

NIRMA UNIVERSITY
School of Engineering, Institute of Technology
B.Tech. in Chemical Engineering
Interdisciplinary Minor in Chemical Engineering
Third Year /Semester VI

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| Institute: | Institute of Technology |
| Name of Programme: | B. Tech. (Chemical Engineering) |
| Course Code: | 3CH703IE24 |
| Course Title: | Energy Efficiency and Plant Utilities |
| Course Type: | Interdisciplinary minor |
| Year of introduction: | 2024-25 |

| L | T | Practical component | | | |
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| | | LPW | PW | W | S |
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Course Learning Outcomes (CLOs):

At the end of the course, the student will be able to –

1. select utilities and equipment for process requirement (BL3)
2. identify energy saving opportunities in process utilities (BL4)
3. assess the utility system for energy conservation and efficiency (BL5)
4. evaluate the performance of utility system (BL6)

Total Teaching hours: 45

Syllabus

| | | Teaching hours |
|-----------------|--|-----------------------|
| Unit I | Plant Utilities and Energy Efficiency Common plant utilities, general aspects of plant utilities and energy efficiency | 02 |
| Unit II | Steam Systems and Boilers Types of boilers, performances evaluation, analysis of losses, feed water treatment; blow down, energy conservation opportunities Assessment of steam distribution losses, steam leakages, steam trapping, condensate and flash steam recovery system | 09 |
| Unit III | HVAC and Refrigeration system Vapor compression refrigeration cycle, Vapor absorption refrigeration system, refrigerants, coefficient of performance, capacity, factors affecting performance of Refrigeration and Air conditioning system, energy saving opportunities. | 09 |
| Unit IV | Waste-Heat Recovery Classification, advantages and applications, commercially viable waste heat recovery devices, energy saving potential. | 08 |
| Unit V | Pumps and Pumping System Types of pumps, performance evaluation, efficient system operation, flow control strategies, energy saving opportunities. | 08 |

Unit VI Compressed Air System

09

Types of air compressors, Compressed air system components, compressor efficiency, efficient compressor operation, energy saving opportunities.

Self Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self study contents.

Tutorial Work:

Tutorial work will be based on the above content of course.

Suggested Readings/References:

1. Wayne C. Turner, Steve Doty, Energy Management Handbook, The Fairmont Press, Inc., Publication.
2. Y.P. Abbi, Shashank Jain, Handbook on Energy Audit and Environment Management, TERI Press Publisher.
3. Bureau of Energy Efficiency (BEE), Energy Performance Assessment for Equipment and Utility Systems, Guide Books for National Certificate Examination.
4. Jack Broughton, Process Utility Systems: Introduction to Design, Operation and maintenance, Institution of Chemical Engineers Publication.
5. Donald R. Wulfinghoff, Energy Efficiency Manual, Energy Institute Press Publication.
6. Pawan Kumar, Training Manual on Energy Efficiency for Small and Medium Enterprises, Asian Productivity Organisation Publication.
7. Albert Thumann, William J. Younger, Terry Niehus, Handbook of Energy Audits, The Fairmont Press, Inc., Publication.

L= Lecture, T=Tutorial, P= Practical, C=Credit