Subject Description Form

Subject Code	EE3004 / EE3004A
Subject Title	Power Transmission and Distribution
Credit Value	3
Level	3
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite for EE3004: EE2004 or EEE2002 Pre-requisite for EE3004A: EE2004A
Objectives	To introduce students to the fundamental knowledge which is essential for electrical power engineers. It leads to a deeper insight into the design, planning, operation, and equipment characteristics of modern electrical power systems.
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. ***Reactive power and voltage control*****:** Voltage drop and power loss calculation. Voltage control using tap-changing and booster transformer, regulator, series and shunt compensation. Reactive power flow. Power factor improvement. 2. ***Surges*****:** Travelling wave, surge impedance and standing voltage. Lightning and switching surges. Surge mitigation, reflection and refraction. Use of lattice diagram. Protection against overvoltage. 3. ***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. Sequence current and voltage measurements. 4. ***Switchgear and protection*****:** Construction and application of different types of switching devices. Arc extinction and transient recovery voltages. AC and DC current interruption, current chopping. Role and component of protection systems. Coordination, selection and zoning of protection. Overcurrent relays. Differential and distance protection schemes. **Laboratory Experiment(depending on equipment availability etc):** • Voltage regulation and reactive power compensation for short and medium length transmission lines. • Static and electromechanical current measuring relays. • Studies of surges on transmission lines. • Symmetric and Asymmetric fault using interactive package “Powerworld”. • Symmetrical components. • Effects of different earthing methods in distribution system. • 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	62%	✓	✓	
2. Class tests	18%	✓	✓	
3. Lab performance and report	10%		✓	✓
4. Assignments	10%	✓	✓	
Total	100%			

The outcomes on concepts, design and applications are assessed by the usual means of examination, tests and assignments. 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	57 Hrs.
Total student study effort	105 Hrs.

Reading List and References

Textbooks:

1. C.R. Bayliss and B.J. Hardy, Transmission and Distribution Electrical Engineering, Oxford, 4th Edition, 2012
2. W.D. Stevenson, Elements of Power System Analysis, McGraw Hill, 4th Edition, 1982
3. B.M. Weedy, Electric Power Systems, Wiley, 5th Edition, 2012

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