LANDMARK UNIVERSITY, OMU-ARAN

COURSE COMPACT

COLLEGE: SCIENCE AND ENGINEERING
DEPARTMENT: MECHANICAL ENGINEERING
PROGRAMME: MECHANICAL ENGINEERING
COURSE COMPACT for: 2017/18 ALPHA SEMESTER

Course

Course code: MCE 432
Course title: Energy Conversion
Credit unit: 2
Course status: Optional

Lecturer's Data

Name of the lecturer: ENGR. KOMOLAFE, C.A
Qualifications obtained: M. Eng. (Mechanical), Ph.D. Mechanical Engineering (In View), MNSE, MNIMechE, MNIAE, COREN Reg.
Department: Mechanical Engineering
College: Science and Engineering
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Office Location: Room A 220 New College Building

Consultation Hours: 1-3pm Wed. – Fri.

INTRODUCTION TO THE COURSE

Course Description

Energy conversion (or heat-power engineering, as it was called prior to the Second World War), has been one of the central themes in the development of the engineering profession. It is concerned with the transformation of energy from sources such as fossil geothermal, nuclear fuels and the sun (solar) into conveniently used forms such as electrical energy, rotational and propulsive energy, and heating and cooling. All these energy sources are for more extensive development and use by mankind.

Course Objectives

- To understand the physics and engineering aspects of energy conversion systems.
- To know both conventional and Non-conventional conversion systems
- To acquire basic skills in power station economics, power load estimation and forecasting
- To know about nuclear and photovoltaic power as well as Magneto hydrodynamics.

Course Content

Primary and secondary types of energy and their inter-convertibility, physical, chemical, Magneto-Hydrodynamics (MHD), wind, geothermal, thermo mechanical nuclear biomass, etc. Principal fuels for energy conversion. Direct and indirect conversion of primary energy. Power station economics power load estimation and forecasting.

Course Expectations:

S/N	GRADING	SCORE (%)
1	Continuous Assessments • C.A. I • C.A. II (Mid-Semester Test) • C.A. III	 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 (30 hours)

LECTURE CONTENT

Module 1

- **Week 1:** Introduction to energy conversion systems

- **Objectives**

  The students at the end of the lecture for the week should be able to understand:

  (a) basics of energy conversion systems

- **Description**

  First Hour: Introduction to energy conversion systems (Physics and Engineering aspect)

  Second Hour: Introduction to energy conversion systems

Study Questions:

(1) What do you understand by energy conversion?
(2) State different sources of energy.

Reading List

Petrecca, G. 2014. Energy Conversion and Management: Principles and Applications. Springer International Publishing, Switzerland.

Sorensen, B. 2007. Renewable Energy: Conversion, Transmission and Storage. AP Publishing; Third edition.

Weston, K.C. 2000. Energy Conversion. Spring of 2000, Brook/Cole Publisher; First edition.

Caparareda, S.C. 2013.Introduction to Biomass Energy Conversions. CRC Press, Taylor and Francis Group, UK.

Nelson, V. 2011. Introduction to Renewable Energy. CRC Press, Taylor and Francis group, LLC.

Fornasiero, P. and Graziani M. 2012. Renewable Resources and Renewable Energy: A Global Challenge.

Module 2

- **Week 2 :** Primary and secondary types of energy and their inter-convertibility

- **Objectives**

The students at the end of the lecture for the week should be able to understand:

(a) Primary and secondary types of energy
(b) Energy inter-convertibility

- **Description**

First Hour: Primary and secondary types of energy

Second Hour: Energy inter-convertibility

- **Study Questions:**

(1) Distinguish between the following types of energy:
(a)Primary and secondary energy
(b)Renewable and non- renewable energy
(c)Conventional and non-conventional energy
(d)Commercial and non-commercial energy

(2) Classify sources of energy into primary and secondary.

Reading List

Petrecca, G. 2014. Energy Conversion and Management: Principles and Applications. Springer International Publishing, Switzerland.

Sorensen, B. 2007. Renewable Energy: Conversion, Transmission and Storage. AP Publishing; Third edition.

Weston, K.C. 2000. Energy Conversion. Spring of 2000, Brook/Cole Publisher; First edition.

Capararеda, S.C. 2013. Introduction to Biomass Energy Conversions. CRC Press, Taylor and Francis Group, UK.

Nelson, V. (2011). Introduction to Renewable Energy. CRC Press, Taylor and Francis group, LLC.

Fornasiero, P. and Graziani M. 2012. Renewable Resources and Renewable Energy: A Global Challenge.

Module 3

Week 3: Primary and secondary types of energy and their inter-convertibility

- **Objectives**

The students at the end of the lecture for the week should be able to understand:

(a) Inter-convertibility of primary and secondary types of energy.

