|  |
| --- |
| **Jaipur Engineering College and Research Centre**  **Electrical Engineering Department** Course Plan   **Name of the Faculty: Shailendra Shrivastava**  **Designation: Assistant Professor**  **Name of the Subject:** PSE **Subject Code: 7EE5A**  **Semester: VII** **Academic Year: 2016 – 17** |
| Vision of Institute:  To become a renowned centre of outcome based learning, and work towards academic, professional, cultural and social enrichment of the lives of individuals and communities. |
| Mission of Institute:  • Focus on evaluation of learning outcomes and motivate students to inculcate research aptitude by project  Based learning.  • Identify, based on informed perception of Indian, regional and global needs, areas of focus and provide  platform to gain knowledge and solutions.  • Offer opportunities for interaction between academia and industry. • Develop human potential to its fullest extent so that intellectually capable and imaginatively gifted leaders  can emerge in a range of professions. |
| Vision of Department:  To emerge as a Center of Excellence in teaching in the area of Electrical Engineering, to serve as a valuable resource for society by promoting excellence. |
| Mission of Department:  M1: To provide professional and ethical guidance to the students to make them employable. M2: To improve quality of education through different quality development programs for faculty and  Students. M3: To encourage students to acquire practical knowledge through projects and participation in national  and international events.  M4: To prepare our students for upcoming challenges of life through guidance for competitive  examinations. |

