Surigao City Campus

Bachelor of Science in Electrical Engineering

SURIGAO STATE COLLEGE OF TECHNOLOGY


SSCT

"For Nation's Greater Heights"

I.4.3. development of software for power system analysis and design;

**COLLEGE OF ENGINEERING AND INFORMATION TECHNOLOGY**
City Campus
SecondSemester, Academic Year 2021-2022

**Outcomes Based-Education (OBE) Syllabus in EE 431**
**Power Systems Analysis**
Course Credit: 4.0 units **(108hrs)**

**Institutional Vision, Mission, and Goals**

**Vision:**
An innovative and technologically-advanced State College in Caraga.

**Mission:**
To provide relevant,

a. high quality and sustainable instruction,
b. research, production and extension programs and
c. services within a culture of credible and responsive institutional governance.

**Goals:**

1. Foster application of the discipline and provide its learner with industry-based training and education particularly in engineering, technology and fisheries.
2. Conduct and utilize studies for the development of new products, systems and services relevant to Philippine life and of the global village.
3. Promote transfer of technology and spread useful technical skills, thus empowering its learners and their activities.

**SSCT Core Values**

**S**ervice-Oriented **S**ocially Responsive **C**ommitted Transformational

**SSCT Quality Policy**

Surigao State College of Technology provides quality instruction, research, extension programs and production services to satisfy its customers by responding to their needs and expectations and continually improving its quality management system.

**Institutional Graduate Attributes (IGA)** :

- Visionary Leader
- Effective Communicator
- Competent Technologist
- Self-Directed Lifelong Learner

**Program Goals**

The Electrical Engineering program aims to design and apply the generation, transmission, and distribution of electrical energy to produce competent engineers that exhibit positive work ethics and flexibility in work conditions for the development of Caraga.

**ProgramEducational Objectives (PEO) and Relationship to Institutional Mission**

| Program Educational Objectives (PEO) | Mission | | |
|---|---|---|---|
| | a | b | c |
| EE-PEO1. Demonstrate professionalism in electrical engineering and apply professional ethics thru communication and collaboration. | / | / | / |
| EE-PEO2. Use appropriate techniques, resources, and modern tools necessary for analysis, design, and modeling of complex electrical systems | / | / | / |
| EE-PEO3. Plan, lead, and implement designated tasks, interact with other engineering professionals, and take leadership roles in electrical engineering organization. | / | / | / |
| EE-PEO4. Engage in lifelong learning able to discover new opportunities for continuing personal and professional development in electrical engineering | / | / | / |

**Program Outcomes (PO) and Relationship to Program Educational Objectives (PEO)**

| Program Outcomes (PO) | Program Educational Objectives (PEO) | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| EE-POa.Apply knowledge of mathematics and sciences to solve complex engineering problems | | | | |
| EE-POb.Develop and conduct appropriate experimentation, analyze and interpret data | | | | |
| EE-POc.Design a system, component, or process to meet desired needs within | / | / | / | / |

| | | | | |
|---|---|---|---|---|
| realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability, in accordance with standards | | | | |
| EE-POd.Function effectively on multi-disciplinary and multi-cultural teams that establish goals, plan tasks, and meet deadlines | | | | |
| EE-POe.Identify, formulate, and solve complex problems in electrical engineering | / | / | / | / |
| EE-POf.Recognize ethical and professional responsibilities in engineering practice | | | | |
| EE-POg.Communicate effectively with a range of audiences | / | / | / | / |
| EE-POh.Understand the impact of engineering solutions in a global, economic, environmental, and societal context | | | | |
| EE-POi.Recognize the need for additional knowledge and engage in lifelong learning | | | | |
| EE-POj.Articulate and discuss the latest developments in the field of electrical engineering | / | / | / | / |
| EE-POk.Apply techniques, skills, and modern engineering tools necessary for electrical engineering practice | / | / | / | / |
| EE-POl.Demonstrate knowledge and understanding of engineering and management principles as a member and/or leader in a team to manage projects in multidisciplinary environments | | | | |

**Course Description**

This course deals with the study on the basic structure of power systems, recent trends and innovations in power systems, transmission line parameters, network modeling and calculations, load flow studies, short circuit calculations and use of computer software for simulation.

