Students' Handbook

Mechanical Engineering (Manufacturing and Production; Naval Architecture and Boat Building; Materials and Corrosion options)

Faculty of Engineering, Akpakip Oro University (AOU)

Academic year: [to be inserted]

Draft for Faculty approval

1. Welcome

Welcome to the Department of Mechanical Engineering. This handbook explains the Mechanical Engineering (Manufacturing and Production; Naval Architecture and Boat Building; Materials and Corrosion options) programme: what you will study, how you will be assessed, and where to get help. Read it alongside the university's academic regulations, which take precedence where they differ.

2. About the Programme

The programme trains engineers who design, make and maintain machines, materials and vessels. Years 1 and 2 build foundations in mathematics, mechanics, thermodynamics, fluid mechanics and materials. Years 3 to 5 add the option specialisation, culminating in an integrated design project and defence.

Graduate profile

- Design machines, components and systems to applicable standards.
- Select materials and processes for service and manufacturing conditions.
- Plan, control and improve production and quality systems.
- Assess corrosion, failure and integrity of engineering assets and vessels.
- Work ethically and communicate effectively in teams.

Career pathways

Graduates may work in manufacturing and process industries, oil and gas and power plants, shipyards and boat builders, marine and port authorities, materials and testing laboratories, additive manufacturing service bureaus, and consultancies. Graduates who register with COREN may practise as professional engineers in Nigeria. Postgraduate study is also an option.

Professional registration

Registration with the Council for the Regulation of Engineering in Nigeria (COREN) requires an accredited qualification and professional experience. Keep your SIWES records and project reports, as they support your later registration.

3. Programme Structure

The tables list every course, its units, the semester in which it is taken, and its track. Codes and units are provisional until confirmed in the approved CCMAS schedule.

Track: 'Core' is taken by all students. 'MP' marks Manufacturing and Production option courses. 'AM' marks the Additive Manufacturing track, which sits within the Manufacturing and Production option. 'NA' marks Naval Architecture and Boat Building option courses. 'MC' marks Materials and Corrosion option courses.

Year 1: Engineering Foundations

Semester 1 (First semester)

Code	Course	Units	Track
MEC 101	Mathematics I	3	Core
MEC 102	General Physics I	3	Core
MEC 103	General Chemistry I	2	Core
MEC 104	Introductory Engineering	2	Core
MEC 105	Introduction to Computing	2	Core
MEC 106	Communication in English	2	Core
MEC 107	Engineering Laboratory Practicals	1	Core
MEC 108	Introduction to Mechanical Engineering	2	Core

Code	Course	Units	Track
	Semester total	**17**	

Semester 2 (Second semester)

Code	Course	Units	Track
MEC 109	Mathematics II	3	Core
MEC 110	General Physics II	3	Core
MEC 111	Engineering Drawing and Graphics	2	Core
MEC 112	Programming and Engineering Computation	2	Core
MEC 113	Nigerian Peoples and Cultures	2	Core
MEC 114	Physics Practicals	1	Core
MEC 115	Engineering Workshop and Safety	2	Core
MEC 116	Electrical Principles	3	Core
	Semester total	**18**	

Year 2: Core Engineering

Semester 3 (First semester)

Code	Course	Units	Track
MEC 201	Engineering Mechanics: Statics	3	Core
MEC 202	Strength of Materials I	3	Core
MEC 203	Engineering Mathematics	3	Core
MEC 204	Thermodynamics I	3	Core
MEC 205	Fluid Mechanics I	3	Core
MEC 206	Engineering Materials I	2	Core
MEC 207	Computer-Aided Design	2	Core
MEC 208	Manufacturing Processes I	3	Core
	Semester total	**22**	

Semester 4 (Second semester)

Code	Course	Units	Track
MEC 209	Engineering Mechanics: Dynamics	3	Core
MEC 210	Strength of Materials II	3	Core
MEC 211	Numerical Methods for Engineers	3	Core
MEC 212	Thermodynamics II	3	Core
MEC 213	Fluid Mechanics II	3	Core
MEC 214	Engineering Materials II	2	Core
MEC 215	Manufacturing Processes II	3	Core
MEC 216	Mechanical Engineering Laboratory I	2	Core
	Semester total	**22**	

Year 3: Specialist Foundations

Semester 5 (First semester)

Code	Course	Units	Track
MEC 301	Machine Design I	3	Core

Code	Course	Units	Track
MEC 302	Heat Transfer	3	Core
MEC 303	Engineering Metrology and Quality Control	3	Core
MEC 304	Machine Tools and Machining	3	Core
MEC 305	Materials Science and Metallurgy	3	Core
MEC 306	Engineering Statistics and Research Methods	2	Core
MEC 307	Control Systems Fundamentals	2	Core
MEC 308	Mechanical Engineering Laboratory II	2	Core
	Semester total	**21**	

Semester 6 (Second semester)

Code	Course	Units	Track
MEC 309	Machine Design II	3	Core
MEC 310	Fluid Machinery	3	Core
MEC 311	Corrosion Fundamentals	3	MC
MEC 312	Production Planning and Control	3	MP
MEC 313	Polymer and Composite Materials	3	MC
MEC 314	Joining and Welding Technology	3	MP
MEC 315	Computer-Aided Manufacturing	3	MP
MEC 316	Engineering Economics	2	Core
	Semester total	**23**	

Year 4: Advanced Design and Industrial Practice

Semester 7 (First semester)

Code	Course	Units	Track
MEC 401	Advanced Manufacturing Processes	3	MP
MEC 402	Additive Manufacturing Fundamentals	3	AM
MEC 403	Design for Manufacturing and Assembly	3	MP
MEC 404	Naval Architecture I: Hydrostatics and Stability	3	NA
MEC 405	Electrochemistry and Corrosion Control	3	MC
MEC 406	Finite Element Methods	3	Core
MEC 407	Lean Manufacturing and Operations	2	MP
MEC 408	Research Project I	2	Core
	Semester total	**22**	

