

LESSON PLAN

Engineering Materials and Metallurgy

(ME 2253)

**DEPARTMENT OF MECHANICAL
ENGINEERING**



Name of the Faculty: **M.PALANIVENDHAN**

Year/semester: **II/IV**

SYLLABUS:

ME1353 – POWER PLANT ENGINEERING

UNIT I INTRODUCTION TO POWER PLANTS AND BOILERS

Layout of steam, hydel, diesel, MHD, nuclear and gas turbine power plants – Combined power cycles – Comparison and selection – Load duration curves – Steam boilers and cycles – High pressure and super critical boilers – Fluidised bed boilers.

UNIT II STEAM POWER PLANT

Fuel and ash handling – Combustion equipment for burning coal – Mechanical stokers – Pulveriser – Electrostatic precipitator – Draught – Surface condenser types – Cooling towers.

UNIT III NUCLEAR AND HYDEL POWER PLANTS

Nuclear energy – Fission – Fusion reaction – Types of reactors – Pressurized water reactor – Boiling water reactor – Waste disposal and safety.
Hydel power plant – Essential elements – Selection of turbines – Governing of turbines – Micro hydel Developments

UNIT IV DIESEL AND GAS TURBINE POWER PLANT

Types of diesel plants components – Selection of engine type – Applications gas turbine power plant – Fuels – Gas – Turbine material – Open and closed cycles – Reheating – Regeneration and intercooling – Combined cycle.

UNIT V OTHER POWER PLANTS AND ECONOMICS OF POWER PLANTS

Geo thermal – OTEC – Tidel - Pumped storage - Solar thermal central receiver system – Cost of electric energy – Fixed and operating costs – Energy rates – Types of tariffs – Economics of load sharing – Comparison of economics of various power plants.

Total: 45

TEXT BOOKS

1. Arora, S.C. and Domkundwar, S., “A Course in Power Plant Engineering”, Dhanpatrai, 2001.
2. Nag, P.K., “Power Plant Engineering”, Tata McGraw-Hill, 1998.

REFERENCES

1. Nagpal, G.R., “Power Plant Engineering”, Hanna Publishers, 1998.
2. Ramalingam, K.K., “Power Plant Engineering”, Scitech Publications, 2002.
3. Rai, G.D., “Introduction to Power Plant Technology”, Khanna Publishers, 1995.
4. Rajput, R.K., “Power Plant Engineering”, Laxmi Publications, 1995

L = 45 PERIODS

REFERENCES:

1. Power station Engineering and Economy by Bernhardt G.A.Skrotzki and William A. Vopat-Tata McGraw Hill Publishing Company Ltd., New Delhi, 20th reprint 2002.
2. An introduction to power plant technology by G.D. Rai-Khanna Publishers, Delhi-110 005.

3. Power Plant Technology, M.M. El-Wakil McGraw Hill 1984.

| Unit No & Name | Lecture No | Topic(s) | Book Used for teaching | Page Number |
|--|-------------------|--|-------------------------------|--------------------|
| UNIT I INTRODUCTION TO POWER PLANTS AND BOILERS | 1 | Basic thermodynamic cycles | | |
| | 2 | various components of steam power plant-layout-pulverized coal burners | | |
| | 3 | Fluidized bed combustion-coal handling systems-ash handling systems | | |
| | 4 | Forced draft and induced draft fans | | |
| | 5 | Boilers-feed pumps-super heater | | |
| | 6 | regenerator-condenser | | |
| | 7 | dearearators-cooling tower | | |
| UNIT II STEAM POWER PLANT | 9 | Layout-dams | | |
| | 10 | selection of water turbines | | |
| | 11 | types & pumped storage hydel plants | | |
| UNIT III NUCLEAR AND HYDEL POWER PLANTS | 12 | Principles of nuclear energy | | |
| | 13 | Fission reactions | | |
| | 14 | nuclear reactor | | |
| | 15 | nuclear power plants | | |
| UNIT IV DIESEL AND GAS TURBINE POWER PLANT | 16 | Types, open and closed cycle gas turbine | | |
| | 17 | work output & thermal efficiency | | |
| | 18 | methods to improve performance | | |
| | 19 | reheating, intercooling | | |
| | 20 | regeneration-advantage and disadvantages | | |