**DACUM Main Duties (DMD)**

EE-DMD1. Diagnose electrical problems using the electrical diagrams or blue print (as built electrical plans)
EE-DMD2. Install, repair, and maintenance electrical power systems( building wiring, controls, electrical machines and transformers)
EE-DMD3. Facilities Manager
EE-DMD4. Power Plant Manager
EE-DMD5. Electrical Researchers, Professor and Faculty

**Course Outcomes (CO) and Relationship to Program Outcomes (PO)**

| Program Outcome (PO) /Level | Course Outcomes (CO) | Assessment Task (CO-AT) | DACUM Links | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 |
| EE-POc(Enabling).Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability, in accordance with standards. | *EE431-CO1*: Design and Create computational models for analysis power systems and able to understand per unit system. | Students conduct electrical engineering simulations. These simulations serve as a group activity where they will analyze and design a power system.<br><br>Criteria – Functionality and lab report<br><br>Total Points: 100 points | / | | / | / | / |
| EE-POe(Enabling). Identify, formulate, and solve complex problems in electrical engineering. | *EE431-CO2*: Calculate complex electrical engineering problems related to mathematical description and use of symmetrical component theory. | Students calculate sets of electrical engineering problems using the mathematical description of symmetrical component theory.<br>Criteria – 70% correct answers and solutions<br>Total Points: 100 points | / | | | | / |
| EE-POg(Enabling).Communicate effectively with a range of audiences | *EE431-CO3*: Communicate effectively with the team, group or other range of audiences when conducting reports and presentations. | Students create a design and present them in the class.<br>Criteria – creativity, functionality, delivery<br>Total Points: 100 points | | | / | / | / |
| EE-POj.(Enabling).Articulate and discuss the latest developments in the field of | *EE431-CO4*:Discuss and articulate with the team or group the latest | Students present and discuss the power system design. | | | / | / | / |

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| electrical engineering | developments in the power system. | Criteria - functionality and delivery<br>Total Points: 100 points | | | | | |
| EE-POk.(Demonstrates). Apply techniques, skills, and modern engineering tools necessary for electrical engineering practice | *EE431-CO5*:Apply simulation tools to perform comprehensive short circuit studies, load flow studies, and optimal power flow studies. | Students conduct electrical engineering simulations. These simulations serve as a group activity where they will analyze and design a power system.<br>Criteria – Functionality and lab report<br>Total Points: 100 points | / | | / | / | / |

**Course Outcomes (CO) and Relationship to Intended Learning Outcomes (ILO)**

| Course Outcomes (CO) | Intended Learning Outcomes (ILO) |
|---|---|
| *EE431-CO1*: Design and Create computational models for analysis power systems and able to understand per unit system.<br><br>*EE431-CO2*: Calculate complex electrical engineering problems related to mathematical description and use of symmetrical component theory.<br><br>*EE431-CO3*: Communicate effectively with the team, group or other range of audiences when conducting reports and presentations.<br><br>*EE431-CO4*:Discuss and articulate with the team or group the latest developments in the power | *EE431-ILO1*: Define the basic concepts of Power system analysis, power system units, and power system elements and calculate problems utilizing these concepts.<br><br>*EE431-ILO2*: Analyze power system operation and stability control.<br><br>*EE431-ILO3*: Apply modelling of generators, transformers, lines and cables in positive, negative, and zero sequence systems.<br><br>*EE431-ILO4*: Analyze and use power system models based on nodal admittance and impedance matrices for the analysis of large-scale power networks. |

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| system<br><br>*EE431-CO5*:Apply simulation tools to perform comprehensive short circuit studies, load flow studies, and optimal power flow studies. | *EE431-ILO5*: Describe the behaviors of inductors and capacitors when combined in parallel and series.<br><br>*EE431-ILO6*:<br>Understand Positive Sequence, Negative & zero sequence system and fault analysis. |

