FUTURE UNIVERSITY IN EGYPT جامعة المستقبل

## Faculty of Engineering & Technology

## Power System Analysis 1

**Information :**

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| **Course Code :** | EPR 411 | **Level :** | Undergraduate | **Course Hours :** | 3.00- Hours |

**Department :** Specialization of Electrical Power Engineering

**Instructor Information :**

| Title | Name | Office hours |
|---|---|---|
| Professor | Said Fouad Mohamed Mekhemar | 7 |
| Assistant Lecturer | Ahmed Moreab Hussien Mohamed | 5 |

**Area Of Study :**

Develop the students' knowledge about the power system operation under both normal and abnormal conditions.
Prepare students to analyze power systems under normal operation and fault conditions.
Train students to use commercial software packages to study the normal operation of power systems.
Train students to perform basic experiments on power system simulator.

**Description :**

Symmetrical components: Synthesis of unsymmetrical phasor diagrams from their symmetrical components, Symmetrical components of unsymmetrical systems, Power in terms of symmetrical components, Positive, negative and zero phase sequence networks, Unsymmetrical faults: Shunt faults, Series faults, Network matrices: Network topology, System admittance and system impedance matrices, Load flow solutions and control: Load flow equations, The Gauss-Seidel method, Newton-Raphson method and approximations, De-coupled methods, Regulating transformers.

**Course outcomes :**

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| **a.Knowledge and Understanding: :** | |
| 1 - | Describe power flow equations in both rectangular and polar forms. |
| 2 - | Explain the transformation from phase domain to symmetrical components domain and vice versa. |
| **b.Intellectual Skills: :** | |
| 1 - | b1. Convert power system parameters from normal units to per unit and vice versa. |
| 2 - | b2. Solve power flow equations using Gauss-Seidel, Newton-Raphson and Fast-Decoupled methods. |
| 3 - | b3. Apply symmetrical components' method to analyze unsymmetrical three-phase circuits. |
| 4 - | b4. Analyze power systems under symmetrical and unsymmetrical faults. |
| **c.Professional and Practical Skills: :** | |
| 1 - | c1. Use measuring instruments, and laboratory equipment to practice power system simulator experiments, collect, analyze and interpret results. |
| 2 - | c2. Use of techniques, equipment, and software packages pertaining to power system analysis. |
| 3 - | c3. Apply modern techniques, skills and numerical modeling methods to power system analysis. |

| d.General and Transferable Skills: : | |
|---|---|
| 1 - | d1. Collaborate effectively within team. |
| 2 - | d2. Work in stressful environment and within constraints. |
| 3 - | d3. Communicate effectively |
| 4 - | d4. Effectively manage tasks, time, and resources. |
| 5 - | d5. Demonstrate efficient IT capabilities. |

**Course Topic And Contents :**

| Topic | No. of hours | Lecture | Tutorial / Practical |
|---|---|---|---|
| Bus admittance and bus impedance matrices | 5 | 3 | 2 |
| Power flow problem | 5 | 3 | 2 |
| Solving power flow equations using Gauss-Seidel method | 5 | 3 | 2 |
| Power System Modeling and per unit system | 5 | 3 | 2 |
| Solving power flow equations using Newton-Raphson method | 5 | 3 | 2 |
| Application of Fast decoupled method | 5 | 3 | 2 |
| Use of PowerWorld Simulator in solving power flow problems | 5 | 3 | 2 |
| System modeling under fault conditions | 5 | 3 | 2 |
| System representation, Symmetrical fault | 5 | 3 | 2 |
| Symmetrical faults solution using bus impedance matrix | 5 | 3 | 2 |
| Definition of symmetrical components, Sequence networks of loads and series impedances | 5 | 3 | 2 |
| Sequence networks of machines and transformers | 5 | 3 | 2 |
| Single-Line to Ground fault | 5 | 3 | 2 |
| Line-Line and Line-Line to Ground faults | 5 | 3 | 2 |
| Experiment on Power System Simulator | 5 | 3 | 2 |

**Teaching And Learning Methodologies :**

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| Interactive Lecturing |
| Problem Solving |
| Experiential Learning |

**Course Assessment :**

| Methods of assessment | Relative weight % | Week No | Assess What |
|---|---|---|---|
| Computer project | 10.00 | | |
| Final Written exam | 40.00 | | |
| In Class Quizzes | 5.00 | | |
| Lab Experiment | 5.00 | | |
| Mid-Term Exams | 40.00 | | |

**Recommended books :**

1- Hadi Saadat, ñPower System Analysisò McGraw-Hill, 2nd edition, 2004
2- J. D. Glover, M. S. Sarma and T. J. Overbye, "Power System analysis and Design", Cengage Learning, USA, 5th Edition, 2012.
3- J. J. Grainger and W. D. Stevenson, Jr., ñpower system analysisò McGraw-Hill, Int. editions 1994.