Module Code | Module Title | Core/Optional | Semester | Duration | Learning Outcomes | Pre-requisites | Corequisites | Prerequisites | Syllabus | Assessment | Enrolment Limiting RLt
--- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | ---
ME2134 | Fluid Mechanics | Core | 3 | 100 hours | • Understand the fundamentals of fluid mechanics, including kinematics and dynamics of fluids, and be able to apply these concepts to solve engineering problems. | | | | • Ideal and irrotational flow. • Continuity equation. • Potential flow. • Potential and irrotational flow. • Potential theory. • Vortex motion. • Vorticity and velocity potential. • Flow separation. • Flow around bluff bodies. • Drag reduction techniques. | Final Examination (60%), Lab, Mid-term (40%)
ME2112 | Mechanics of Fluids | Core | 3 | 100 hours | • Understand the fundamental principles of fluid mechanics, including kinematics and dynamics of fluids, and be able to apply these concepts to solve engineering problems. | | | | • Fluid mechanics. • Continuum hypothesis. • Kinematics of solids and fluids. • Dynamics of solids and fluids. | Final Examination (60%), Lab, Mid-term (40%)
ME3001 | Mechatronics | Core | 4 | 100 hours | • Understand the principles of mechatronics, including sensors, transducers, actuators, and control systems, and be able to apply these concepts to solve engineering problems. | | | | • Sensors and Transducers: Bridges and their applications. • Variable resistance elements: potentiometers, strain gauges. • DC power supply and instrumentation. | Final Examination (60%), Lab, Mid-term (40%)
ME2114 | Heat Exchangers | Core | 3 | 100 hours | • Understand the principles of heat transfer, including conduction, convection, and radiation, and be able to apply these concepts to solve engineering problems. | | | | • Heat transfer processes, including conduction, convection, and radiation. • Heat exchangers and their applications. • Heat transfer analysis and design. | Final Examination (60%), Lab, Mid-term (40%)
ME3110 | Advanced Electronics | Core | 4 | 100 hours | • Understand the principles of advanced electronics, including digital and analog circuits, and be able to apply these concepts to solve engineering problems. | | | | • Advanced electronics. • Digital systems. • Analog circuits. • Control systems. | Final Examination (60%), Lab, Mid-term (40%)
ME2135 | Mechanical Design | Core | 3 | 100 hours | • Understand the principles of mechanical design, including materials and manufacturing processes, and be able to apply these concepts to solve engineering problems. | | | | • Design and materials. • Manufacturing processes. • Stress analysis. • Fatigue and fracture. | Final Examination (60%), Lab, Mid-term (40%)
ME2143 | Materials Science | Core | 3 | 100 hours | • Understand the principles of materials science, including properties and applications, and be able to apply these concepts to solve engineering problems. | | | | • Materials science. • Properties of materials. • Applications of materials. | Final Examination (60%), Lab, Mid-term (40%)
Module Code: ME3211
Module Title: Materials for Engineers
Credits: 4

Module Description:
An introduction to the study of engineering materials, the classification of engineering materials and their applications; cost of a project. This module provides the student with a basic understanding of the mechanical properties, selection, and application of engineering materials. The discipline of materials science and engineering focuses on the relationships between the structure and properties of engineering materials, and their performance in real systems.

Learning Outcomes:
1. Describe the variety of engineering materials, their classification, and application.
2. Analyze the relationship between the microstructure of materials and their mechanical properties.
3. Evaluate the economic and environmental impacts of material selection.
4. Design components that meet specific requirements using materials science principles.
5. Analyze the performance of materials in real-world applications.

Pre-requisites: Nil
Corequisites: Nil
Prerequisites: Nil

Assessment:
Lab, Multi-Project Evaluation, End Examination

Compulsory Reading:

Illustrative Reading List

Compulsory Reading:

Supplementary Reading:
Module: Introduction to material forming and additive manufacturing processes; design for material forming processes; design for injection moulding. The module is targeted at students specializing in mechanical Engineering. This is an elective for Mechanical Engineering students specializing in Processeng Engineering.

