

Techno India NJR Institute of Technology



Course File

Power System Planning (6EE5-11)

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(Professor)

Department of Electrical Engineering

Syllabus:



RAJASTHAN TECHNICAL UNIVERSITY, KOTA

Syllabus

III Year - VI Semester: B.Tech. (Electrical Engineering)

6EE5-11: POWER SYSTEM PLANNING

Credit: 3
3L+0T+0P

Max. Marks: 150(IA:30, ETE:120)
End Term Exam: 3 Hours

SN	CONTENTS	HOURS
1	Introduction: Objective, scope and outcome of the course.	01
2	Introduction of power planning: National and Regional Planning, structure of Power System, planning tools. Electricity Regulation, Electrical Forecasting, forecasting techniques modeling.	08
3	Power system Reliability: System Reliability, Reliability Planning Criteria for Generation, Transmission and Distribution, Grid Reliability, Reliability Target, Security Requirement, Disaster Management, Roadmap for Reliability and Quality.	08
4	Generation Planning: Objectives & Factors affecting Generation Planning, Generation Sources, Integrated Resource Planning, Generation System Model, Loss of Load (Calculation and Approaches), Outage Rate, Capacity Expansion, Scheduled Outage, Loss of Energy, Evaluation Methods. Interconnected System, Factors affecting interconnection under Emergency Assistance.	08
5	Transmission & Distribution Planning: Introduction, Objectives of Transmission Planning, Network Reconfiguration, System and Load Point Indices, Data required for Composite System Reliability. Radial Networks – Introduction, Network Reconfiguration, Evaluation Techniques, Interruption Indices, Effects of Lateral Distribution Protection, Effects of Disconnects, Effects of Protection Failure, Effects of Transferring Loads, Distribution Reliability Indices	08
6	Demand Side Planning: Computer aided planning, wheeling. Environmental effects, the greenhouse effect. Technological impacts. Insulation coordination. Reactive compensation.	08
	TOTAL	41

Course Overview:

Power system planning is an activity related to the development of plans for designing and construction of the system and its elements, which will satisfy assumed future needs, starting from the given state. First paper presents basic principles of power system development planning with its concepts. Electrical energy losses as well as forecasting of energy consumption are taken into consideration. Basic principles of development planning for each subsystem (generation, transmission and distribution) are presented.

Course Outcome:

CO. NO.	Cognitive Level	Course Outcome
1	Synthesis	Students will be able to discuss primary components of power system planning, planning methodology for optimum power system expansion, various types of generation, transmission and distribution.
2	Synthesis	Students will be able to show knowledge of forecasting of future load requirements of both demand and energy by deterministic and statistical techniques using forecasting tools.
3	Analysis	Students will be able to categorize and select methods to mobilize resources to meet the investment requirement for the power sector
4	Application	Students will be able to apply and modify economic appraisal to allocate the resources efficiently and appreciate the investment decisions.
5	Analysis	Students will be able to apply computer aided planning, wheeling, Insulation coordination, reactive compensation.

Prerequisites:

1. The prerequisites for this course are Electrical forecasting, Electricity regulation.
2. Students should be known to reliability planning criteria for generation, transmission and distribution.
3. Students should be familiar with electrical network topologies.
4. Demand site planning.

Course Outcome Mapping with Program Outcome:

Course Outcome	Program Outcomes (PO's)											
CO. NO.	Domain Specific (PSO)					Domain Independent (PO)						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	2	1	-	-	-	-	-	-	-
CO2	2	1	2	2	-	-	-	-	-	-	-	-
CO3	2	3	2	2	1	-	-	-	-	-	-	-
CO4	2	3	2	2	1	-	-	-	-	-	-	-
CO5	2	2	1	2	2	-	-	-	-	-	-	-

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Course Coverage Module Wise:

