Subject Description Form

Subject Code	EE3004B
Subject Title	Power Transmission and Distribution
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: EE2002B
Objectives	To introduce the fundamental knowledge of electric power systems and provide an overview of the supply, utilization, and control of electrical power.
Subject Intended Learning Outcomes	Upon completion of the subject, students will: a. Have acquired the fundamental knowledge and analytical techniques on electrical power systems. b. Be able to identify, analyze, and solve technical problems in power system design, planning, and operation, making use of mathematics and engineering techniques. c. Be able to work in teams when conducting laboratory investigations.
Subject Synopsis/ Indicative Syllabus	1. ***Electric power system:*** Power system structure. Power generation, transmission and distribution. Substation, busbar, overhead lines and cables. Circuit breaking and protection. 2. ***Basic principles:*** Phasor. Single-phase circuit. Complex power flow. Power factor correction. Three-phase circuit. Per-phase analysis. Per unit system. 3. ***Transformer and line models:*** Transformer equivalent circuits, open and short circuit tests. Three-phase transformers and phase grouping. Primary (RLCG) and general (ABCD) line parameters. 4. ***Voltage control:*** Voltage drop and power loss. Reactive power flow. Voltage control using tap-changing and booster transformer, series and shunt compensation. 5. ***Fault analysis*****:** Balanced 3-phase fault calculation. Fault current limiting concepts. Unbalanced fault calculation by symmetrical components method including line-to-ground, line-to-line, and double-line-to-ground faults. 6. ***Surges and protection*****:** Travelling wave, surge impedance and standing voltage. Lightning and switching surges. Surge mitigation, reflection and refraction. Overvoltage protection. Principle of overcurrent, differential and distance protection schemes. **Laboratory Experiment:** • Experiments on single phase transformer. • Experiments on three phase transformer. • Studies of surges on transmission lines. • Fault analysis using the interactive package “Powerworld”. • Grading of overcurrent relays.
Teaching/Learning Methodology	Lectures and tutorials are the primary means of conveying the basic concepts and theories. Experiences on system analysis, design and practical applications are given through experiments, in which students are expected to solve the power system design, planning, and operation problems with practical constraints and to attain pragmatic solutions with critical and analytical thinking. Experiments are designed to supplement the lecturing materials so that students are encouraged to take extra readings and to look for relevant information.

Teaching/Learning Methodology	Outcomes		
	a	b	c
Lectures	✓	✓	
Tutorials	✓	✓	
Experiments			✓

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed		
		a	b	c
1. Examination	60%	✓	✓	
2. Class tests	18%	✓	✓	
3. Lab performance and report	10%			✓
4. Mini-project and report	12%			✓
Total	100%			

The outcomes on concepts, design and applications are assessed by the usual means of examination and tests. Experiments and written reports assess those on analytical skills, problem-solving techniques and practical considerations of power system design, as well as technical reporting and teamwork.

Student Study Effort Expected

Class contact:	
▪ Lecture/Tutorial	33 Hrs.
▪ Laboratory	6 Hrs.
Other student study effort:	
▪ Laboratory preparation/report	9 Hrs.
▪ Self-study	52 Hrs.
Total student study effort	100 Hrs.

Reading List and References

Textbooks:

1. H. Saadat: Power System Analysis. McGraw Hill, 3rd Edition, 2011.
2. B.M. Weedy, B.J. Cory, et al.: Electric Power Systems. Wiley, 5th Edition, 2012.
3. C. Bayliss, B. Hardy: Transmission and Distribution Electrical Engineering. Oxford, 4th Edition, 2011.

Reference Books:

1. L. Grigsby, Electric Power Generation, Transmission and Distribution, Electric Power Engineering Handbook, 3rd Edition, CRC Press, 2012
2. A.R. Bergen and V. Vittal, Power System Analysis, Prentice Hall, 2nd Edition, 2000
3. T. Gönen, Modern Power System Analysis, 2nd Edition, CRC Press, 2013