Kurdistan Region Government
Ministry of Higher Education
and Scientific Research
Erbil Polytechnic University

# Module(Course Syllabus)Catalogue

# 2023-2024

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| College/ Institute | Erbil Technology College | |
| Department | Automotive Engineering technology | |
| Module Name | Heat Transfer | |
| Module Code | | |
| Degree | Technical Diploma [ ] Bachelor [*]<br>High Diploma [ ] Master [ ] PhD [ ] | |
| Semester | 6th Semester | |
| Qualification | Ph.D. in Mechanical Engineering | |
| Scientific Title | Lecturer | |
| ECTS (Credits) | 6 | |
| Module type | Prerequisite [ ] Core [*] Assist. [ ] | |
| Weekly hours | 4 | |
| Weekly hours (Theory) | ( 2 )hr Class | (162)Total hrs Workload |
| Weekly hours (Practical) | ( 2 )hr Class | (162)Total hrs Workload |
| Number of Weeks | 12 | |
| Lecturer (Theory) | Dr. Lizan Mahmood Zangana | |
| E-Mail& Mobile NO. | Lizan.khorsheed@epu.edu.iq<br>07511220401 | |
| Lecturer (Practical) | Dr. Lizan Mahmood Zangana | |
| E-Mail & Mobile NO. | Lizan.khorsheed@epu.edu.iq<br>07511220401 | |
| Websites | | |

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| **Course Description** | This course is an introduction to Heat transfer and the further study of Thermodynamics. The Heat transfer part of the course covers the mechanisms and basic calculations of 3 heat transfer modes: conduction, convection and radiation, and Heat exchanger design and performance estimation calculations. The Thermodynamics part of the course mainly introduce the applications of thermodynamic principles in variouse cycles, including Vapour power cycles; Gas power cycles and refrigeration cycles; This part also covers some advanced topics in thermodynamics, eg. Exergy analysis, non-reacting mixtures and psychrometry, and reacting processes and combustion. At the end of the course students are expected to have the knowledge to be able to assist design, assess and compare different heat transfer and thermodynamic systems, factoring in economic impacts. |
| **Course objectives** | ▪ Understand the basic parameters associated with heat transfer.<br>▪ Know the process of conduction thoroughly.<br>▪ Know the process of convection thoroughly.<br>▪ Understand the mechanisms of condensation systems.<br>▪ Know how to design a heat exchanger.<br>▪ Understand pinch analysis for heat transfer optimization.<br>▪ Know how to construct heat exchanger network diagrams and optimize for maximum energy recovery.<br>▪ Understand how to solve complex heat integration systems.<br>▪ Understand how to construct and analyze the nodal networks and energy balance methods and form matrices.<br>▪ Know how to define the key characteristics of the thermal and velocity boundary layers.<br>▪ Understand the effect the flow regime has on the rate of heat transfer and the fluid flow effects.<br>▪ Be able to perform thermal analysis to determine heat fluxes, and identify the different types of boiling.<br>▪ Understand the complex nature of radiation heat transfer and model |
| **Student's obligation** | ▪ The student must attendance the hall 2 hour and 2 hour in practical lab the lecturer instruction wherein early attendance and bringing requisite tools and keep the hall clean and protect furniture.<br>▪ The student submits a weekly report about what have done in the Lab section. For examination, there are semester exam and final |

exam for the practical and the theory parts. During the class hours there will be some quizzes.

**Required Learning Materials**

- To avoid student bared in the hall lecturer uses several tools, whiteboard, data show and other demonstrate tools to interest student.

**Evaluation**

| Task | | Weight (Marks) | Due Week | Relevant Learning Outcome |
|---|---|---|---|---|
| Paper Review | | | | |
| Assignments | Homework | 5 | | |
| | Class Activity | 2 | | |
| | Report | 5 | | |
| | Seminar | 5 | | |
| | Essay | | | |
| | Project | | | |
| Quiz | | 8 | | |
| Lab. | | 10 | | |
| Midterm Exam | | 25 | | |
| Final Exam | | 40 | | |
| Total | | 100 | | |

**Specific learning outcome:**

- The course on heat transfer is devised to introduce fundamental aspects of fluid flow behaviour.
- Students will learn to develop steady state mechanical energy balance equation for heat transfer.
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**Course References:**


- Bergman, Lavine, Incropera and Dewitt., Fundamentals of Heat and Mass Transfer, 7th Edition, John Wiley & Sons, 2011.
- Moran and Shapiro, Fundamentals of Engineering Dynamics, 6th Edition, John Wiley & Sons, 200

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| | **Recommended Resources**<br>The Barr Smith Library has many textbooks, which are concerned with Heat Transfer and Thermodynamics. Students are encouraged to consult these books to enrich their knowledge in both topics |

| Course topics (Theory) | Week | Learning Outcome |
|---|---|---|
| Heat transfer by conduction, convection and radiation | 1 | |
| One-dimensional steady state conduction | 2 | |
| Systems with conduction-convection | 3 | |
| Overall heat transfer coefficient | 4 | |
| Critical thickness of the insulator | 5 | |
| Heat source systems | 6 | |
| Extended Surface (Fins) | 7 | |
| Unsteady state conduction | 8 | |
| Heat exchangers | 9 | |
| Mean logarithmic difference of temperature | 10 | |
| Heat transfer by radiation | 11 | |
| Properties of radiation | 12 | |
| **Practical Topics** | **Week** | **Learning Outcome** |
| Thermal Conductivity of Metal Rod | 1 | |
| Thermal Conductivity of Liquid | 2 | |
| Heat Transfer Coefficient in Natural Convection | 3 | |
| Heat Transfer Coefficient in Forced Convention | 4 | |
| Critical Heat Flux | 5 | |

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|---|---|---|
| Emissivity of Surface | 6 | |
| Stefan Boltzman Constant | 7 | |
| Effectiveness of Heat Exchangers | 8 | |
| Vapour Compression Refrigeration | 9 | |
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## Questions Example Design

./ What are the practical methods to measure the thermal conductivity? Then explain

10 Marks

e procedure of one of these methods only?

Q2/ Calculate the rate of heat transfer by natural convection between a shed roof ofarea 20 m x 20 m and amb air, if the roof surface temperature is *27°C*, the air temperature *3°C*, and the average convection heat tran coefficient *10 W/m2 K*.

10 Marks

Q3/ After sunset, radiant energy can be sensed by a person standing near a brick wall. Such walls frequently have surface temperatures around *44 oC*, and typical brick emissivity values are on the order of 0.92. What would be the radiant thermal flux per square foot from a brick ll at this temperature?

10 Marks

## Extra notes:

Student must be any time ready for quizzes.

## External Evaluator

I have read the terms of this article and acknowledge that it meets the required purpose.

**Ramzi Barwari**

Asst. Prof

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