

Name of Institute : Indus Institute of Technology & Engineering

Name of Faculty : Mechanical Engineering

Course code : ME0517

Course name : Power Plant Engineering

Pre-requisites: : Heat and mass transfer, Engg Thermodynamics

Credit points : 3

Offered Semester : V

Course Coordinator (01-12)

Full name: Bhavin Khatri

Department with siting location: FPE Lab, 1st Floor, Bhanwar Building

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Consultation times: 9:00 AM to 5:00 PM

Course Objectives

By participating in and understanding all facets of this course a student will:

The course objective is to give fundamental knowledge of construction and working of various types of thermal power plants i.e. steam turbine, gas turbine, nuclear etc.

Course Outcomes (CO)

Students will be able to :

1. Understand the different power generation methods, its economics and global energy situation
2. Apply the basic thermodynamics and fluid flow principles to different power generation methods
3. Analyze thermodynamic cycles of steam power plant and understand construction, working and significance of its various systems
4. Analyze thermodynamic cycles of gas turbine power plant, nuclear power plant and jet propulsion systems

Program Outcomes (PO)

PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Environment and sustainability: Understand the impact of the Professional solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Course Outline

UNIT-I

[08]

Thermal Power Plant:

General layout of modern thermal power plant, Site selection, Presents status of power generation in India.

High Pressure Boilers & Accessories:

Unique features and advantages of high pressure boilers, La-Mont, Benson, Loeffler, Schmidt- Hartmann, Velox, supercritical, Supercharged and fluidized bed combustion boiler. Different types of super-heaters, Reheaters, economizers, Air pre- heaters, Methods of superheat control, Corrosion in boilers and its prevention.

UNIT-II

[08]

Coal & Ash Handling Systems:

Coal handling storage of coal, Burning systems, Types of stokers their working, Pulverized fuel handling systems, Unit and central systems, Pulverized mills- ball mill, Bowl mill, Ball & race mill, Impact or hammer mill, Pulverized coal burners, Oil burners. Necessity of ash disposal, Mechanical, Hydraulic, pneumatic and steam jet ash handling system, Dust collection and its disposal, Mechanical dust collector, Electrostatic precipitator.

Draught System:

Natural draught- estimation of height of chimney, Maximum discharge, Condition, Forced, Induced and balanced draught, Power requirement by fans.

UNIT-III

[10]

Diesel Power Plant:

Essential components of diesel power plant, Different systems like fuel supply system, Engine cooling system, Engine lubrication system, Exhaust system, Engine starting and stopping system.

Nuclear Power Plant:

Nuclear fusion and fission, Chain reaction, Nuclear fuels, Components of nuclear reactor, Classification of reactors, Pressurized water reactor, Boiling water reactor, Gas cooled reactor, CANDU reactor, Fast breeder reactor, Nuclear waste and its disposal, Nuclear power plants in India.

UNIT-IV

[10]

Condensers and Cooling Towers:

Types of condensers, sources of air in condenser, Effects of air leakage, Methods of obtaining maximum vacuum in condenser, Dalton's law of partial pressure, vacuum & condenser efficiency, Mass of cooling water required, Air Pump- Edward air pump. Necessity of cooling ponds and cooling towers, Condenser water cooling systems, Types of cooling

Economics of Power Generation:

Load curves, Load duration curves, connected load, Maximum load, Peak load, base load and peak load power plants, Load factor, Plant capacity factor, Plant use factor, Demand factor, Diversity factor, cost of power plant, Performance and operating characteristics of power plant, Tariff for electric energy, Power plant engineering software-design, construction, operation and life cycle analysis.

towers, cooling ponds.Method of delivery

Lectures (Chalk & talk, PPT)

Tutorials (Chalk & talk, PPT)

Video lectures for some relevant topics

Study time

3 hours for Lectures per week

CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO1	3	1	1	-	-	-	-	-	-	-	-	1
CO2	3	2	3	1	3	-	-	-	-	-	-	-
CO3	3	2	2	2	3	-	-	-	-	-	-	-
CO4	2	2	1	-	-	-	-	-	-	-	-	1

