



LANDMARK UNIVERSITY, OMU-ARAN

## COURSE COMPACT

COLLEGE: COLLEGE OF SCIENCE AND ENGINEERING

DEPARTMENT: MECHANICAL ENGINEERING

PROGRAMME: MECHANICAL ENGINEERING

COURSE COMPACT: 2017/2018 SESSION.

### Course

*Course code: MCE 211*

*Course title: INTRODUCTION TO MECHANICAL ENGINEERING*

*Course Units: 2 UNITS.*

*Course status: compulsory.*

### Lecturer Data

*Name of the lecturer: Engr. Aliyu Samuel Jacob.*

*Qualifications obtained: M. Eng. (Thermo-Fluid. Power Plant & Auto. Option.), MNSE, R.COREN.*

*Department: Mechanical Engineering.*

*College: College of Science and Engineering*

*E-mail: [aliyu.samuel@lmu.edu.ng](mailto:aliyu.samuel@lmu.edu.ng)*

*Office Location: New college Building, Wing A, Second floor, Room A 218.*

*(Engr. Aliyu Samuel Jacob).*

*Consultation Hours: 24/7 (Days and time).*

### Course Description:-

*Introducing students to general mechanical engineering ethics and areas of applications mechanical science. The students are to be exposed to different of engineering within mechanical engineering as a body. Mechanical engineering as the spinal cord to all engineering facets has many faces in which the students must be aware of, e.g, the automotive industry, aircraft industry, medical industry, water resources, general production industries, etc.*

### Course Justification:-

- *The course will introduce general mechanical engineering and establish its relevance in engineering applications.*
- *Develop the fundamental principles underlying the subject.*
- *Demonstrate how these are used for the design of simple engineering components.*
- *With the wealth of sound, practical and theoretical knowledge, students can fit into organisations handling engineering projects. In addition, students can be change agents pioneering such projects in their sphere of influence.*

## Course objectives

At the end of this course, students would be able to:

- Know historical perspectives of combustion engines and other forms of energy conversion.
- Know component parts of engines- motor car
- Acquire basic skills in materials selection
- Understand career paths opened to mechanical engineers.

## Course Content :-

Place of mechanical engineers in the design, developing, manufacturing, and testing energy conversion of systems. Historical survey of their efforts that have resulted in the creation of combustion engines (used in automobiles, trucks, locomotives, airplanes, factories, and utility power plants) and other forms of energy conversion equipment, such as heat pumps, air conditioners, machine tools, and appliances. Challenges faced by Mechanical Engineers in structural analysis, materials selection, manufacturing, and design. Examples of their current roles in technology in relation to building of spacecraft and power systems, artificial limbs, and textile equipment, to mention a few. Career pursuits of mechanical engineers after graduation in sales, product quality control, maintenance, patent law, or research and development. The second part of this course shall be "Car Practical". This is to introduce the students to engines in general. A car will be made available to be dismantled and the various parts distributed to the students to study and find out their design characteristics and mechanisms of working. There shall be a Seminar at the end for the students to present their findings.

## Course Expectation

To gain maximally from this course, students should be familiar with the various facets of mechanical engineering, designs and machine operations; students are also expected to be sound in simple calculations by synthesizing knowledge from various courses they have been exposed to during the cause of study.

### Method of Grading- An example below

S/N	Grading	Score (%)
1.	<i>Continuous Assessments</i>	
	• C.A-I	7%
	• C.A-II	15%
	• C.A-III	8%
2.	<i>Assignment</i>	10%
3.	<i>Practical (work)</i>	
4.	<i>Final Examination</i>	60%
	<b>Total</b>	<b>100</b>

## Course Delivery Strategies

1. *Interactive class discussions complimented by lecture notes. Students are also given take-home assignments which further buttresses the course objectives.*
2. *The use of the public address system for audibility during lecture delivery.*
3. *The use of the electronic surface writing medium and the use of a projector and accessories.*
4. *Teaching aids with practical illustrations.*
5. *Giving the students class work during the lecture period.*

**Course Duration:** *Two hours per week for 15 weeks (30 hours)*

# LECTURE CONTENT

## **Week 1:** *Topic for the week*

*Historical survey of mechanical engineers efforts which resulted in the creation of combustion engines and other forms of energy conversion equipment.*

### ➤ **Objectives (list the objectives)**

- *At the end of the lecture for this week:*
- *Students should by the way of introduction know what mechanical engineering is all-about.*
- *Students should know the role of mechanical engineering in global development.*
- *Students should understand the indebt theoretical (technical) knowledge of the subject matter before embarking on the practical operation.*