**Detailed Course Content**

| Intended Learning Outcomes (ILO) | Topics | Time Frame | Teaching and Learning Activities(TLA) | Assessment Tasks (ILO-AT) | Target | Resources | Values Integration | Remarks |
|---|---|---|---|---|---|---|---|---|
| *EE431-ILO1*: Define the basic concepts of Power system analysis, power system units, and power system elements and calculate problems utilizing these concepts. (EE431-CO3, EE431-CO4) | **1. Elements of Power System Analysis**<br>*1.1. Fundamentals of Power Systems*<br>*1.2. Line Constants calculation*<br>*1.3. Capacitance of Transmission lines*<br>*1.4. Circuit Elements*<br>*1.5. Applications* | 9.0 hrs. lec | Learning Module 1 *Asynchronous* | Problem solving quiz on the elements of power system analysis. | 70% of the students shall have a rating of at least 3.0 | Modules, e-books, textbooks, and worksheets | Core Value: *Committed*<br><br>Sub-Value: *Determined in learning the basic concepts of electric circuits* | |
| *EE431-ILO2*: Analyze power system operation and stability control. (EE431-CO1, EE431-CO2, EE431-CO5) | **2. Economic operation of power systems**<br>*2.1. Performance of Lines*<br>*2.2. High Voltage DC Transmission*<br>*2.3. Corona* | 9.0 hrs.lec/ 10.0 hrs. lab | Learning Module 2 *Asynchronous* | Problem solving quiz on the Economic operation of power system. | 70% of the students shall have a rating of at least 3.0 | Videos online, modules, e-books,Multisim software, and worksheets | Core Value: *Committed*<br><br>Sub-Value: *Determined in learning the basic laws to solve basic electric circuits* | |

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|---|---|---|---|---|---|---|---|---|
| *EE431-ILO3*: Apply modelling of generators, transformers, lines and cables in positive, negative, and zero sequence systems. (EE431-CO1, EE431-CO2, EE431-CO5) | **3. Modelling power system components**<br>*3.1. Mechanical Design of Transmission Lines*<br>*3.2. Overhead Line Insulators*<br>*3.3. Insulated Cables* | 9.0 hrs.lec./ 15.0 hrs. lab | Learning Module 3 *Asynchronous* | Designing a power system models. | 70% of the students shall have a rating of at least 3.0 | Videos online, modules, e-books,Multisim software, and worksheets | Core Value: *Committed*<br><br>Sub-Value: *Dedicated in solving linear electrical circuits using nodal and mesh analysis* | |
| **MIDTERM EXAMINATION– 2.0 Hrs.** | | | | | | | | |
| *EE431-ILO4*: Analyze and use power system models based on nodal admittance and impedance matrices for the analysis of large-scale power networks. (EE431-CO1, EE431-CO2, EE431-CO5) | **4. Load flow analysis**<br>*4.1. Voltage Control*<br>*4.2. Neutral Grounding*<br>*4.3. Transients in Power System* | 8.0 hrs.lec / 10.0 hrs. lab | Learning Module 4 *Asynchronous* | Problem solving quiz on the load flow in the power system. | 70% of the students shall have a rating of at least 3.0 | Videos online, modules, e-books,Multisim software, and worksheets | Core Value: *Committed*<br><br>Sub-Value: *Perseverant in learning new concepts* | |
| *EE431-ILO5*: Understand Positive Sequence, Negative & zero sequence system and fault analysis.(EE431-CO1, EE431-CO2, EE431-CO5) | **5. Short circuit analysis and calculations**<br>*5.1. Symmetrical Components and Fault Calculations* | 8.0 hrs.lec / 10.0 hrs. lab | Learning Module 5 *Asynchronous* | Problem solving quiz on the fault current in the power system. | 70% of the students shall have a rating of at least 3.0 | Modules, e-books,Multisim software, and worksheets | Core Value: *Transformational*<br><br>Sub-Value: *Optimistic in analysing first-order RL and RC circuits* | |

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| *EE431-ILO6*: Recommend what protection device will be used in the power system. (EE431-CO1, EE431-CO2, EE431-CO5) | **6. Power system protection: selection and coordination of protection system**<br>*6.1. Protective relays*<br>*6.2. Circuit Breakers*<br>*6.3. Insulation Coordination and Overvoltage Protection* | 7.0 hrs.lec / 5.0 hrs. lab | Learning Module 6 *Asynchronous* | Designing the protection system of a given power system. | 70% of the students shall have a rating of at least 3.0 | Modules, e-books,Multisim software, and worksheets | Core Value: *Confidence*<br><br>Sub-Value: ability to communicate effectively to professionals and non-specialists alike through reports and presentations. | |
| **FINAL EXAMINATION – 2.0 Hrs.** | | | | | | | | |

**References:**

*Textbooks*

J. Duncan Glover, Mulukutla S. Sarma& Thomas J. Overbye (2016), Power System Analysis & Design, 5th ed.,
Charles Alexander & Matthew Sadiku (2016).*Fundamentals of Electric Circuits*.6th ed. McGraw-Hill Education
William H. Hayt, Jr. et. al(2012).*Engineering Circuit Analysis*.8th ed.McGraw-Hill

