AOU Electrical/Electronic Engineering — Lecturer Handbook (Part I)

B.Eng. · Mechatronics & Robotics track · COREN / Washington Accord · OBE

AKPAKIP ORO UNIVERSITY (AU)

Oro Nation, Akwa Ibom State, Nigeria

FACULTY OF ENGINEERING

DEPARTMENT OF ELECTRICAL/ELECTRONIC/MECHATRONIC/ROBOTIC ENGINEERING

LECTURER HANDBOOK

PART I

B.Eng. Electrical/Electronic Engineering

(with Mechatronics and Robotics Engineering Specialisation Track)

Teaching Schedule, Scheme of Work, Course-File and Outcome-Mapping Requirements

Curriculum Framework: NUC CCMAS + AU Institutional Curriculum, aligned to Washington Accord Graduate Attributes | Quality Framework: Outcome-Based Education (OBE)

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A. Quality Framework, Programme Educational Objectives and Programme Outcomes

A.1 Accreditation and Quality Framework

This handbook is prepared to meet the Nigerian Universities Commission (NUC) Core Curriculum and Minimum Academic Standards (CCMAS) for engineering programmes, and is additionally structured to align with international outcome-based accreditation conventions — including the twelve Washington Accord graduate attributes used by ABET, ECUK/Engineers Ireland, ECSA and comparable international accreditation bodies.

Delivery follows Outcome-Based Education (OBE): every course, weekly topic and assessment you set must be traceable to stated Course Learning Outcomes (CLOs) and, in aggregate, to the Programme Outcomes (POs) listed below. You are responsible for demonstrating this traceability in your course file (Section E).

A.2 Programme Educational Objectives (PEOs)

Within three to five years of graduation, graduates of the Department are expected to:

PEO1: Apply mathematical, scientific and engineering principles to identify, formulate and solve problems in electrical power, electronics, communications, control, mechatronics and robotics relevant to the Niger Delta, the Gulf of Guinea and the wider international engineering context.

PEO2: Pursue and attain professional registration and certification (COREN, IEEE, IET, or equivalent international bodies) and progress into engineering practice, research, or postgraduate study.

PEO3: Practise engineering with integrity, ethical judgement and leadership grounded in the Oro (Oron) Nation's and wider African cultural values of dignity, empathy, inclusion and justice.

PEO4: Design, automate and maintain reliable, efficient and sustainable electrical, electronic, control, mechatronic and robotic systems for industrial, energy and community applications.

PEO5: Engage in continuous, life-long learning, innovation and the responsible application of digital, AI-enabled and automation tools throughout a professional career.

A.3 Programme Outcomes (POs)

Your teaching, assessment design and CLOs must collectively build toward the following twelve outcomes:

No.

Outcome

Description

PO1

Engineering Knowledge

Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialisation to the solution of complex engineering problems.

PO2

Problem Analysis

Identify, formulate, research literature and analyse complex engineering problems, reaching substantiated conclusions.

PO3

Design/Development of Solutions

Design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health, safety, and the environment.

PO4

Investigation

Conduct investigations of complex problems using research-based knowledge and methods, including design of experiments, analysis and interpretation of data.

PO5

Modern Tool Usage

Create, select and apply appropriate techniques, resources and modern engineering and IT tools, including digital, AI-enabled and prediction tools, with an understanding of their limitations.

PO6

Engineer and Society

Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.

PO7

Environment and Sustainability

Understand the impact of professional engineering solutions on societal and environmental contexts and demonstrate knowledge of and need for sustainable development.

PO8

Ethics

Apply ethical principles and commit to professional ethics, responsibilities and norms of engineering practice.

PO9

Individual and Team Work

Function effectively as an individual and as a member or leader in diverse and multidisciplinary teams.

PO10

Communication

Communicate effectively on complex engineering activities, including preparing reports, design documentation, and giving and receiving clear instructions.

PO11

Project Management and Finance

Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work and in multidisciplinary environments.

PO12

Life-Long Learning

Recognise the need for and engage in independent and life-long learning in the broadest context of technological change.

