LANDMARK UNIVERSITY, OMU-ARAN

COLLEGE: COLLEGE OF SCIENCE AND ENGINEERING

DEPARTMENT: MECHANICAL ENGINEERING

PROGRAMME: MECHANICAL ENGINEERING
COURSE COMPACT for: ALPHA

Course

Course code: **GEC213**
Course title: **MATERIALS SCIENCE & RAW MATERIALS STUDIES**
Credit unit: **2**
Course status: **COMPULSORY**

Lecturer's Data

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INTRODUCTION TO THE COURSE
Course Description:

Materials constitute a foundation of technology, hence, all Engineers should have a basic knowledge of materials. Their chemistry, physical properties are so important. This knowledge will metamorphous in the selection of appropriate materials for a given application.

Course Justification:

Materials and innovative materials development are in the fore front of development in recent times. Materials are so important in the development of human civilization such that historians have identified civilization by the name of most used material. Thus, we have: Stone Age, Bronze Age etc. These showcased the importance of materials and their impact on human civilization. We are presently in Space Age marked by many technological developments towards development of materials resulting in stronger and light materials like composites, electronic materials like semiconductors, materials for space voyage like high temperature ceramics, biomaterials, etc.

Course Objectives:

- To know types of raw materials and their distribution in Nigeria
- To know processing techniques for various materials-composites, alloys, polymers.
- To acquire basic skills of unit operation and processes
- To know the production and uses of different materials and their starting raw materials.

Course Content:

Raw material deposit survey in Nigeria: quantity, location. Processing techniques and existing processed products. Material characteristics and composition. Material re-cycling. Physics of materials. Chemistry of materials.

Course Expectations:

S/N	GRADING	SCORE(%)
1.	Continuous Assessments • C.AI • C.AII (Mid-Semester Test) • C.AIII	 7% 15% 8%
2.	Assignment	
3.	Practical (Laboratory work)/ Case Studies	10%
4.	Final Examination	60%
5.	Total	100

Course Delivery Strategies:

- ❖ Provision of detailed explanation in class on the topic.
- ❖ Provision of adequate illustration on the board.
- ❖ Making lecturing periods interactive.
- ❖ Giving the students class work during the lecture period.
- ❖ Giving take-home assignments at the end of each lecture.

Course Duration: Two hours per week for 15 weeks

LECTURE CONTENT

Module 1

- **Week 1: Introduction to Materials science and raw materials distribution in Nigeria.**

- **Objectives:**

At the successful completion of this topic students should be able to;

(i) explain what material science is
(ii) mention the location, deposit and type(s) of raw materials in various geo-political zones in Nigeria

First hour:

Definition of material science and other related terms, brief history on advancement of materials reviewing from early man till date.

Second hour

Raw materials; where they can be found within the geo-political zones in Nigeria

- **Study Question:**

What is material science?
Mention three raw materials each in the geo-political zones in Nigeria
State the importance of materials science in Engineering

- **Reading List –**

Materials science and engineering: An introduction by William D Callister Jr.

- **Week 2: Processing, properties and applications of metals/alloys**
- **Objectives:**

At the successful completion of this topic students should be able to;

(i) describe the relationship between properties, processing and application of metal/alloys

First hour:

Succinct discussion on processing, properties and applications of metal/alloys

Second hour

Succinct discussion on processing, properties and applications of metal/alloys
Entertainment of questions from students and group discussion on the topic

- **Study Question:**

Represent the triangular relationship for metal/alloys system

- **Reading List –**

Materials science and engineering: An introduction by William D Callister Jr.

Week 3: Thermal processing of metals and alloys, deterioration and recycling

- **Objectives:**

At the successful completion of this topic students should be able to;

(i) explain the thermal processing of metals and alloys deterioration and recycling
(ii) explain in details what annealing is

First hour:

What thermal processing of metal and alloys are. Mode of recycling, case hardening, the different forms of case hardening

Second hour

Different types of annealing; questions on thermal processing of metals and alloys

- **Study Question:**

1. The percentage carbon in medium carbon steels ranges from _.

   (a) 0.3 – 0.4 (b) 0.3 – 0.5 (c) 0.3 – 0.6 (d) None

2. Stainless steel is so called because of its __.

   (a) High strength (b) High corrosion resistance (c) High ductility (d) Brittleness

3. In white cast irons, carbon present as ____.

   (a) Graphite flakes (b) Graphite nodules (c) Cementite (d) Carbon does not exist

4. Which of these is a refractory metal? (a) Ag (b) W (c) Pt (d) Ni

Reading List

The work work done by Adediran et al., (2015). Mechanical properties of dual phase steel quenched in bitumen medium, Leonardo Electronic Journal of Practices and Technologies (LEJPT), Issue 26 (January-June), 2015 (14), p. 1-16, http://lejpt.academicdirect.org/A26/001_016.pdf

The work done by Daramola et al., (2015). Evaluation of the mechanical properties and corrosion behaviour of coconut shell ash reinforced aluminium (6063) alloy composites,
Leonardo Electronic Journal of Practices and Technologies (LEJPT), Issue 27 (July-December), 2015 (14), p. 107-11, http://lejpt.academicdirect.org/A27/107_119.pdf

Module 2

Week 4

Topic: Processing, properties and applications of ceramics

Objectives:

At the successful completion of this topic students should be able to;

(i) describe the processing, properties and applications of ceramics

First hour:

Definition of ceramics material.

