# Course Outline (Higher Education)

**School / Faculty:** Faculty of Science and Technology

**Course Title:** DESIGN OF THERMAL SYSTEMS

**Course ID:** ENGIN5303

**Credit Points:** 15.00

**Prerequisite(s):** ENGIN3301 and ENGIN4302

**Co-requisite(s):** Nil

**Exclusion(s):** ENMEC7070 DESIGN OF THERMAL SYSTEMS

**ASCED Code:** 030701

**Grading Scheme:** Graded (HD, D, C, etc.)

**Program Level:**

| AQF Level of Program | | | | | | |
|---|---|---|---|---|---|---|
| | 5 | 6 | 7 | 8 | 9 | 10 |
| **Level** | | | | | | |
| Introductory | | | | | | |
| Intermediate | | | | | | |
| Advanced | | | | | ✔ | |

**Learning Outcomes:**

On successful completion of the course the students are expected to be able to:

**Knowledge:**

**K1.** Explain the complexity of heat transfer and heat exchanger theory and translate this complexity into functional systems analysis for problem solving.

**K2.** Relate salient design aspects of advanced heat transfer techniques to an array of engineering systems.

**K3.** Recall the critical design principles of compact heat exchangers using complex heat transfer modelling techniques.

**Skills:**

**S1.** Investigate and determine suitable methods for thermal system design.

**S2.** Utilise advanced analytical and problem-solving skills based on the creative application of established theory and concepts.

**S3.** Conduct a research-based analysis of heat exchanger design.

**Application of knowledge and skills:**

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**A1.** Apply previous knowledge of fluid mechanics, thermodynamics, and heat transfer to analyse systems and formulate design solutions.

**A2.** Formulate advanced methods to determine heat transfer design parameters.

**A3.** Apply heat exchanger theory to demonstrate the appropriateness of a design solution.

**Course Content:**

Topics may include:

- Introduction, revision and heat transfer mechanisms.
- Heat conduction and generation.
- Thermal resistance.
- Convection.
- External forced convection: Flow over plates, tubes and tube banks.
- Internal forced convection: Flow in pipes.
- Intro to design of worst case.
- Heat exchanger.
- Natural convection, finned surfaces.
- Radiation.
- Heat exchangers and log mean temperature difference.
- Heat exchangers effectiveness-NTU method.
- Automotive cooling systems.
- Heat pipes.
- Automotive HVAC systems and refrigerants.

**Values and Graduate Attributes:**

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**Values:**

**V1.** Knowledge and research-driven appreciation of the significance of critical evaluation and scepticism as applied to scientific endeavour.

**V2.** Appreciation of advanced research-skills, problem-solving initiative and further learning for accomplished professional engineers.

**V3.** Research-driven appreciation of the various constraints which impact the performance of engineering systems.

**Graduate Attributes:**

FedUni graduate attributes statement. To have graduates with knowledge, skills and competence that enable them to stand out as critical, creative and enquiring learners who are capable, flexible and work ready, and responsible, ethical and engaged citizens.

| Attribute | Brief Description | Focus |
|---|---|---|
| Knowledge, skills and competence | Mechanical engineering is a fast-changing technological area which impacts on our every-day life. Students will develop an appreciation that learning is a life-long process. | High |
| Critical, creative and enquiring learners | Development of independent, critical and creative learners is an essential feature of engineering education. Assessments tasks are individualised, so students need to rely on their personal efforts to arrive at their conclusions. | High |
| Capable, flexible and work ready | Mechanical engineering study requires a team work approach to execute tasks to achieve common objectives. Training for engagements is built in to the Mechanical program. A student will graduate with a new outlook as an engaging capable, flexible and work ready individual. | High |
| Responsible, ethical and engaged citizens | Through the Mechanical programme delivery, a student will value the engineering input for the advancement of humanity. Students are made aware that the engineer does not work or act in isolation, but is part of a wider community that includes many stakeholders, some of which may have no technical knowledge of what the engineer does. An awareness of community as a responsible, ethical and engaged citizen is important when finding a design solution. | Medium |

**Learning Task and Assessment:**

| Learning Outcomes Assessed | Assessment Task | Assessment Type | Weighting |
|---|---|---|---|
| K1-3, S1-3, A1-3 | Research-based numerical design. | Report | 50-70% |
| K1-3, S1-3, A1-3 | An examination on any or all of the material covered in this course. | Examination | 30-50% |

**Adopted Reference Style:**

Other (IEEE-Refer to the library website for more information)