| | | | | |
|---|----|---------------------------------|--|--|
| OTHER POWER PLANTS AND ECONOMICS OF POWER PLANTS | 25 | wind power plants | | |
| | 26 | tidal power plants | | |
| | 27 | geothermal resources | | |
| | 28 | Fuel cell | | |
| | 29 | MHD power generation-principle | | |
| | 30 | thermoelectric power generation | | |
| | 31 | thermionic power generation | | |

TEXT BOOKS:

1. A Course in Power Plant Engineering by Arora and Domkundwar, Dhanpat Rai and Co.Pvt.Ltd., New Delhi.
2. Power Plant Engineering by P.K. Nag, Tata McGraw Hill, Second Edition , Fourth reprint 2003.

TEST PATTERNS:

DAT (Daily Assessment Test)

| | | | |
|----------|-------------------------|----|--------------------------|
| | Short answers (2 Marks) | 4 | Questions are compulsory |
| provided | Long answers (16 Marks) | 16 | Alternate options are |

CAT (Cyclic Assessment Test)

| | | | |
|----------|-------------------------|----|--------------------------|
| | Short answers (2 Marks) | 18 | Questions are compulsory |
| provided | Long answers (16 Marks) | 32 | Alternate options are |

SEMINAR TOPICS:

- Wind power plants
- Regeneration-advantage and disadvantages
- Basic thermodynamic cycles

ASSIGNMENT TOPICS:

- Fission reactions

- OETC
- Fuel cell

QUESTION BANK

UNIT I

THERMAL POWER PLANTS

PART A (2 marks)

1. What is a thermodynamic cycle?
2. What are the assumptions made for air standard cycle analysis?
3. Define air standard cycle efficiency.
4. List out the major advantages of high pressure boilers in modern thermal power plants.
5. What is the function of economizer?
6. What are the modern trends in generating steam of high pressure boiler?
7. What are types of fluidized bed boilers?
8. What are all the features of the high-pressure boilers?
9. What is cooling tower approach?
10. What the advantages of burning coal are in pulverized form?

PART B (16 marks)

1. Explain the construction and working of Steam power plant with a layout.
2. (a) Why are feed water heaters used?
(b) Explain with a sketch the working of a Barometric condenser?
3. (a) Discuss the relative merits of different out plant coal handling.
(b) Describe the hydraulic ash handling system.
4. (a) Draw a chart showing operations and devices used in coal handling plant.
(b) Describe different types of coal conveyors.
5. What is the importance of thermal power development in the country? Describe its development in the last 10 years.
6. Explain the construction and working of any one High pressure boiler with a layout.
7. Explain the construction and working of any one Fluidised bed boiler with a layout.

UNIT II

HYDRO ELECTRIC POWER PLANTS

PART A (2 marks)

1. What is the purpose of surge tank in a hydroelectric power plant?
2. What are the three main factors for power output of hydroelectric plant?

3. Give an example for a low head turbine, a medium head turbine and a high head turbine.
4. What are reaction turbines? Give example.
5. Differentiate the impulse and reaction turbine.
6. Define unit speed of turbine.
7. What is the significance of specific speed of hydraulic turbines?
8. What is the function of surge tank in a hydro electric power plant?
9. What is a draft tube? In which type turbine it is mostly used?
10. Write the function of draft tube in turbine outlet?