Semester 8 (Second semester)

Code	Course	Units	Track
MEC 409	Additive Manufacturing Processes and Materials	3	AM
MEC 410	Additive Manufacturing Design and Post-processing	2	AM
MEC 411	Ship Resistance and Propulsion	3	NA
MEC 412	Marine Structures and Boat Construction	3	NA
MEC 413	Surface Engineering and Protective Coatings	3	MC
MEC 414	Failure Analysis and Materials Degradation	3	MC
MEC 415	Automation in Manufacturing	2	MP

Code	Course	Units	Track
MEC 416	Industrial Training (SIWES)	3	Core
	Semester total	**22**	

Year 5: Specialisation, Integration and Professional Readiness

Semester 9 (First semester)

Code	Course	Units	Track
MEC 501	Advanced Additive Manufacturing	3	AM
MEC 502	Additive Manufacturing Quality and Certification	2	AM
MEC 503	Ship Design Project	3	NA
MEC 504	Seakeeping and Ship Motions	3	NA
MEC 505	Advanced Corrosion Engineering	3	MC
MEC 506	Advanced Materials Selection	2	MC
MEC 507	Research Project II	3	Core
MEC 508	Technical Elective I	2	Core
	Semester total	**21**	

Semester 10 (Second semester)

Code	Course	Units	Track
MEC 509	Integrated Mechanical Systems Design	3	Core
MEC 510	Manufacturing Systems Design	2	MP
MEC 511	Marine Vessel Construction and Survey	2	NA
MEC 512	Asset Integrity and Corrosion Management	2	MC
MEC 513	Engineering Professional Practice and Ethics	2	Core
MEC 514	Environmental Impact and Sustainability	2	Core
MEC 515	Final-Year Design Project and Defence	4	Core
MEC 516	Technical Elective II	2	Core
	Semester total	**19**	

4. Course Specifications

Each entry gives the course description, learning outcomes, topics, assessment and recommended texts. Your lecturer issues the week-by-week scheme for each course.

Year 1: Engineering Foundations

MEC 101 Mathematics I

Units: 3 | Year 1, Semester 1 (First semester)

Description. Algebra, calculus and coordinate geometry for engineering.

Learning outcomes:

- Solve algebraic and trigonometric problems
- Apply differentiation to engineering rates

Course topics:

1. Functions and graphs
2. Differentiation
3. Integration
4. Applications

Assessment: CA 30 / Exam 70

Recommended texts: Stroud and Booth, Engineering Mathematics (latest edition)

MEC 102 General Physics I

Units: 3 | Year 1, Semester 1 (First semester)

Description. Mechanics, waves and thermal physics for engineers.

Learning outcomes:

- Analyse forces, motion and energy
- Apply conservation laws

Course topics:

1. Kinematics and dynamics
2. Work and energy
3. Rotation
4. Oscillations

Assessment: CA 30 / Exam 70

Recommended texts: Halliday, Resnick and Walker (latest edition)

MEC 103 General Chemistry I

Units: 2 | Year 1, Semester 1 (First semester)

Description. Atomic structure, bonding and stoichiometry relevant to materials and corrosion.

Learning outcomes:

- Explain atomic structure and bonding
- Perform stoichiometric calculations

Course topics:

1. Atomic structure
2. Bonding
3. Stoichiometry
4. Solutions

Assessment: CA 30 / Exam 70

Recommended texts: Chang and Goldsby (latest edition)

MEC 104 Introductory Engineering

Units: 2 | Year 1, Semester 1 (First semester)

Description. Overview of engineering disciplines, problem solving and professional ethics.

Learning outcomes:

- Describe engineering disciplines
- Apply a structured problem-solving method

Course topics:

1. Disciplines and roles
2. Units
3. Problem solving
4. Professional ethics

Assessment: CA 50 / Exam 50

Recommended texts: Dym and Little (latest edition)

MEC 105 Introduction to Computing

Units: 2 | Year 1, Semester 1 (First semester)

Description. Computer fundamentals and productivity tools.

Learning outcomes:

- Use common computing tools
- Explain computer system components

Course topics:

1. Hardware
2. Operating systems
3. Productivity tools
4. Data management

Assessment: CA 60 / Exam 40

Recommended texts: Shelly and Vermaat (latest edition)

MEC 106 Communication in English

Units: 2 | Year 1, Semester 1 (First semester)

Description. Academic and technical writing and presentation.

Learning outcomes:

- Write clear technical reports
- Deliver structured presentations

Course topics:

1. Academic writing
2. Technical reports
3. Presentations
4. Listening

Assessment: CA 60 / Exam 40

Recommended texts: Swales and Feak (latest edition)

MEC 107 Engineering Laboratory Practicals

Units: 1 | Year 1, Semester 1 (First semester)

Description. Introductory measurement, error analysis and laboratory safety.

Learning outcomes:

- Record and analyse measurement data
- Apply laboratory safety procedures

Course topics:

1. Units and measurement
2. Error analysis
3. Data presentation
4. Laboratory safety

Assessment: Lab reports 100

Recommended texts: Institutional laboratory manual

MEC 108 Introduction to Mechanical Engineering

Units: 2 | Year 1, Semester 1 (First semester)

Description. Scope of mechanical engineering and its role in industry, marine and materials sectors.

Learning outcomes:

- Describe mechanical engineering subdisciplines
- Discuss career and professional pathways

Course topics:

1. Subdisciplines
2. Industry roles
3. Materials and manufacturing
4. Professional bodies

Assessment: CA 40 / Exam 60

Recommended texts: Departmental reading list, to be confirmed

MEC 109 Mathematics II

Units: 3 | Year 1, Semester 2 (Second semester)

Description. Matrices, series, vectors and differential equations.