**Course Requirements:**

- Laboratory Reports(CO-AT1)
- Problem Sets(CO-AT2)
- Group Project(CO-AT3)
- Quizzes and Assignments
- Midterm and Final exams

**Course Evaluation:**

| Criteria | Lecture Grade |
|---|---|

- Quizzesand online outputs/interaction (ILO-AT) 20%
- Performance Tasks (CO-AT) 40%
- Major Exams (Midterm and Final) 40%

**TOTAL 100%**

Grade Computation: $\frac{Midterm\ Grade + Final\ Grade}{2} = Average\ Grade$

| Grade Point | Description |
|---|---|
| 1.0 | Excellent |
| 1.5 – 1.1 | Very Good |
| 2.0 – 1.6 | Highly Satisfactory |
| 2.5 – 2.1 | Good |
| 2.9 – 2.6 | Satisfactory |
| 3.0 | Passing |
| 5.0 | Failed due to poor performance, absences, withdrawal without notice |
| DRP | Dropped with approved dropping slip |
| INC | Incomplete requirements but w/ passing class standing. INC is for non-graduating students only |
| NG | No Grade |

Source: *SSCT Student Handbook*

**Course Policies:**

1. Attendance shall be checked in every class session in the Google Meet. This is to monitor the absences incurred by the students in terms of the allowable number of absences for a course as stipulated in the Student Handbook.
2. During online classes, video camera shall be turned on all the time and microphone shall be turned off. The microphone shall be unmuted only if the student's name is called to participate in class discussion.
3. Major examinations in multiple-choice type shall be done online. For problem solving type, detailed solutions shall be written legibly in separate sheets of paper and shall be converted to pdf form prior to submission.
4. Cheating in major examinations which include attempts to defraud, deceive, or mislead the instructor in arriving at an honest assessment shall entail zero score.

5. Plagiarism which is a form of cheating that involves presenting the ideas or work of another as one's own work shall entail zero score.
6. Projects shall be submitted on or before the deadline. Students who submit unsatisfactory projects shall be given the chance to improve their works on the condition that they resubmit the revised outputs on the date set by the instructor. Non-submission of a project on the deadline shall entail zero score.
7. An INC grade shall be given to students who fail to submit the course requirements of at least 95% of the projects and quizzes or failure to take the major examinations.

**Revision History:**

| Revision No. | Revised by | Date of Revision | Date of Implementation | Highlight of Revision |
|---|---|---|---|---|
| 1 | Engr. Vernon V. Liza | August 2019 | August 2019 | Followed OBTL Format as per CMO #101 S. 2017 |
| 2 | Engr. Andy Bong F. Navarro | July 19, 2021 | August 23, 2021 | DACUM Workshop vis-à-vis CMO No. 101 S. 2017 |
| | | | | |

Prepared by:

**ENGR. ANDY BONG F. NAVARRO**
Guest Lecturer

Date: 1-25-2022

Checked and reviewed by:

**ENGR. VICENTE Z. DELANTE**
Program Chair, BSEE

Date: 1-28-2022

Noted by:

**ENGR. ROBERT R. BACARRO, MECE, MBA**
Dean, COLLEGE

Date: 1-28-2022

Recommended by:

**RONITA E. TALINGTING, PhD**
Campus Director

Date: 1-31-2022

Approved by:

**EMMYLOU A. BORJA, EdD**
VP for Academic Affairs

Date: 1-31-2022

**COLLEGE OF ENGINEERING AND INFORMATION TECHNOLOGY**
City Campus
Second-Semester, Academic Year 2021-2022

**Outcomes Based-Education (OBE) Syllabus in EE 433**
**Distribution Systems and Substation Design**
Course Credit: 3.0 units **(90hrs)**

**Institutional Vision, Mission, and Goals**

**Vision:**
An innovative and technologically-advanced State College in Caraga.

**Mission:**
To provide relevant,

a. high quality and sustainable instruction,
b. research, production and extension programs and
c. services within a culture of credible and responsive institutional governance.

**Goals:**

1. Foster application of the discipline and provide its learner with industry-based training and education particularly in engineering, technology and fisheries.
2. Conduct and utilize studies for the development of new products, systems and services relevant to Philippine life and of the global village.
3. Promote transfer of technology and spread useful technical skills, thus empowering its learners and their activities.

