# TEACHING PLAN: POWER PLANT ENGINEERING

| SCHOOL: SOET | ACADEMIC SESSION 2022-23 | FOR STUDENTS' BATCH: 2019-2023 |
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| 1 | **Course code** | PCC – ME 404 |
| 2 | **Course Title** | POWER PLANT ENGINEERING |
| 3 | **Credits** | **3** |
| 4 | **Learning Hours** | **Contact Hours: 45**<br>**Practical Teaching: 00**<br>**Project, Tutorial and Assessment: 15**<br>**Total hours: 60** |
| 5 | **Course Objective** | I. Tocreateawarenessaboutvarioustypes of powerplants<br>II. To understand steam power plant working<br>III. To understand working of nuclear andhydro-electric power plants<br>IV. Abletolearnaboutgas turbine and diesel power plants.<br>V. Tounderstand of renewable energy generation, pollution control techniques and applytheconceptsofeconomicsinpower plants |
| 6 | **Course Outcomes** | 1. Enablestudentstounderstandabout different types of power plants and boilers and combined power plant<br>2. Identify elements and their functions and operations of steam power plants.<br>3. Identify elements and their functions and operations of nuclear and hydel power plants<br>4. Identify elements and their functions and operations of diesel and gas turbine power plants<br>5. To illustrate the students to get the exposure of different renewable energy resources and to understand the economicsofpower plantsandpollution control techniques. |
| 7 | **Outline syllabus:** | |

| 7.01 | Paper Code | Unit | Introduction | Reference number | Teaching methods |
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| 7.02 | PCC – ME 404 | I | **Introduction To Power Plants & 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 | T1, R1 | PPT, Seminar, Chalk & Talk |
| 7.03 | | II | **SteamPowerPlant:**FuelandAshHandling,CombustionEquipmentforburningcoal,MechanicalStokers, Pulveriser,ElectrostaticPrecipitator,Draught,differenttypes,SurfaceCondenserTypes,CoolingTowers | T1, R1 | PPT, Seminar, Chalk & Talk |
| 7.04 | | III | **Nuclear And Hydel Power Plants:** Basics of nuclear energy conversion, Layout and subsystems of nuclear power plants, Nuclear Energy, Fission, Fusion Reaction, Types of Reactors, pressurized water reactor, Boiling Water Reactor, Waste Disposal and safety measures for nuclear power plants. Hydel Power Plant, Essential Elements, Selection of Turbines, | T1,R2, R3 | PPT, Seminar, Chalk & Talk |

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| | | | Governing of Turbines, Micro Hydel developments. | | |
| | | 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 Inter-cooling, Combined Cycle. | T1, R1,R2 | PPT, Seminar, Chalk & Talk |
| **7.05** | | V | **Other Power Plants:** Hydroelectric power plants, classification, typical layout and components, principles of wind, tidal, solar PV and solar thermal, geothermal, biogas and fuel cell power systems. capital and operating cost of different power plants, pollution control technologies including waste disposal options for coal and nuclear plants, Energy Rates, Types of Tariffs, power tariffs and Economics of load sharing, comparison of economics of various power plants | T1, R1,R3 | PPT, Seminar, Chalk & Talk |

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| **8** | **Course Evaluation** | |
| **8.10** | **CA: 20%** | |
| **8.1** | **Attendance** | 5% |
| **8.12** | **Homework** | - |
| **8.13** | **Quizzes** | 4 Quizzes, 5% |
| **8.14** | **Projects** | 1 Project, 5% |
| **8.15** | **Presentation** | 1 Presentation, 5% |
| **8.16** | **Any other** | -- |
| **8.2** | **MTE(IA)** | 20% |
| **8.3** | **End-term examination: 60%** | |
| **9** | **Text Books & References** | |
| **9.1** | **Text books** | 1. G.R.Nagpal,"PowerPlant Engineering",Hanna Publishers, 1998.<br>2. NagP.K.,PowerPlantEngineering, 3rded.,TataMcGrawHill, 2008.<br>3. ElWakilM.M.,PowerPlantTechnology, TataMcGrawHill,2010. |
| **9.2** | **References** | 1. AnIntroductiontoPowerPlantTechnology/G.D.Rai/KhannaPublishers<br>2. Power plant engineering Arora and DomkundwarDhanpat rai & CO (P) LTD<br>3. A Text Book of Power Plant Engineering. R K Rajput Laxmi Publications<br>4. Power Plant Engineering A K Raja, Amit Prakash Srivastava and Manish Dwivedi New age international Publishers |
| **9.3** | **Video References** | i. http://nptel.ac.in/courses/112105051/<br>ii. https://www.youtube.com/watch?v=Ota2_LUuar0<br>iii. https://www.youtube.com/watch?v=Ota2_LUuar0<br>iv. https://www.youtube.com/watch?v=3dJAtHaSQ98<br>v. https://www.youtube.com/watch?v=xokHLFE96h8<br>vi. http://www.tatapower.com/businesses/renewable-energy.aspx<br>vii. http://www.cleanlineenergy.com/technology/wind-and-solar<br>viii. https://www.youtube.com/watch?v=kbuLfXgw4Gs<br>ix. https://www.youtube.com/watch?v=r9q80sSHxKM<br>x. https://www.youtube.com/watch?v=GZKKWz_tX1c |

