



SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

Approved by AICTE, Affiliated to Anna University, Chennai, Accredited by NBA,

'A' Grade Accreditation by NAAC & ISO 9001:2015 Certified Institution

SRM Nagar, Kattankulathur - 603 203



DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING

QUESTION BANK



V SEMESTER

PEI302 - Thermal Power Plant Instrumentation

Regulation - 2023

Academic Year 2025-2026

Prepared by

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SUBJECT : PEI302 – Thermal Power Plant Instrumentation

SEM / YEAR : V / III

UNIT I - POWER GENERATION METHODS

Brief survey of methods of power generation: hydro, thermal, nuclear, solar and wind power – importance of instrumentation in power generation – thermal power plants: building blocks, details of boiler processes P&I diagram of boiler – cogeneration.

PART – A

Q.No.	Questions	BT Level	CO	Competence
1.	Differentiate between Renewable and Non-Renewable energy sources.	BTL 2	CO1	Understand
2.	Justify, Why we can't completely depend on solar and wind power plant?	BTL 2	CO1	Understand
3.	Mention the advantage of Hydro power plant.	BTL 2	CO1	Understand
4.	List the non-renewable sources of energy.	BTL 1	CO1	Remember
5.	Give major building block of thermal power plant?	BTL 1	CO1	Remember
6.	List the major components in nuclear power plant.	BTL 1	CO1	Remember
7.	Classify the methods of power generation.	BTL 2	CO1	Understand
8.	Identify the two important use of surge tank.	BTL 1	CO1	Remember
9.	Give any two role of air preheater.	BTL 1	CO1	Remember
10.	Name the four commonly used moderators in nuclear power plants.	BTL 1	CO1	Remember
11.	Mention the functions of two important components of Nuclear power plant.	BTL 2	CO1	Understand
12.	What is enriched uranium?	BTL 1	CO1	Remember
13.	Define Chain Reaction.	BTL 1	CO1	Remember
14.	Give the disadvantages of Nuclear Power Plant.	BTL 1	CO1	Remember
15.	How to control nuclear reactor in nuclear power plant?	BTL 2	CO1	Understand
16.	Write working principle of Solar Photo Voltaic Cell.	BTL 2	CO1	Understand
17.	Classify the types of wind power plant.	BTL 2	CO1	Understand
18.	Point out the four significant need of instrumentation in power	BTL 1	CO1	Remember

	generation.			
19.	State the two major importance of instrumentation in power generation	BTL 1	CO1	Remember
20.	Name the three basic cycle of Thermal Power Plant.	BTL 1	CO1	Remember
21.	What is the role of Economiser in thermal power plant?	BTL 1	CO1	Remember
22.	What are the basic factors to be considered for thermal power plant?	BTL 2	CO1	Understand
23.	Define the term Cogeneration.	BTL 1	CO1	Remember
24.	Draw the instrument line symbol for pneumatic signal.	BTL 2	CO1	Understand
PART-B				
1.	Illustrate with a neat sketch, the process of electric power generation using Wind Energy	BTL-4	CO1	Analyze
2.	Explain with a neat sketch, the process of electric power generation using Solar Energy.	BTL-3	CO1	Apply
3.	Discuss in detail with a schematic diagram the hydro power plant generation.	BTL-4	CO1	Analyze
4.	Describe the various process take place in thermal power plant with neat diagram.	BTL-4	CO1	Analyze
5.	Describe the working Principle of solar cells with neat diagram.	BTL-3	CO1	Apply
6.	With a block diagram explain the operation of nuclear power plant and also mention the important parameters to be monitored in each block.	BTL-3	CO1	Apply
7.	Describe the various operations involved in thermal power plant.	BTL-3	CO1	Apply
8.	Compare and evaluate the performance characteristics of thermal and nuclear power plants based on each component.	BTL-3	CO1	Apply
9.	Illustrate the schematic diagram and explain the operations of Pressurized water Nuclear Reactor & Boiling water reactor.	BTL-3	CO1	Apply
10.	Discuss the various role of instrumentation system in thermal power plant. Also list the desirable qualities of measurement requirements.	BTL-3	CO1	Apply
11.	Draw the Piping and Instrumentation diagram of a Boiler system in a thermal power plant with the functions of each unit.	BTL-3	CO1	Apply
12.	Explain the applications of cogeneration in power plant.	BTL-3	CO1	Apply
13.	What is meant by cogeneration? Also explain the topping cycle and bottoming cycle operation of cogeneration system.	BTL-3	CO1	Apply
14.	Explain any two types of combined cycle power generation unit with neat sketch and working.	BTL-4	CO1	Analyze
15.	Compare the various methods of power generation and present the summary in table from various factors.	BTL-4	CO1	Analyze
16.	Elaborate the Boiler Process with neat diagram.	BTL-3	CO1	Apply
17.	Compile the process used for converting thermal energy into electrical energy	BTL-4	CO1	Analyze

