

Techno India NJR Institute of Technology



Course File

Power Generation Processes (3EE3-04)

Mr. Rajkumar Soni
(Assistant Professor)

Department of Electrical Engineering

For Techno India NJR Institute of Technology
पंकज पोरवाल
Dr. Pankaj Kumar Porwal
(Principal)

Syllabus:



RAJASTHAN TECHNICAL UNIVERSITY, KOTA SYLLABUS

2nd Year - III Semester: B.Tech. (Electrical Engineering)

3EE3-04: Power Generation Processes

Credit: 2

Max. Marks: 100 (IA:20, ETE:80)

2L+0T+0P

End Term Exam: 2 Hours

SN	CONTENTS	Hours
1.	Conventional Energy Generation Methods Thermal Power plants: Basic schemes and working principle. (ii) Gas Power Plants: open cycle and closed cycle gas turbine plants, combined gas & steam plants-basic schemes. Hydro Power Plants: Classification of hydroelectric plants. Basic schemes of hydroelectric and pumped storage plants. (iv) Nuclear Power Plants: Nuclear fission and nuclear fusion. Fissile and fertile materials. Basic plant schemes with boiling water reactor, heavy water reactor and fast breeder reactor. Efficiencies of various power plants.	6
3.	New Energy Sources Impact of thermal, gas, hydro and nuclear power stations on environment. Green House Effect (Global Warming).Renewable and nonrenewable energy sources. Conservation of natural resources and sustainable energy systems. Indian energy scene. Introduction to electric energy generation by wind, solar and tidal.	6
4.	Loads and Load Curves Types of load, chronological load curve, load duration curve, energy load curve and mass curve. Maximum demand, demand factor, load factor, diversity factor, capacity factor and utilization.	2
5.	Power Factor Improvement Causes and effects of low power factor and advantages of power factor improvement. Power factor improvement using shunt capacitors and synchronous condensers.	3
6.	Power Plant Economics Capital cost of plants, annual fixed and operating costs of plants, generation cost and depreciation. Effect of load factor on unit energy cost. Role of load diversity in power system economics. Calculation of most economic power factor when (a) kW demand is constant and (b) kVA demand is constant. (iii) Energy cost reduction: off peak energy utilization, co-generation, and energy conservation.	5
7.	Tariff Objectives of tariffs. General tariff form. Flat demand rate, straight meter rate, block meter rate. Two part tariff, power factor dependent tariffs, three part tariff, Spot (time differentiated) pricing.	3
8.	Selection of Power Plants Comparative study of thermal, hydro, nuclear and gas power plants. Base load and peak load plants. Size and types of generating units, types of reserve and size of plant. Selection and location of power plants.	4
Total		28

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Office of Dean Academic Affairs

Course Overview:

This course represents the power generation processes using conventional and non conventional energy resources. In this course student will learn conventional energy generation methods, new energy sources, loads and load curves power factor improvement, power plant economics from this 28-hour course. In electrical engineering power generation transmission and distribution is very important. After going through this course student will be able to analyse the effect of conventional energy resources on the environment. This course covers different type of power generation process from thermal power plants, hydropower plants, nuclear power plants and renewable energy sources like solar energy and wind energy

This course will make student for any power plan commissioning, power production planning and tariff management. This course will help student to get employed in any power plant or power generation industry.

Course Outcome:

CO. NO.	Cognitive Level	Course Outcome
1	Synthesis	The student will be able to explain the operations of the thermal power plant with all main parts and cycles.
2	Synthesis	The student will be aware of the principle of operation, components, layout, location, environmental and social issues of nuclear, diesel and gas power plants.
3	Application	Students will be able to identify and demonstrate the components of hydropower plant. Explain the operation of hydropower plant.
4	Analysis	Students will be able to categorize the operation of electrical energy generation using biomass, tidal, geothermal, hydel plants.
5	Analysis	Students will be able to categorize the operation of electrical energy base load and peak load selection and location of power plants.

Prerequisites:

1. Fundamentals of Energy Sources.
2. Students should be efficient in basic mathematical calculations.
3. Students should know electrical machines and power systems.
4. Students should know about the basics of the tariff of commercial and non-commercial consumption.

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Course Outcome Mapping with Program Outcome:

Subject Code : 3EE3-04	Subject Name: Power Generation Process
CO1	Explain the operations of thermal power plant with all main parts and cycles.
CO2	Be aware of the principle of operation, components, layout, location, environmental and social issues of nuclear, diesel and gas power plant.
CO3	Identify and demonstrate the components of hydro power plant. Explain operation of hydro power plant.
CO4	Understand the operation of electrical energy generation using biomass, tidal, geothermal, hydel plants.
CO5	Objectives of tariffs. General tariff form. Flat demand rate, straight meter rate, block meter rate.

