COURSE OUTLINE

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Course Code: MKEP1623 **Total Contact Hours: 42**	**Semester: 2** **Academic Session: 2016/2017**

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Synopsis : This course is divided into 2 parts: The first part introduces students to power systems transmission system while the second part introduces students to power systems security. In the first part, it will cover the power transmission in details ranging from transmission line modelling to transmission line design. Key issues such as transmission losses in determining the economic dispatch of power system will be covered. In the second part, it will cover the issue of power system security in which the concentration will be given involving transmission system security. The concept of contingency analysis, N-1 security will be discussed. Then the issue of congestion management and allocation in deregulated electricity market will be covered in this course.

LEARNING OUTCOMES

By the end of the course, students should be able to:

No.	Course Learning Outcome	Programme Outcome	Taxonomies (C, P, A)	Weightage (%)	Assessment Methods
	Apply transmission network modelling in solving transmission line problem	PO1	C3	30%	HW(5%),T(17.5%), F(7.5%)
	Able to perform sag and tension analysis in designing power systems transmission line.	PO2	C4	15%	T(7.5%), F(7.5%)
	Able to analyse the operating state of the system and perform generation dispatch base on different electricity market model considering security	PO2	C4	25%	F(15%)

Prepared by:	Certified by: (Course Panel Head)
Name: **Signature:** **Date:**	**Name:** **Signature:** **Date:**

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	Able to design a secured power system operation considering various system constraints and electrcity market model	PO3	C5	20%	HW(5%), Pr(5%), F(20%)
	plan and perform case study and design project responsibly, professionally and ethically	PO4	EM1, LL1	10%	Pr(10%)

(T – Test ; PR – Project ; Q – Quiz; HW – Homework ; Pr – Presentation; F – Final Exam)

STUDENT LEARNING TIME (SLT)

Teaching and Learning Activities	Student Learning Time (hours)
1. Face-to-Face Learning	(46)
a. Lecturer-Centered Learning i. Lecture	30
b. Student-Centered Learning (SCL) i. Laboratory/Tutorial ii. Student-centered learning activities – Active Learning, Project Based Learning	4 12
2. Self-Directed Learning	(58)
a. Non-face-to-face learning or student-centered learning (SCL) such as manual, assignment, module, etc.	28
b. NALI/MOOCs/e-Learning	10
c. Revision	10
d. Assessment Preparations	10
3. Formal Assessment	(16)
a. Continuous Assessment	13
b. Final Exam	3
Total (SLT)	**120**

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TEACHING METHODOLOGY

- Class Lecture
- In-class discussion, Active learning
- Case studies
- Individual Assignment
- Group Project

WEEKLY SCHEDULE

Week 1	:	Introduction to Power Systems Transmission
Week 2	:	Transmission Line Modelling- Short, Medium, Long model, Complex power flow, Voltage Regulation, Efficiency
Week 3	:	Surge impedance loading, Reactive power compensation
Week 4	:	Basic design principle of transmission system, factors affecting lines design
Week 5	:	Sag and tension analysis- Catenery Method, Parabolic Method
Week 6	:	Sag and tension analysis- Effect of wind and ice, asymmetrical span
Week 7	:	Economic operation of power system, optimization problem
Week 8	:	Mid-Semester Break
Week 9	:	Economic dispatch problem principle, effect of constraints- generation, transmissions, security
Week 10	:	Introduction to Power systems security analysis and control, N-1 Security,Power Systems security states, Transmission line constraint: thermal, voltage, system operating constraints
Week 11	:	Contingency analysis, contingency ranking
Week 12	:	Linear sensitivity factor for security analysis: Power transfer distribution factor, Line Outage distribution factor
Week 13	:	Introduction to electricity market, monopoly, single buyer, deregulated market
Week 14	:	Comparison between vertically integrated market, single buyer, pool market and bilateral market
Week 15	:	Power Systems security issues in deregulated electricity market, power systems security management (in pool & bilateral market), security Cost allocation
Week 16-18	:	Revision Week and Final Examination

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REFERENCES :

[1] Turan Gonen, "Electric Power Transmission System Engineering: Analysis and Design", John Wiley & Sons, 1988

[2] Hadi Saadat, "Power System Analysis", McGraw Hill, 1999.

[3] Allen J Wood and Bruce F Wollenberg, "Power Generation, Operation and Control", Second edition, John Wiley & Sons, 1996.

[4] Daniel S. Kirschen, "Fundamentals of Power System Economics", John Wiley & Sons, 2004

GRADING:

Assignment 1	:	5%
Assignment 2	:	5%
Project	:	15%
Test	:	25%
Final Examination	:	50%