UNIT II - MEASUREMENTS IN POWER PLANTS

Metal temperature measurement in boilers, impulse-piping system for pressure measuring devices, Thermal analysers, flame monitoring. Introduction to turbine supervising system, pedestal vibration, shaft vibration, eccentricity measurement. Installation of non-contacting transducers for speed measurement, rotor and casing movement and expansion measurement.

Q.No.	Questions	BT Level	CO	Competence
1.	What type of sensor is commonly used for metal temperature measurement in boiler tubes?	BTL 2	CO2	Understand
2.	Why is it important to measure metal temperature in superheater tubes?	BTL 2	CO2	Understand
3.	Mention the function of impulse piping in pressure measurement.	BTL 2	CO2	Understand
4.	Why should impulse lines be properly sloped in steam service?	BTL 2	CO2	Understand
5.	Name any two types of thermal analyzers and their applications.	BTL 1	CO2	Remember
6.	What parameter does a Thermogravimetric Analyzer (TGA) measure?	BTL 2	CO2	Understand
7.	List two types of flame detectors used in boilers.	BTL 1	CO2	Remember
8.	What action is taken when a flame failure is detected in a boiler?	BTL 2	CO2	Understand
9.	Mention the purpose of a Turbine Supervising System.	BTL 2	CO2	Understand
10.	List any two parameters monitored by a Turbine Supervising System.	BTL 1	CO2	Remember
11.	What is the main cause of excessive pedestal vibration in turbines?	BTL 2	CO2	Understand
12.	Which sensor is used to measure shaft vibration non-contact?	BTL 2	CO2	Understand
13.	When is eccentricity measurement of the turbine rotor typically performed?	BTL 2	CO2	Understand
14.	What does a high eccentricity reading indicate in a turbine rotor?	BTL 2	CO2	Understand
15.	Name two types of non-contacting transducers used for speed measurement.	BTL 1	CO2	Remember
16.	Why are non-contacting transducers preferred for turbine speed measurement?	BTL 2	CO2	Understand
17.	What instrument is commonly used to measure rotor axial displacement?	BTL 2	CO2	Understand
18.	Why is monitoring casing expansion important in steam turbines?	BTL 2	CO2	Understand
19.	What could be the consequences of ignoring shaft misalignment in turbines?	BTL 2	CO2	Understand
20.	Why accurate pressure measurement is critical in boiler operation?	BTL 2	CO2	Understand
21.	Classify the types of turbine speed measurement.	BTL 2	CO2	Understand
22.	What is the need of correction factor in temperature measurement of Steam in High Pressure Boiler.	BTL 2	CO2	Understand
23.	Give the two scales used for temperature measurements in power plants.	BTL 1	CO2	Remember