Expected outcomes of the module:

- Students will be able to develop the knowledge and skills necessary to design for manufacturing processes.
- Students will be able to understand the principles of design for injection moulding.
- Students will be able to understand the principles of design for additive manufacturing.

Module: Design for Manufacturing and Assembly

Expected outcomes of the module:

- Students will be able to understand the principles of design for manufacturing and assembly.
- Students will be able to understand the principles of design for injection moulding.
- Students will be able to understand the principles of design for additive manufacturing.

Module: CAD: Geometric Modeling

Expected outcomes of the module:

- Students will be able to understand the principles of geometric modeling.

Module: Numerical Methods in Engineering

Expected outcomes of the module:

- Students will be able to understand the principles of numerical methods.
- Students will be able to understand the principles of geometric modeling.
Module Description

The study is to focus on the integration of knowledge in the field of thermal science, heat transfer, and fluid mechanics. It aims at enhancing the understanding of the principles and applications of heat transfer, fluid flow, and energy conservation in various engineering systems. The module will cover topics such as heat conduction, convection, and radiation, as well as the principles of thermodynamics and fluid mechanics.

Learning Outcomes

1. Understand and apply the fundamental laws of thermodynamics to analyze and design systems.
2. Analyze and model heat transfer processes in different configurations using analytical and numerical methods.
3. Design systems for thermal management in various engineering applications.
4. Understand the principles of fluid flow and their applications in different engineering systems.
5. Analyze and design systems for heat exchangers and heat pipes.

Pre-requisites

 Nil

Corequisites

Nil

Syllabus

1. Introduction to Heat Transfer
   - Heat Transfer: Conduction, Convection, and Radiation
   - Energy Conservation and the First Law of Thermodynamics
   - Heat Transfer Equations
   - Two-Dimensional Steady and Unsteady Heat Conduction
   - Laminar and Turbulent Flow
   - Heat Transfer Processes
   - Heat Exchangers
   - Heat Pipes
   - Thermoelectric Devices
   - Phase Change
   - Heat Pipe Applications
   - Heat Pipe Design

Assessment

- Mid-Term Exam
- Assignments
- Final Examination

Suggested Reading


Module Code: ME4213
Module Title: Aircraft Structures
Module Credits: 9
Module Controller: Dr. T.H.G. Megson
Semester: 4
Description: This module covers topics in structural analysis, mechanics of materials, and design for aircraft structures. It aims to provide students with a comprehensive understanding of the principles and design considerations for aircraft structures and their components.

Learning Outcomes

1. Understand the principles of structural mechanics and their applications in aircraft design.
2. Analyze and design aircraft structures using advanced computational methods.
3. Understand the design considerations for aircraft structures and their components.

Pre-requisites

- Nil

Corequisites

- Nil

Syllabus

1. Introduction to Aircraft Structures
   - Aircraft Structures: Types and Components
   - Aircraft Materials
   - Aircraft Design Considerations
   - Aircraft Structures: Analysis and Design
   - Aircraft Structures: Advanced Topics

Assessment

- Mid-Term Exam
- Assignments
- Final Examination

Suggested Reading


Module Code: ME4212
Module Title: Gas Technology
Module Credits: 9
Module Controller: Dr. T.H.G. Megson
Semester: 4
Description: This module covers topics in gas technology, including gas production, processing, and utilization. It aims to provide students with a comprehensive understanding of the principles and applications of gas technology in various engineering systems.

Learning Outcomes

1. Understand the principles of gas technology and their applications in engineering systems.
2. Analyze and design gas production and processing systems using advanced computational methods.
3. Understand the design considerations for gas technology systems and their components.

