Department of Electrical and Electronics Engineering

Course Modules of the Subject taught for the Even Session AY: 2024-25

Course Syllabi with CO's

Faculty Name : **Maria Sushma S**			Academic Year: **2024-25**				
Department: Electrical & Electronics Engineering							
Course Code	Course Title	Core/ Elective	Prerequisite	Contact Hours			Total Hrs/ Sessions
				L	T	P	
BEE601	**POWER SYSTEM ANALYSIS I**	**Core-PCC**	Power Generation and Economics, Transmission and Distribution,	**3**		2	40 Hours Theory+10 Lab slots

Objectives

1. To introduce the per unit system and explain its advantages and computation.
2. To explain the concept of one line diagram and its implementation in problems.
3. To explain the necessity and conduction of short circuit analysis.
4. To explain analysis of three phase symmetrical faults on synchronous machine and simple power systems.
5. To discuss selection of circuit breaker.
6. To explain symmetrical components, their advantages and the calculation of symmetrical components of voltages and currents in un-balanced three phase circuits.
7. To explain the concept of sequence impedance and its analysis in three phase unbalanced circuits.
8. To explain the concept of sequence networks and sequence impedances of an unloaded synchronous generator, transformers and transmission lines.
9. To explain the analysis of synchronous machine and simple power systems for different unsymmetrical faults using symmetrical components.
10. To discuss the dynamics of synchronous machine and derive the power angle equation for a synchronous machine.
11. Discuss stability and types of stability for a power system and the equal area criterion for the evaluation of stability of a simple system.

Topics Covered as per Syllabus

MODULE- 1

Representation of Power System Components: Introduction, Single-phase Representation of Balanced Three Phase Networks, One-Line Diagram and Impedance or Reactance Diagram, Per Unit (PU) System, Steady State Model of Synchronous Machine, Power Transformer, Transmission of Electrical Power, Representation of Loads**.** **10 Hours**

MODULE- 2

Symmetrical Fault Analysis: Introduction, Transient on a Transmission Line, Short Circuit of a Synchronous Machine(On No Load), Short Circuit of a Loaded Synchronous Machine, Illustrative simple examples on power systems. Selection of Circuit Breakers. **10 Hours**

MODULE- 3

Symmetrical Components: Introduction, Symmetrical Component Transformation, Phase Shift in Star-Delta Transformers, Sequence Impedances of Transmission Lines, Sequence Impedances and Sequence Network of Power System, Sequence Impedances and Networks of Synchronous

Machine, Sequence Impedances of Transmission Lines, Sequence Impedances and Networks of Transformers, Construction of Sequence Networks of a Power System. **10 Hours**

MODULE- 4

Unsymmetrical Fault Analysis: Introduction, Symmetrical Component Analysis of Unsymmetrical Faults, Single Line-To-Ground (LG) Fault, Line-To-Line (LL) Fault, Double Line-To-Ground (LLG) Fault, Open Conductor. **10 Hours**

MODULE-5

Power System Stability: Introduction, Dynamics of a Synchronous Machine, Review of Power Angle Equation, Simple Systems, Steady State Stability, Transient Stability, Equal Area Criterion. **10 Hours**

PRACTICAL COMPONENT OF IPCC

Experiments

1. Write a program to draw power angle curves for salient and non-salient pole synchronous machines, reluctance power, excitation, EMF and regulation.
2. Write a program to calculate Sag of a transmission line for i)Poles at equal height ii)Poles at unequal height
3. Write a program to determine the efficiency, Regulation, ABCD parameters for short and long transmission line and verify AD-BC=1.
4. Write a program to determine the efficiency, Regulation and ABCD parameters for medium transmission line for i) Π- configuration ii) T- Configuration and verify AD-BC=1.
5. Write a program to calculate sequence components of line voltages given the unbalanced phase voltages.
6. Write a program to calculate the sequence components of line currents, given the unbalanced phase currents in a three phase i) 3-wire system ii) 4 wire system.
7. Determination of fault currents and voltages in a single transmission line for
i) Single Line to Ground Fault. ii)Line to Line Fault
iii) Double Line to Ground Fault Using suitable simulating software package.
8. Determination of fault currents and voltages in a single transmission line for Three phase Fault Using suitable simulating software package.
9. Write a program to obtain critical disruptive voltage for various atmospheric and conductor conditions.
10. Write a program to evaluate transient stability of single machine connected to infinite bus.

Teaching-Learning Process	**Chalk and Board, Power Point Presentation.**

List of Text Books

TEXT BOOKS:

1. Modern Power System, D. P. Kothari, McGraw Hill, 4th Edition, 2011.

List of Reference Books:

1. Elements of Power System, William D. Stevenson Jr, McGraw Hill, 4th Edition, 1982.
2. Power System Analysis and Design, J. Duncan Gloveretal, Cengage, 4th Edition, 2008.
3. Power System Analysis, Hadi Sadat, McGraw Hill,1stEdition,2002.

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Web links and Video Lectures (e-Resources): https://nptel.ac.in/courses/108104051 Activity Based Learning (Suggested Activities in Class)/ Practical Based learning Activity Based Learning, Quizzes, Seminars.	
Course Outcomes	**At the end of the course the student will be able to:** 1. Model the power system components & construct per unit impedance diagram of power system. [L2] 2. Analyze three phase symmetrical faults on power system [L4]. 3. Compute unbalanced phasors in terms of sequence components and vice versa, also develop sequence networks [L3]. 4. Analyze various unsymmetrical faults on power system [L4]. 5. Examine dynamics of synchronous machine and determine the power system stability. [L3]

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

The IPCC means the practical portion integrated with the theory of the course. CIE marks for the theory component are 25 marks and that for the practical component is 25 marks.

CIE for the theory component of the IPCC

- 25 marks for the theory component are split into 15 marks for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and 10 marks for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.
- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

- 15 marks for the conduction of the experiment and preparation of laboratory record, and 10 marks for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test (duration 02/03 hours) after completion of all the experiments shall be conducted for 50 marks and scaled down to 10 marks.
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for 25 marks.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

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SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored by the student shall be proportionally scaled down to 50 Marks

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.

- The minimum marks to be secured in CIE to appear for SEE shall be 10 (40% of maximum marks-25) in the theory component and 10 (40% of maximum marks -25) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 sub-questions are to be set from the practical component of IPCC, the total marks of all questions should not be more than 20 marks.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify for the SEE. Marks secured will be scaled down to 50.
- The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

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The Correlation of Course Outcomes (CO's) and Program Outcomes (PO's)

Course Code:	BEE601	TITLE: Power System Analysis I						Faculty Name:		Maria Sushma S	
List of Course Outcomes	Program Outcomes										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	3	3	2	2	2	-	-	-	3	2	-	2
CO-2	3	3	2	2	2	2	-	-	3	2	-	2
CO-3	3	3	2	2	2	-	-	-	3	2	-	2
CO-4	3	3	2	2	2	2	-	-	3	2	-	2
CO-5	3	3	2	2	2	2	-	-	3	2	-	2

Note: 3= Strong Contribution 2 = Average Contribution 1 = Weak Contribution '-'= No Contribution

The Correlation of Course Outcomes (CO's) and Program Specific Outcomes (PSO's)

Course Code:	BEE601	TITLE: Power System Analysis I	Faculty Name:	Maria Sushma S
List of Course Outcomes	Program Specific Outcomes			
	PSO1	PSO2		
CO-1	-	2		
CO-2	3	2		
CO-3	3	2		
CO-4	3	-		
CO-5	3	3		

Note: 3= Strong Contribution 2 = Average Contribution 1 = Weak Contribution '-' = No Contribution