A.4 How to Use This Handbook

Use the semester scheme in Part B as the minimum teaching framework for every course you teach, and develop a full course file per Section E.

A.5 Credit Unit and Grading Convention

One (1) credit unit is equivalent to one hour of lecture/tutorial contact per week, or two-to-three hours of laboratory/workshop contact per week, over a fifteen-week semester. Indicative total load is approximately 180-190 credit units; final unit-load balancing is subject to Faculty Board/Senate ratification. SIWES is Pass/Fail, no unit weight. Continuous assessment shall typically constitute 30-40% of the total course grade.

B.Eng. Electrical/Electronic Engineering

Incorporates Mechatronics and Robotics Engineering as a specialisation track within the Department of Electrical/Electronic/Mechatronic/Robotic Engineering.

Programme Emphasis

The programme develops engineers capable of designing, analysing and maintaining electrical power, electronics, communications, control, mechatronic and robotic systems, with particular attention to power and instrumentation needs of the Niger Delta's energy, maritime and

industrial base.

Curriculum Structure — Semester-by-Semester Summary

Semester

Level

Academic Theme

Semester 1

100 Level, First Semester

Engineering Foundation I

Semester 2

100 Level, Second Semester

Engineering Foundation II

Semester 3

200 Level, First Semester

Core Engineering Science and Circuits

Semester 4

200 Level, Second Semester

Application of Engineering Science

Semester 5

300 Level, First Semester

Professional Electrical Engineering Practice

Semester 6

300 Level, Second Semester

Control, Power and Embedded Systems

Semester 7

400 Level, First Semester

Specialised Electrical/Electronic Engineering Practice

Semester 8

400 Level, Second Semester

Industrial Application and Professional Integration

Semester 9

500 Level, First Semester

Engineering Management and Advanced Systems

Semester 10

500 Level, Second Semester

Integrated Engineering Design and Professional Readiness

Semester 1 — 100 Level, First Semester

Academic Theme: Engineering Foundation I

Registered Courses

Code

Course Title

Units

Status

Prerequisite

GST 101

Communication in English I

2

C

None

GST 103

Nigerian Peoples and Culture

2

C

None

CHM 101

General Chemistry I

3

C

None

EEE 101

Engineering in Society

1

C

None

EEE 103

Engineering Graphics and Solid Modelling I

2

C

None

MTH 101

Elementary Mathematics I

3

C

None

PHY 101

General Physics I

3

C

None

EEE 105

Introduction to Electrical/Electronic Engineering

2

C

None

Total Units This Semester

18

Weekly Teaching Scheme of Work

Weeks

Topics / Learning Activities

Weeks 1-2

Orientation; what electrical/electronic engineers do; engineering ethics.

Weeks 3-6

Elementary mathematics, vectors, and physics for electrical engineering.

Weeks 7-10

Chemistry and materials relevant to electrical engineering.

Weeks 11-13

Engineering graphics and solid modelling.

Weeks 14-15

Introduction to electrical/electronic engineering disciplines; revision.

Coursework Requirements

Mathematics problem sets

Physics laboratory report

Chemistry practical report

Engineering drawing portfolio

Career reflection essay

Semester Project: "My First Circuit"

Students build and test a simple DC circuit (e.g. an LED flasher) and present a short report.

Semester 2 — 100 Level, Second Semester

Academic Theme: Engineering Foundation II

Registered Courses

Code

Course Title

Units

Status

Prerequisite

GST 102

Communication in English II

2

C

GST 101

GST 104

Use of Library, Study Skills and ICT

1

C

None

MTH 102

Elementary Mathematics II

3

C

MTH 101

PHY 102

General Physics II

3

C

PHY 101

CHM 102

General Chemistry II (Materials Chemistry)

2

C

CHM 101

EEE 104

Engineering Graphics and Solid Modelling II

2

C

EEE 103

EEE 106

Electrical Circuits I (DC Circuits)

2

C

PHY 101

EEE 108

Introduction to Digital Logic

2

C

None

EEE 110

Workshop Practice

1

C

None

Total Units This Semester

18

Weekly Teaching Scheme of Work

Weeks

Topics / Learning Activities

Focus

DC circuit analysis (Ohm's and Kirchhoff's laws); introductory digital logic (gates, Boolean algebra); engineering graphics; workshop safety and practice.