Learning outcomes:

- Solve linear systems
- Solve first and second order differential equations

Course topics:

1. Matrices
2. Vectors
3. Series
4. Differential equations

Assessment: CA 30 / Exam 70

Recommended texts: Stroud and Booth (latest edition)

MEC 110 General Physics II

Units: 3 | Year 1, Semester 2 (Second semester)

Description. Electricity, magnetism, optics and modern physics.

Learning outcomes:

- Analyse electric and magnetic fields
- Apply optics and modern physics concepts

Course topics:

1. Electrostatics
2. Magnetism
3. Optics
4. Modern physics

Assessment: CA 30 / Exam 70

Recommended texts: Halliday, Resnick and Walker (latest edition)

MEC 111 Engineering Drawing and Graphics

Units: 2 | Year 1, Semester 2 (Second semester)

Description. Orthographic and assembly drawing for machines and components.

Learning outcomes:

- Produce orthographic drawings
- Read assembly drawings

Course topics:

1. Orthographic projection
2. Sections
3. Dimensioning
4. Assembly drawings

Assessment: Coursework 60 / Exam 40

Recommended texts: Giesecke et al., Technical Drawing (latest edition)

MEC 112 Programming and Engineering Computation

Units: 2 | Year 1, Semester 2 (Second semester)

Description. Structured programming and numerical methods.

Learning outcomes:

- Write structured programs for engineering problems
- Apply numerical methods

Course topics:

1. Programming basics
2. Control structures
3. Functions
4. Numerical methods

Assessment: CA 50 / Exam 50

Recommended texts: Chapra (latest edition)

MEC 113 Nigerian Peoples and Cultures

Units: 2 | Year 1, Semester 2 (Second semester)

Description. Nigerian history, cultures and national development, or applicable general studies as prescribed.

Learning outcomes:

- Describe Nigerian cultural diversity
- Discuss national development issues

Course topics:

1. Nigerian history
2. Cultural diversity
3. Governance
4. Contemporary issues

Assessment: CA 40 / Exam 60

Recommended texts: Departmental reading list, to be confirmed

MEC 114 Physics Practicals

Units: 1 | Year 1, Semester 2 (Second semester)

Description. Laboratory experiments reinforcing physics theory.

Learning outcomes:

- Perform standard physics experiments
- Write accurate laboratory reports

Course topics:

1. Experimental methods
2. Measurement
3. Physics experiments
4. Report writing

Assessment: Lab reports 100

Recommended texts: Institutional laboratory manual

MEC 115 Engineering Workshop and Safety

Units: 2 | Year 1, Semester 2 (Second semester)

Description. Workshop practice, machine tools and machine safety.

Learning outcomes:

- Use common machine tools safely
- Apply workshop safety standards

Course topics:

1. Workshop safety
2. Hand tools
3. Machine tools
4. Fabrication practice

Assessment: Practical 70 / Exam 30

Recommended texts: Institutional workshop manual

MEC 116 Electrical Principles

Units: 3 | Year 1, Semester 2 (Second semester)

Description. Basic DC and AC circuit analysis for mechanical and electrical systems.

Learning outcomes:

- Analyse resistive DC circuits
- Apply basic AC circuit concepts

Course topics:

1. DC circuits
2. Network theorems
3. AC fundamentals
4. Power

Assessment: CA 30 / Exam 70

Recommended texts: Hughes, Electrical and Electronic Technology (latest edition)

Year 2: Core Engineering

MEC 201 Engineering Mechanics: Statics

Units: 3 | Year 2, Semester 3 (First semester)

Description. Equilibrium of particles and rigid bodies.

Learning outcomes:

- Analyse equilibrium of rigid bodies
- Determine forces in frames

Course topics:

1. Force systems
2. Equilibrium
3. Trusses and frames
4. Friction

Assessment: CA 30 / Exam 70

Recommended texts: Hibbeler, Engineering Mechanics: Statics (latest edition)

MEC 202 Strength of Materials I

Units: 3 | Year 2, Semester 3 (First semester)

Description. Stress, strain and deformation of members and beams.

Learning outcomes:

- Calculate stresses and strains
- Analyse bending and shear

Course topics:

1. Stress and strain
2. Axial loading
3. Torsion
4. Bending and shear

Assessment: CA 30 / Exam 70

Recommended texts: Gere and Goodno, Mechanics of Materials (latest edition)

MEC 203 Engineering Mathematics

Units: 3 | Year 2, Semester 3 (First semester)

Description. Partial derivatives, multiple integrals and Laplace transforms.

Learning outcomes:

- Apply Laplace transforms
- Solve partial differential problems

Course topics:

1. Partial derivatives
2. Multiple integrals
3. Laplace transforms
4. Fourier series

Assessment: CA 30 / Exam 70

Recommended texts: Kreyszig (latest edition)

MEC 204 Thermodynamics I

Units: 3 | Year 2, Semester 3 (First semester)

Description. Energy, work and heat and the first and second laws.

Learning outcomes:

- Apply the first law to closed and open systems
- Apply the second law to cycles

Course topics:

1. First law
2. Second law
3. Properties of pure substances
4. Cycles

Assessment: CA 30 / Exam 70

Recommended texts: Cengel and Boles, Thermodynamics (latest edition)

MEC 205 Fluid Mechanics I

Units: 3 | Year 2, Semester 3 (First semester)

Description. Fluid properties, hydrostatics and conservation principles.