**SSCT Core Values**

**S**ervice-Oriented **S**ocially Responsive **C**ommitted **T**ransformational

**SSCT Quality Policy**

Surigao State College of Technology provides quality instruction, research, extension programs and production services to satisfy its customers by responding to their needs and expectations and continually improving its quality management system.

**Institutional Graduate Attributes (IGA)** :

- Visionary Leader
- Effective Communicator
- Competent Technologist
- Self-Directed Lifelong Learner

**Program Goals**

The Electrical Engineering program aims to design and apply the generation, transmission, and distribution of electrical energy to produce competent engineers that exhibit positive work ethics and flexibility in work conditions for the development of Caraga.

**ProgramEducational Objectives (PEO) and Relationship to Institutional Mission**

| Program Educational Objectives (PEO) | Mission | | |
|---|---|---|---|
| | a | b | c |
| EE-PEO1. Demonstrate professionalism in electrical engineering and apply professional ethics thru communication and collaboration. | / | / | / |
| EE-PEO2. Use appropriate techniques, resources, and modern tools necessary for analysis, design, and modeling of complex electrical systems | / | / | / |
| EE-PEO3. Plan, lead, and implement designated tasks, interact with other engineering professionals, and take leadership roles in electrical engineering organization. | / | / | / |
| EE-PEO4. Engage in lifelong learning able to discover new opportunities for continuing personal and professional development in electrical engineering | / | / | / |

**Program Outcomes (PO) and Relationship to Program Educational Objectives (PEO)**

| Program Outcomes (PO) | Program Educational Objectives (PEO) | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| EE-POa.Apply knowledge of mathematics and sciences to solve complex engineering problems | | | | |
| EE-POb.Develop and conduct appropriate experimentation, analyze and interpret data | | | | |
| EE-POc.Design a system, component, or process to meet desired needs within | / | / | / | / |

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|---|---|---|---|---|
| realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability, in accordance with standards | | | | |
| EE-POd.Function effectively on multi-disciplinary and multi-cultural teams that establish goals, plan tasks, and meet deadlines | | | | |
| EE-POe.Identify, formulate, and solve complex problems in electrical engineering | / | / | / | / |
| EE-POf.Recognize ethical and professional responsibilities in engineering practice | / | / | / | / |
| EE-POg.Communicate effectively with a range of audiences | / | / | / | / |
| EE-POh.Understand the impact of engineering solutions in a global, economic, environmental, and societal context | / | / | / | / |
| EE-POi.Recognize the need for additional knowledge and engage in lifelong learning | | | | |
| EE-POj.Articulate and discuss the latest developments in the field of electrical engineering | | | | |
| EE-POk.Apply techniques, skills, and modern engineering tools necessary for electrical engineering practice | | | | |
| EE-POl.Demonstrate knowledge and understanding of engineering and management principles as a member and/or leader in a team to manage projects in multidisciplinary environments | | | | |

**Course Description**

The course deals with study and design of primary and secondary distribution networks, load characteristics, voltage regulation, metering techniques and systems, and protection of distribution systems.

**DACUM Main Duties (DMD)**

EE-DMD1. Diagnose electrical problems using the electrical diagrams or blue print (as built electrical plans)
EE-DMD2. Install, repair, and maintenance electrical power systems( building wiring, controls, electrical machines and transformers)
EE-DMD3. Facilities Manager
EE-DMD4. Power Plant Manager
EE-DMD5. Electrical Researchers, Professor and Faculty

**Course Outcomes (CO) and Relationship to Program Outcomes (PO)**

| Program Outcome (PO) /Level | Course Outcomes (CO) | Assessment Task (CO-AT) | DACUM Links | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 |
| EE-POc(Demonstrates).Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability, in accordance with standards | *EE433-CO1*: Develop and conduct electrical engineering experimentations and then analyze and interpret the data. | Students design electrical power distribution. These designs serve as a group activity and present them in class.<br><br>Criteria – Functionality and design<br><br>Total Points: 100 points | / | / | | | / |
| EE-POe(Enabling). Identify, formulate, and solve complex problems in electrical engineering. | *EE433-CO2*: Calculate complex electrical engineering problems related to power distribution.<br>. | Students calculate sets of Distribution and transmission system problems.<br>Criteria – 70% correct answers and solutions<br>Total Points: 100 points | / | | | | / |
| EE-POf(introductory).Recognize ethical and professional responsibilities in engineering practice | *EE433-CO3*: Prepare and present topical issues relevant to the evolution of utility distribution systems. | Students create a group design project and present them in the class.<br>Criteria – creativity, functionality, delivery<br>Total Points: 100 points | | | / | / | / |
| EE-POg.(Enabling) Communicate effectively with a range of audiences | *EE433-CO4:* Communicate effectively with the team, group or other range of audiences when conducting reports | Students create a group design project and present them in the class.<br>Criteria – creativity, | | | / | / | / |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | and presentations. | functionality, delivery<br>Total Points: 100 points | | | | | |
| EE-POh.(Enabling) Understand the impact of engineering solutions in a global, economic, environmental, and societal context | *EE433-CO5:* Prepare and present the design of subtransmission lines and distribution substations. | Students create a group design project and present them in the class.<br>Criteria – creativity, functionality, delivery<br>Total Points: 100 points | / | | / | / | / |

