22ME801 Human exergy and Bio-Energetics 3 0 0 3

Course Description: Second law efficiency, The Decrease of Exergy Principle and Exergy Destruction, human body thermoregulatory system, exergy analysis of human system, Metabolism of Nutrients, Respiratory Quotient, Exergy of the ATP to ADP Conversion Process, State of Health, and Life Expectancy, Computer aided diagnosis - Nature of medical
images: X-ray imaging – Tomography, Image Enhancement - Gray level transforms - Histogram transformation.

Learning Objectives:

- To provide understanding of fundamentals of exergy analysis
- To impart the concepts of exergy analysis on human system
- To introduce the concepts of bioenergetics
- To comprehend the applications of biomedical image processing

Pedagogy:
Conventional method – black board and PPT, case studies

Syllabus:

Unit-1:

Fundamentals of exergy and energy analyses

Exergy: Work Potential of Energy, Second-Law Efficiency, Exergy Change of a Fixed Mass and Flow Stream, Exergy Transfer by Heat, Work, and Mass, The Decrease of Exergy Principle and Exergy Destruction, Exergy Balance of Closed Systems and Control volumes. Human-Body Thermoregulatory System, Water balance, Energy and entropy balance, Thermal exergy balance, Practical examples.

Unit-2

Bioenergetics

Human system and energy inputs, Metabolism of Nutrients, Respiratory Quotient, Exergy of the ATP to ADP Conversion Process, Energy and Exergy Expenditures in the Human Body, Physical Activity – Work Production, Destruction of Exergy, Entropy Production, Life, State of Health, and Life Expectancy.

Unit -3

Energy processing techniques

Objectives of biomedical image analysis - Computer aided diagnosis - Nature of medical
images: X-ray imaging - Tomography - Nuclear medicine imaging - SPECT

imaging - Positron imaging tomography - Ultrasonography - Magnetic resonance imaging - Removal of artifacts - Image Enhancement - Gray level transforms - Histogram transformation

References:

1. Yunus A Cengel and Michael A Boles, *Thermodynamics: An Engineering Approach (SIE).* McGraw Hill,2010.
2. Efstathios Michaelides, *Exergy Analysis for Energy Conversion Systems.* Cambridge University Press,2021.
3. Ibrahim Dincer and Marc A. Rosen, *Exergy - Energy, Environment and Sustainable Development.* Elsevier,2007.
4. Masanori Shukuya, *Exergy - Theory and Applications in the Built Environment.* Springer,2013.
5. Rangayyan R M, *Biomedical Image Analysis*, Fifth Edition, CRC Press, 2005

Course Outcome:
At the end of the course, students can able to

CO1 Ability to understand the concept of exergy analysis
CO2 Ability to apply different techniques for the exergy analysis of human body
CO3 Ability to analyse the various features bioenergetics
CO4 Ability to evaluate the performances of human body using energy processing techniques

Evaluation Pattern:

First assessment: 20%

Second assessment: 20%

Continuous evaluation: 10%

End semester examination: 50%

Employability:
Healthcare consultant in alternative medical fields