Learning outcomes:

- Calculate hydrostatic forces
- Apply continuity and Bernoulli principles

Course topics:

1. Fluid properties
2. Hydrostatics
3. Continuity
4. Bernoulli equation

Assessment: CA 30 / Exam 70

Recommended texts: Streeter, Wylie and Bedford (latest edition)

MEC 206 Engineering Materials I

Units: 2 | Year 2, Semester 3 (First semester)

Description. Structure and properties of metals and alloys.

Learning outcomes:

- Explain crystal structure and defects
- Relate microstructure to properties

Course topics:

1. Crystal structure
2. Defects
3. Phase diagrams
4. Mechanical properties

Assessment: CA 40 / Exam 60

Recommended texts: Callister and Rethwisch (latest edition)

MEC 207 Computer-Aided Design

Units: 2 | Year 2, Semester 3 (First semester)

Description. Solid modelling of parts and assemblies.

Learning outcomes:

- Model parts and assemblies in CAD
- Produce engineering drawings from models

Course topics:

1. Solid modelling
2. Assemblies
3. Drawings
4. Tolerances

Assessment: Coursework 100

Recommended texts: Institutional CAD manual

MEC 208 Manufacturing Processes I

Units: 3 | Year 2, Semester 3 (First semester)

Description. Casting, forming and material removal processes.

Learning outcomes:

- Select casting and forming processes
- Explain material removal mechanics

Course topics:

1. Casting
2. Forming
3. Machining basics
4. Process selection

Assessment: CA 40 / Exam 60

Recommended texts: Kalpakjian and Schmid, Manufacturing Engineering and Technology (latest edition)

MEC 209 Engineering Mechanics: Dynamics

Units: 3 | Year 2, Semester 4 (Second semester)

Description. Kinematics and kinetics of particles and rigid bodies.

Learning outcomes:

- Analyse motion of rigid bodies
- Apply work-energy and impulse-momentum

Course topics:

1. Kinematics
2. Kinetics
3. Work and energy
4. Impulse and momentum

Assessment: CA 30 / Exam 70

Recommended texts: Meriam and Kraige (latest edition)

MEC 210 Strength of Materials II

Units: 3 | Year 2, Semester 4 (Second semester)

Description. Advanced stress analysis, columns and combined loading.

Learning outcomes:

- Analyse combined stresses
- Design for column buckling

Course topics:

1. Combined stresses
2. Beam deflection
3. Columns
4. Statically indeterminate members

Assessment: CA 30 / Exam 70

Recommended texts: Gere and Goodno (latest edition)

MEC 211 Numerical Methods for Engineers

Units: 3 | Year 2, Semester 4 (Second semester)

Description. Numerical solution of engineering equations.

Learning outcomes:

- Apply numerical root finding and interpolation
- Solve ODEs numerically

Course topics:

1. Root finding
2. Interpolation
3. Numerical integration
4. ODE solvers

Assessment: CA 40 / Exam 60

Recommended texts: Chapra (latest edition)

MEC 212 Thermodynamics II

Units: 3 | Year 2, Semester 4 (Second semester)

Description. Gas and vapour cycles, refrigeration and psychrometrics.

Learning outcomes:

- Analyse gas and vapour power cycles
- Analyse refrigeration cycles

Course topics:

1. Gas cycles
2. Vapour cycles
3. Refrigeration
4. Psychrometrics

Assessment: CA 30 / Exam 70

Recommended texts: Cengel and Boles (latest edition)

MEC 213 Fluid Mechanics II

Units: 3 | Year 2, Semester 4 (Second semester)

Description. Pipe flow, open channel flow and dimensional analysis.

Learning outcomes:

- Design pipe systems
- Apply dimensional analysis

Course topics:

1. Pipe flow
2. Head losses
3. Open channel flow
4. Dimensional analysis

Assessment: CA 30 / Exam 70

Recommended texts: Streeter, Wylie and Bedford (latest edition)

MEC 214 Engineering Materials II

Units: 2 | Year 2, Semester 4 (Second semester)

Description. Non-ferrous metals, polymers, ceramics and composites.

Learning outcomes:

- Select non-ferrous and non-metallic materials
- Explain property trade-offs

Course topics:

1. Non-ferrous metals
2. Polymers
3. Ceramics
4. Composites

Assessment: CA 40 / Exam 60

Recommended texts: Callister and Rethwisch (latest edition)

MEC 215 Manufacturing Processes II

Units: 3 | Year 2, Semester 4 (Second semester)

Description. Joining, sheet metal and powder processes.

Learning outcomes:

- Select joining and sheet processes
- Explain powder processing

Course topics:

1. Welding
2. Sheet metal forming
3. Powder processing
4. Process selection

Assessment: CA 40 / Exam 60

Recommended texts: Kalpakjian and Schmid (latest edition)

MEC 216 Mechanical Engineering Laboratory I

Units: 2 | Year 2, Semester 4 (Second semester)

Description. Tensile, hardness and thermo-fluid experiments.

Learning outcomes:

- Carry out mechanical tests
- Write technical lab reports

Course topics:

1. Tensile tests
2. Hardness tests
3. Thermo-fluid tests
4. Reporting

Assessment: Lab reports 100

Recommended texts: Institutional laboratory manual

Year 3: Specialist Foundations

MEC 301 Machine Design I

Units: 3 | Year 3, Semester 5 (First semester)

Description. Design of shafts, fasteners, springs and bearings.

Learning outcomes:

- Design shafts and fasteners
- Select springs and bearings

Course topics:

1. Shaft design
2. Fasteners
3. Springs
4. Bearings

Assessment: CA 30 / Exam 70

Recommended texts: Shigley and Mischke, Mechanical Engineering Design (latest edition)

MEC 302 Heat Transfer

Units: 3 | Year 3, Semester 5 (First semester)

Description. Conduction, convection and radiation in engineering systems.