### ➤ **Description**

- First hour: *Definition of the role of an engineer and a scientist.*
- Second hour: *Introducing the student to mechanical engineering that would enable the student to clarify the objective of a mechanical engineering education, including the purpose of different type of courses.*
- Third hour, etc:

### ➤ **Study Question: This section entails study question for the week lecture.**

1. *Distinguish between a solution and a problem.*
2. *What are the roles of a mechanical engineer in an industry?*
3. *Who is a mechanical engineer?*

### ➤ **Reading List - Books and materials students can read. Illustration below:**

- *Edward. V. Krick, 1969, Engineering and Engineering Design, SBN 471 50741 5.*
- *A. Oyediran Adedeji, 2007, Professional Engineering Fundamentals, ISBN-978-38280-4-5*
- *S.I. Oluka et..al, 1999,Engineer-in-Society,ISBN 978-2952-35-4.*

## Week 2: Topic for the week

*Historical survey on heat pumps, and air conditioners.*

### ➤ Objectives (list the objectives)

*The students at the end of the lectures for the week should be able to:-*

- 1. Know type of heat pumps used for specific purposes.*
- 2. Know why they are called reversed heat engines.*
- 3. Determine Coefficient of performance for refrigerators and heat pumps.*

### ➤ Description

- First hour: *Introducing the students to heat engine, refrigerator and heat pump.*
- Second hour: *Knowing the governing equations and their characteristics type of measuring tools.*
- Third hour, etc:

### ➤ Study Question: This section entails study question for the week lecture.

- 1. A heat engine produces work equivalent to 80 kW with an efficiency of 40%. Determine the heat transfer rate to and from the working fluid.*
- 2. A heat engine develop a 10 kW power when receiving heat at the rate of 2250 kJ/min. Evaluate the corresponding rate of heat rejection from the engine and its thermal efficiency.*
- 3. A machine operating as a heat pump extracts heat from the surrounding atmosphere, is driven by a 6.5 kW motor and supplies  $2 \times 10^5$  kJ/hr heat to a house needed for its heating in winter. Find coefficient of performance for the heat pump. How this COP will be affected if the objective of the same machine is to cool the house in summer requiring  $2 \times 10^5$  kJ/hr of heat rejection? Comment on the result.*

### ➤ Reading List -

*Dr. D. S. Kumar, 2011, Applied Thermodynamics,*

## Week 3: Topic for the week

*Historical survey on machine tools and appliances.*

### ➤ Objectives (list the objectives)

*The students at the end of the lectures for the week should be able to:-*

- 1. Knowing how bench tools are handled and used for an operation.*
- 2. Know how to read engineering drawings.*
- 3. Knowing how to select working tools and materials.*
- 4. Students should understand the uniqueness of the end product.*

### ➤ Description

- First hour: *Bringing components to shape by the removal of metal at the bench using hand tools, machine tools.*
- Second hour: *Distinguishing machine producing components on a machine tool and producing components on the bench.*
- Third hour, etc:

- **Study Question: This section entails study question for the week lecture.**
  1. Mention three operations to be carried out before mounting a job on a vice.
  2. Mention three type of vices which can be use for bench operations.
  3. Why is it difficult to produce a flat surface when using a file?
  4. Why is it important to keep hack saw as closely as possible to a scribed line?
- **Reading List - Books and materials students can read.**
  - R. T. Pritchard, 1976, *Workshop Processes, Vol.1*, ISBN 0 340 04938 3.
  - Tim Gilles, 2011, *Automotive Engines, Sixth Edition*, ISBN-13 978-1-4354-8826-7.
  - Alex Weiss, 1999, *Workshop Materials, Nexus Special Interests Ltd.* ISBN 1 85486 192 1.
  - Les Oldridge, 1988, *Basic Bench-work, Argus books Ltd.* ISBN 0 85242 920 7.

**Week 4: Topic for the week**

*The place of mechanical engineers in the design, development, manufacturing, and testing of energy conversion of systems.*

➤ **Objectives (list the objectives)**

*The students at the end of the lectures for the week should be able to:-*

1. Understand the constructional features.
2. Know how draw sectional diagrams of elementary machine parts.
3. Know the laws that govern the operation of the conversion system.
4. Know the factors that influence the starting torque and the slip at which maximum torque occurs.
5. Know type of energy transformations e.g when a vehicle is brought to rest.