Pre-requisites

- Nil

Corequisites

- Nil

Syllabus

1. Introduction to Gas Technology
   - Gas Production: Principles and Practices
   - Gas Processing: Principles and Practices
   - Gas Utilization: Principles and Practices

Assessment

- Mid-Term Exam
- Assignments
- Final Examination

Suggested Reading

Module: ME4231
Module Title: Aircraft Design
Module Coordinator:
Module Description: This module is targeted at students who are interested in aerodynamics, the basic principles of fluid flow simulation, and heat transfer problems. Students will acquire an understanding of supersonic flow past thin wings. The module aims to teach the students the basic principles of fluid dynamics, thermodynamics, and heat transfer, and how they interrelate. The module is designed to provide a foundation for students who wish to pursue careers in aerospace engineering, particularly in the area of aerodynamics.
Learning Outcomes:
1. Understand the theory and of supersonic flow around thin airfoils and how to identify the critical design features.
2. Solution of Incompressible Viscous Fluid Flow and Energy Equations (19.5 hrs)
   - Isolation theorem for ODEs and finite difference equations.
   - Finite difference approximation of derivatives; Reducing a partial differential equation (PDE) into a set of ordinary differential equations (ODEs).
   - Governing equations and boundary conditions for incompressible viscous flows; Three solution structures of Incompressible Viscous Fluid Flow and Energy Equations.
   - Finite-volume methods: SIMPLE/R/C including implementation of boundary conditions.
   - Streamfunction-vorticity formulation
   - Integration schemes.
   - Isolation theorem for ODEs and finite difference equations.
   - Finite difference approximation of derivatives; Reducing a partial differential equation (PDE) into a set of ordinary differential equations (ODEs).
   - Governing equations and boundary conditions for incompressible viscous flows; Three solution structures of Incompressible Viscous Fluid Flow and Energy Equations.
7. Internal combustion engine performance parameters and characteristics
9. Internal combustion engine performance parameters and characteristics
10. Internal combustion engine performance parameters and characteristics
11. Manufacturing and quality assurance

Supplementary reading:
Module Code: ME4261 | Module Title: Control
Module Coordinator: Dr. T. Obikawa
Module Description: This module introduces students to life science topics. Students gain an understanding of metal machining and tool design.
Learning Outcomes:
1. Design single point cutting tools, drills and milling cutters
2. Understand the nomenclature of cutting tools
3. Analyze different materials and their properties
4. Prepare to write the necessary life science topics
5. Complete the task of designing and analyzing the cutting tool
6. Take corrective measures such as changes in the design and safety of the cutting tool
Examinations:
- Mid-term Examination: 30%
- Final Examination: 70%

Module Code: ME3162 | Module Title: Materials Failure
Module Coordinator: Dr. Y. Yamane
Module Description: This module addresses the failure of engineering systems governed by material properties.
Learning Outcomes:
1. Characterize the load-bearing capacity of a material on the basis of its composition, properties, and structural integrity.
2. Understand the mechanics of fracture in brittle and ductile materials.
3. Conduct failure analysis of various engineering components.
4. Assess the service life and reliability of materials under various conditions.
5. Identify the factors that influence the failure of materials.
Examinations:
- Mid-term Examination: 30%
- Final Examination: 70%

Module Code: ME2151 | Module Title: Basic Engineering Mechanics
Module Coordinator: Dr. T. Obikawa
Module Description: This module introduces students to the study of basic engineering mechanics.
Learning Outcomes:
1. Understand the fundamental principles of mechanics.
2. Analyze the behavior of mechanical systems.
3. Perform calculations and solve problems related to mechanics.
Examinations:
- Mid-term Examination: 30%
- Final Examination: 70%

Module Code: ME3161 | Module Title: Biomaterials
Module Coordinator: Dr. Y. Yamane
Module Description: This module involves the integration of engineering materials with biological entities in the body.
Learning Outcomes:
1. Understand the selection and evaluation of biomaterials for medical applications.
2. Analyze the biocompatibility and degradation of biomaterials.
3. Study the properties and applications of various biomaterials.
Examinations:
- Mid-term Examination: 30%
- Final Examination: 70%