Lect. No.	Unit	Topic
1	1	INTRODUCTION: Objective, Scope and Outcome Of The Course.
2	2	INTRODUCTION: Power Planning
3	2	National and Regional Planning,
4	2	National and Regional Planning,
5	2	Structure of Power System,
6	2	planning tools
7	2	Electricity Regulation, Electrical Forecasting
8	2	forecasting techniques modeling
9	3	POWER SYSTEM RELIABILITY: System Reliability
10	3	Reliability Planning Criteria for Generation
11	3	Reliability Planning Criteria for Generation
12	3	Transmission and Distribution
13	3	Grid Reliability,
14	3	Reliability Target, Security Requirement
15	3	Disaster Management,
16	3	Roadmap for Reliability and Quality
17	4	GENERATION PLANNING: Objectives & Factors affecting Generation Planning,
18	4	Generation Sources, Integrated Resource Planning
19	4	Generation System Model,

20	4	Loss of Load (Calculation and Approaches), Outage Rate,
21	4	Capacity Expansion, Scheduled Outage,
22	4	Loss of Energy, Evaluation Methods
23	4	Interconnected System, Factors affecting
24	4	Interconnection under Emergency Assistance.
25	5	TRANSMISSION & DISTRIBUTION PLANNING: Introduction, Objectives of Transmission Planning,
26	5	Network Reconfiguration
27	5	System and Load Point Indices,
28	5	Data required for Composite System Reliability.
29	5	Radial Networks – Introduction, Network Reconfiguration
30	5	Evaluation Techniques, Interruption Indices
31	5	Effects of Lateral Distribution Protection,
32	5	Effects of Disconnects, Effects of Protection Failure
33	5	Effects of Transferring Loads, Distribution Reliability Indices
34	6	COMPUTER AIDED PLANNING: Computer Aided Planning
35	6	Wheeling.
36	6	Environmental effects
37	6	The greenhouse effect
38	6	Technological impacts.
39	6	Insulation coordination
40	6	Reactive compensation
41		Revision to course work.
42		Revision to course work.

Text/Reference Books:

- 1 X. Wang, J. R. Mc Donald: Modern Power System Planning, MGH.
- 2 Electric Power Planning, A. S. Pabla, McGraw Hill, 2nd Edition, 2016
- 3 S. Pabla: Electrical Power System Planning, Machmillan India Ltd
- 4 M. Tillic, F. Faliana and L. Fink: Power System Restructuring Engineering and Economics, Kulwar Academic Publisher.
- 5 L. L. Lie: Power System Restructuring and Deregulation, John Willey & Sons UK.

Teaching and Learning resources:

NPTEL Course Link	https://nptel.ac.in/courses/108/106/108106025/
Quiz	https://sites.google.com/site/eeenotes2u/courses/power-system-generation-transmission-and-distribution
Notes	https://quizizz.com/admin/quiz/5f3f442dc042c6001c82801d/power-system-protection

Assessment Methodology:

1. Assignments one from each unit.
2. Midterm subjective paper where they have to solve the given problem. (Twice during the semester)
3. Final paper at the end of the semester subjective

Previous Year Paper

6E1576	Roll No. _____	[Total No. of Pages : 2]
	6E1576 B.Tech. VI Sem. (Main/Back) Examination, June - 2022 Electrical Engg. 6EE5-11 Power System Planning	

Time : 3 Hours

Maximum Marks : 120

Min. Passing Marks : 42

Instructions to Candidates:

Attempt all ten questions from Part A, five questions out of Seven from Part B and Four questions out of Five from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Use of following supporting materials is permitted during examination. (Mentioned in form No. 205)

PART - A

(Answer should be given up to 25 words only)

All questions are compulsory (10×2=20)

1. Explain the electrical forecasting.
2. Write the few names of regulatory authorities which involves in power system planning.
3. Explain reliability target.
4. Explain security requirement in power system reliability.
5. List the various methods of cogeneration.
6. List the factors affecting generation planning.
7. What are the effects of disconnects?
8. What are the effects of lateral distribution protection?
9. What is reactive compensation?
10. What are the technological impacts of green house effect?

PART - B

(Analytical/Problem solving questions)

Attempt any five questions. (5×8=40)

1. What are the challenges faced by power system planning engineers?
2. Explain the concept of least cost utility planning with the aid of flowchart.

3. Briefly explain the reliability planning criteria for generation.
4. Why integrated power generation is required?
5. What are the different factors affecting the interconnection under emergency assistance?
6. Write the objectives of power system transmission planning.
7. Explain minimum assured reliability constraints by using optimization techniques of solution by programming.