➤ **Description**

- First hour: *Introducing the students to various types of energy conversion systems.*
- Second hour: *The transformation of potential energy to kinetic energy and then to electricity from water fall through a turbine (Hydro-dams). Laboratory experiment in automotive lab.*
- Third hour, etc:

➤ **Study Question: This section entails study question for the week lecture.**

1. What do you understand as internal combustion engines?
  - a) Give a sketch drawing of Otto- four stroke type of an engine and explain how it operates.
  - b) What are the advantages and disadvantages of two stroke engines?
  - c) During a particular process, the specific heat of the working fluid comprising a system is given by the relation,  $c = (0.2 + 0.002 T) \text{ kJ/kg K}$ , where  $T$  is the absolute temperature in degrees Kelvin. What amount of heat is required to be supplied to this fluid system to raise its temp from 300 K to 400 K? Also determine the mean value of specific heat.
2. State four conclusions of the law of conservation of energy.
3. A domestic refrigerator is loaded with fresh food and the door closed. During a certain period, the machine consumes 1.2kWh of electrical energy in cooling the food

*and the internal energy of the system decreases by 4500kJ. Find the magnitude and sign of net heat transfer for the system. The refrigerator and its contents may be considered as the system.*

➤ **Reading List - Books and materials students can read. Illustration below:**

- *Chris C. Okoro, 2010, Energy conversion Principles and Systems For Power Engineering, ISBN 978-978-49588-0-6*
- *R. T. Pritchard, 1976, Workshop Processes, Vol.1, ISBN 0 340 04938 3.*
- *Tim Gilles,2011, Automotive Engines, Sixth Edition, ISBN-13 978-1-4354-8826-7.*
- *Dr. D. S. Kumar,2011, Applied Thermodynamics,*

**Week 5: Topic for the week**

*Introduction to challenges faced by mechanical engineers in structural analysis, materials selection, manufacturing, and design.*

➤ **Objectives (list the objectives)**

*The students at the end of the lectures for the week should be able to:-*

1. *Know how an engineer is a problem solver.*
2. *Know how to initiate a design.*
3. *Know how to collaborate the tailored team toward a milestone.*
4. *Know how to meet with the target date of project completion.*

➤ **Description**

- *First hour: Introducing the students to engineering fundamentals on project analysis.*
- *Second hour: Project survey, scope and execution- all on the design table- are crucial for project completion.*
- *Third hour, etc:*

➤ **Study Question: This section entails study question for the week lecture.**

1. *What do you suppose an engineer does when he must solve a problem, yet there is no scientific theory on which to base his solution?*
2. *In almost every instance the engineer must propose a solution to a problem in a rather limited period of time. What do you imagine are the consequences of this restriction? (e.g. What must he resort to, What sacrifice must he made, What must he forego that the perfectionist would like to do?)*

➤ **Reading List - Books and materials students can read.**

- *Edward. V. Krick, 1969, Engineering and Engineering Design, SBN 471 50741 5.*
- *A. Oyediran Adedeji, 2007, Professional Engineering Fundamentals, ISBN-978-38280-4-5*
- *S.I. Oluka et..al, 1999,Engineer-in-Society,ISBN 978-2952-35-4.*

**Week 6: Topic for the week**

*Roles and challenges in building of spacecraft and power systems .*

➤ **Objectives (list the objectives)**

*The students at the end of the lectures for the week should be able to:-*

1. *Know the project terminology on air transportation.*
2. *Know that air craft building take several years to be completed.*
3. *Know that design stability problems are some of the stickiest, requiring much mathematical skill and frequent use of computer.*

- **Description**
  - First hour: *Introduction of major and minor aspect of air craft design.*
  - Second hour: *Production of prototypes, models etc, and other thermodynamic relations and fluid engineering variables.*
  - Third hour, etc:
- **Study Question: This section entails study question for the week lecture.**
  1. *For one of the following problems identify the major solution variables; then generate as many partial solutions as you can for each variable. Present them in the form alternative trees.*
    - a) *An alarm clock for deaf persons.*
    - b) *Transoceanic transportation system.*
    - c) *Typewriter design.*
- **Reading List - Books and materials students can read.**
  - *Edward. V. Krick, 1969, Engineering and Engineering Design, SBN 471 50741 5.*
  - *A. Oyediran Adedeji, 2007, Professional Engineering Fundamentals, ISBN-978-38280-4-5*
  - *S.I. Oluka et..al, 1999,Engineer-in-Society,ISBN 978-2952-35-4.*