Learning outcomes:

- Calculate conduction through walls and fins
- Apply convection and radiation correlations

Course topics:

1. Conduction
2. Fins
3. Convection
4. Radiation

Assessment: CA 30 / Exam 70

Recommended texts: Incropera et al., Fundamentals of Heat and Mass Transfer (latest edition)

MEC 303 Engineering Metrology and Quality Control

Units: 3 | Year 3, Semester 5 (First semester)

Description. Dimensional measurement, tolerancing and statistical quality control.

Learning outcomes:

- Measure and inspect components
- Apply statistical process control

Course topics:

1. Measurement systems
2. Tolerancing
3. Inspection
4. Statistical process control

Assessment: CA 40 / Exam 60

Recommended texts: Groover, Fundamentals of Modern Manufacturing (latest edition)

MEC 304 Machine Tools and Machining

Units: 3 | Year 3, Semester 5 (First semester)

Description. Machine tool configuration, cutting mechanics and machining economics.

Learning outcomes:

- Select cutting parameters
- Analyse tool wear and machining economics

Course topics:

1. Cutting mechanics
2. Tool life
3. Machine tools
4. Machining economics

Assessment: Lab 40 / Exam 60

Recommended texts: Kalpakjian and Schmid (latest edition)

MEC 305 Materials Science and Metallurgy

Units: 3 | Year 3, Semester 5 (First semester)

Description. Phase transformations, heat treatment and failure mechanisms.

Learning outcomes:

- Interpret phase diagrams
- Specify heat treatments

Course topics:

1. Phase transformations
2. Heat treatment
3. Fracture
4. Fatigue

Assessment: CA 30 / Exam 70

Recommended texts: Callister and Rethwisch (latest edition)

MEC 306 Engineering Statistics and Research Methods

Units: 2 | Year 3, Semester 5 (First semester)

Description. Statistics and research design for engineering.

Learning outcomes:

- Apply descriptive and inferential statistics
- Design simple experiments

Course topics:

1. Descriptive statistics
2. Probability
3. Hypothesis testing
4. Research design

Assessment: CA 40 / Exam 60

Recommended texts: Montgomery and Runger (latest edition)

MEC 307 Control Systems Fundamentals

Units: 2 | Year 3, Semester 5 (First semester)

Description. Introduction to feedback and control of mechanical systems.

Learning outcomes:

- Explain feedback concepts
- Analyse simple response behaviour

Course topics:

1. Feedback
2. Transfer functions
3. Response
4. Stability basics

Assessment: CA 40 / Exam 60

Recommended texts: Ogata (latest edition)

MEC 308 Mechanical Engineering Laboratory II

Units: 2 | Year 3, Semester 5 (First semester)

Description. Machining, metrology and materials experiments.

Learning outcomes:

- Carry out machining and metrology experiments
- Write laboratory reports

Course topics:

1. Machining tests
2. Metrology
3. Materials tests
4. Reporting

Assessment: Lab reports 100

Recommended texts: Institutional laboratory manual

MEC 309 Machine Design II

Units: 3 | Year 3, Semester 6 (Second semester)

Description. Design of gears, couplings, brakes and clutches.

Learning outcomes:

- Design gear trains
- Design brakes and clutches

Course topics:

1. Gears
2. Couplings
3. Brakes
4. Clutches

Assessment: CA 30 / Exam 70

Recommended texts: Shigley and Mischke (latest edition)

MEC 310 Fluid Machinery

Units: 3 | Year 3, Semester 6 (Second semester)

Description. Pumps, turbines and compressors.

Learning outcomes:

- Select pumps and turbines
- Analyse compressor performance

Course topics:

1. Pumps
2. Turbines
3. Compressors
4. System matching

Assessment: CA 30 / Exam 70

Recommended texts: Munson et al., Fundamentals of Fluid Mechanics (latest edition)

MEC 311 Corrosion Fundamentals

Units: 3 | Year 3, Semester 6 (Second semester)

Description. Electrochemical basis of corrosion and its forms.

Learning outcomes:

- Explain electrochemical corrosion
- Identify corrosion forms

Course topics:

1. Electrochemical basis
2. Galvanic corrosion
3. Pitting
4. Environmental factors

Assessment: CA 30 / Exam 70

Recommended texts: Jones, Principles and Prevention of Corrosion (latest edition)

MEC 312 Production Planning and Control

Units: 3 | Year 3, Semester 6 (Second semester)

Description. Demand forecasting, capacity and scheduling in production.

Learning outcomes:

- Forecast demand
- Schedule production

Course topics:

1. Forecasting
2. Capacity planning
3. Scheduling
4. Inventory

Assessment: CA 40 / Exam 60

Recommended texts: Vollmann et al., Manufacturing Planning and Control Systems (latest edition)

MEC 313 Polymer and Composite Materials

Units: 3 | Year 3, Semester 6 (Second semester)

Description. Polymer and composite structure, processing and properties.

Learning outcomes:

- Explain polymer structure
- Select composites for applications

Course topics:

1. Polymer structure
2. Processing
3. Composites
4. Properties

Assessment: CA 30 / Exam 70

Recommended texts: Callister and Rethwisch (latest edition)

MEC 314 Joining and Welding Technology

Units: 3 | Year 3, Semester 6 (Second semester)

Description. Welding processes, weld design and inspection.

Learning outcomes:

- Select welding processes
- Specify weld procedures

Course topics:

1. Arc welding
2. Resistance welding
3. Weld design
4. Inspection

Assessment: CA 40 / Exam 60

Recommended texts: Kou, Welding Metallurgy (latest edition)

MEC 315 Computer-Aided Manufacturing

Units: 3 | Year 3, Semester 6 (Second semester)

Description. CNC programming and computer-aided manufacturing systems.