**Introduction**

In Power System engineering emphasis is on to reduce the operating cost of a power plant and make the power system stable in various abnormal conditions. Ever since the 20th century, till the recent times all major power generating stations over the globe has mainly relied on A.C. distribution system as the most effective and economical option for the [transmission of electrical power](http://www.electrical4u.com/electrical-power-transmission-system-and-network/). Even the most effective way to produce bulk amount of power has been with the evolution of A.C. machine (i.e. [alternator](http://www.electrical4u.com/alternator-or-synchronous-generator/) or [synchronous generator](http://www.electrical4u.com/alternator-or-synchronous-generator/)). In the power plants, several [synchronous generators](http://www.electrical4u.com/alternator-or-synchronous-generator/) with different voltage ratings are connected to the bus terminals having the same frequency and phase sequence as the generators, while the consumer ends are feeded directly from those bus terminals. And therefore for stable operation it is important for the bus to be well synchronized with the generators over the entire duration of transmission, and for this reason the **power system stability** is also referred to as **synchronous stability** and is defined as the ability of the system to return to synchronism after having undergone some disturbance due to switching on and off of load or due to line transience.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **S. No.** | **Lecture No.** | **Topic to be discussed** | **Objective of lecture** | **Outcome of Lecture** | **Book referred** | **From page to** |
| 1 | UNIT I-1 | Economic Operation of Power Systems: Introduction, system constraints | Understanding power system limitation,economics of power system | Able to Implement the knowledge of power system limitation and economics of power system | Modern Power System Analysis (Fourth Edition) | 252-262 |
| [D.P. Kothari,I.J. Nagrath](https://www.abebooks.com/servlet/SearchResults?an=D.P.+Kothari%2CI.J.+Nagrath&cm_sp=det-_-bdp-_-author) |
| Published by Tata McGraw-Hill Education Pvt. Ltd, 2011 |
| 2 | 2 | optimal operation of power systems | Analysing optimal operation of power systems | Able to implement optimal solution on large power systems | Modern Power System Analysis (Fourth Edition) | 252-262 |
| [D.P. Kothari,I.J. Nagrath](https://www.abebooks.com/servlet/SearchResults?an=D.P.+Kothari%2CI.J.+Nagrath&cm_sp=det-_-bdp-_-author) |
| Published by Tata McGraw-Hill Education Pvt. Ltd, 2011 |
| 3 | 3 | Input output, heat rate and incremental rate curves of thermal generating units | Analyze Input output, heat rate and incremental rate curves of thermal generating units | Able to design thermal generating units according to requirement of the real world | Modern Power System Analysis (Fourth Edition) | 252-262 |
| [D.P. Kothari,I.J. Nagrath](https://www.abebooks.com/servlet/SearchResults?an=D.P.+Kothari%2CI.J.+Nagrath&cm_sp=det-_-bdp-_-author) |
| Published by Tata McGraw-Hill Education Pvt. Ltd, 2011 |
| 4 | 4 | Economic distribution of load between generating units within a plant | Understanding the Economic distribution of load between generating units within a plant | Able to distribute the load between generating units economically within the unit | J. J. Grainger and W. D. Stevenson: Power System Analysis, MGH | 532 - 539 |
|
|
| 5 | 5 | Economic distribution of load between power stations, transmission loss equation | Analyze Economic distribution of load between power stations, transmission loss equation | Able to distribute the load between all given generating units economically | J. J. Grainger and W. D. Stevenson: Power System Analysis, MGH | 540 551 |
|
|
| 6 | 6 | Economic distribution of load between power stations, transmission loss equation | Analyze Economic distribution of load between power stations, transmission loss equation | Able to distribute the load between all given generating units economically | J. J. Grainger and W. D. Stevenson: Power System Analysis, MGH | 540 551 |
|
|
| 7 | 7 | Introduction to unit commitment and dynamic programming | Understanding unit commitment and dynamic programming | Able to distribute the load between all given generating units economically | Modern Power System Analysis (Fourth Edition) | 307-313 |
| [D.P. Kothari,I.J. Nagrath](https://www.abebooks.com/servlet/SearchResults?an=D.P.+Kothari%2CI.J.+Nagrath&cm_sp=det-_-bdp-_-author) | 427 |
| Published by Tata McGraw-Hill Education Pvt. Ltd, 2011 |  |
| 8 | 8 | Introduction to unit commitment and dynamic programming | Understanding unit commitment and dynamic programming | Able to distribute the load between all given generating units economically | Modern Power System Analysis (Fourth Edition) | 307-313 |
| [D.P. Kothari,I.J. Nagrath](https://www.abebooks.com/servlet/SearchResults?an=D.P.+Kothari%2CI.J.+Nagrath&cm_sp=det-_-bdp-_-author) | 427,262 |
| Published by Tata McGraw-Hill Education Pvt. Ltd, 2011 |  |
| 9 | UNIT-II-1 | Power System Stability-I: Power angle equations and power angle curves under steady state and transient conditions | Analyze Power angle equations and power angle curves under steady state and transient conditions | Able to understand and model a system | J. J. Grainger and W. D. Stevenson: Power System Analysis, MGH | 707-713 |