**Week 7:** *Topic for the week*

*Roles and challenges in making artificial limbs, and textile equipment.*

- **Objectives (list the objectives)**

*The students at the end of the lectures for the week should be able to:-*

  1. *Know the roles of engineers in medicine.*
  2. *Know that engineering needs more practitioners dedicated to applying their unique qualities where the society's needs are greatest.*
  3. *Know the need for engineers to bring fresh ideas to the many long-standing, still unsatisfactorily solved problems.*
- **Description**
  - First hour: *Introducing the engineer in the field of medicine.*
  - Second hour: *Outlining clinical equipments and appliances vital for saving life in a medical facility.*
  - Third hour, etc:
- **Study Question: This section entails study question for the week lecture.**
  1. *List five type of diagnostic equipment in a health centre.*
  2. *Mention two type of sensors used in the hospitals.*
  3. *What do you envisaged as to be a definite role of biomedical engineering in comparison to incumbent engineering fields?*
- **Reading List - Books and materials students can read. Illustration below:**
  - *Edward. V. Krick, 1969, Engineering and Engineering Design, SBN 471 50741 5.*
  - *A. Oyediran Adedeji, 2007, Professional Engineering Fundamentals, ISBN-978-38280-4-5*
  - *S.I. Oluka et..al, 1999,Engineer-in-Society,ISBN 978-2952-35-4.*

**Week 8:** *Topic for the week.*

*Roles and challenges in development of new materials.*

➤ **Objectives (list the objectives)**

*The students at the end of the lectures for the week should be able to:-*

1. *Introducing the student to development on finding out other ways to new materials..*
2. *Know the basic roles of the material engineering and metallurgical engineering.*
3. *Establish the connectivity linkages between mineral processing alteration of mechanical/strength properties of metals.*

➤ **Description**

- First hour: *Introduction and definitions of material and metallurgical engineering.*
- Second hour: *Type of metal forming activities and their machineries.*
- Third hour, etc:

➤ **Study Question: This section entails study question for the week lecture.**

1. *What is metal remover rate?; and explain tool life.*
2. *Distinguish between a metallurgist and a material engineer.*

➤ **Reading List - Books and materials students can read.**

- *Edward. V. Krick, 1969, Engineering and Engineering Design, SBN 471 50741 5.*
- *A. Oyediran Adedeji, 2007, Professional Engineering Fundamentals, ISBN-978-38280-4-5*
- *S.I. Oluka et..al, 1999, Engineer-in-Society, ISBN 978-2952-35-4.*

**Week 9: Topic for the week.**

*Career pursuits of mechanical engineers after graduation in sales, product quality control, maintenance, patent law, or research and development*

➤ **Objectives:**

*At the end of the lecture for this week:*

- 1 *Introducing the Students to the world of mechanical engineering.*
- 2 *Students should understand that a mechanical engineer can fit-in to any organization if given the opportunity to serve.*
- 3 *Students should understand that mechanical engineering is not “jack of all trade” but jack of necessity.*

➤ **Description:**

- First Hour: *Defining areas for career opportunity.*
- Second Hour: *After graduation, there is every opportunity to be self employed.*
- Third hour, etc:

➤ **Study Questions:**

1. *As a mechanical engineer, which form of employment do you deem beneficial to recover your resources within a short period of graduation?*

➤ **Reading List**

- *Edward. V. Krick, 1969, Engineering and Engineering Design, SBN 471 50741 5.*
- *A. Oyediran Adedeji, 2007, Professional Engineering Fundamentals, ISBN-978-38280-4-5*

- *S.I. Oluka et..al, 1999,Engineer-in-Society, ISBN 978-2952-35-4.*

**Week 10:** *Topic for the week.*

*Car practical. Practical lesson in automotive workshop.*

➤ **Objectives:**

*At the end of the lecture for this week:*

- i. Students should know the components and arrangements of car assembly.*
- ii. Students should know the casting principles.*
- iii. Students should know the classification of car parts.*
- iv. Students should understand the design, construction and working operations of a car.*
- v. Students will be divided into groups to carry out studies on different parts of an engine component.*

➤ **Description:**

- First Hour: *Introducing the students to engine Components and arrangements.*
- Second Hour: *Classification of the design, construction and working principle of the engine.*
- Third hour, etc:

➤ **Study Questions:**

- 1. Explain the principles of of the component you studing.*
- 2. Why are certain equipments or components casted?*
- 3. Which types of moulds are suitable for engine parts production?*