**Course Outcomes (CO) and Relationship to Intended Learning Outcomes (ILO)**

| Course Outcomes (CO) | Intended Learning Outcomes (ILO) |
|---|---|
| *EE433-CO1*: Develop and conduct electrical engineering experimentations and then analyze and interpret the data.<br><br>*EE433-CO2*: Calculate complex electrical engineering problems related to power distribution.<br><br>*EE433-CO3*: Prepare and present topical issues relevant to the evolution of utility distribution systems.<br><br>*EE433-CO4:* Communicate effectively with the team, group or other range of audiences when conducting reports and presentations.<br><br>*EE433-CO5:* Prepare and present the design of subtransmission lines and distribution substations. | *EE433-ILO1: Understand the basic of Distribution System, Primary Distribution, and Secondary Distribution and calculate problems utilizing these concepts.*<br><br>*EE433-ILO2: Solve load analysis problems using load characteristic terms.*<br><br>*EE433-ILO3: Identify the mathematical models of regression analysis needed in load forecasting.*<br><br>*EE433-ILO4: Describe and interpret the distribution transformer's basic principles, construction and operation.*<br><br>*EE433-ILO5: Identify the advantages and disadvantages of underground distribution line over overhead distribution lines.*<br><br>*EE433-ILO6: Describe the concept of line-drop compensation and calculate problems related to this concept and voltage regulation.*<br><br>*EE433-ILO7: Comprehend the process of protective devices' coordinationand recognize the lightning protection methods.* |

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| | *EE201-ILO8: Recognize the circuit configurations utilized in analyzing the reliability of distribution circuits.*<br><br>*EE201-ILO9: Identify the programs and methods used to improve distribution reliability and restoration.* |

**Detailed Course Content**

| Intended Learning Outcomes (ILO) | Topics | Time Frame | Teaching and Learning Activities(TLA) | Assessment Tasks (ILO-AT) | Target | Resources | Values Integration | Remarks |
|---|---|---|---|---|---|---|---|---|
| *EE433-ILO1: Understand the basic of Distribution System, Primary Distribution, and Secondary Distribution and calculate problems utilizing these concepts.* (EE433-CO1, EE433-CO2) | **1. Overview of Distribution Systems**<br>*1.1. Primary Distribution, Radial System, Loop/Ring System,*<br>*1.2. Secondary Distribution* | 2.0 hrs. lec | Learning Module 1 *Asynchronous* | Identification quiz on the overview of Distribution systems. | 70% of the students shall have a rating of at least 3.0 | Modules, e-books, textbooks, and worksheets | Core Value: *Committed*<br><br>Sub-Value: *Determined in learning the basic Distribution Systems concept.* | |
| *EE433-ILO2: Solve load analysis problems using load characteristic terms.* (EE433-CO1, EE433-CO2, EE433-CO3)<br><br>*EE433-ILO3: Identify the mathematical models of* | **2. Load Characteristics**<br>*2.1. Load Graph*<br>*2.2. Maximum Demand*<br>*2.3. Average Demand*<br>*2.4. Demand Factor*<br>*2.5. Utilization* | 4.0 hrs.lec/ 5.0 hrs. lab | Learning Module 2 *Asynchronous* | Problem solving quiz on the Load Charactiristics. | 70% of the students shall have a rating of at least 3.0 | Videos online, modules, e-books,Multisim software, and worksheets | Core Value: *Committed*<br><br>Sub-Value: *Determined in learning the basic laws to solve basic electric* | |