24.	Quote the digital methods of measuring speed.	BTL 1	CO2	Remember
PART-B				
1.	Explain in detail the methods used for metal temperature measurement in boiler components.	BTL-4	CO2	Apply
2.	Describe the construction, layout, and operational principles of an impulse piping system used in steam pressure measurement.	BTL-4	CO2	Apply
3.	Discuss the challenges in maintaining impulse lines in high-temperature and high-pressure environments. Suggest suitable mitigation measures.	BTL-5	CO2	Evaluate
4.	With neat sketches, explain the types and working principles of flame detectors used in industrial boilers.	BTL-5	CO2	Evaluate
5.	What are thermal analyzers? Explain different types of thermal analyzers and their applications in power plants.	BTL-4	CO2	Analyze
6.	Define Turbine Supervising System. Explain the various parameters it monitors and how they contribute to turbine safety.	BTL-3	CO2	Apply
7.	Describe the working and placement of vibration monitoring systems in turbine pedestals. What causes abnormal vibration, and how is it mitigated?	BTL-3	CO2	Apply
8.	Explain in detail the measurement of shaft vibration using non-contact proximity probes.	BTL-3	CO2	Apply
9.	What is eccentricity in turbine rotors? Describe the method used to measure eccentricity and the importance of this parameter during turbine startup.	BTL-3	CO2	Apply
10.	Discuss the role of a Turbine Supervising System in detecting mechanical issues such as misalignment, rubs, and thermal distortion. Support with examples.	BTL-4	CO2	Analyze
11.	Explain the types of non-contacting transducers used for turbine speed measurement.	BTL-4	CO2	Analyze
12.	Describe how rotor axial and radial movements are monitored in a turbine.	BTL-3	CO2	Apply
13.	What is casing expansion in turbines? Explain how it is measured and the impact of uncontrolled expansion on turbine operation.	BTL-4	CO2	Analyze
14.	Discuss the working principle of LVDTs and their application in measuring casing and rotor displacement. Provide diagrams	BTL-4	CO2	Analyze
15.	Explain the installation and calibration procedure for a speed sensor in a high-speed rotating turbine system.	BTL-5	CO2	Evaluate
16.	With neat diagrams, explain the complete vibration monitoring system in a large steam turbine.	BTL-4	CO2	Analyze
17.	Discuss the maintenance procedures and safety precautions required for the instrumentation of turbine supervisory systems.	BTL-5	CO2	Evaluate

UNIT III - BOILER CONTROL - I

Draught plant: Introduction, natural draught, forced draught, induced draught, balanced draught, power requirements for draught systems. Fan drives and control, control of airflow. Combustion control: Fuel/Air ratio, oxygen, CO and CO₂ trimming, combustion efficiency, excess air, parallel and cross limited combustion control, control of large systems.

PART – A

Q.No.	Questions	BT Level	CO	Competence
1.	Define draught in a boiler system.	BTL-1	CO3	Remember
2.	What is natural draught?	BTL-1	CO3	Remember
3.	Mention two limitations of natural draught.	BTL-2	CO3	Understand
4.	Define forced draught and state one application.	BTL-1	CO3	Remember
5.	What is induced draught and how does it work?	BTL-2	CO3	Understand
6.	What is balanced draught and why is it used?	BTL-2	CO3	Understand
7.	Differentiate between forced and induced draught.	BTL-2	CO3	Understand
8.	Point out the function of furnace draft and how to quantify furnace draft.	BTL-2	CO3	Understand
9.	List any two types of fans used in draught systems.	BTL-1	CO3	Remember
10.	Mention the purpose of a chimney in natural draught systems.	BTL-2	CO3	Understand
11.	What is the role of a damper in airflow control?	BTL-1	CO3	Remember
12.	Define fuel-air ratio.	BTL-1	CO3	Remember
13.	What is the significance of maintaining an optimal fuel/air ratio in combustion systems?	BTL-2	CO3	Understand
14.	What is excess air in combustion and why is it needed?	BTL-2	CO3	Understand
15.	Point out the effect of excess air in combustion.	BTL-1	CO3	Remember
16.	Give the requirements to be considered for firing due to load change.	BTL-1	CO3	Remember
17.	What happens when the air-fuel ratio is too rich or too lean?	BTL-2	CO3	Understand
18.	What is O ₂ trimming in combustion control?	BTL-2	CO3	Understand
19.	State the typical CO ₂ percentage in flue gases for efficient combustion.	BTL-1	CO3	Remember
20.	What is meant by combustion efficiency?	BTL-2	CO3	Understand
21.	List two factors affecting combustion efficiency.	BTL-1	CO3	Remember
22.	Define cross-limited combustion control.	BTL-1	CO3	Remember
23.	What is the advantage of using parallel combustion control?	BTL-2	CO3	Understand
24.	Why is control of airflow important in large boilers?	BTL-2	CO3	Understand
PART – B				
1.	Explain with neat sketches the working of natural, forced, and induced draught systems.	BTL-3	CO3	Apply

