**The University of Jordan**
**School of Engineering**
**Electrical Engineering Department**
1st Semester – A.Y. 2023/2024

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| **Course:** | **High Voltage Engineering – 0933584 (3 Cr. – Required Course)** |
| **Instructor:** | Prof. Eyad A. Feilat<br>Office: E306, Telephone: 06/5355000 ext 22857, Email: e.feilat@ju.edu.jo<br>Office Hours: 11:00-12:00 |
| **Course website:** | http://elearning.ju.edu.jo/ |
| **Catalog description:** | Introduction to high voltage engineering. Conduction and breakdown in gases, liquids and solids. Generation of high voltages and high currents. Measurement techniques for high voltages and currents. Performance of high-voltage line insulators and calculation of voltage distribution along insulators. High voltage cables. Corona discharge. Applications of insulating materials, power circuit breakers and switchgear. |
| **Prerequisites by course:** | **EE 0953481** Power System Analysis (pre-requisite) |
| **Prerequisites by topic:** | Students are assumed to have a background in the following topics:<br>• Basic electrical circuit analysis techniques.<br>• Electromagnetics.<br>•Transformers and synchronous machines.<br>• Power systems components and layout..□ |
| **Textbook:** | **M.S. Naidu and V. Kamaraju, High Voltage Engineering. 5th ed., McGraw-Hill, Education Group, November, 2013.** |
| **References:** | 1. E. Kuffel, W.S. Zaengl, High Voltage Engineering Fundamentals. Pergamon Press, Reprinted 1st Ed. 1984, Oxford/England, 1986.<br>2. C. L. Wadhwa, High Voltage Engineering, New Age International Publisher, 2nd Ed. 2007<br>3. Power Systems Analysis by Arthur R. Bergen and Vijay Vittal, Pearson, 2nd edition, 1999.<br>4. M. Abdel-Salam, H. Anis, A. El-Morshedy and R. Radwan: High-Voltage Engineering: Theory and Practice. 2nd ed., Marcel Dekker Inc., New York, USA,<br>5. A. Haddad, D.F. Warne, Advances in High Voltage Engineering, IET power Engineering Series, 2004.<br>6. T. J. Gallagher and A. J. Pearmain, High Voltage Measurement, Testing and Design, NY: Wiley, 1983.<br>7. R.D. Garzon: High Voltage Circuit Breakers: Design and Applications, 2nd ed., Marcel Dekker Inc., New York, USA, 2002. |
| **Schedule:** | 16 Weeks, 42 lectures (50 minutes each) plus exams. |
| **Course goals:** | To provide students with a thorough understanding of the physical basis and concepts of high-voltage engineering and the associated phenomena. |

## Course learning outcomes (CLO) and relation to ABET student outcomes (SO):

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| Upon successful completion of this course, a student will: | | **[SO]** |
| 1. | understand the origin and mitigation of overvoltages and insulation coordination in electric power systems. | **[7]** |
| 2. | understand the voltage and current wave propagation on lines and cables and the applications of surge arresters. | **[1]** |
| 3. | understand the basic knowledge of the phenomena associated with the electrical conduction and breakdown in various states of matter. | **[1]** |
| 4. | understand the generation and measurements of different types of high voltages and high currents. | **[2]** |
| 5. | understand the performance of high-voltage line insulators of the conventional and non-conventional type. | **[2]** |
| 6. | understand what is meant by the corona phenomenon on OHTL and the factors affecting it. | **[1]** |
| 7. | understand the performance of different types of high-voltage power cables. | **[2]** |
| 8. | learn the types and applications power circuit breakers and switchgear | **[1]** |

## Course topics:

| | | Hrs |
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| 1. | The importance of using high voltages in power systems. | **2** |
| 2. | Types of overvoltages, insulation coordination and surge arresters. | **10** |
| 3. | High voltage generation and measurement. | **10** |
| 4. | Dielectric breakdown of different states of matter. | **10** |
| 5. | Overhead Line Insulators, insulator materials, types of insulators, voltage distribution over insulator string, improvement of string efficiency. | **4** |
| 6. | Circuit interruption and circuit breakers. | **1** |
| | High voltage cables | **3** |
| 7. | Corona and partial dscharges | **2** |

**Ground rules:** Attendance is required and highly encouraged. To that end, attendance will be taken every lecture. Eating and drinking are not allowed during class, and cell phones must be set to silent mode. All exams (including the final exam) should be considered cumulative. Exams are closed book. No scratch paper is allowed. You will be held responsible for all reading material assigned, even if it is not explicitly covered in lecture notes.

**Assessment & grading policy:**

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| Assignments | 0% | | Quizzes | 0% |
| Midterm Exam | 30% | | Projects | 20% |
| Second Exam | 0% | | Lab Reports | 0% |
| Final Exam | 50% | | Presentation | 0% |
| | | | **Total** | **100%** |

**Last Revised:** July 2024