- **Description**

First and Second Hour : Energy inter-convertibility

- **Study Questions:**

(1) What is energy transformation ?
(2) Explain conversion or transformation processes from primary to secondary energy.

Reading List

Petrecca, G. 2014. Energy Conversion and Management: Principles and Applications. Springer International Publishing, Switzerland.

Sorensen, B. 2007. Renewable Energy: Conversion, Transmission and Storage. AP Publishing; Third edition.

Weston, K.C. 2000. Energy Conversion. Spring of 2000, Brook/Cole Publisher; First edition.

Capararеda, S.C. 2013. Introduction to Biomass Energy Conversions. CRC Press, Taylor and Francis Group, UK.

Nelson, V. (2011). Introduction to Renewable Energy. CRC Press, Taylor and Francis group, LLC.

Fornasiero, P. and Graziani M. 2012. Renewable Resources and Renewable Energy: A Global Challenge.

Module 4

Week 4: Principal fuels for energy conversion

- **Objectives**

The students at the end of the lecture for the week should be able to know :

(a) Principal fuels for energy conversion

- **Description**

First & Second Hour: Principal fuels for energy conversion

- **Study Questions:**

(1) What are the principal fuels for energy conversion?
(2) Secondary energy source as a delivered or energy carrier. Discuss.

Reading List

Petrecca, G. 2014. Energy Conversion and Management: Principles and Applications. Springer International Publishing, Switzerland.

Sorensen, B. 2007. Renewable Energy: Conversion, Transmission and Storage. AP Publishing; Third edition.

Weston, K.C. 2000. Energy Conversion. Spring of 2000, Brook/Cole Publisher; First edition.

Caparareda, S.C. 2013. Introduction to Biomass Energy Conversions. CRC Press, Taylor and Francis Group, UK.

Nelson, V. 2011. Introduction to Renewable Energy. CRC Press, Taylor and Francis group, LLC.

Fornasiero, P. and Graziani M. 2012. Renewable Resources and Renewable Energy: A Global Challenge.

Module 5

Week 5 : Energy sources such as fossil fuels, biomass including refuse-derived biomass fuels, nuclear, solar radiation, wind, geothermal and the terminologies and units use for each energy resource and their equivalence.

- **Objectives**

The students at the end of the lecture for the week should be able to know :

(a) various energy sources
(b) terminologies and units for each resources

- **Description**

First Hour : First C.A. 1 and introduction to energy sources.

Second Hour : Energy sources (fossil fuels, biomass, nuclear , solar radiation, wind and geothermal)

- **Study Questions:**

(1) Describe the various sources of energy.
(2) When will a source of energy be considered as renewable ?

Reading List

Petrecca, G. 2014. Energy Conversion and Management: Principles and Applications. Springer International Publishing, Switzerland.

Sorensen, B. 2007. Renewable Energy: Conversion, Transmission and Storage. AP Publishing; Third edition.

Weston, K.C. 2000. Energy Conversion. Spring of 2000, Brook/Cole Publisher; First edition.

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Nelson, V. (2011). Introduction to Renewable Energy. CRC Press, Taylor and Francis group, LLC.

Fornasiero, P. and Graziani M. 2012 . Renewable Resources and Renewable Energy: A Global Challenge.

Module 6

Week 6: As in week 5

Module 7

Week 7: The development, current use, and future of nuclear fission.

- **Objectives**

  The students at the end of the lecture for the week should be able to know :

  (a) the development, current use, and future of nuclear fission.

- **Description**

  First & Second Hour: the development, current use, and future of nuclear fission.

Study Questions:

(1) Define nuclear energy

(2) Discuss the major areas where the use of nuclear energy could be considered as being productive.

Reading List

Petrecca, G. 2014. Energy Conversion and Management: Principles and Applications. Springer International Publishing, Switzerland.

Sorensen, B. 2007. Renewable Energy: Conversion, Transmission and Storage. AP Publishing; Third edition.

Weston, K.C. 2000. Energy Conversion. Spring of 2000, Brook/Cole Publisher; First edition.

Caparareda, S.C. 2013. Introduction to Biomass Energy Conversions. CRC Press, Taylor and Francis Group, UK.

Nelson, V. (2011). Introduction to Renewable Energy. CRC Press, Taylor and Francis group, LLC.

Fornasiero, P. and Graziani M. 2012. Renewable Resources and Renewable Energy: A Global Challenge.