Course Coverage Module Wise:

Lect. No.	Unit	Topic
1	1	CONVENTIONAL ENERGY GENERATION METHODS Thermal Power plants: Basic schemes and working principle.
2	1	(ii) Gas Power Plants: open cycle and closed cycle gas turbine plants
3	1	Combined gas & steam plants-basic schemes. Hydro Power Plants: Classification of hydroelectric plants. Basic schemes of hydroelectric and pumped storage plants
4	1	(iv) Nuclear Power Plants: Nuclear fission and nuclear fusion. Fissile and fertile materials.
5	1	Basic plant schemes with boiling water reactor, heavy water reactor and fast breeder reactor.
6	1	Efficiencies of various power plants.
7	2	NEW ENERGY SOURCES Impact of thermal, gas
8	2	Hydro and nuclear power stations on environment. Green House Effect (Global Warming).
9	2	Renewable and non renewable energy sources.
10	2	Conservation of natural resources and sustainable energy systems. Indian energy scene.
11	2	Introduction to electric energy generation by wind
12	2	Solar and tidal.
13	3	LOADS AND LOAD CURVES Types of load, chronological load curve, load duration curve, energy load curve and mass curve.
14	3	Maximum demand, demand factor, diversity factor, capacity factor and utilization.

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15	4	POWER FACTOR IMPROVEMENT Causes and effects of low power factor
16	4	Advantages of power factor improvement
17	4	Power factor improvement using shunt capacitors and synchronous condensers
18	5	POWER PLANT ECONOMICS Capital cost of plants, annual fixed and operating costs of plants,
19	5	Generation cost and depreciation. Effect of load factor on unit energy cost.
20	5	Role of load diversity in power system economics. Calculation of most economic power factor when
21	5	a) KW demand is constant and (b) kVA demand is constant. (iii) Energy cost reduction
22	5	Off peak energy utilization, co-generation, and energy conservation
23	6	TARIFF Objectives of tariffs. General tariff form
24	6	Flat demand rate, straight meter rate, block meter rate
25	6	Two part tariff, power factor dependent tariffs, three part tariff. Spot (time differentiated) pricing.
26	7	SELECTION OF POWER PLANTS Comparative study of thermal, hydro
27	7	Nuclear and gas power plants. Base load and peak load plants.
28	7	Size and types of generating units, types of reserve and size of plant.
29	7	Selection and location of power plants.

Text/Reference Books:

1. B. R. Gupta. Generation of Electrical Energy (4/e), S. Chand Publication. 2013
2. S. L. Uppal. Electrical Power (13/e), Khanna Publishers
3. V. K. Mehta, Principles of Power system (3/e), S. Chand Publication 2005
4. Soni, Gupta and Bhatnagar, Generation of Electrical Power, Dhanpat Rai & Sons

Teaching and Learning resources:

NPTEL Course Link	https://onlinecourses.nptel.ac.in/noc20_me10/preview https://nptel.ac.in/courses/108/102/108102047/
Quiz	https://quizizz.com/admin/quiz/5de29d7c644873001bc0b91b/energy-production-quiz https://instrumentationtools.com/top-100-power-plant-engineering-objective-questions-answers/
Notes	https://nptel.ac.in/courses/108/102/108102047/

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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 Years Question Paper

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3E1142

Total No of Pages: 2

3E1142
B. Tech. III - Sem. (Main) Exam., Dec. - 2018
ESC Electrical & Electronics Engineering
3EX3 - 04 Power Generation Process
EE, EX

Time: 2 Hours

Maximum Marks: 80

Instructions to Candidates:

Attempt all five questions from Part A, four questions out of six questions from Part B and two questions out of three from Part C.

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

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

1. NIL

2. NIL

PART - A

(Answer should be given up to 25 words only)

[5×2=10]

All questions are compulsory

- Q.1 What is the function of combustion chamber in gas power plant?
- Q.2 How fertile material can be used for power generation in nuclear plant?
- Q.3 Name the different types of solar collector for solar thermal energy conversion system?
- Q.4 What is the effect of load factor on unit generation cost?
- Q.5 Where are shunt capacitors located?

[3E1142]

[4040]

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PART – B

(Analytical/Problem solving questions)

[4×10=40]

Attempt any four questions

- Q.1 Draw key diagram of a thermal (coal fired) power plant? Explain the advantages of pulverized coal.
- Q.2 What is breeding ratio for fertile atoms used in nuclear process? Explain any type of nuclear reactor with diagram indicating name of components.
- Q.3 What is the necessity of long and short term load forecasting? Write the differences between chronological load curve and load duration curve?
- Q.4 How can most economic power factor and KVAR of capacitor be calculated? Compare the advantages and disadvantages of using a synchronous condenser and a capacitor for power factor improvement. <http://www.rtuonline.com>
- Q.5 Discuss the role of load factor on the cost of electrical energy. Why should the total generation cost per unit of thermal energy depend on the station load factor? Draw a typical curve showing this variation and justify its shape.
- Q.6 Discuss the factors which tend to limit the size of units in steam plants. Distinguish between operating reserve and spinning reserve.

PART – C

(Descriptive/Analytical/Problem Solving/Design Question)

[2×15=30]

Attempt any two questions

- Q.1 Explain the functions of various components of a thermal power plant?
- Q.2 Explain causes and effects of low power factor and advantages of power factor improvements.
- Q.3 Explain Indian energy scene and give detail of planning for conservation of natural resources and sustainable energy systems.