Learning outcomes:

- Write CNC programs
- Simulate machining operations

Course topics:

1. CNC programming
2. CAM software
3. Simulation
4. Post-processing

Assessment: Practical 50 / Exam 50

Recommended texts: Groover (latest edition)

MEC 316 Engineering Economics

Units: 2 | Year 3, Semester 6 (Second semester)

Description. Economic evaluation of engineering projects.

Learning outcomes:

- Evaluate project cash flows
- Compare investment options

Course topics:

1. Time value of money
2. Cash flow
3. Depreciation
4. Appraisal

Assessment: CA 40 / Exam 60

Recommended texts: Blank and Tarquin (latest edition)

Year 4: Advanced Design and Industrial Practice

MEC 401 Advanced Manufacturing Processes

Units: 3 | Year 4, Semester 7 (First semester)

Description. Advanced machining, grinding and precision processes.

Learning outcomes:

- Select advanced processes
- Analyse surface integrity

Course topics:

1. Advanced machining
2. Grinding
3. Precision processes
4. Surface integrity

Assessment: CA 30 / Exam 70

Recommended texts: Kalpakjian and Schmid (latest edition)

MEC 402 Additive Manufacturing Fundamentals

Units: 3 | Year 4, Semester 7 (First semester)

Description. Principles and classes of additive manufacturing processes.

Learning outcomes:

- Classify additive manufacturing processes
- Explain layer-based build principles

Course topics:

1. AM principles
2. Process classes
3. Layer build
4. Applications

Assessment: CA 30 / Exam 70

Recommended texts: Gibson, Rosen and Stucker, Additive Manufacturing Technologies (latest edition)

MEC 403 Design for Manufacturing and Assembly

Units: 3 | Year 4, Semester 7 (First semester)

Description. Design rules for ease of manufacture and assembly.

Learning outcomes:

- Apply DFM and DFA rules
- Evaluate design alternatives

Course topics:

1. DFM rules
2. DFA rules
3. Cost analysis
4. Design alternatives

Assessment: CA 30 / Exam 70

Recommended texts: Boothroyd, Dewhurst and Knight (latest edition)

MEC 404 Naval Architecture I: Hydrostatics and Stability

Units: 3 | Year 4, Semester 7 (First semester)

Description. Buoyancy, hydrostatics and intact stability of vessels.

Learning outcomes:

- Calculate buoyancy and hydrostatic properties
- Assess intact stability

Course topics:

1. Buoyancy
2. Hydrostatic curves
3. Metacentric height
4. Intact stability

Assessment: CA 30 / Exam 70

Recommended texts: Rawson and Tupper, Basic Ship Theory (latest edition)

MEC 405 Electrochemistry and Corrosion Control

Units: 3 | Year 4, Semester 7 (First semester)

Description. Electrochemical kinetics and corrosion control methods.

Learning outcomes:

- Apply electrochemical kinetics
- Select corrosion control methods

Course topics:

1. Electrode kinetics
2. Polarisation
3. Cathodic protection
4. Inhibitors

Assessment: CA 30 / Exam 70

Recommended texts: Jones (latest edition)

MEC 406 Finite Element Methods

Units: 3 | Year 4, Semester 7 (First semester)

Description. Finite element formulation and analysis of structures and heat transfer.

Learning outcomes:

- Formulate simple finite element models
- Interpret analysis results

Course topics:

1. Element formulation
2. Meshing
3. Boundary conditions
4. Result interpretation

Assessment: Coursework 60 / Exam 40

Recommended texts: Cook et al., Concepts and Applications of Finite Element Analysis (latest edition)

MEC 407 Lean Manufacturing and Operations

Units: 2 | Year 4, Semester 7 (First semester)

Description. Lean principles, waste reduction and operations improvement.

Learning outcomes:

- Apply lean tools
- Measure operational performance

Course topics:

1. Lean principles
2. Value stream mapping
3. Waste reduction
4. Performance measures

Assessment: CA 40 / Exam 60

Recommended texts: Womack and Jones, Lean Thinking (latest edition)

MEC 408 Research Project I

Units: 2 | Year 4, Semester 7 (First semester)

Description. Literature review and proposal for the final-year project.

Learning outcomes:

- Conduct a literature review
- Write a research proposal

Course topics:

1. Literature search
2. Research questions
3. Methodology
4. Proposal writing

Assessment: Proposal 100

Recommended texts: Supervisor guidance and departmental guide

MEC 409 Additive Manufacturing Processes and Materials

Units: 3 | Year 4, Semester 8 (Second semester)

Description. Powder bed, extrusion, photopolymer and metal additive processes and their materials.

Learning outcomes:

- Compare additive processes
- Select materials for additive builds

Course topics:

1. Powder bed fusion
2. Extrusion
3. Photopolymerisation
4. Build materials

Assessment: CA 30 / Exam 70

Recommended texts: Gibson, Rosen and Stucker (latest edition)

MEC 410 Additive Manufacturing Design and Post-processing

Units: 2 | Year 4, Semester 8 (Second semester)

Description. Design for additive manufacture and post-build treatment.

Learning outcomes:

- Apply design for additive manufacture
- Specify post-processing steps

Course topics:

1. Design rules
2. Support structures
3. Heat treatment
4. Finishing

Assessment: Coursework 60 / Exam 40

Recommended texts: Departmental reading list, to be confirmed

MEC 411 Ship Resistance and Propulsion

Units: 3 | Year 4, Semester 8 (Second semester)

Description. Hull resistance and propeller theory.

Learning outcomes:

- Estimate ship resistance
- Analyse propeller performance

Course topics:

1. Resistance components
2. Model testing
3. Propeller theory
4. Propulsive efficiency

Assessment: CA 30 / Exam 70

Recommended texts: Molland and Turnock, Marine Rudders and Control Surfaces (latest edition); Molland et al., Ship Resistance and Propulsion (latest edition)

MEC 412 Marine Structures and Boat Construction

Units: 3 | Year 4, Semester 8 (Second semester)

Description. Structural design and construction of hulls and boats.