PART B (16 marks)

1. Explain the construction and working of Hydel power plant with a layout.
2. What are the various factors to be considered in selecting the site for a hydro electric power plant and discuss about primary and secondary investigations.
3. Explain the design aspects of a pelton wheel.
4. Describe the classification of turbines.
5. What are the components of the Francis turbine and describe briefly.
6. (a) Explain in detail the spillways, baffle piers and drainage gallery.
(b) Explain the various factors to be considered in the selection of a hydraulic

turbine.

7. (a) What is surge tanks and state its purpose.

(b) Differentiate Francis turbine between Kaplan turbines.

8. (a) Explain the terms catchment area, rain fall and run off.

(b) Explain the arrangement of the components of a hydro electric power plant

with a neat sketch.

UNIT III

NUCLEAR POWER PLANTS

PART A (2 marks)

1. How the nuclear reactors are classified?

2. Give the requirements of chain reaction.

3. What is “half life” of nuclear fuels?

4. What do you understand by moderation?

5. Explain the function of the moderator.

6. Define the term “Breeding”

7. What factors control the selection of a particular type of a reactor?

8. What are the components pressurized water reactor nuclear power plant?

9. What are the components of supercritical water reactor nuclear power plant?

10. List down the nuclear waste disposal methods

PART B (16 marks)

1. Explain the construction and working of Nuclear power plant with a layout.
2. (a) What is a chain reaction? How it is controlled.
(b) Describe the fast breeder reactor.
(c) What is function of shield? What are the different types of shields?
3. (a) With neat sketch explain the boiling water reactor power plant.
(b) What are the advantages and disadvantages of nuclear power plant?
4. (a) What are the advantages and disadvantages of breeder reactor?
(b) What do you mean by fission of nuclear fuel?
(c) Explain briefly about radiation hazards and shielding?
5. (a) What do you understand by thermal shielding?
(b) What are the functions of a reflector?
(c) Explain the working and characteristic features of a homogeneous reactor.

UNIT IV

GAS AND DIESEL POWER PLANTS

PART A (2 marks)

1. What are the main units in a gas turbine power plant?
2. How the gas turbine blades are cooled?
3. Mention the various processes of the brayton cycle.
4. Define mean effective pressure as applied to gas power cycles.

5. How it is related to indicated power of an I.C. engine?
6. Draw the p-V and T-s diagram of Brayton cycle.
7. Sketch the schematic arrangement of open cycle gas turbine plant and name the components.
8. Discuss the effect of inter colling in a gas turbine plant.
9. What is the principle of operation of simple jet propulsion system?
10. Why is the maximum cycle temperature of gas turbine plant much lower than that of diesel power plant?
11. List out the inherent advantages of the combined power cycle.

PART B (16 marks)

1. Explain the construction and working of Gas turbine power plant with a layout.
2. (a) Explain with the help of a block diagram the fuel storage and supply system
of diesel power plant.
(b) Explain with the help of a block diagram the water cooling system of diesel
power plant.
3. (a) Mention the advantages and disadvantages of a diesel power plant over a gas turbine power plant.
(b) Give a maintenance schedule for Diesel engine power plant.
4. Describe the following systems in brief with respect Diesel Power Plant.
(a) Fuel storage and supply system

(b) Exhaust system

(c) Lubrication system

5. (a) Draw a neat layout of a diesel power plant and label all the components.

(b) List the advantages of diesel power plants over other thermal power plants.

6. (a) Explain the cooling system of a Diesel power plant.

(b) What are the different types of engines used in Diesel power plants.

7. With a neat sketch explain the working of a simple constant pressure gas turbine. Mention its advantages and disadvantages.

8. (a) With help of a block diagram explain the main components of an open cycle

gas turbine power plant.

UNIT V

NON – CONVENTIONAL POWER GENERATION

PART A (2 marks)

1. What is geothermal energy?

2. What are the applications of geothermal energy?

3. What are the different geothermal fluids?

4. What are the forms of geothermal energy stored deeply inside the earth?

5. What are the important criteria while selecting the geothermal energy?

6. What are the different types of geothermal energy deposits?
7. What are the different working fluids in binary cycle geothermal power plants?
8. What are the different types of OTEC?
9. What are the working fluids in closed cycle OTEC?
10. What are the components of Tidal power plants?