**Mapping of COs & POs**

| Course Outcome | Program Outcome | | | | | | | | | | | | PSO | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 |
| CO1 | 2 | 2 | 2 | | | | 2 | | | | 2 | | 3 | 2 | 2 | 2 |
| CO2 | 2 | 2 | 2 | | | | 2 | | | | 2 | | 3 | 2 | 2 | 2 |
| CO3 | 2 | 2 | 2 | | | | 2 | | | | 2 | | 3 | 2 | 2 | 2 |
| CO4 | 2 | 2 | 2 | | | | 2 | | | | 2 | | 3 | 2 | 2 | 1 |
| CO 5 | 2 | 2 | 2 | | | 2 | 2 | | | | 2 | | 3 | 2 | 2 | 1 |

## QUESTION BANK

UNIT I

1. Draw a general layout of steam power plant with neat diagram and explain the working of different circuits.
2. Explain the Benson boiler with neat diagram: Draw a general layout of thermal power plant and explain the working of different circuits.
3. Describe the working of a high pressure boiler with super heaters.
4. Draw a neat diagram of Lamont boiler and explain its working.
5. What do you understand by fluidized bed combustion?
6. Discusstheessential componentsofthe dieselpowerplant withneatlayout.
7. Howdoyouselectengineforadieselpowerplant?Drawadieselpowerplantandexplain itsmajorcomponents
8. Explaintheconstructionandworkingof gasturbinepower plantwithalayout
9. Discusstheworkingofcombined cyclepower plant
10. Withneatdiagram,explaintheworkingprincipleofMHD.
11. Compare different types of power plants and discuss.
12. Explainthe Constructionand workingof nuclear power plant with alayout.
13. Whataretheessentialelementsofhydropowerplant?Explainwithaneat sketch
14. Explain load duration curve in detail.

UNIT II

1. Write short notes on the requirements of surface condensers.
2. Explain in detail the coal handling system with a suitable block diagram.
3. Describe the different types of over feed stokers and discuss its merits and demerits of each over others.
4. Why is coal pulverized? Explain any one type of pulverized systems used now-a-days.
5. With the help of a neat sketch describe the working of any one type of ash handling system.
6. Differentiate between forced draught and induced draught cooling tower.
7. What is stoker? Classify it.
8. With the help of a neat sketch describe the working of electrostatic precipitator (ESP).

UNIT III

1. Nuclear power plant Layout and working procedure.
2. Define nuclear fission, nuclear fusion and chain reaction.
3. Draw nuclear reactor mark all the components and working of BWR, BWR, CANDU
4. Draw and explain Liquid metal cooled reactor, GCR, Fast Breeder Reactor
5. Write the advantages, disadvantages and applications of nuclear power plants.

UNIT IV

1. Discuss the essential components of the diesel power plant with neat layout.
2. How do you select engine for a diesel power plant? Draw a diesel power plant and explain its major components.

3. Explain the construction and working of gas turbine power plant with a layout.
4. Discuss the working of combined cycle power plant
5. Explain different components and operation of gas turbine power plant.
6. Draw the diagrams and explain difference between open cycle and closed cycle gas turbine power plants.
7. With aid of block diagram, explain the working principle of closed cycle gas turbine power plant.
8. What are the elements of gas turbine power plant? Explain

UNIT V

1. Discuss various components of wind energy system.
2. What are the essential elements of hydro power plant? Explain with a neat sketch.
3. Explain the working of Pelton turbine with a neat diagram. What is the function of a draft tube?
4. Describe the working of a low head hydro plant with a neat diagram.
5. Explain with a neat sketch a pumped storage power plant.
6. Explain the spring tides and neap tides. Discuss the different tidal power schemes and configurations with neat sketches.
7. Draw a schematic diagram of a solar power plant and explain the operation of it. Also mention its merits and demerits.
8. Explain the construction and working of geo thermal power plant and tidal power plants.
9. Define the terms anaerobic digestion, Fermentation and What are the advantages and disadvantages of floating drum plant Give the list of the materials used for biogas generation
10. Describe the principle of a fuel cell and discuss the choice of fuels required.
11. (i) Explain the construction and working of fuel cell also mention its merits and demerits.
    (ii)List the advantages and disadvantages of wind energy system.
12. Explain with a neat sketch working of a distributed (Parabolic) trough Solar Power Plant.
13. Explainthemethodstocontrolpollutioninthermalandnuclear powerplants.
14. Writeanexplanatorynoteon theeconomics ofpowergeneration.
15. What is meant by load factor and diversity factor?
16. Elucidate the objectives and requirements to tariff and general form of tariff.
17. Whataretheelementswhichcontributetothecostof,theelectricity'?Andhowcantheco stpowergenerationbereduced?
18. Explain briefly the various methods used to, calculate the depreciation cost.
19. Whatare thefixedandoperatingcostsofsteampowerplant?How are theyaccountedforfixingcostofelectricity?
20. Explain the analysis of pollution from thermal power plants. What ismethods used forcontrol the pollutants?
21. Writeshort noteson nuclearwaste disposal.
22. (i) Explain the site selection criterion of hydro power plant.
    (ii)A peak load on the thermal power plant is 75 MW. The loads having maximumdemands of 35 kW, 20 MW, 15 MW and 18 MW are connected to the power plant. Thecapacity of the plant is 90 MW and annual load factor is 0.53. Calculate the average loadonpower plant, energysupplied peryear,demandfactorand diversityfactor.