Coursework Requirements

DC circuits lab report

Digital logic exercise

CAD portfolio

Workshop logbook

Semester Project: "Semester Output"

Portfolio demonstrating basic circuits, digital logic and drawing skills.

Semester 3 — 200 Level, First Semester

Academic Theme: Core Engineering Science and Circuits

Registered Courses

Code

Course Title

Units

Status

Prerequisite

GST 201

Entrepreneurship Studies I

2

C

None

MTH 201

Engineering Mathematics III

3

C

MTH 102

EEE 201

Electrical Circuits II (AC Circuits)

3

C

EEE 106

EEE 203

Electronics I (Semiconductor Devices)

3

C

PHY 102

EEE 205

Engineering Materials

2

C

CHM 102

CSC 201

Computing and Programming for Engineers

2

C

None

EEE 207

Electromagnetic Fields I

3

C

MTH 201

EEE 291

SIWES I

0

C

Pass/Fail, logged

Total Units This Semester

18

Weekly Teaching Scheme of Work

Weeks

Topics / Learning Activities

Focus

AC circuit analysis (phasors, impedance, resonance); diodes and transistors; engineering materials; introductory programming (C/Python/MATLAB); electromagnetic field fundamentals.

Coursework Requirements

AC circuits lab report

Semiconductor devices lab

Materials report

Programming assignment

Field theory problem sets

SIWES

Students begin structured industrial exposure (SIWES) in accordance with the approved SIWES arrangement.

Semester 4 — 200 Level, Second Semester

Academic Theme: Application of Engineering Science

Registered Courses

Code

Course Title

Units

Status

Prerequisite

MTH 202

Engineering Mathematics IV

3

C

MTH 201

EEE 202

Electronics II (Analog Circuits)

3

C

EEE 203

EEE 204

Digital Electronics and Logic Design

3

C

EEE 108

EEE 206

Electrical Measurements and Instrumentation

2

C

EEE 201

EEE 208

Signals and Systems

3

C

MTH 202

EEE 210

Engineering Computing (MATLAB/Simulink)

2

C

CSC 201

GST 202

Entrepreneurship Studies II

2

C

GST 201

Total Units This Semester

18

Weekly Teaching Scheme of Work

Weeks

Topics / Learning Activities

Focus

Analog amplifier circuits; combinational and sequential digital logic; measurement instruments; signals and systems (Laplace/Fourier); MATLAB/Simulink modelling.

Coursework Requirements

Analog electronics lab report

Digital logic design project

Instrumentation report

Signals assignment

MATLAB exercise

Semester Project: "Mini Project — Instrumentation Amplifier Circuit"

Design, build and test an instrumentation amplifier circuit with a short technical report.

Semester 5 — 300 Level, First Semester

Academic Theme: Professional Electrical Engineering Practice

Registered Courses

Code

Course Title

Units

Status

Prerequisite

EEE 301

Control Systems I

3

C

EEE 208

EEE 303

Power Systems I (Generation and Transmission)

3

C

EEE 201

EEE 305

Microprocessors and Microcontrollers

3

C

EEE 204

EEE 307

Communication Systems I

3

C

EEE 208

EEE 309

Electromagnetic Fields II

2

C

EEE 207

MTH 301

Engineering Mathematics V (Statistics and Numerical Methods)

3

C

MTH 202

EEE 311

Engineering Communication

1

C

GST 102

EEE 391

SIWES II

0

C

Pass/Fail, logged

Total Units This Semester

18

Weekly Teaching Scheme of Work

Weeks

Topics / Learning Activities

Focus

Classical control (transfer functions, block diagrams, stability); power generation and transmission fundamentals; microcontroller programming; analog/digital communication fundamentals; electromagnetic wave propagation.