Blooms Taxonomy and Knowledge retention

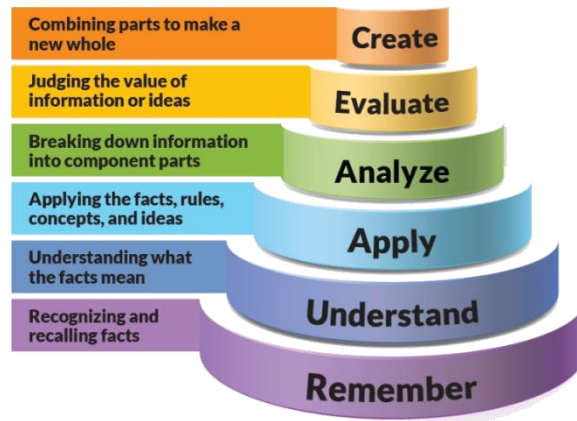


Figure 1: Blooms Taxonomy

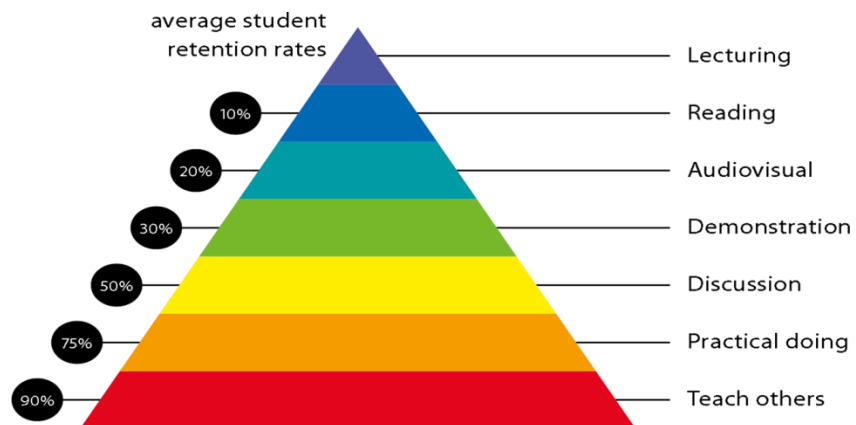


Figure 2: Knowledge retention

Graduate Qualities and Capabilities covered

(Qualities graduates harness crediting this Course)

General Graduate Qualities	Specific Department of Graduate Capabilities
<p>Informed</p> <p>Have a sound knowledge of an area of study or profession and understand its current issues, locally and internationally. Know how to apply this knowledge. Understand how an area of study has developed and how it relates to other areas.</p>	<p>1 Professional knowledge, grounding & awareness</p>
<p>Independent learners</p> <p>Engage with new ideas and ways of thinking and critically analyze issues. Seek to extend knowledge through ongoing research, enquiry and reflection. Find and evaluate information, using a variety of sources and technologies. Acknowledge the work and ideas of others.</p>	<p>2 Information literacy, gathering & processing</p>
<p>Problem solvers</p> <p>Take on challenges and opportunities. Apply creative, logical and critical thinking skills to respond effectively. Make and implement decisions. Be flexible, thorough, innovative and aim for high standards.</p>	<p>4 Problem solving skills</p>
<p>Effective communicators</p> <p>Articulate ideas and convey them effectively using a range of media. Work collaboratively and engage with people in different settings. Recognize how culture can shape communication.</p>	<p>5 Written communication</p>
	<p>6 Oral communication</p>
	<p>7 Teamwork</p>

<p>Responsible</p> <p>Understand how decisions can affect others and make ethically informed choices. Appreciate and respect diversity. Act with integrity as part of local, national, global and professional communities.</p>	<p>10 Sustainability, societal & environmental impact</p>
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Practical work:

NIL

Lecture/tutorial times

(Give lecture times in the format below)

<p>Monday9:00 AM to 10:00AM</p> <p>Wednesday.....10:00 AM to 11:00 AM</p> <p>Thursday.....12:20 PM to 1:20 PM</p>

Attendance Requirements

The University norms states that it is the responsibility of students to attend all lectures, tutorials, seminars and practical work as stipulated in the course outline. Minimum attendance requirement as per university norms is compulsory for being eligible for semester examinations.

Text books

1. Arora S.C and Domkundwar S, "A Course in Power Plant Engineering", Dhanpat Rai, 2001
2. El-Wakil M.M, Power "Plant Technology," Tata McGraw-Hill 1984
3. K.K.Ramalingam, "Power Plant Engineering ", Scitech Publications, 2002
4. G.R, Nagpal , "Power Plant Engineering", Khanna Publishers 1998
5. G.D.Rai, "Introduction to Power Plant technology" Khanna Publishers, 1995
6. F.T.Morse, Power Plant Engineering, Affiliated East-West Press Pvt. Ltd; New Delhi Madras.
7. P.K. Nag, Power Plant Engineering, Tata McGraw Hill.
8. R.Yadav, Steam & Gas Turbines & Power Plant Engineering, Central Publication House

Additional Materials

Web Resources

<https://www.youtube.com/watch?v=iWWyI8CZhUw>

<https://www.youtube.com/watch?v=IdPTuwKEfmA>

<https://www.youtube.com/watch?v=-LJkqydYbls&list=PLYuR1TUYRLpFrm4CAEIBP1-2XPB7QxD4>

ASSESSMENT GUIDELINES

Assignments & class test	60%	Objectives (1-5)
Final exam (closed book)	40%	Objectives (1-5)

Your final course mark will be calculated from the following:

SUPPLEMENTARY ASSESSMENT

Students who receive an overall mark less than 40% in internal component or less than 40% in the end semester will be considered for supplementary assessment in the respective components (i.e. internal component or end semester) of semester concerned. Students must make themselves available during the supplementary examination period to take up the respective components (internal component or end semester) and need to obtain the required minimum 40% marks to clear the concerned components.