| | | | | | | | | |
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| *regression analysis needed in load forecasting.* (EE433-CO1, EE433-CO2, EE433-CO3) | *Factor*<br>*2.6. Load Factor*<br>*2.7. Diversity Factor*<br>*2.8. Load Diversity* | | | | | | *circuits* | |
| *EE433-ILO4: Describe and interpret the distribution transformer's basic principles, construction and operation.* (EE433-CO3, EE433-CO4, EE433-CO5) | **3. Distribution Transformer Applications**<br>*3.1. Load Management of Transformers* | 5.0 hrs.lec./ 7.0 hrs. lab | Learning Module 3 *Asynchronous* | Problem solving and labelling diagrams on the Distribution Transformer Applications. | 70% of the students shall have a rating of at least 3.0 | Videos online, modules, e-books,Multisim software, and worksheets | Core Value: *Committed*<br><br>Sub-Value: *Dedicated in solving linear electrical circuits using nodal and mesh analysis* | |
| *EE433-ILO5: Identify the advantages and disadvantages of underground distribution line over overhead distribution lines.* (EE433-CO3, EE433-CO4, EE433-CO5) | **4. Distribution Lines**<br>*4.1. Overhead and Underground* | 6.0 hrs.lec / 12 hrs. lab | Learning Module 4 *Asynchronous* | Q & A about the characteristics of overhead and underground distribution lines. | 70% of the students shall have a rating of at least 3.0 | Videos online, modules, e-books,Multisim software, and worksheets | Core Value: *Transformational*<br><br>Sub-Value: *Adaptive in learning other techniques to solve complex circuits* | |
| *EE433-ILO6: Describe the concept of line-drop compensation and calculate problems related to this concept and voltage regulation.* (EE433-CO3, EE433-CO4, EE433-CO5) | **5. Voltage Regulators**<br>*5.1. Voltage Drop Calculations*<br>*5.2. Shunt Capacitor Placement*<br>*5.3. Voltage Regulating Transformers* | 6.0 hrs.lec / 7.0 hrs. lab | Learning Module 5 *Asynchronous* | Problem solving on the voltage regulators related problems. | 70% of the students shall have a rating of at least 3.0 | Videos online, modules, e-books,Multisim software, and worksheets | Core Value: *Committed*<br><br>Sub-Value: *Perseverant in learning new concepts* | |

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| | *5.4. Tap Changers* | | | | | | | |
| **MIDTERM EXAMINATION – 3.0 Hrs.** | | | | | | | | |
| *EE433-ILO7: Comprehend the process of protective devices' coordinationand recognize the lightning protection methods.*(EE433-CO3, EE433-CO4, EE433-CO5) | **6. Distribution Over-current Protection and Coordination**<br>*6.1. Surge Protection*<br>*6.2. Zones of Protection*<br>*6.3. Transformer Protection*<br>*6.4. Bus Protection*<br>*6.5. Differential Relaying* | 2.0 hrs.lec / 7.0 hrs. lab | Learning Module 6 *Asynchronous* | Problem solving quiz on the protections of distribution system. | 70% of the students shall have a rating of at least 3.0 | Modules, e-books,Multisim software, and worksheets | Core Value: *Transformational*<br><br>Sub-Value: *Optimistic in analysing first-order RL and RC circuits* | |
| *EE201-ILO8: Recognize the circuit configurations utilized in analyzing the reliability of distribution circuits.* (EE433-CO3, EE433-CO4, EE433-CO5) | **7. Substations Layout: Ring Bus, Breaker and a Half, Double Bus-Double Breaker Components:**<br>*7.1. Primary/Secondary Power Lines*<br>*7.2. Auxiliary Transformer*<br>*7.3. Disconnect Switch*<br>*7.4. Circuit Breaker*<br>*7.5. Current Transformer*<br>*7.6. Circuit Breaker, Current Transformer,*<br>*7.7. Lightning Arrester* | 3.0 hrs.lec / 8.0 hrs. lab | Learning Module 7 *Asynchronous* | Problem solving quiz on second-order RLC circuits. | 70% of the students shall have a rating of at least 3.0 | Modules, e-books,Multisim software, and worksheets | Core Value: *Committed*<br><br>Sub-Value: *Perseverant in analysing second-order RLC circuits* | |