Coursework Requirements

Control systems assignment

Power systems problem sets

Microcontroller project

Communication systems lab

Statistics project

Semester 6 — 300 Level, Second Semester

Academic Theme: Control, Power and Embedded Systems

Registered Courses

Code

Course Title

Units

Status

Prerequisite

EEE 302

Control Systems II

3

C

EEE 301

EEE 304

Power Systems II (Distribution and Protection)

3

C

EEE 303

EEE 306

Embedded Systems Design

3

C

EEE 305

EEE 308

Communication Systems II (Digital Communications)

3

C

EEE 307

EEE 310

Introduction to Mechatronics and Robotics

2

C

None

EEE-E1

Specialisation Elective (choose one; see options below)

3

E

Varies

Total Units This Semester

17

Specialisation / Pathway Options

Code

Option Title

EET-A01

Power Systems Analysis and Protection

EET-B01

Electronics and Communication Fundamentals

EET-C01

Mechatronics and Robotics Fundamentals

EET-D01

Control and Instrumentation Fundamentals

Weekly Teaching Scheme of Work

Weeks

Topics / Learning Activities

Focus

State-space control; power distribution networks and protection devices; embedded systems design and programming; digital modulation techniques; introductory robotics and mechatronic system integration.

Coursework Requirements

Control systems design project

Protection coordination exercise

Embedded systems project

Digital communications lab

Mechatronics case study

Semester Project: "Introductory Mechatronic System"

Students design and demonstrate a simple sensor-actuator mechatronic system (e.g. a line-following device).

Semester 7 — 400 Level, First Semester

Academic Theme: Specialised Electrical/Electronic Engineering Practice

Students formally declare one specialisation pathway at the start of Semester 7, carried through Semester 8: (A) Power Systems Engineering, (B) Electronics and Communication Engineering, (C) Mechatronics and Robotics Engineering, or (D) Control and Instrumentation Engineering.

Registered Courses

Code

Course Title

Units

Status

Prerequisite

EEE 401

Advanced Control Systems

3

C

EEE 302

EEE 403

Power Electronics

3

C

EEE 304

EEE 405

Professional Practice and Engineering Ethics

1

C

None

EEE 407

Research Methods and Project Proposal

2

C

None

EEE 409

Renewable Energy Systems

2

C

EEE 303

EEE 411

AI, Machine Learning and Convergent Technologies in Engineering

2

C

CSC 201

EEE-P1

Pathway Course (choose track A, B, C or D)

3

E

Declared pathway

Total Units This Semester

16

Specialisation / Pathway Options

Code

Option Title

A - EEE 413

High Voltage Engineering and Protection

B - EEE 415

RF and Wireless Communication Systems

C - EEE 417

Robotics: Kinematics, Dynamics and Control

D - EEE 419

Industrial Instrumentation and SCADA Systems

Weekly Teaching Scheme of Work

Weeks

Topics / Learning Activities

Fieldwork

At least one supervised engineering field exercise (power station, telecom facility, or automation plant) shall be undertaken.

Coursework Requirements

Advanced control design project

Power electronics lab

Renewable energy case study

Research proposal

Pathway case study report

Semester 8 — 400 Level, Second Semester

Academic Theme: Industrial Application and Professional Integration

Registered Courses

Code

Course Title

Units

Status

Prerequisite

EEE 402

Power System Operation and Stability

3

C

EEE 401

EEE 404

VLSI and Digital System Design

3

C

EEE 306

EEE 406

Engineering Law

2

C

None

EEE 408

Engineering Project Management

2

C

None

EEE 410

Research Methodology and Project Proposal II

2

C

EEE 407

EEE-P2

Pathway Course (continuation of declared track)

3

E

Declared pathway

Total Units This Semester

15

Specialisation / Pathway Options

Code

Option Title

A - EEE 412

Power Plant Instrumentation and Control

B - EEE 414

Optical and Satellite Communication

C - EEE 416

Robot Programming and Automation Systems

D - EEE 418

SCADA, PLC and Industrial Automation

Weekly Teaching Scheme of Work

Weeks

Topics / Learning Activities

Output

Each student prepares a preliminary final-year project proposal containing a problem statement, literature review, objectives, methodology, expected results, work programme and preliminary budget.