Practical Work Report/Laboratory Report:

A report on the practical work is due the subsequent week after completion of the class by each group.

Late Work

Late assignments will not be accepted without supporting documentation. Late submission of the reports will result in a deduction of -% of the maximum mark per calendar day

Format

All assignments must be presented in a neat, legible format with all information sources correctly referenced. **Assignment material handed in throughout the session that is not neat and legible will not be marked and will be returned to the student.**

Retention of Written Work

Written assessment work will be retained by the Course coordinator/lecturer for two weeks after marking to be collected by the students.

University and Faculty Policies

Students should make themselves aware of the University and/or Faculty Policies regarding plagiarism, special consideration, supplementary examinations and other educational issues and student matters.

Plagiarism - Plagiarism is not acceptable and may result in the imposition of severe penalties. Plagiarism is the use of another person's work, or idea, as if it is his or her own - if you have any doubts at all on what constitutes plagiarism, please consult your Course coordinator or lecturer. Plagiarism will be penalized severely.

Do not copy the work of other students.

Do not share your work with other students (except where required for a group activity or assessment)

Course schedule(subject to change)

(Mention quiz, assignment submission, breaksetcas well in the table under the Teaching Learning Activity Column)

Week #	Topic & contents	CO Addressed	Teaching Learning Activity (TLA)
Weeks 1	General layout of modern thermal power plant, Site selection, Presents status of power generation in India.	CO-1,2	Lecture , chalk and talk , PPT
Weeks 2	Unique features and advantages of high pressure boilers, La-Mont, Benson, Loeffler, Schmidt- Hartmann,	CO-2	Lecture & Tutorial
Week 3	Velox, supercritical, Supercharged and fluidized bed combustion boiler. Different types of super-heaters, Reheaters,economizers,	CO-3,1	Lecture , chalk and talk , PPT
Week 4	Air pre- heaters, Methods of superheat control, Corrosion in boilers and its prevention.	CO-1,3	Lecture & Tutorial
Week 5	Coal handling storage of coal, Burning systems, Types of stokers their working, Pulverized fuel handling systems, Unit and central systems, Pulverized mills- ball mill, Bowl mill, Ball &race mill,	CO-1,3	Lecture & Tutorial
Week 6	Impact or hammer mill, Pulverized coal burners, Oil burners. Necessity of ash disposal, Mechanical, Hydraulic, pneumatic and steam jet ash handling system, Dust collection and its disposal, Mechanical dust collector, Electrostatic precipitator.Methods of superheat control, Corrosion in boilers and its prevention	CO-1,4	Lecture , chalk and talk , PPT

Week 7	<p>Draught System: Natural draught- estimation of height of chimney, Maximum discharge, Condition, Forced, Induced and balanced draught, Power requirement by fans. Diesel Power Plant: Essential components of diesel power plant, Different systems like fuel supply system,</p>	CO-1,3	Lecture & Tutorial
Week 8	<p>Nuclear Power Plant: Nuclear fusion and fission, Chain reaction, Nuclear fuels, Components of nuclear reactor, Classification of reactors, Pressurized water reactor,</p>	CO-1,4	Lecture , chalk and talk , PPT
Week 9	<p>Boiling water reactor, Gas cooled reactor, CANDU reactor, Fast breeder reactor, Nuclear waste and its disposal, Nuclear power plants in India.</p>	CO-1,4	Lecture & Tutorial
Week 10	<p>Condensers and Cooling Towers: Types of condensers, sources of air in condenser, Effects of air leakage, Methods of obtaining maximum vacuum in condenser, Dalton's law of partial pressure, vacuum & condenser efficiency, Mass of cooling water required,</p>	CO-1,3	Lecture & Tutorial
Week 11	<p>Air Pump- Edward air pump. Necessity of cooling ponds and cooling towers, Condenser water cooling systems, Types of cooling towers, cooling ponds. Economics of Power Generation: Load curves, Load duration curves, connected load, Maximum load, Peak load, base load and peak load power plants, Load factor,</p>	CO-1,4	Lecture , chalk and talk , PPT
Week 12	<p>Plant capacity factor, Plant use factor, Demand factor, Diversity factor, cost of power plant, Performance and operating characteristics of power plant, Tariff for electric energy, Power plant engineering software-design, construction, operation and life cycle analysis.</p>	CO-1,4	Lecture & Tutorial

B.TECH MECHANICAL ENGINEERING (2019)

