| No | Course Information | |
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| 1 | Unit name: | Computer Aided Electrical Engineering |
| 2 | Code: | EP-61033 |
| 3 | Classification: | Engineering subject |
| 4 | Credit value: | 1.5 |
| 5 | Semester/ Year Offered: | 1/6 |
| 6 | Pre-requisite: | NA |
| 7 | Mode of delivery: | Lecture, Practical |
| 8 | Assessment system and breakdown of marks: | Tutorial, Practical, Attendence, Classwork |
| | Tutorial, Practical | 40 |
| | Attendence | 30 |
| | Classwork | 30 |
| 9 | Academic staff teaching unit: | |
| 10 | Course outcome of unit:<br>In this course students will be able<br>• Solve the mathematical problems including matrix algebra, complex arithmetic, linear systems and non-linear differential equations, etc by aiding computer.<br>• Compute the power flow solution of an interconnected power system.<br>• Estimate the real and reactive power scheduling of power plant in such a way to minimize the operating cost.<br>• Predict bus voltages and line currents during various types of faults.<br>• Create simulation block diagrams and graphics. | |
| 11 | Synopsis of unit:<br>The course covers computer software package for high performance numerical computation and visualization. These functions provide solulions to a broad range of mathematical problems including matrix algebra, complex arithmetic, linear systems, differential equations, signal processing, optimization, non-linear systems, and many other types of scientific computations. The most important feature of computer aiding is its programming capability which is very easy to learn and to use, and which | |

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| | allows user-developed functions.<br><br>Topic:<br><br>**Chapter Title** |
| | Appendix A Introduction to MATLAB.<br>Installing the text toolbox<br>Running matlab<br>Variables<br>Output format<br>Character string<br>Vector operations<br>Elementary matrix operations<br>Complex numbers<br>Polynomial roots and characteristic polynomial<br>Graphics<br>Loops and logical statement<br>Solution of differential equations<br>Nonlinear Systems<br>Simulation diagram<br>Chapter 6 Power Flow Analysis<br>Introduction<br>Bus admittance matrix<br>Solution of nonlinear algebraic equations<br>Power flow solution<br>Gauss-Seidel power flow solution<br>Line flows and losses<br>Tap changing transformers<br>Power flow programs<br>Data preparation<br>Newton-Raphson power flow solution<br>Fast decoupled power flow solution<br>Chapter 7 Optimal dispatch of generation<br>Nonlinear function optimization |

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| | Operation cost of a thermal plant<br>Economic dispatch neglecting losses and no generator limit<br>Economic dispatch neglecting losses and including generator limit<br>Economic dispatch including losses<br>Derivation of loss formula<br>Chapter 9 Balanced Fault<br>Balanced three-phase fault<br>Short-Circuit capacity<br>Systematic fault analysis using bus impedance matrix<br>Algorithm for formation of the bus impedance matrix<br>Zbuild and symfault program<br>Chapter 10 Symmetrical Components and Unbalanced Fault<br>Fundamentals of symmetrical components<br>Sequence impedances<br>Sequence networks of a loaded generator<br>Single line-to-ground fault<br>line-to-line fault<br>Double line-to-ground fault<br>Unbalanced fault analysis using bus impedance matrix<br>Unbalanced fault programs<br>Chapter 11 Stability<br>Swing equation<br>Synchronous machine models for stability studies<br>Steady-state stability small disturbances<br>Transient stability equal area criterion<br>Application to three-phase fault<br>Numerical solution of nonlinear equation<br>Numerical solution of the swing equation<br>Multimachine systems<br>Multimachine transient stability |
| 14 | Main references:<br>Power System Analysis, Hadi Saada<br>Essential Matlab for Engineers and Scientists, Third Edition, Brian Hahn & |

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| | Daniel T. Valentine |
| 15 | Additional references:<br>Matlab for Engineers, Third Edition, Holly Moore.<br>MATLAB for Beginners, Revised Edition, Peter I. Kattan. |

**Information on Lab Practical**

**JOB-1 Elementary Matrix Operation**

**Objective:**

To solve the elementary operation by using Matlab software

**Required Equipment**

Computer installed with Matlab software

**Job-2 Graphics**

**Objective:**

- To create two dimensional plots

**Required Equipment**

Computer installed with Matlab software

**Job-3 Simulation Block Diagram**

**Objective:**

- To create simulink block diagram
- To see the simulink result in the computer screen

**Required Equipment**

Computer installed with Matlab software

**Job-4 Power Flow Solution**

**Objective:**

- To solve the power flow problems of an interconnected power system

**Required Equipment**

Computer installed with Matlab software

**Job-5 Fault Calculation**

**Objective:**

- To become familiar with modelling and analysis of power systems under faulted condition and to compute the fault level, post-fault voltages and currents for different types of faults, both

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| | symmetric and unsymmetric.<br><br>**Required Equipment**<br>• Computer installed with Matlab software |