Coursework Requirements

Power system stability assignment

Digital system design project

Engineering law case study

Project proposal

Semester 9 — 500 Level, First Semester

Academic Theme: Engineering Management and Advanced Systems

Registered Courses

Code

Course Title

Units

Status

Prerequisite

EEE 501

Engineering Project Management II

2

C

EEE 408

EEE 503

Engineering Law and Professional Practice II

2

C

EEE 406

EEE 505

Electrical Machines and Drives

3

C

EEE 403

EEE 507

Final Year Project I (Proposal, Literature Review and Methodology)

3

C

EEE 410

EEE-E2

AU Specialist Elective I

3

E

Declared pathway

EEE-E3

AU Specialist Elective II

3

E

Declared pathway

Total Units This Semester

16

Weekly Teaching Scheme of Work

Weeks

Topics / Learning Activities

Project Phase I

Proposal approval; literature review; design methodology; data collection; preliminary analysis.

Coursework Requirements

Electrical machines lab report

Project proposal

Project management plan

Engineering law case study

Semester 10 — 500 Level, Second Semester

Academic Theme: Integrated Engineering Design and Professional Readiness

Registered Courses

Code

Course Title

Units

Status

Prerequisite

EEE 599

Final Year Project II (Design, Analysis and Defence)

6

C

EEE 507

EEE 502

Seminar in Electrical/Electronic Engineering

1

C

None

EEE 504

Professional Practice, Ethics and Engineering Registration

2

C

EEE 503

EEE-E4

AU Specialist Elective III

3

E

Declared pathway

EEE-E5

AU Specialist Elective IV

3

E

Declared pathway

Total Units This Semester

15

Weekly Teaching Scheme of Work

Weeks

Topics / Learning Activities

Requirements

Complete technical investigation; produce engineering design; conduct analysis/simulation where appropriate; produce drawings/prototype; prepare technical report; defend project before a panel; submit corrected final copy.

Graduation Portfolio Requirements

Transcript

Project report

Project drawings/prototype

Laboratory/field reports

SIWES evidence

Professional development record

Selected coursework portfolio

D. Common Teaching and Assessment Schedule

A normal fifteen-week teaching semester shall generally follow:

Week(s)	Activity
Week 1	Orientation / course introduction.
Weeks 2-5	Core theory and guided tutorials.
Week 6	Continuous assessment / test.
Weeks 7-10	Advanced theory plus laboratory/workshop/field activities.
Week 11	Practical/coursework assessment.
Weeks 12-13	Integrated problem-solving/design work.
Week 14	Revision and project presentation.
Week 15	Final revision / course completion.
Examination period	As separately published by the University.

D.1 Coursework Principle

Every technical course should normally contain a balanced combination of individual assignments, group problem-solving, tutorials, laboratory/workshop work, fieldwork where appropriate, quizzes/tests, design exercises, technical reports and presentations. Lecturers shall not rely exclusively on final examinations.

E. Lecturer Course-File Requirement

For every course, you shall compile and maintain a course file containing:

Course specification (aims, CLOs, credit load, contact hours).

Course Learning Outcomes (CLOs), mapped to Programme Outcomes (PO1-PO12).

Weekly scheme of work.

Lecture materials.

Tutorial questions.

Practical/laboratory manual, where applicable.

Assignment questions.

Quiz/test instruments.

Examination paper.

Marking scheme.

Attendance record.

Student feedback.

CLO attainment analysis.

PO mapping evidence.

Course review report.

F. Student Weekly Study Model (For Lecturer Awareness)

Students are expected to plan their week across lectures, tutorials, practical work, independent study, coursework and group work, and to maintain a personal Engineering Learning Portfolio across the ten semesters.

