** PRINCE SATTAM BIN ABDULAZIZ UNIVERSITY**

# COLEGE OF ENGINEERING AT WADI ADDAWASER

**Teaching Plan**

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| Course Number and Name | **EE3350 Electromechanical Energy Conversion** | | |
| Contact Hours | **9 Hrs/week** | Credit Hours | **5** |
| Prerequisites | **EE2020, EE2030** | Academic Year & Semester | **2022-2023 & 2** |
| Co-requisites | **None** | Level | **9** |
| Required, Elective or Selective course: | | **R** | |
| Instructor’s/ Coordinators Name | | **Prof. Kanagaraj** | |

**Course Description\***

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| **Theory: DC machine:**  Construction, winding diagram, Classification, Motor Characteristics, Speed and Torque calculation, Speed Control, Starting, Generator Characteristics, Voltage and Current Calculation.  **Transformers:** Construction, Operation of single-phase transformers, Equivalent circuit, Voltage regulation and Efficiency, Autotransformers, three phase transformers.  **AC machinery fundamentals**  **Three-phase induction machines:** Construction, operation, equivalent circuit, Performance calculation, Starting of induction motors, Speed control  **Small AC motors:** Single phase induction motors, reluctance and hysteresis motors, Universal motors, servo motors, Stepper motors  **Practical:** Performance study of DC motors and DC generators. Speed control of DC shunt motor. Performance study of single-phase transformer. Open and short circuit test on single-phase transformer to determine the equivalent circuit parameters. Predetermination efficiency and voltage regulation of single-phase transformer. Load test on three-phase transformer. |

\**University specified syllabus*

**References**

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| 1. Electric Machinery Fundamentals, Stephen J. Chapman, 4th Edition, McGraw Hill |

**Class Schedule**

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| Lecture: 4 credits (4 hours X 11 weeks)  Tutorial: 0 credit (1 hours X 11weeks)  Laboratory: 1 credit (4 hours X 11 weeks) |

**Course Outcomes:** *On successful completion of this course students will be able to*

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| --- | --- |
| **CO1** | understand the constructional details, principle of operation and Performance of DC Machines |
| **CO2** | expose constructional details, principle of operation of Transformers |
| **CO2** | demonstrate AC machinery fundamentals as applied to alternative current machines |
| **CO4** | interpret constructional details, principle of operation, starting, speed control of three phase induction motor and small AC motors. |
| **CO5** | design and conduct experiments on DC machines and transformer to analyze their performance. |

**Student Outcomes (SOs)**

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| **1.6** | An ability to apply knowledge of science to solve complex engineering problems |
| **1.7** | An ability to apply knowledge of engineering to identify complex engineering problems |
| **1.8** | An ability to apply knowledge of engineering to formulate complex engineering problems |
| **1.9** | An ability to apply knowledge of engineering to solve complex engineering problems |
| **6.1** | An ability to develop appropriate experimentation, analyze and interpret data, and use  engineering judgment to draw conclusions |
| **6.2** | An ability to conduct appropriate experimentation, analyze and interpret data, and use  engineering judgment to draw conclusions |

## Alignment of Course Outcomes with Student Outcomes and Assessment Methods

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Outcomes** | **Student Outcomes** | | | | | | **Assessment Methods**  (Assignment, Quiz, written test, oral test, presentation, project etc.) |
| 1.6 | 1.7 | 1.8 | 1.9 | 6.1 | 6.2 |
| **CO1** | **√** |  |  |  |  |  | Assignment, Quiz, Mid exam and Final exam |
| **CO2** |  | **√** |  |  |  |  | Assignment, Quiz, Course project and Final exam |
| **CO3** |  |  | **√** |  |  |  | Assignment, Quiz, and Final exam |
| **CO4** |  |  |  | **√** |  |  | Quiz and Final exam |
| **CO5** |  |  |  |  | **√** | **√** | Laboratory report and Practical exam |

**Assessment Task**

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| Assessment methods | Week Due | Percentage of Total Assessment Score |
| Assignments / HomeWorks | 3, 5, 7, 9 | 5% |
| Quizzes | 4, 5, 8, 9, 10 | 10% |
| Mid-Term Test | 6 | 20% |
| Practical exam | 11 | 20% |
| Course Project | 11 | 5% |
| Final Exam | 12 | 40% |
| **Total Score** | | **100%** |

**Topics to be Covered**

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| --- | --- | --- | --- |
| **Week No.** | **Topics** | **Mode of Delivery** | **Contact Hours** |
| **Theory:** | | | |
| 1, 2 | DC MACHINE: Construction, Winding diagram, Classification, Motor Characteristics, Speed and Torque calculation. | Lecture & Tutorial | **10** |
| 3 | Generator Characteristics, Voltage and Current Calculation. | Lecture & Tutorial | **5** |
| 4 | TRANSFORMERS (Single Phase): Construction, Operation, Equivalent circuit, Voltage regulation and Efficiency. | Lecture & Tutorial | **5** |
| 5 | Determination of transformer equivalent circuit parameters, Autotransformer, Three-phase transformer. | Lecture & Tutorial | **5** |
| 6 | AC MACHINERY FUNDAMENTALS | Lecture & Tutorial | **5** |
| 7 | THREE-PHASE INDUCTION MOTOR: Construction and advantages | Lecture & Tutorial | **3** |
| 8 | Operation, Equivalent circuit of three-phase induction motor. | Lecture & Tutorial | **5** |
| 9,10 | Performance calculation, Starting, Speed control of three-phase induction motor. | Lecture & Tutorial | **10** |
| 11 | SMALL AC MOTORS: Single phase induction motors, reluctance and hysteresis motors, Universal motors, servo motors, Stepper motors. | Lecture & Tutorial | **5** |
| **Practical:** | | | |
| 1 | Demonstration of laboratory equipment usage and safety precaution measures | Presentation | **4** |
| 2 | Performance study on DC shunt motor | Practical | **4** |
| 3 | Performance study on DC series motor | Practical | **4** |
| 4 | Performance study on DC cumulative compound motor | Practical | **4** |
| 5 | Performance study on DC differential compound motor | Practical | **4** |
| 6 | Study the electrical performance of DC shunt generator | Practical | **4** |
| 7 | Study the electrical performance of DC series generator | Practical | **4** |
| 8 | Polarity test on single-phase transformer | Practical | **4** |
| 9 | Load test on single-phase transformer | Practical | **4** |
| 10 | Open and short circuit test on single-phase transformer to determine equivalent circuit parameters | Practical | **4** |
| Total | | | **93** |

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| Prepared by: | Checked by: | Approved by: |
| Name: Prof. Kanagaraj  Position: Associate Professor  Date: 04-12-2023 | Name: Position: Head of Electrical Engineering  Date: | Name: Dr. Mohammed Al Haider Position: Dean  Date: |