rate of 6kg/min. Find (i) the brake power delivered (ii) the brake mean effective pressure (iii) the brake specific fuel consumption (iv) the brake specific air consumption (v) the brake thermal efficiency (vi) the volumetric efficiency and (vii) the air fuel ratio.

[30 Marks]

QUESTION 5

Calculate the diameter of the fuel orifice of a four stroke diesel engine which develops 25kw per cylinder at 2500 rpm. The specific fuel consumption using 0.3 kg/kW h fuel of 30° API. The fuel is injected at a pressure of 150 bar over a crank travel of 25°. The pressure in the combustion chamber is 40 bar. Coefficient of velocity is 0. 875 and specific gravity is given by $S.G = \frac{141.5}{131.5 + °API}$

[20 Marks].

QUESTION 6

The air-standard Dual cycle has a compression ratio of 10. The pressure and temperature at the beginning are 1 bar and 27°C respectively. The maximum pressure reached is 42 bar and the maximum temperature is 1500°C. Determine (i) the temperature at the end of constant volume heat addition (ii) cut-off ratio (iii) work done per kg of air and (iv) the cycle efficiency. Assume C_p =1.004 KJ/kg K and C_v =0.717KJ/kg for air   **[20 Marks].**

QUESTION 7

The following results were obtained in a test on a gas engine:

Gas used=0.16m³/min at NTP

Calorific value of gas at NTP=14MJ/m³

Density of gas at NTP=0.65kg/m³

Air Used=1.50kg/min

Specific heat of exhaust gas=1.0kJ/kg K

Temperature of exhaust gas=400°C

Room Temperature=20°C

Cooling water per minute=6kg

Specific heat of water=4.18kJ/kg K

Rise in temperature of cooling water=30°C

ip=12.5kW

bp=10.5kW

Draw a heat balance sheet for the test on per hour basis in kJ

[20 Marks]