|
|
| 10 | 10 | Power System Stability-I: Power angle equations and power angle curves under steady state and transient conditions | Analyze Power angle equations and power angle curves under steady state and transient conditions | Able to understand and model a system | J. J. Grainger and W. D. Stevenson: Power System Analysis, MGH | 707-714 |
|
|
| 11 | 11 | Power System Stability-I: Power angle equations and power angle curves under steady state and transient conditions | Analyze Power angle equations and power angle curves under steady state and transient conditions | Able to understand and model a system | J. J. Grainger and W. D. Stevenson: Power System Analysis, MGH | 707-714 |
|
|
| 12 | 12 | Rotor dynamics and swing equation (solution of swing equation not included) | Study Rotor dynamics and swing equation (solution of swing equation not included) | Able to understand transient and steady state condition of a machine | J. J. Grainger and W. D. Stevenson: Power System Analysis, MGH | 698-702 |
|
|
| 13 | 13 | Rotor dynamics and swing equation (solution of swing equation not included) | Study Rotor dynamics and swing equation (solution of swing equation not included) | Able to understand transient and steady state condition of a machine | J. J. Grainger and W. D. Stevenson: Power System Analysis, MGH | 698-702 |
|
|
| 14 | 14 | Synchronizing power coefficient | Analyzing Synchronizing power coefficient | Able to understand the synchronizing coefficient of a unit. | J. J. Grainger and W. D. Stevenson: Power System Analysis, MGH | 714 |
|
|
| 15 | 15 | Introduction to steady state and dynamic stabilities | Introduction to steady state and dynamic stabilities | Able to understand the stability phenomenon of interconnected power system | J. J. Grainger and W. D. Stevenson: Power System Analysis, MGH | 426-433 |
|
|
| 16 | 16 | steady state stability limit | Understanding the steady state stability limit | Able to model a system with maintain the steady state stability | Modern Power System Analysis (Fourth Edition) | 444-446 |
| [D.P. Kothari,I.J. Nagrath](https://www.abebooks.com/servlet/SearchResults?an=D.P.+Kothari%2CI.J.+Nagrath&cm_sp=det-_-bdp-_-author) |
| Published by Tata McGraw-Hill Education Pvt. Ltd, 2011 |
| 17 | UNIT-III-1 | Power System Stability-II: Introduction to transient stability | Introduction to transient stability | Able to understand transient stability | Modern Power System Analysis (Fourth Edition) | 448-449 |
| [D.P. Kothari,I.J. Nagrath](https://www.abebooks.com/servlet/SearchResults?an=D.P.+Kothari%2CI.J.+Nagrath&cm_sp=det-_-bdp-_-author) |
| Published by Tata McGraw-Hill Education Pvt. Ltd, 2011 |
| 18 | 18 | Equal area criterion and its application to transient stability studies under basic disturbances | Analyze Equal area criterion and its application to transient stability studies under basic disturbances | Able to design protection system for basic disturbances | Modern Power System Analysis (Fourth Edition) | 450-460 |
| [D.P. Kothari,I.J. Nagrath](https://www.abebooks.com/servlet/SearchResults?an=D.P.+Kothari%2CI.J.+Nagrath&cm_sp=det-_-bdp-_-author) |
| Published by Tata McGraw-Hill Education Pvt. Ltd, 2011 |
| 19 | 19 | Equal area criterion and its application to transient stability studies under basic disturbances | Analyze Equal area criterion and its application to transient stability studies under basic disturbances | Able to design protection system for basic disturbances | Modern Power System Analysis (Fourth Edition) | 450-460 |
| [D.P. Kothari,I.J. Nagrath](https://www.abebooks.com/servlet/SearchResults?an=D.P.+Kothari%2CI.J.+Nagrath&cm_sp=det-_-bdp-_-author) |
| Published by Tata McGraw-Hill Education Pvt. Ltd, 2011 |
| 20 | 20 | Equal area criterion and its application to transient stability studies under basic disturbances | Analyze Equal area criterion and its application to transient stability studies under basic disturbances | Able to design protection system for basic disturbances | Modern Power System Analysis (Fourth Edition) | 450-460 |
| [D.P. Kothari,I.J. Nagrath](https://www.abebooks.com/servlet/SearchResults?an=D.P.+Kothari%2CI.J.+Nagrath&cm_sp=det-_-bdp-_-author) |
| Published by Tata McGraw-Hill Education Pvt. Ltd, 2011 |
| 21 | 21 | Critical clearing angle and critical clearing time | Understanding Critical clearing angle and critical clearing time | Able to understand the problem range and also able to design proper protection system | Modern Power System Analysis (Fourth Edition) | 450-460 |
| [D.P. Kothari,I.J. Nagrath](https://www.abebooks.com/servlet/SearchResults?an=D.P.+Kothari%2CI.J.+Nagrath&cm_sp=det-_-bdp-_-author) |
| Published by Tata McGraw-Hill Education Pvt. Ltd, 2011 |
| 22 | 22 | Critical clearing angle and critical clearing time | Understanding Critical clearing angle and critical clearing time | Able to understand the problem range and also able to design proper protection system | Modern Power System Analysis (Fourth Edition) | 450-460 |
| [D.P. Kothari,I.J. Nagrath](https://www.abebooks.com/servlet/SearchResults?an=D.P.+Kothari%2CI.J.+Nagrath&cm_sp=det-_-bdp-_-author) |
| Published by Tata McGraw-Hill Education Pvt. Ltd, 2011 |
| 23 | 23 | Factors affecting stability and methods to improve stability | Study the Factors affecting stability and methods to improve stability | Able to create a network model to improve stability | Power System Stability And Control,Prabha Kundur,TMH | 1104-1127 |