Appendix I: Course Learning Outcome (CLO) to Programme Outcome (PO) Mapping — Template and Worked Example

Every course specification in your course file (Section E) must include a CLO-PO mapping matrix of this form. A worked example is provided below.

Worked Example — EEE 401: Advanced Control Systems

Course Learning Outcome

Mapped Programme Outcome(s)

CLO1: Model dynamic systems using state-space and transfer-function representations.

PO1, PO2

CLO2: Design and tune controllers to meet stability and performance specifications.

PO2, PO3, PO5

CLO3: Simulate and validate control system designs using appropriate software tools.

PO4, PO5

CLO4: Communicate control system design decisions in a professional technical report.

PO10, PO11

Appendix II: Course Specification Template

Use this template as the first page of every course file (Section E):

Course Code and Title:

Credit Units / Status (Core or Elective):

Pre-requisite(s):

Level and Semester:

Course Aim(s):

Course Learning Outcomes (CLO1-CLOn):

CLO-to-PO Mapping Matrix (see Appendix I):

Weekly Topics (15-week scheme):

Teaching Methods (lecture/tutorial/laboratory/fieldwork ratio):

Assessment Breakdown (continuous assessment % / examination %):

Recommended Textbooks and References:

Required Equipment/Software/Laboratory Facilities:

Appendix III: Recommended Textbooks and References

This master reading list supports the 'Recommended Textbooks and References' field of the Course Specification Template (Appendix II).

Appendix III.1 — B.Eng. Electrical/Electronic Engineering (including Mechatronics and Robotics Track)

Mathematics and Physics

Stroud, K.A. and Booth, D.J. — Engineering Mathematics, Palgrave Macmillan.

Kreyszig, E. — Advanced Engineering Mathematics, Wiley.

Halliday, D., Resnick, R. and Walker, J. — Fundamentals of Physics, Wiley.

Circuits and Electronics

Sadiku, M.N.O. and Alexander, C.K. — Fundamentals of Electric Circuits, McGraw-Hill.

Boylestad, R.L. — Introductory Circuit Analysis, Pearson.

Sedra, A.S. and Smith, K.C. — Microelectronic Circuits, Oxford University Press.

Boylestad, R.L. and Nashelsky, L. — Electronic Devices and Circuit Theory, Pearson.

Electromagnetics

Sadiku, M.N.O. — Elements of Electromagnetics, Oxford University Press.

Hayt, W.H. and Buck, J.A. — Engineering Electromagnetics, McGraw-Hill.

Power Systems and Power Electronics

Glover, J.D., Sarma, M.S. and Overbye, T.J. — Power System Analysis and Design, Cengage.

Wadhwa, C.L. — Electrical Power Systems, New Age International.

Rashid, M.H. — Power Electronics: Circuits, Devices and Applications, Pearson.

Control Systems and Instrumentation

Ogata, K. — Modern Control Engineering, Pearson.

Nise, N.S. — Control Systems Engineering, Wiley.

Digital Systems, Microprocessors and Embedded Systems

Mano, M.M. and Ciletti, M.D. — Digital Design, Pearson.

Mazidi, M.A., Mazidi, J.G. and McKinlay, R.D. — The 8051 Microcontroller and Embedded Systems, Pearson.

Communication Systems

Haykin, S. — Communication Systems, Wiley.

Proakis, J.G. and Salehi, M. — Digital Communications, McGraw-Hill.

Mechatronics and Robotics (Specialisation Track)

Bolton, W. — Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, Pearson.

Craig, J.J. — Introduction to Robotics: Mechanics and Control, Pearson.

Siciliano, B., Sciavicco, L., Villani, L. and Oriolo, G. — Robotics: Modelling, Planning and Control, Springer.

Renewable Energy and Sustainability

Masters, G.M. — Renewable and Efficient Electric Power Systems, Wiley.

Engineering Project Management and Professional Practice

Kerzner, H. — Project Management: A Systems Approach to Planning, Scheduling and Controlling, Wiley.

COREN — Code of Conduct for Engineering Practitioners in Nigeria (current edition).