Second hour

Processing techniques for ceramics materials, properties of ceramic materials and areas of application of ceramics materials.

- **Study Question:**

What are ceramics materials?
Mention three areas of application of ceramics materials

Week 5:

Topic: Advances in ceramics, glass from agricultural wastes and recycling

Objectives:

At the successful completion of this topic students should be able to;

(i) Mention the advances in ceramics materials and constituents of glassy materials

First hour:

Definition of glassy materials.

Second hour

Methods of recycling of agricultural wastes, different types of glass

Week 6

Topic: Processing, properties and applications of polymers

Objectives:

At the successful completion of this topic students should be able to;

(i) define polymeric materials
(ii) state the processing routes involved in polymer processing

First hour:

Definition of polymeric materials. Areas of application of polymeric materials

Second hour

Processing and properties of polymeric materials

- Study Question:

What are polymeric materials?
List five examples of polymeric materials
Mention three areas of application of polymeric materials

Module 3

Week 7:

Topic: Processing, properties of composite materials

Objectives:

At the successful completion of this topic students should be able to;

(i) define composite materials

First hour:

Explanation of composite materials, examples and properties

Second hour

Processing of composite materials

- Study Question:

What are composite materials?
State four processing routes for composite materials

Reading List

The work done by Daramola et al., (2015). Evaluation of the mechanical properties and corrosion behaviour of coconut shell ash reinforced aluminium (6063) alloy composites,
Leonardo Electronic Journal of Practices and Technologies (LEJPT), Issue 27 (July-December), 2015 (14), p. 107-11, http://lejpt.academicdirect.org/A27/107_119.pdf

Week 8:

Topic: Degradation and recycling of composite materials

Objectives:

At the successful completion of this topic students should be able to;

(i) Explain the degradation and recycling of composite materials

First hour:

Explanation on composite degradation and recycling techniques

Second hour

Explanation on composite degradation and recycling techniques

- Study Question:

On can we carry out recycling of composite materials?

Week 9:
Topic: Raw materials from the atmosphere and processing of gases

Objectives:
At the successful completion of this topic students should be able to;

(i) identify the raw materials from the atmosphere

First hour:
Explanation on materials from the atmosphere and processing of gases

Second hour
Explanation on materials from the atmosphere and processing of gases

- **Study Question:**

What are the raw materials from the atmosphere?
How can we process gases?

Module 4
Week 10:

Topic: Raw materials from the lithosphere and processing of crude oil.

Objectives:
At the successful completion of this topic students should be able to;

(ii) identify the raw materials from the lithosphere and processing of crude oil

First hour:
Explanation on materials from the lithosphere and processing of crude oil

Second hour
Explanation on materials from the lithosphere and processing of crude oil

- **Study Question:**

What are the raw materials from the lithosphere?
State the processing routes involved in crude oil processing

Week 11:
Topic: Iron ore, ore dressing and extraction of iron.
Objectives:
At the successful completion of this topic students should be able to;

(i) differentiate between iron ore and ore dressing

First hour:
Processes involved in ore dressing

Second hour
Extraction of iron

- **Study Question:**

State the processes involved in ore dressing
Briefly discuss iron extraction

Week 12:
Topic: Raw materials from agricultural products and agricultural waste.
Objectives:
At the successful completion of this topic students should be able to;

(i) identify the raw materials from agricultural waste

First hour:
Explanation on different materials from agricultural waste

Second hour

Raw materials from agricultural products

- **Study Question:**

What are the raw materials from agricultural products?
State ten materials from agricultural waste

Reading List

The work done by Daramola et al., (2015). Evaluation of the mechanical properties and corrosion behaviour of coconut shell ash reinforced aluminium (6063) alloy composites,
Leonardo Electronic Journal of Practices and Technologies (LEJPT), Issue 27 (July-December), 2015 (14), p. 107-11, http://lejpt.academicdirect.org/A27/107_119.pdf

Module 5
Week 13:
Topic: Uses and applications of some agricultural products
At the successful completion of this topic students should be able to;

(i) identify the uses and applications of some agricultural products

First hour:

Identification of some agricultural products and application of these products

Second hour

Identification of some agricultural products and application of these products

- **Study Question:**

List some agricultural products and their application

Week 14:
Topic: Power generation from agricultural waste
At the successful completion of this topic students should be able to;

(i) identify the potentials in agricultural waste with emphasis on power generation

First hour:

Power generation from agricultural waste and application of these products

Second hour

Thermal effect of some agricultural waste and their application

- **Study Question:**

List some agricultural products and their application

Week 15: Revision
RECOMMENDED BOOKS
Materials science and engineering: An introduction by William D Callister Jr
Applied physical metallurgy by R A Higgins