PART B (16 marks)

1. Explain the construction and working of Geo thermal power plant.
2. What are the different types of geothermal energy system?
3. Explain the working principle of OTEC.
4. What are the different types of Tidal power plants?
5. Explain the Solar thermal central receiver system.
6. What are the different types of ocean thermal energy conversion system?
7. Explain the analysis of a central receiver system.

UNIVERSITY QUESTION BANK

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2010

Fourth Semester

Electrical and Electronics Engineering

EE2252 — POWER PLANT ENGINEERING

(Regulation 2008)

Time: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A — (10 × 2 = 20 Marks)

1. Mention the various modern ash handling systems.
2. What are the factors affecting cooling of water in cooling tower?
3. Enumerate advantages and disadvantages of hydropower plants.
4. What is a surge tank?
5. What are the requirements of fission process?
6. What are the essential components of a nuclear reactor?
7. State the merits and demerits of closed cycle gas turbine over open cycle gas turbine power plant.
8. State the applications of diesel power plant.
9. What is a fuel cell?
10. What are the advantages and limitations of tidal power plant?

PART B — (5 × 16 = 80 Marks)

11. (a) Give the layout of a modern steam power plant and explain it briefly.
Or
(b) How are cooling towers classified? Explain any one of them with a neat sketch.
12. (a) Explain with a neat sketch a pumped storage power plant.
Or
(b) What is the function of a hydraulic turbine? How are the turbines classified? Explain any one with a suitable sketch.
13. (a) With the help of a sketch show all the important part of nuclear reactor. Describe briefly the functions of each part.
Or
(b) Explain the following terms:
 - (i) Fission of nuclear fuel
 - (ii) Distribution of fission energy
 - (iii) The chain reaction.
14. (a) Discuss briefly the methods employed for improvement of thermal efficiency of open gas turbine power plant.
Or
(b) List the essential components of a diesel power plant and explain them briefly.
15. (a) Explain with a neat diagram of wind electric generating power plant.
Or
(b) Describe open cycle MHD system with suitable sketch.

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2011
Fourth Semester
Electrical and Electronics Engineering

EE 2252 — POWER PLANT ENGINEERING
(Regulation 2008)
Time : Three hours Maximum : 100 marks

Answer ALL questions

PART A — (10 × 2 = 20 marks)

1. State and explain the Carnot cycle process.
2. Define boiler mountings and boiler accessories.
3. Mention the merits of hydro electric power plants.
4. Classify the hydro electric turbines with respect to high medium and low head.
5. What is nuclear fission?
6. State the fuels used in the gas turbine power plants.
7. Distinguish between PHWR and LMFBR.
8. What is meant by combined cycle power plant?
9. State the application of solar thermal system.
10. What are the different types of geothermal fluid and give its temperature range.

PART B — (5 × 16 = 80 marks)

11. (a) Draw a Rankin cycle for a coal fired and steam thermal power plant. State the means of increasing the efficiency of the plant.

Or

- (b) Explain in detail the coal handling system with suitable block diagram.
12. (a) With a neat sketch explain in detail the construction and working principle of Hydro electric power plant.

Or

(b) Neatly explain the hydro electric energy resources in India.

13. (a) Write a detailed technical note on the following

(i) Boiling water reactor

(ii) Gas cooled reactor.

Or

(b) Explain the importance of nuclear waste management.

14. (a) Write a detailed technical note on the following :

(i) Reheating

(ii) Regeneration.

Or

(b) With a neat sketch explain in detail, about the component and layout of Diesel engine power plant.

15. (a) Explain in detail, about the various types of wind Energy system.

Or

(b) Classify and explain in detail about the Tidal Energy Conversion System.