Department of Electrical and Electronics Engineering

Course Modules of the Subject taught for the Even Session Aug to Dec-2025-26

Course Syllabi with CO's

Faculty Name : **Maria Sushma S**			Academic Year: **2025-26**				
Department: Electrical & Electronics Engineering							
Course Code	Course Title	Core/ Elective	Prerequisite	Contact Hours			Total Hrs/ Sessions
				L	T	P	
BEE703	**POWER SYSTEM ANALYSIS 2**	**Core-IPCC**	Power Generation and Economics, Transmission and Distribution, PSA 1	**3**	**0**	**2**	**40+10=50**
Objectives	1. To explain formulation of network models and bus admittance matrix for solving load flow problems. 2. To discuss optimal operation of generators on a bus bar and optimum generation 3. scheduling. 4. To explain symmetrical fault analysis and algorithm for short circuit studies. 5. To explain formulation of bus impedance matrix for the use in short circuit studies on power systems. 6. To explain numerical solution of swing equation for multi-machine stability. 7. To develop admittance and impedance matrices of interconnected power systems. 8. To explain the use of suitable standard software package. 9. To solve power flow problem for simple power systems. 10. To perform fault studies for simple radial power systems. 11. To study optimal generation scheduling problems for thermal power plants.						
Topics Covered as per Syllabus							
Module-1:Network Topology: Introduction and basic definitions of Elementary graph theory Tree, cut-set, loop. Formation of Incidence Matrices. Primitive network-Impedance form and admittance form, Formation of Y Bus by Singular Transformation. Y bus by Inspection Method. Illustrative examples. **Module-2: Load Flow Studies**: Introduction, Classification of buses. Power flow equation, Operating Constraints, Data for Load flow, Gauss Seidel iterative method. Illustrative examples. **Module-3: Load Flow Studies(continued):**Newton-Raphson method derivation in Polar form, Fast decoupled load flow method, Flow charts of LF methods. Comparison of Load Flow Methods. Illustrative examples **Module-4: Economic Operation of Power System**: Introduction and Performance curves Economic generation Scheduling neglecting losses and generator limits Economic generation scheduling including generator limits and neglecting losses Economic dispatch including transmission losses Derivation of transmission loss formula. Illustrative examples. **Unit Commitment**: Introduction, Constraints and unit commitment solution by prior list method and							

dynamic forward DP approach (Flow chart and Algorithm only).

Module-5: Symmetrical Fault Analysis: Z Bus Formulation by Step by step building algorithm without mutual Coupling between the elements by addition of link and addition of branch. Illustrative examples. Z bus Algorithm for Short Circuit Studies excluding numerical.

Power System Stability: Numerical Solution of Swing Equation by Point by Point method and Runge Kutta Method. Illustrative examples

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

Experiments

1. To obtain Swing Curve and to Determine Critical Clearing Time, Regulation, Inertia Constant/Line Parameters /Fault Location/Clearing Time/Pre-Fault Electrical Output for a Single Machine connected to Infinite Bus through a Pair of identical Transmission Lines Under 3-Phase Fault On One of the two Lines. (Using suitable simulation package.)
2. Y-Bus Formation for Power Systems with and without Mutual Coupling, by Singular Transformation.
3. Y-Bus Formation for Power Systems without Mutual Coupling, by Inspection method.
4. Formation of Z-Bus (without mutual coupling) using Z-Bus Building Algorithm.
5. Formation of Jacobian matrix in Polar Coordinates, for a System having less than 4 Buses.
6. Determination of Bus Currents, Bus Power and Line Flows, for a Specified System Voltage.
7. Load Flow Analysis using Gauss Siedal Method for the system with both PQ buses and PV Buses. By simulation.
8. Load Flow Analysis using NR Method and Fast Decoupled Method for the system with both PQ buses and PV Buses. (Using suitable simulation package.)
9. Write a program to generate unit commitment schedule for a system with three units using priority listing method (priority based on least cost).
10. Optimal Generation Scheduling for Thermal power plants (Using suitable simulation package.)

Suggested Learning Resources:

1. Modern Power System Analysis, D P Kothari, I J Nagrath, McGraw Hill, 4th Edition, 2011.
2. Computer Methods in Power Systems Analysis, Glenn W. Stagg, Ahmed H Ei- Abiad, Scientific International, Pvt. Ltd,1stEdition, 2019.
3. Power Generation Operation and Control, AllenJ Wood etal, Wiley, 2nd Edition, 2016.
4. Computer Techniques in Power System Analysis, M.A. Pai,McGraw Hill, 2ndEdition, 2012.
5. Power System Analysis, Hadi Saadat, McGraw Hill, 2nd Edition, 2002.

Web links and Video Lectures (e-Resources):

https://nptel.ac.in/courses/108102047
https://nptel.ac.in/courses/108105067
https://nptel.ac.in/courses/108104051

Course Outcomes	**Students will be able to:** **CO1: Construct** network matrices and models for solving load flow problems.[**L3]** **CO2: Apply** and perform steady state power flow analysis of power systems using numerical iterative techniques. **[L4]** **CO3**: **Solve** issues of economic load dispatch and unit commitment problems. **[L3]** **CO4: Analyse** short circuit faults in power system networks using bus impedance matrix. Also Solve Swing equation using Point by Point method and Runge Kutta Method. **[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 component of IPCC (that is for 25 marks). 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.

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.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Activity Based Learning, Quizzes, Seminars

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

Course Code:	BEE703		TITLE: Power System Analysis 2					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	3	-	-	-	2	3	-	2
CO-2	3	3	2	2	3	-	-	-	2	3	-	2
CO-3	3	3	2	2	3	-	-	-	2	3	-	2
CO-4	3	3	2	2	3	-	-	-	2	3	-	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:	BEE703	TITLE: Power System Analysis 2	Faculty Name:	Maria Sushma S
List of Course Outcomes		Program Specific Outcomes		
		PSO1	PSO2	
CO-1		3	-	
CO-2		3	-	
CO-3		3	-	
CO-4		3	-	

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