

## ELECTRIC POWER SYSTEMS 2016-2017

Bachelor Degree:	Electrical Engineering	804G
Course title:	Electric Power Systems	626
Year/Semester:	3/2	ECTS Credits: 6

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Unit 1. Introduction to Electric Power Systems.

- 1.1. The power system.
- 1.2. Elements of the power system.
- 1.3. Representation of elements of the power system: per unit values.
- 1.4. Power system management.
- 1.5. The spanish power system.

Unit 2. Steady state of electric power systems: Load flow.

- 2.1. Relations among variables.
- 2.2. Bus bars clasification.
- 2.3. Gauss-Seidel's method.
- 2.4. Newton-Rhapson's method.
- 2.5. Decoupled method.
- 2.6. Quick decoupled method.
- 2.7. Direct current load flow.

Unit 3. Symmetrical components and sequence networks.

- 3.1. Introduction.
- 3.2. Symmetrical components.
- 3.3. Sequence networks for loads.
- 3.4. Sequence networks for rotating machines.
- 3.5. Sequence networks for power transformers.

Unit 4. Transient state of electric power systems: Symmetric short circuits.

- 4.1. Thevenin network of an electric power system.
- 4.2. Open circuit voltages calculation.
- 4.3. Symmetric short-circuit calculation.
- 4.4. Systematic calculation of symmetric short-circuits.

Unit 5. Transient state of electric power systems: Asymmetric short circuits

- 5.1. Symmetrical components and sequence networks in asymmetric short-circuits.
- 5.2. Examples of asymmetric short circuits in reduced networks: connection of the sequence networks.
- 5.3. Systematic calculation of asymmetric short-circuits.

Unit 6. Protection of electrical power systems.

- 6.1. Introduction to protections.
- 6.2. Protection of radial networks.
- 6.3. Differential protection of system elements.
- 6.4. Protection areas.

Unit 7. Power system operation.

- 7.1. Introduction to the operation and control of electric power systems.
- 7.2. Automatic generation control.
- 7.3. Frequency control.
- 7.4. Control of voltage and reactive power.
- 7.5. Optimal load flow.

Unit 8. Transient Stability.

- 8.1. Introduction to stability.
- 8.2. System with a single generator. Equal areas criterion.
- 8.3. System with multiple generators.

## REFERENCES

Title
Power system analysis. Hadi Saadat. McGraw-Hill. 2004.
Power systems modelling and fault analysis: theory and practice. Nasser D. Tleis. Ed. Elsevier. 2008
Electric power transmission system engineering: analysis and design. Turan Gönen. Ed. CRC Press. 2009.
Operation and control in power systems. P.S.R. Murty. Ed. CRC Press. 2011
Optimization of power system operation. Jizhong Zhu. Ed. Wiley. 2009
Power system analysis: short-circuit load flow and harmonics. J.C. Das. Ed. CRC Press. 2012
Principles of power engineering analysis. Robert C. Degeneff, M. Harry Hesse. Ed. CRC Press. 2012
Power system analysis. B. Subramanyam, B. Venkata Prasanth. New Delhi. International Publishing House, 2012

## EVALUATION SYSTEM

Observing techniques
Written reports (laboratory)
Written test