Learning outcomes:

- Analyse hull girder loads
- Specify boat construction methods

Course topics:

1. Hull loads
2. Stiffened plates
3. Construction methods
4. Materials for marine use

Assessment: CA 30 / Exam 70

Recommended texts: Departmental reading list, to be confirmed

MEC 413 Surface Engineering and Protective Coatings

Units: 3 | Year 4, Semester 8 (Second semester)

Description. Coatings, surface treatments and their performance.

Learning outcomes:

- Select protective coatings
- Specify surface preparation

Course topics:

1. Surface preparation
2. Paints and coatings
3. Metallic coatings
4. Performance testing

Assessment: CA 30 / Exam 70

Recommended texts: Departmental reading list, to be confirmed

MEC 414 Failure Analysis and Materials Degradation

Units: 3 | Year 4, Semester 8 (Second semester)

Description. Investigation of fractures and degradation in service.

Learning outcomes:

- Analyse fracture surfaces
- Diagnose degradation mechanisms

Course topics:

1. Fracture mechanics
2. Fatigue
3. Fractography
4. Degradation mechanisms

Assessment: CA 30 / Exam 70

Recommended texts: Callister and Rethwisch (latest edition)

MEC 415 Automation in Manufacturing

Units: 2 | Year 4, Semester 8 (Second semester)

Description. Automation systems and robots in production.

Learning outcomes:

- Describe automation systems
- Assess automation options

Course topics:

1. Automation systems
2. Sensors and control
3. Robots in production
4. Economics

Assessment: CA 40 / Exam 60

Recommended texts: Departmental reading list, to be confirmed

MEC 416 Industrial Training (SIWES)

Units: 3 | Year 4, Semester 8 (Second semester)

Description. Supervised industrial attachment in a relevant organisation.

Learning outcomes:

- Apply engineering knowledge in practice
- Keep a professional logbook

Course topics:

1. Workplace induction
2. Practical tasks
3. Reporting
4. Professional conduct

Assessment: Logbook 40 / Report 40 / Assessor 20

Recommended texts: SIWES guidelines issued by the Industrial Training Fund and AOU

Year 5: Specialisation, Integration and Professional Readiness

MEC 501 Advanced Additive Manufacturing

Units: 3 | Year 5, Semester 9 (First semester)

Description. Metal additive manufacturing, multi-material and lattice structures.

Learning outcomes:

- Design lattice and multi-material parts
- Evaluate metal additive processes

Course topics:

1. Metal additive
2. Lattices
3. Multi-material
4. Process monitoring

Assessment: CA 30 / Exam 70

Recommended texts: Departmental reading list, to be confirmed

MEC 502 Additive Manufacturing Quality and Certification

Units: 2 | Year 5, Semester 9 (First semester)

Description. Quality control, testing and certification of additive parts.

Learning outcomes:

- Plan quality control for additive parts
- Apply certification requirements

Course topics:

1. Quality control
2. Non-destructive testing
3. Qualification
4. Certification

Assessment: CA 40 / Exam 60

Recommended texts: Departmental reading list, to be confirmed

MEC 503 Ship Design Project

Units: 3 | Year 5, Semester 9 (First semester)

Description. Preliminary design of a vessel to a stated brief.

Learning outcomes:

- Produce a preliminary vessel design
- Justify design choices

Course topics:

1. Hull form
2. General arrangement
3. Stability check
4. Design report

Assessment: Design project 60 / Exam 40

Recommended texts: Departmental design brief

MEC 504 Seakeeping and Ship Motions

Units: 3 | Year 5, Semester 9 (First semester)

Description. Wave loads and motions of ships at sea.

Learning outcomes:

- Describe ship motions in waves
- Assess seakeeping performance

Course topics:

1. Wave spectra
2. Ship motions
3. Response amplitude
4. Seakeeping criteria

Assessment: CA 30 / Exam 70

Recommended texts: Departmental reading list, to be confirmed

MEC 505 Advanced Corrosion Engineering

Units: 3 | Year 5, Semester 9 (First semester)

Description. Advanced corrosion mechanisms and prediction.

Learning outcomes:

- Predict corrosion rates
- Evaluate corrosion-resistant alloys

Course topics:

1. Corrosion prediction
2. Stress corrosion cracking
3. Alloy selection
4. Monitoring

Assessment: CA 30 / Exam 70

Recommended texts: Jones (latest edition)

MEC 506 Advanced Materials Selection

Units: 2 | Year 5, Semester 9 (First semester)

Description. Systematic materials selection for engineering design.

Learning outcomes:

- Apply material selection charts and indices
- Justify material choices

Course topics:

1. Selection charts
2. Indices
3. Trade-offs
4. Justification

Assessment: CA 40 / Exam 60

Recommended texts: Ashby, Materials Selection in Mechanical Design (latest edition)

MEC 507 Research Project II

Units: 3 | Year 5, Semester 9 (First semester)

Description. Execution, analysis and reporting of the final-year project.

Learning outcomes:

- Execute a research project
- Report findings professionally

Course topics:

1. Data collection
2. Analysis
3. Writing
4. Oral presentation

Assessment: Project 100

Recommended texts: Supervisor guidance and departmental guide

MEC 508 Technical Elective I

Units: 2 | Year 5, Semester 9 (First semester)

Description. Elective from the approved mechanical engineering list.

Learning outcomes:

- Apply specialist knowledge in the chosen area
- Evaluate case studies

Course topics:

1. Selected topic
2. Case studies
3. Applications
4. Review

Assessment: CA 40 / Exam 60

Recommended texts: As specified for the chosen elective

MEC 509 Integrated Mechanical Systems Design

Units: 3 | Year 5, Semester 10 (Second semester)

Description. Capstone design of an integrated mechanical system.