Module Code: ME4255 | Module Title: Intelligent Control
Module Coordinator: Dr. T. Obikawa
Module Description: This module introduces students to the advanced topics of intelligent control.
Learning Outcomes:
1. Understand the principles of intelligent control.
2. Analyze the design and implementation of intelligent control systems.
3. Study the applications of intelligent control in various fields.
Examinations:
- Mid-term Examination: 30%
- Final Examination: 70%
<table>
<thead>
<tr>
<th>Module Code</th>
<th>Module Title</th>
<th>Module Credits (L+S+E)</th>
<th>Semesters</th>
<th>Description</th>
<th>Learning Outcomes</th>
<th>Pre-requisites</th>
<th>Corequisites</th>
<th>Syllabus</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME4253</td>
<td>Manufacturing</td>
<td>4 (L+S+E)</td>
<td>Semester 4</td>
<td>This module introduces the fundamentals of finite element methods (FEM) used in the modern understanding of structural analysis problems in engineering. Students will learn the basic concepts of FEM and its applications in solving structural engineering problems.</td>
<td>Students should be able to:</td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1. Understand the basic concepts of the finite element method and its applications in solving structural engineering problems.</td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
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<td></td>
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<td>2. Apply the FEM to solve simple structural problems and understand the basic principles involved in the solution process.</td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
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<td>3. Use FEM software packages and solve a range of problems to reinforce the theory and concepts.</td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
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### Learning Outcomes

- Students will be able to:
  - Understand the basic procedures in using a commercial software package, including geometry creation/importing, meshing, use of different types of element, analysis and post-processing.
  - Apply the FEM to solve simple structural problems and understand the basic principles involved in the solution process.
  - Use FEM software packages and solve a range of problems to reinforce the theory and concepts.

### Syllabus

- **Week 1:** Introduction to FEM (1 hour)
  - Basic concepts of FEM, its history and applications.
  - Derivation of the governing equations for solids, truss, beam and plate elements.
- **Week 2:** Review of solid and structural mechanics (2 hours)
  - Kinematics, equilibrium, strain, stress, and constitutive relations.
  - Solution of linear equations and numerical methods.
  - Introduction to FEM software packages.
- **Week 3:** Structural and Solid Mechanics Problems (4 hours)
  - Formulation of the finite element method for solids and structures.
  - Shape functions for 3-D solids, FE equations.
  - Use of special elements for stress analysis and problems of infinite domains.
- **Week 4:** Heat Transfer Problems (4 hours)
  - Formulation of the finite element method for heat transfer problems.
  - Use of special elements for stress analysis and problems of infinite domains.
- **Week 5:** FEM FOR 2-D SOLIDS (5 hours)
  - Analysis of plain strain and plane stress problems.
  - FE equations for truss, beam and frame elements.
  - Shape functions for 2-D solids, FE equations.
- **Week 6:** FEM FOR 3-D SOLIDS (1 hour)
  - Analysis of 3-D solids.
  - Shape functions for 3-D solids, FE equations.
- **Week 7:** FEM FOR PLATES AND SHELLS (4.5 hours)
  - Analysis of plate and shell problems.
  - Use of special elements for stress analysis.
- **Week 8:** FEM FOR HEAT TRANSFER PROBLEMS (4 hours)
  - Analysis of heat transfer problems.
  - Use of special elements for stress analysis.
- **Week 9:** FEM FOR THERMAL PROBLEMS (4 hours)
  - Analysis of thermal problems.
  - Use of special elements for stress analysis.
- **Week 10:** FEM FOR ELECTRICAL PROBLEMS (2 hours)
  - Analysis of electrical problems.
  - Use of special elements for stress analysis.
- **Week 11:** Advanced FEM Topics (4 hours)
  - Advanced topics in FEM, including complex geometries, contact problems, and non-linear analysis.
  - Use of special elements for stress analysis.
- **Week 12:** FEM FOR STRUCTURAL PROBLEMS (4 hours)
  - Analysis of structural problems.
  - Use of special elements for stress analysis.
- **Week 13:** FEM FOR MECHANICAL PROBLEMS (2 hours)
  - Analysis of mechanical problems.
  - Use of special elements for stress analysis.
- **Week 14:** FEM FOR BIO-MEDICAL APPLICATIONS (2 hours)
  - Analysis of biomedical problems.
  - Use of special elements for stress analysis.

### References


### Supplementary Reading