2.	Describe the construction and working of a balanced draught system.	BTL-3	CO3	Apply
3.	Compare natural draught and mechanical draught systems in terms of efficiency, cost, and control.	BTL-3	CO3	Apply
4.	Explain the working of centrifugal and axial flow fans used in draught systems.	BTL-4	CO3	Analyze
5.	Describe how air is delivered to the furnace at the right conditions of flow and temperature using air heater and different types of fans in the draught plant	BTL-3	CO3	Apply
6.	Discuss the various methods of controlling fan speed in large combustion systems.	BTL-3	CO3	Apply
7.	What is the importance of controlling the fuel/air ratio in combustion systems?	BTL-3	CO3	Apply
8.	Explain the methods of measuring and controlling excess air in a boiler.	BTL-5	CO3	Evaluate
9.	Describe in detail the concept of O ₂ , CO and CO ₂ trimming in combustion control.	BTL-3	CO3	Apply
10.	With a block diagram, explain parallel combustion control system.	BTL-3	CO3	Apply
11.	With a neat sketch, describe cross-limited combustion control and its advantages.	BTL-3	CO3	Apply
12.	Summarise about the various combustion control system adapted in Power plant. Explain the principle and operation of "Cross-limited" combustion control system with necessary diagram	BTL-3	CO3	Apply
13.	Describe the control strategies used for combustion in large-scale boilers.	BTL-3	CO3	Apply
14.	How is airflow measured and controlled in power plant boilers?	BTL-3	CO3	Apply
15.	Explain the control of flue gas emissions using modern combustion control techniques.	BTL-3	CO3	Apply
16.	Explain the method of controlling the combustion by Oxygen trim control.	BTL-4	CO3	Analyze
17.	Explain the flue gas dew point control with control diagram.	BTL-3	CO3	Apply

UNIT IV - BOILER CONTROL - II

Boiler drum level measurement methods, feedwater control, soot-blowing operation, steam temperature control, coordinated control, boiler following mode operation, turbine following mode operation, constant / sliding pressure operation, selection between boiler and turbine following modes. Distributed control system in power plants-interlocks in boiler operation.

PART - A

Q.No.	Questions	BT Level	CO	Competence
1.	What is the function of a boiler drum?	BTL-2	CO4	Understand
2.	Name any two methods used for boiler drum level measurement.	BTL-1	CO4	Remember
3.	What is shrink and swell in drum level control?	BTL-2	CO4	Understand
4.	Why is drum level control important in boilers?	BTL-2	CO4	Understand
5.	What is single-element drum level control?	BTL-2	CO4	Understand
6.	What is three-element drum level control?	BTL-2	CO4	Understand
7.	Mention two advantages of three-element drum level control over single-element.	BTL-2	CO4	Understand
8.	Define feedwater control in boilers.	BTL-1	CO4	Remember
9.	What is the role of feedwater pumps in boiler operation?	BTL-2	CO4	Understand
10.	Mention the purpose of soot blowing in boilers.	BTL-2	CO4	Understand
11.	When is soot blowing typically carried out?	BTL-2	CO4	Understand
12.	Why is steam temperature control necessary in thermal power plants?	BTL-2	CO4	Understand
13.	List two methods of steam temperature control.	BTL-1	CO4	Remember
14.	What is coordinated control in power plants?	BTL-2	CO4	Understand
15.	List the advantage of coordinated boiler-turbine control.	BTL-1	CO4	Remember
16.	What is boiler-following mode operation?	BTL-2	CO4	Understand
17.	What is turbine-following mode operation?	BTL-2	CO4	Understand
18.	How does turbine-following mode respond to load demand?	BTL-2	CO4	Understand
19.	What is constant pressure operation in boilers?	BTL-2	CO4	Understand
20.	Define sliding pressure operation.	BTL-1	CO4	Remember
21.	What is an interlock system in boiler operation?	BTL-2	CO4	Understand
22.	List any two boiler interlocks.	BTL-1	CO4	Remember
23.	Name two benefits of using DCS in power plants.	BTL-1	CO4	Remember
24.	Differentiate between hardwired and software interlocks.	BTL-2	CO4	Understand