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| | *7.8. Main Transformer* | | | | | | | |
| *EE201-ILO9: Identify the programs and methods used to improve distribution reliability and restoration.* (EE433-CO3, EE433-CO4, EE433-CO5) | **8. Power Quality** | 2.0 hrs.lec / 8.0 hrs. lab | Learning Module 7 *Asynchronous* | Problem solving quiz on Power Quality. | 70% of the students shall have a rating of at least 3.0 | Modules, e-books,Multisim software, and worksheets | Core Value: *Committed*<br><br>Sub-Value: *Perseverant in analysing second-order RLC circuits* | |
| **FINAL EXAMINATION – 3.0 Hrs.** | | | | | | | | |

**References:**

*Textbooks*
Abdelhay A. Sallam& Om P. Malik.Electric Distribution Systems. John Wiley & Sons, 2nd ed. 2019
T.A. Short. Electric Power Distribution Handbook. CRC Press, Taylor & Francis Group, 2nd ed. 2014

*eBooks*
Turan G¨hen. Electric Power Distribution Engineering.CRC Press, Taylor & Francis Group, 3rd ed. 2014

**Course Requirements:**

- Laboratory Reports(CO-AT1)
- Problem Sets(CO-AT2)
- Group Project(CO-AT3)
- Quizzes and Assignments
- Midterm and Final exams

**Course Evaluation:**

| Criteria | Lecture Grade |
|---|---|
| ➢ Quizzesand online outputs/interaction (ILO-AT) | 20% |
| ➢ Performance Tasks (CO-AT) | 40% |
| ➢ Major Exams (Midterm and Final) | 40% |
| **TOTAL** | **100%** |

Grade Computation: $\frac{Midterm\ Grade + Final\ Grade}{2} = Average\ Grade$

| Grade Point | Description |
|---|---|
| 1.0 | Excellent |
| 1.5 – 1.1 | Very Good |
| 2.0 – 1.6 | Highly Satisfactory |
| 2.5 – 2.1 | Good |
| 2.9 – 2.6 | Satisfactory |
| 3.0 | Passing |
| 5.0 | Failed due to poor performance, absences, withdrawal without notice |
| DRP | Dropped with approved dropping slip |
| INC | Incomplete requirements but w/ passing class standing. INC is for non-graduating students only |
| NG | No Grade |

Source: *SSCT Student Handbook*

**Course Policies:**

1. Attendance shall be checked in every class session in the Google Meet. This is to monitor the absences incurred by the students in terms of the allowable number of absences for a course as stipulated in the Student Handbook.
2. During online classes, video camera shall be turned on all the time and microphone shall be turned off. The microphone shall be unmuted only if the student's name is called to participate in class discussion.
3. Major examinations in multiple-choice type shall be done online. For problem solving type, detailed solutions shall be written legibly in separate sheets of paper and shall be converted to pdf form prior to submission.

4. Cheating in major examinations which include attempts to defraud, deceive, or mislead the instructor in arriving at an honest assessment shall entail zero score.
5. Plagiarism which is a form of cheating that involves presenting the ideas or work of another as one's own work shall entail zero score.
6. Projects shall be submitted on or before the deadline. Students who submit unsatisfactory projects shall be given the chance to improve their works on the condition that they resubmit the revised outputs on the date set by the instructor. Non-submission of a project on the deadline shall entail zero score.
7. An INC grade shall be given to students who fail to submit the course requirements of at least 95% of the projects and quizzes or failure to take the major examinations.

**Revision History:**

| Revision No. | Revised by | Date of Revision | Date of Implementation | Highlight of Revision |
|---|---|---|---|---|
| 1 | Engr. Andy Bong F. Navarro | August 2019 | August 2019 | Followed OBTL Format as per CMO #101 S. 2017 |
| 2 | Engr. Andy Bong F. Navarro | July 19, 2021 | August 23, 2021 | DACUM Workshop vis-à-vis CMO No. 101 S. 2017 |
| | | | | |

Prepared by:

**ENGR. ANDY BONG F. NAVARRO**
Guest Lecturer

Date: 1-25-2022

Checked and reviewed by:

**ENGR. VICENTE Z. DELANTE**
Program Chair, BSEE

Date: 1-28-2022

Noted by:

**ENGR. ROBERT R. BACARRO, MECE, MBA**
Dean, COLLEGE

Date: 1-28-2022

Recommended by:

**RONITA E. TALINGTING, PhD**
Campus Director

Date: 1-31-2022

Approved by:

**EMMYLOU A. BORJA, EdD**
VP for Academic Affairs

Date: 1-31-2022