Learning outcomes:

- Integrate mechanical, thermal and control subsystems
- Produce a coordinated design

Course topics:

1. System integration
2. Design documentation
3. Testing
4. Review

Assessment: Design project 100

Recommended texts: Departmental design brief

MEC 510 Manufacturing Systems Design

Units: 2 | Year 5, Semester 10 (Second semester)

Description. Layout and design of manufacturing systems.

Learning outcomes:

- Design manufacturing cells and layouts
- Evaluate system performance

Course topics:

1. Cell design
2. Layout
3. Capacity
4. Performance evaluation

Assessment: CA 40 / Exam 60

Recommended texts: Departmental reading list, to be confirmed

MEC 511 Marine Vessel Construction and Survey

Units: 2 | Year 5, Semester 10 (Second semester)

Description. Construction, outfitting and survey of marine vessels.

Learning outcomes:

- Plan vessel construction
- Describe survey requirements

Course topics:

1. Construction sequence
2. Outfitting
3. Survey
4. Classification

Assessment: CA 40 / Exam 60

Recommended texts: Departmental reading list, to be confirmed

MEC 512 Asset Integrity and Corrosion Management

Units: 2 | Year 5, Semester 10 (Second semester)

Description. Management of corrosion and integrity of plant and structures.

Learning outcomes:

- Plan integrity management
- Assess corrosion risk

Course topics:

1. Integrity management
2. Inspection planning
3. Risk-based inspection
4. Corrosion monitoring

Assessment: CA 40 / Exam 60

Recommended texts: Departmental reading list, to be confirmed

MEC 513 Engineering Professional Practice and Ethics

Units: 2 | Year 5, Semester 10 (Second semester)

Description. Professional conduct, registration and engineering law.

Learning outcomes:

- Apply professional ethics
- Describe registration and legal responsibilities

Course topics:

1. Ethics
2. Professional bodies
3. Registration
4. Engineering law

Assessment: CA 50 / Exam 50

Recommended texts: Departmental reading list, to be confirmed

MEC 514 Environmental Impact and Sustainability

Units: 2 | Year 5, Semester 10 (Second semester)

Description. Environmental assessment of mechanical and marine systems.

Learning outcomes:

- Assess environmental impacts
- Apply sustainability criteria

Course topics:

1. Impact assessment
2. Lifecycle
3. Emissions
4. Sustainability criteria

Assessment: CA 40 / Exam 60

Recommended texts: Departmental reading list, to be confirmed

MEC 515 Final-Year Design Project and Defence

Units: 4 | Year 5, Semester 10 (Second semester)

Description. Culminating integrated design project with defence.

Learning outcomes:

- Produce a complete design project
- Defend design decisions orally

Course topics:

1. Design development
2. Documentation
3. Presentation
4. Defence

Assessment: Project 60 / Defence 40

Recommended texts: Departmental project guide

MEC 516 Technical Elective II

Units: 2 | Year 5, Semester 10 (Second semester)

Description. Second elective from the approved mechanical engineering list.

Learning outcomes:

- Apply specialist knowledge in the chosen area
- Evaluate case studies

Course topics:

1. Selected topic
2. Case studies
3. Applications
4. Review

Assessment: CA 40 / Exam 60

Recommended texts: As specified for the chosen elective

5. Industrial Training (SIWES)

- SIWES is taken in Year 4, Semester 8, for 3 units.
- Keep a daily or weekly logbook that records tasks, supervision and what you learned.
- Obtain the placement letter and supervisor details before you start.
- Your final report and assessor's evaluation are part of your assessment.
- Follow the Industrial Training Fund and AOU SIWES guidelines throughout.

6. Assessment and Academic Regulations

Assessment follows the university's approved academic regulations, which govern grading, attendance, progression, carry-over and classification. This summary does not replace those regulations.

- Continuous assessment (CA) is set by course. Examinations form the remainder unless a course states otherwise.
- Practical and laboratory courses are assessed on reports, practical work and, where stated, a viva.
- Design projects and the final-year defence are assessed by a panel using published rubrics.
- Report any missed assessment through the department as soon as possible, with supporting evidence.
- Grading and classification are as set out in the regulations: [insert AOU grading table].

7. Student Support and Conduct

- **Academic advising:** each student is assigned an adviser. Meet your adviser at least once a semester.
- **Academic integrity:** plagiarism, falsified data and unauthorised collaboration are serious offences.
- **Respect and inclusion:** treat staff, colleagues and communities with dignity; report harassment through the appropriate channel.
- **Wellbeing:** seek help early from your adviser or the university welfare services.

8. Laboratory, Workshop and Field Safety

- Wear the prescribed personal protective equipment (PPE) in laboratories, workshops and on sites.
- Follow the instructions of the technician and lecturer. Never operate equipment you have not been trained to use.
- Report every accident, near miss and damaged equipment immediately.
- Machine guarding, rotating tools and coolants are hazards: use guards, fixed PPE and never clean moving parts.
- Welding, cutting and additive post-processing produce fumes and sparks: use extraction and the prescribed PPE.
- Corrosion and electrochemistry work uses acids, alkalis and electrolytes: store and dispose of them as the data sheets require.
- Boat-building and marine work involves lifting, working at height and confined spaces: follow the permit and lifting procedures.

9. Contacts

Role	Name	Contact
Head of Department	[to be inserted]	[to be inserted]
Programme coordinator	[to be inserted]	[to be inserted]
Level advisers	[to be inserted]	[to be inserted]
SIWES coordinator	[to be inserted]	[to be inserted]

Role	Name	Contact
Laboratory technical officer	[to be inserted]	[to be inserted]