|
|
| 24 | 24 | Factors affecting stability and methods to improve stability | Study the Factors affecting stability and methods to improve stability | Able to create a network model to improve stability | Power System Stability And Control,Prabha Kundur,TMH | 1104-1127 |
|
|
| 25 | UNIT-IV-1 | Excitation Systems: Introduction of excitation systems of synchronous machines, types of excitation systems | Study the excitation systems of synchronous machines and types of excitation systems | Able to design excitation systems of synchronous machines for different applications | Power System Stability And Control,Prabha Kundur,TMH | 315-316 |
|
|
| 26 | 26 | Elements of various excitation systems and their control (functional block diagrams and their brief description) | Analyze Elements of various excitation systems and their control (functional block diagrams and their brief description) | Able to design excitation systems for different applications | Power System Stability And Control,Prabha Kundur,TMH | 315-316 |
|
|
| 27 | 27 | DC excitation systems | Analyze DC excitation systems | Able to design DC exciter for an alternator | Power System Stability And Control,Prabha Kundur,TMH | 319-320 |
|
|
| 28 | 28 | AC excitation systems, brushless excitation system | Analyze AC excitation systems, brushless excitation system | Able to design AC exciter | Power System Stability And Control,Prabha Kundur,TMH | 320-326 |
|
|
| 29 | 29 | Interconnected Power Systems: Introduction to isolated and interconnected powers systems | Introduction to isolated and interconnected powers systems | Able to understand the power system network | Generation of Electrical Energy ByDr.BR Gupta | 293 |
|
|
| 30 | 30 | Reserve capacity of power stations, spinning and maintenance resaves | Analyze reserve capacity of power stations, spinning and maintenance resaves | Able to maintain uninterrupted power supply to the load and also satisfy the load demand | Generation of Electrical Energy ByDr.BR Gupta | 86 |
|
|
| 31 | 31 | Advantages and problems of interconnected power systems | Study the Advantages and problems of interconnected power systems | Able to understand the power system network | Generation of Electrical Energy ByDr.BR Gupta | 293 |
|
|
| 32 | 32 | Power systems inter connection in India | Study the Power systems inter connection in India | Able to understand the power system network | Generation of Electrical Energy ByDr.BR Gupta | 330-332 |
|
|
| 33 | UNIT-V-1 | Tap Changing transformer | Analyze the Tap Changing transformer | Able to improve power system performance using Tap Changing transformer | J. J. Grainger and W. D. Stevenson: Power System Analysis, MGH | 76-79 |
|
|
| 34 | 34 | phase angle control and phase shifting transformer | phase angle control and phase shifting transformer | Able to improve power system performance using phase shifting transformer | Power System Stability And Control,Prabha Kundur,TMH | 245 |
|
|
| 35 | 35 | Series compensation of transmission lines | Analyze the Series compensation of transmission lines | Able to improve power system performance using series compensation of transmission lines | Power System Stability And Control,Prabha Kundur,TMH | 654-671 |
|
|
| 36 | 36 | location and protection of series capacitors, advantages and problems | Analyze the location and protection of series capacitors, advantages and problems | Able to set the location of series capacitors to improve power system performance | Modern Power System Analysis (Fourth Edition) | 98-108 |
| [D.P. Kothari,I.J. Nagrath](https://www.abebooks.com/servlet/SearchResults?an=D.P.+Kothari%2CI.J.+Nagrath&cm_sp=det-_-bdp-_-author) |
| Published by Tata McGraw-Hill Education Pvt. Ltd, 2011 |
| 37 | 37 | location and protection of series capacitors, advantages and problems | Analyze the location and protection of series capacitors, advantages and problems | Able to set the location of series capacitors to improve power system performance | Modern Power System Analysis (Fourth Edition) | 98-108 |
| [D.P. Kothari,I.J. Nagrath](https://www.abebooks.com/servlet/SearchResults?an=D.P.+Kothari%2CI.J.+Nagrath&cm_sp=det-_-bdp-_-author) |
| Published by Tata McGraw-Hill Education Pvt. Ltd, 2011 |
| 38 | 38 | Introduction to power system security | Study the power system security | Able to design the power system security for un interrupting power supply. | Modern Power System Analysis (Fourth Edition) | 291-298 |
| [D.P. Kothari,I.J. Nagrath](https://www.abebooks.com/servlet/SearchResults?an=D.P.+Kothari%2CI.J.+Nagrath&cm_sp=det-_-bdp-_-author) |
| Published by Tata McGraw-Hill Education Pvt. Ltd, 2011 |
| 39 | 39 | Introduction to power system security | Study the power system security | Able to design the power system security for un interrupting power supply. | Modern Power System Analysis (Fourth Edition) | 291-298 |
| [D.P. Kothari,I.J. Nagrath](https://www.abebooks.com/servlet/SearchResults?an=D.P.+Kothari%2CI.J.+Nagrath&cm_sp=det-_-bdp-_-author) |
| Published by Tata McGraw-Hill Education Pvt. Ltd, 2011 |
| 40 | 40 | Introduction to voltage stability | Analyze voltage stability | Able to understand voltage stability problem | Power System Stability And Control,Prabha Kundur,TMH | 27-33 |
|
|

