**University of Tehran**
**School of Electrical and Computer Engineering**

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| **Course** | Analysis of Power System Transients | | |
| **Course type, level, credit** | Optional | Graduate | 3 units |
| **Field, Major** | Electrical Engineering | Power | |
| **Co-requisite(s)** | - | | |
| **Prerequisite(s)** | - Insulation and High Voltage<br>- Power System Analysis2 | | |
| **Prerequisite by topic** | - Analysis of Electrical Circuits<br>- Travelling Waves Theory | | |
| **Goals** | Various electromagnetic transients in electrical systems which may damage system equipments are discussed. Students get familiar with the following topics in this course:<br>- Various types of transients<br>- Transients of linear circuits<br>- Transients of nonlinear circuits<br>- Approaches to eliminate overvoltages and overcurrents caused by transients | | |
| **Outcome** | Students who successfully passed the course would learn the following issues**:**<br>- Implementation of electromagnetic and electrical circuit theories for power system transient studies<br>- Study of electrical system transients based on analytical methods and simulations<br>- Practical points for electrical system failure analysis<br>- Introduction of actual power system failures, discussion about their reasons and the corresponding coping strategies | | |
| **Topics** | - Introduction<br>- Classification of power system transients<br>- Transient analysis in linear lumped circuits<br>- Transients of shunt capacitor<br>- Transients of transformer and reactor<br>- Transient model of electrical system equipment, particularly transformer, capacitor, circuit breaker, transmission line, and lightning arrester<br>- Theory and application of travelling wave, and transmission line | | |

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| | switching overvoltage<br>- Study of lightening stroke overvoltage on transmission line<br>In addition, the following experimental studies would be performed:<br>- Measurement of hysteresis curve of magnetic cores<br>- Series ferroresonance test on a single-phase transformer<br>- Parallel ferroresonance test on three-phase transformer<br>- Frequency response analysis or resonance frequency measurement for a shunt capacitor and a transformer winding<br>- Travelling wave tests |
| **Required software** | An electromagnetic transient (EMT) analysis program, such as one of the following software:<br>- PSCAD/EMTDC<br>- EMTP-RV<br>- EMTP/ATP |
| **Assignments** | 4 homework |
| **Projects** | 1 course project |
| **Grading** | Homework and influential attendance: 35 %<br>Project: 20 %<br>Midterm exam: 25 %<br>Final exam: 25 % |
| **Textbook(s)** | [1] J. C. Das, Transients in Electrical Systems-Analysis, Recognition, and Mitigation, Mc. Graw Hill, 2010<br>[2] Allan Greenwood, Electrical transients in power system, Second Edition, John Wiley and Sons, 1991 |
| **Further readings** | [1] Lou van der Sluis, Transients in Power Systems, John Wiley and Sons, 2001<br>[2] Relevant papers from prestigious international journals<br>[3] Reports of investigated failures in electrical systems |