Module 8

Week 8 : Direct energy conversion methods, including, photo-voltaic, fuel cells, Thermoelectric conversion, Thermionic and MHD

- **Objectives**

The students at the end of the lecture for the week should be able to know :

(a) direct energy conversion methods of photo-voltaic and fuel cells
(b) direct energy conversion methods of Thermoelectric conversion, thermionic and MHD

Description

First & Second Hour: Direct energy conversion methods, including, photo-voltaic, fuel cells, Thermoelectric conversion, Thermionic and MHD

Study Questions:

(1) What are the two classes of direct energy conversion?
(2) Explain the direct methods of converting photovoltaic, magneto hydrodynamics and fuel cell.

Reading List

Petrecca, G. 2014. Energy Conversion and Management: Principles and Applications. Springer International Publishing, Switzerland.

Sorensen, B. 2007. Renewable Energy: Conversion, Transmission and Storage. AP Publishing; Third edition.

Weston, K.C. 2000. Energy Conversion. Spring of 2000, Brook/Cole Publisher; First edition.

Caparareda, S.C. 2013. Introduction to Biomass Energy Conversions. CRC Press, Taylor and Francis Group, UK.

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Fornasiero, P. and Graziani M. 2012. Renewable Resources and Renewable Energy: A Global Challenge.

Module 9

Week 9: C.A.II

Module 10

Week 10: Energy storage systems: electrical, electromechanical, mechanical, direct thermal, and Thermo-chemical storage systems

- **Objectives**

  The students at the end of the lecture for the week should be able to know :

(a) different types of energy storage systems

Description

First & Second Hour: Energy storage systems: electrical, electromechanical, mechanical, direct thermal, and Thermo-chemical storage systems

Study Questions:

(1) What are the various methods of storing energy?
(2) Explain three conversion processes of Biomass resources to useful energy

Reading List

Petrecca, G. 2014. Energy Conversion and Management: Principles and Applications. Springer International Publishing, Switzerland.

Sorensen, B. 2007. Renewable Energy: Conversion, Transmission and Storage. AP Publishing; Third edition.

Weston, K.C. 2000. Energy Conversion. Spring of 2000, Brook/Cole Publisher; First edition.

Caparareda, S.C. 2013. Introduction to Biomass Energy Conversions. CRC Press, Taylor and Francis Group, UK.

Nelson, V. (2011). Introduction to Renewable Energy. CRC Press, Taylor and Francis group, LLC.

Fornasiero, P. and Graziani M. 2012. Renewable Resources and Renewable Energy: A Global Challenge.

Module 11

Week 11: As in week 10

Module 12

Week 12 : Storage media that can store and deliver energy.

- **Objectives**

The students at the end of the lecture for the week should be able to know :

(a) different types of Storage media that can store and deliver energy

Description

First Hour : C.A. III

Second Hour: Storage media that can store and deliver energy.

Study Questions:

(1) Explain with examples different types of energy storage materials
(2) State the areas of application of energy storage media in question 1.

Reading List

Petrecca, G. 2014. Energy Conversion and Management: Principles and Applications. Springer International Publishing, Switzerland.

Sorensen, B. 2007. Renewable Energy: Conversion, Transmission and Storage. AP Publishing; Third edition.

Weston, K.C. 2000. Energy Conversion. Spring of 2000, Brook/Cole Publisher; First edition.

Caparareda, S.C. 2013. Introduction to Biomass Energy Conversions. CRC Press, Taylor and Francis Group, UK.

Nelson, V. (2011). Introduction to Renewable Energy. CRC Press, Taylor and Francis group, LLC.

Fornasiero, P. and Graziani M. 2012. Renewable Resources and Renewable Energy: A Global Challenge.

Module 13

Week 13: Power station economics

- **Objectives**

The students at the end of the lecture for the week should be able to know :

(a) Power station economics concept.

- **Description**

First & Second Hour: Power station economics

Study Questions:

(1) Define economics of power generation.
(2) Classify load forecast into three categories.
(3) Briefly explain the three methods of load forecasting.

Reading List

Petrecca, G. 2014. Energy Conversion and Management: Principles and Applications. Springer International Publishing, Switzerland.

Sorensen, B. 2007. Renewable Energy: Conversion, Transmission and Storage. AP Publishing; Third edition.

Weston, K.C. 2000. Energy Conversion. Spring of 2000, Brook/Cole Publisher; First edition.

Caparareda, S.C. 2013. Introduction to Biomass Energy Conversions. CRC Press, Taylor and Francis Group, UK.

Nelson, V. (2011). Introduction to Renewable Energy. CRC Press, Taylor and Francis group, LLC.

Fornasiero, P. and Graziani M. 2012. Renewable Resources and Renewable Energy: A Global Challenge.

Module 14

Week 14: As in week 13

Module 15

Week 15: Revision.

H.OD'S COMMENT _____

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NAME _____ SIGNATURE _____ DATE _____

DEAN 'S COMMENT _____

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