**List of other Text and References Books used**

**Text books:**

1.Electric Power Systems, by B.M.Weedy, 4th Edition, John Wiley.

2.A Text Book on Power System Engineering, by A. Chakraborthy, .L,Soni,

P.V .Gupta, U. S. Bhatnagar, Dhanpat Rai & CO.

**Reference/Suggested Books**

1.J. Nagrath and D.P. Kothari: Power System Engineering 2/e (TMH)

2.J. J. Grainger and W. D. Stevenson: Power System Analysis (TMH)

3.B. R. Gupta, “Power System Analysis and Design” Third Edition, S. Chand & Co.

4.C. L. Wadhwa, “Electrical Power Systems”New age international Ltd. Third Edition

5.W. D. Stevenson, “Element of Power System Analysis”, McGraw Hill.

6.B.R. Gupta,“Generation of Electrical Energy”, S. Chand Publication.

7.Power System Analysis and Design, by J. Duncan Glover and M. Sarma,

University Syllabus: POWER SYSTEM ENGINEERING 7EE5A

Unit-1 Economic Operation of Power Systems: Introduction, system constraints, optimal operation of power systems. Input output, heat rate and incremental rate curves of thermal generating units. Economic distribution of load between generating units within a plant. Economic distribution of load between power stations, transmission loss equation. Introduction to unit commitment and dynamic programming.

Unit-2 Power System Stability -I: Power angle equations and power angle curves under steady state and transient conditions. Rotor dynamics and swing equation (solution of swing equation not included), synchronizing power coefficient. Introduction to steady state and dynamic stabilities, steady state stability limit.

Unit-3 Power System Stability-II: Introduction to transient stability. Equal area criterion and its application to transient stability studies under basic disturbances, critical clearing angle and critical clearing time. Factors affecting stability and methods to improve stability.

Unit-4 (i) Excitation Systems: Introduction of excitation systems of synchronous

machines, types of excitation systems, Elements of various excitation systems and their control (functional block diagrams and their brief description)-DC excitation systems, AC excitation systems, brushless excitation system. (ii) Interconnected Power Systems: Introduction to isolated and interconnected powers systems. Reserve capacity of power stations, spinning and maintenance resaves. Advantages and problems of interconnected power systems. Power systems inter connection in India.

Unit-5 (i) Tap Changing transformer, phase angle control and phase shifting transformer. Series compensation of transmission lines, location and protection of series capacitors, advantages and problems. (ii) Introduction to power system security. (iii) Introduction to voltage stability.