



# GUJARAT TECHNOLOGICAL UNIVERSITY

**Bachelor of Engineering**

**Subject Code: 3172429**

**Subject Name: Power Plant Engineering**

**Semester – VII**

**Type of course:** Open Elective Course

**Prerequisite:**

**Rationale:** Electricity is used in everyday life, in some form or the other. It is used to light bulbs for reading and working in the dark. It is used to run domestic appliances, agricultural pumps, and all kinds of machinery, transport, health care, communication devices and many more. When more electricity is used, it may be inferred that it is a sign of development. Per Capita consumption of electricity may be considered an index of development. Considering this, it becomes necessary for any electrical, mechanical, and allied engineering students to study and understand power plant related concepts. This subject provides an overview of power plants and the associated energy conversion issues.

**Teaching and Examination Scheme:**

| Teaching Scheme |   |   | Credits<br>C | Examination Marks |        |                 |        | Total<br>Marks |
|-----------------|---|---|--------------|-------------------|--------|-----------------|--------|----------------|
| L               | T | P |              | Theory Marks      |        | Practical Marks |        |                |
|                 |   |   |              | ESE (E)           | PA (M) | ESE (V)         | PA (I) |                |
| 2               | 1 | 0 | 3            | 70                | 30     | 0               | 0      | 100            |

**Content:**

| Sr. No. | Course Content                                                                                                                                                                                                                                                                                                                                                             | Total Hrs. |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| 1       | <b>Introduction:</b> Electrical Power Generation concepts, sources of energy like fossil fuels (coal, diesel etc.), atomic power, solar, wind energy, etc., Basics of energy conversion                                                                                                                                                                                    | 2          |
| 2       | <b>Coal Based Thermal Power Plants:</b> Rankine cycle, improvisations, Layout of modern coal power plant, Super Critical Boilers, FBC Boilers, Turbines, Condensers, Steam & Heat rate, Subsystems of thermal power plants, Fuel and ash handling, Draught system, Feed water treatment. Binary Cycles and Cogeneration systems.                                           | 4          |
| 3       | <b>Diesel, Gas Turbine and Combined Cycle Power Plants:</b> Otto, Diesel, Dual & Brayton Cycle, Analysis & Optimization. Components of Diesel and Gas Turbine power plants. Combined Cycle Power Plants. Integrated Gasifier based Combined Cycle systems.                                                                                                                 | 4          |
| 4       | <b>Nuclear Power Plant:</b> Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors, Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANada Deuterium- Uranium reactor (CANDU), Breeder, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.                            | 4          |
| 5       | <b>Power from Renewable Energy:</b> Hydro Electric Power Plants Classification, Typical Layout and associated components including Turbines. Principle, Construction and working of Wind, Tidal, Solar Photo Voltaic (SPV), Solar Thermal, Geothermal, Biogas and Fuel Cell power systems                                                                                  | 8          |
| 6       | <b>Electrical Systems:</b> Generators and generator cooling, transformers and their cooling, bus bar, etc.<br><b>Power Plant Automation and instrumentation:</b> Instrumentation in power plant, Purpose, classification, selection and application, controllers, recorders, and their use, listing of various control rooms. Power plant automation using PLC, SCADA etc. | 4          |
| 7       | <b>Energy, Economic and Environmental Issues of Power Plants:</b> Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants. Pollution control                                                                                                   | 4          |



# GUJARAT TECHNOLOGICAL UNIVERSITY

**Bachelor of Engineering**

**Subject Code: 3172429**

|                                                                                  |  |
|----------------------------------------------------------------------------------|--|
| technologies including Waste Disposal Options for Coal and Nuclear Power Plants. |  |
|----------------------------------------------------------------------------------|--|

**Suggested Specification table with Marks (Theory): (For BE only)**

| Distribution of Theory Marks |           |           |           |           |          |
|------------------------------|-----------|-----------|-----------|-----------|----------|
| R Level                      | U Level   | A Level   | N Level   | E Level   | C Level  |
| <b>35</b>                    | <b>40</b> | <b>10</b> | <b>05</b> | <b>10</b> | <b>0</b> |

**Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)**

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

**Reference Books:**

1. Nag P.K., Power Plant Engineering, 3rd ed., Tata McGraw Hill, 2008.
2. El Wakil M.M., Power Plant Technology, Tata McGraw Hill, 2010.
3. Elliot T.C., Chen K and Swanekamp R.C., Power Plant Engineering, 2nd ed., McGraw Hill, 1998.

**Course Outcome:**

After learning this course, the students should be able:

| Sr. No. | CO statement                                                                                                                 | Marks % weightage |
|---------|------------------------------------------------------------------------------------------------------------------------------|-------------------|
| CO1     | After learning this course, the students should be able to understand the principles of operation for different power plants | 25                |
| CO2     | understand the economics related to different power plants                                                                   | 25                |
| CO3     | analyze impact of different power plants on environment                                                                      | 25                |
| CO4     | identify various electrical and instrumentation system requirements.                                                         | 25                |

**List of Open-Source Software/learning website:**

<https://nptel.ac.in/courses/112/107/112107291/>