➤ **Reading List**

- *Harold Hall, 2007, Model Engineer's Workshop Projects Special Interest Model Books Ltd. ISBN 978 185486 248 8.*
- *Alex Weiss, 1999, Workshop Materials, Nexus Special Interests Ltd. ISBN 1 85486 192 1.*
- *Les Oldridge, 1988, Basic Bench-work, Argus books Ltd. ISBN 0 85242 920 7.*
- *Matin W. Stockel and Matins T. Stockel,1995, Auto-Mechanics Fundamentals,ISBN 0-87006-516-5.*
- *Tim Gilles, 2011,Automotive engines, ISBN-13: 978-1-4354-8826-7*

**Week 11:**

*Car practical. Practical lesson in automotive workshop.*

➤ **Objectives:**

*At the end of the lecture for this week:*

- 1. The students continue their research work on each of the engine components by rotating the groups.*
- 2. The students should be familiar with all engine components.*

➤ **Description:**

- First Hour: *Bringing components to the understanding of the students through series of questions.*
- Second Hour: *Distinguishing machine producing components on a machine tool and producing components on the bench.*
- Third hour, etc:

➤ **Study Questions:**

1. *Why is it important to bring cutting tool as closely as possible to a scribed line?*
2. *Make neat sketches showing the cross-section of the researched component.*
3. *Why is it desirable to use a cutting medium when tapping holes?*
4. *Why is it difficult to produce a flat surface when using a file?*

➤ **Reading List**

- *Harold Hall, 2007, Model Engineer's Workshop Projects Special Interest Model Books Ltd. ISBN 978 185486 248 8.*
- *Alex Weiss, 1999, Workshop Materials, Nexus Special Interests Ltd. ISBN 1 85486 192 1.*
- *Les Oldridge, 1988, Basic Bench-work, Argus books Ltd. ISBN 0 85242 920 7.*
- *Matin W. Stockel and Matins T. Stockel, 1995, Auto-Mechanics Fundamentals, ISBN 0-87006-516-5.*
- *Tim Gilles, 2011, Automotive engines, ISBN-13: 978-1-4354-8826-7*
- *R. T. Pritchard, 1976, Workshop Processes, Vol.1, ISBN 0 340 04938 3.*

**Week 12:** *Topic for the week.*

*Car practical. Practical lesson in automotive workshop.*

➤ **Objectives:**

*At the end of the lecture for this week:*

*The same routine as in week 11 continues.*

➤ **Description:**

- First Hour: *As in week 11 continues*
- Second Hour: *As in week 11 continues.*
- Third hour, etc:

➤ **Study Questions:**

*As in week 11 continue.*

➤ **Reading List**

*As in week 11 continue.*

**Week 13:** *Topic for the week.*

*Seminar on car practical.*

➤ **Objectives:**

*At the end of the lecture for this week:*

- i. *Students should be able to present a technical report on each group component.*
- ii. *Students would be divided for proper coordination for better assessment.*
- iii. *Students should understand the applications and accuracy of these seminars.*

➤ **Description:**

- First Hour: *Introducing the students to technical report writing.*
- Second Hour: *Form of appearance during the seminar presentation and other rules and regulations.*
- Third hour, etc:

➤ **Study Questions:**

- *The students would be examined base on the various research components.*
- **Reading List**  
*Student's technical report.*

**Week 14:** Topic for the week.  
*Seminar on car practical*

- **Objective:**
  - i. *Report presentation continue*
- **Description:**
  - First Hour: *Seminar defence continue.*
  - Second Hour: *Seminar defence continue.*
  - Third hour, etc:
- **Study Questions:**  
*Questions from the report.*
- **Reading List**  
*Technical report.*

**Week 15:** *Topic for the week.*  
*Revision & Examination*

- **Objective:**
  - i. *To examine the students on all that has been taught during the semester.*
- **Description:**  
*Classroom-based examination*
- **Reading List**
  - *Harold Hall, 2007, Model Engineer's Workshop Projects Special Interest Model Books Ltd. ISBN 978 185486 248 8.*
  - *Alex Weiss, 1999, Workshop Materials, Nexus Special Interests Ltd. ISBN 1 85486 192 1.*
  - *Les Oldridge, 1988, Basic Bench-work, Argus books Ltd. ISBN 0 85242 920 7.*

- *Matin W. Stockel and Matins T. Stockel, 1995, Auto-Mechanics Fundamentals, ISBN 0-87006-516-5.*
- *Tim Gilles, 2011, Automotive engines, ISBN-13: 978-1-4354-8826-7*
- *R. T. Pritchard, 1976, Workshop Processes, Vol.1, ISBN 0 340 04938 3.*

HOD's COMMENTS: \_\_\_\_\_  
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Name: \_\_\_\_\_ Signature \_\_\_\_\_ Date: \_\_\_\_\_