DEPARTMENT OF ELECTRICAL ENGINEERING
National University of Sciences and Technology (NUST)

EE-461 Power System Analysis & Design

1. Course Information

Course Number and Title:	EE-461 Power System Analysis & Design
Credits:	3 (3+0)
Instructor(s)-in-charge:	
Course type:	Lecture
Required or Elective:	Required
Course pre-requisites	Nil
Degree and Semester	
Month and Year	

2. Course Schedule

Lecture:	3 hrs/week, Meets twice weekly
Lab:	Nil
Discussion:	1 hrs/week
Office Hours:	3 hrs/week by Instructor.

3. Course Assessment

Exam:	1 Midterm and 1 Final Examination	
Homework:	2-5 Assignments	
Lab reports:	Nil	
Design reports:	-	
Quizzes:	2-5 Quizzes	
Grading:	Quizzes:	10%
	Assignments:	10%
	Mid Term Exam:	30%
	Final Exam:	50%

4. Course book and Related Course Material

Textbooks:	1. PowerSystemAnalysisbyJohnGrainger,WilliamDStevensonJr,McGrawHill,2003 ISBN 978-0070612938 2. Power System Analysis by HadiSaadat, Second Edition, ISBN 007-123955-3
Reference Books:	1. Power System Analysis and design, J Duncan Glover, MulukutlaS.Sarma 6thEd., 2017, CENGAGE Learning ,ISBN0978-1111425777 2. PowerSystemAnalysis,operation&control, AbhijitChakrobarti,2006,PrenticeHall, ISBN 81-203-2777-2)

5. Course Descriptions

The course includes the study of The admittance and impedance model of a power Network, Power flow studies, computer simulations of Power flow studies, symmetrical and unsymmetrical faults ,symmetrical components of unsymmetrical phasors, fault study in a power network, Power system stability studies

6. Course Objectives

This course has been designed to introduce the concept of analyzing various facets of Electrical Power System. It covers detailed study of Power flow, fault (symmetrical and unsymmetrical) and stability of power system. These studies form the basis of further analysis of power system operation, control and its protection issues.

7. Topics covered in the Course and Level of Coverage

Topics	LearningOutcome	Chapter	CLO	Week
General introduction ,Admittance Model and Network Calculation	• General introduction, • the Bus admittance Matrix , • Branch and Node admittances, • Mutually coupled Branches in Y-bus	7	1	Week-1
	• Equivalent admittance Network, Modification of Y-bus; • Incidence matrix and Y-bus	7	1	Week-2
	• Node Elimination (Gauss elimination &Kron Reduction); • Triangular Factorization	7	1,2	Week-3
The Impedance Model and Network Calculations	• The Impedance Model and Network calculations, • Thevenin's Theorem and Z-bus;	8	2	Week-4
	• Modification of an existing Z-bus, Direct determination of Z-bus	8	2	Week-5
Power-Flow Solutions	• Power Flow studies, • the Power flow problem, • Gauss-Siedel iterative method and • algorithm for Power-flow solution	9	2	Week-6
	• Newton Raphson method, • NR-algorithm for Power-flow solution	9	2	Week-7
	• Power-flow studies in system design and operation, Computer simulations (PWS/ETAP)	9	2	Week-8
MID				
Symmetrical Faults	• Fault Analysis: Three-phase symmetrical	10	3	Week-10

	fault, • Transient in RL series circuits •			
	• internal voltages of loaded machines under fault condition	10	3	Week-11
Symmetrical Components and Sequence Networks	• Fault calculations using Z-bus equivalent circuits, selection of a circuit breaker, • Unsymmetrical fault, •	11	3,4	Week-12
	• Symmetrical Components, • Sequence network of symmetrical lines	11	3,4	Week-13
	• synchronous machines • Y-Δ Transformers	11	3,4	Week-14
Unsymmetrical Faults	• Unsymmetrical Faults on power system; • Single line to ground fault, • Line to line fault, • Double line to ground fault, • open conductor fault.	12	3	Week-15
Power System Stability	• Power system stability: • The stability problem, • Rotor dynamics and swing equation	16	3	Week-16
	• Application of swing curve • solution of problems using digital computers, • Factors Effecting stability	16	3,4	Week-17
	End Term			(18) Week

1. Course Outcomes and their Relation to Program Outcomes (Mapping CLO to PLO)

Course Learning Outcome (CLOs)		**PLOs**	Learning Level
CLO 1	*Construct* mathematical Model of a power network by using the knowledge of requisite Algorithms, transformations	3	C3
CLO 2	Solve complex network power flows using iterative methods, and be able to *synthesize* various components to analyze a Power network under a fault condition.	2	C5
CLO 3	*Evaluate* the conditions of a Power system through steady state load flows or transient states stability studies and be able to propose various remedial measures.	4	C4
CLO 4	Enter Power system data correctly for analysis through computer simulation such as Power world software, and *interpret* the output	5	C4

	data.(E-TAP)		

2. Mapping of CLOs to Program Learning Outcomes

PLOs / CLOs	CLO 1	CLO 2	CLO 3	CLO4
PLO:1 (Engineering Knowledge)				
PLO:2 (Problem Analysis)		C5		
PLO:3 (Design/ Development of Solutions)	C3			
PLO:4 (Investigation)			C6	
PLO:5 (Modern Tool Usage)				C4
PLO:6 (The Engineer and Society)				
PLO:7 (Environment and Sustainability)				
PLO:8 (Professional Ethics)				
PLO:9 (Individual and Team Work)				
PLO:10 (Communication)				
PLO:11 (Project Management)				
PLO:12 (Lifelong Learning)				