PART - C

(Descriptive/Analytical/Problem Solving/Design questions)

Attempt any **Four** questions.

(4×15=60)

1. a. Mention and explain factors affecting the load of utility in forecasting modeling.
b. Define the electricity regulators involves in the power system planning.
2. a. How the reliability and quality related in power system planning?
b. Explain the grid reliability in power system.
3. a. Briefly explain the loss of load in generation planning.
b. Explain the terms outage rate and scheduled outage.
4. a. What do you understand by system and load point indices?
b. Define the different distribution reliability indices.
5. a. Define the concept of wheeling and wheeling charges in power system.
b. What is insulation coordination? Explain the principle of insulation coordination.

Mid term papers

TECHNO INDIA NJR INSTITUTE OF TECHNOLOGY

B. TECH III – YEAR (VI SEM.)

Mid Term-1 Session 2022-23

Electrical Engineering

Power System Planning (6EE5-11)



Max Marks: 70

Time: 3 Hrs

Note:

- 1) The paper is divided into 2 parts: Part-A and, Part-B
- 2) Part-A contains 10 questions and carries 2 mark each.
- 3) Part-B contains 5 questions. Each question is having two options and carries 10 marks

each.

PART - A

1.	List major factors affecting power system planning.	[CO]
2.	Describe any planning tool in power system.	[CO]
3.	Name the different power system region in India.	[CO]
4.	Define system reliability.	[CO]
5.	List system regulatory in power system planning.	[CO]
6.	What are the impacts of greenhouse effect on power system planning.	[CO]
7.	What is electrical forecasting?	[CO]
8.	Write the percentage of power generation in India for Thermal. Wind and Solar plants.	[CO]
9.	What is least cost utility in planning?	[CO]
10.	What is the necessity of power system planning?	[CO]

PART - B

1.	Mention and explain the factors affecting the load of utility in forecasting modelling.	[CO]
OR		
1.	Explain power system planning and planning process.	[CO]
2.	What is the objective of power system transmission planning?	[CO]
OR		
2.	Why integrated power generation is required?	[CO]
3.	Explain all power system zones in India.	[CO]
OR		
3.	What are the challenges faced by power system planning engineers?	[CO]
4.	Discuss electricity forecasting schemes.	[CO]
OR		
4.	Discuss power system planning tools in details.	[CO]

5.	Define term strategic planning.	[CO]
OR		
5.	Describe power system resources in detail.	[CO]

TECHNO INDIA NJR INSTITUTE OF TECHNOLOGY, UDAIPUR
B. TECH 3rd – YEAR (VI SEM.) – II MT
Power System Planning (6EE5-11)

Time: 3 Hr

Max. Marks: 70

Note:

- 1) The paper is divided into 2 parts: Part-A and, Part-B.
- 2) Part-A contains 10 questions and carries 2 mark each.
- 3) Part-B contains 5 questions. Each question is having two options and carries 10 marks each.

Part- A (20 Marks)

A.	Explain the electrical forecasting.	CO1
B.	Write few names of regulatory authorities which involves in power system planning.	CO1
C.	Explain reliability target.	CO2
D.	Explain security requirements in power system reliability.	CO2
E.	List various methods of cogeneration.	CO3
F.	List factors affecting generation planning.	CO3
G.	What are the effects of disconnect?	CO4
H.	What is lateral distribution protection?	CO4
I.	Define reactive compensation.	CO5
J.	Describe the impact of greenhouse effect.	CO5

Part- B (50 Marks)

1.	What are the challenges faced by power system planning engineers?	CO1
OR		
1.	Briefly explain the reliability planning criteria for transmission.	CO1
2.	How is the reliability and quality related in power system planning?	CO2
OR		
2.	Write the objectives of power system transmission planning.	CO2
3.	Explain grid reliability in power system.	CO3
OR		
3.	Explain loss of load in generation planning.	CO3
4.	Define the concept of wheeling and wheeling charges in power system.	CO4
OR		
4.	What are the applications of WAMS for improving protection system?	CO4
5.	What is insulation coordination? Explain in details.	CO5
OR		
5.	Explain minimum assured reliability constraint by using optimization techniques of solution by programming.	CO5