PART – B

1.	Explain with diagram the single-element drum level control system.	BTL-4	CO4	Analyze
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2.	Explain with diagram the two-element drum level control system.	BTL-3	CO4	Apply
3.	Explain with diagram the three-element drum level control system.	BTL-3	CO4	Apply
4.	Describe the working and importance of feedwater control in a thermal power plant.	BTL-3	CO4	Apply
5.	List the two basic types of deaerator. Explain any one in detail.	BTL-4	CO4	Analyze
6.	Examine various soot blowing methods used in modern boilers.	BTL-4	CO4	Analyze
7.	Explain fireside control mechanism for control steam temperature in boilers.	BTL-4	CO4	Analyze
8.	Explain waterside control mechanism for control steam temperature in boilers.	BTL-4	CO4	Analyze
9.	Explain the methods used for steam temperature control and their importance.	BTL-3	CO4	Apply
10.	With a block diagram, explain coordinated control in a thermal power plant.	BTL-4	CO4	Analyze
11.	Explain the interface between feedwater control, drum level control, and steam temperature control in large boiler systems.	BTL-3	CO4	Apply
12.	With suitable sketches describe boiler following firing rate control and turbine following firing rate control.	BTL-3	CO4	Apply
13.	Explain the purpose and types of interlocks in boiler operation. Discuss critical interlocks, their role in ensuring safety.	BTL-4	CO4	Analyze
14.	State the need for interlocks in boiler operation. Also, mention the various process/operation connected with interlocks in steam power plant for safety.	BTL-4	CO4	Analyze
15.	List and explain at least five critical boiler interlocks used to ensure safe operation.	BTL-3	CO4	Apply
16.	Explain the architecture of a Distributed Control System (DCS) in a power plant.	BTL-3	CO4	Apply
17.	Explain the functions of a Distributed Control System (DCS) in a power plant with neat sketch.	BTL-3	CO4	Apply

UNIT V - TURBINE CONTROL

Speed measurement, rotor and casing movement- vibration - shell temperature monitoring and control - steam pressure control - lubricant oil temperature – cooling system.

PART – A

Q.No.	Questions	BT Level	CO	Competence
1.	Name two types of sensors used for turbine speed measurement.	BTL-1	CO5	Remember
2.	Classify steam turbines.	BTL-2	CO5	Understand
3.	What is a proximity probe and where is it used?	BTL-2	CO5	Understand
4.	Compare impulse turbine with reaction turbine.	BTL-2	CO5	Understand
5.	List the losses in steam turbine.	BTL-1	CO5	Remember
6.	What are two common causes of turbine vibration?	BTL-2	CO5	Understand
7.	Define critical speed in rotors.	BTL-1	CO5	Remember
8.	What is the function of a vibration monitoring system?	BTL-2	CO5	Understand
9.	Mention the purpose of casing movement monitoring.	BTL-2	CO5	Understand
10.	What type of sensor is used to monitor casing expansion?	BTL-2	CO5	Understand
11.	Define shell temperature in steam turbines.	BTL-1	CO5	Remember
12.	Interpret the need of correction factor in temperature measurement of Steam in High Pressure Boiler?	BTL-2	CO5	Understand
13.	Mention two effects of abnormal shell temperature.	BTL-2	CO5	Understand
14.	What is steam pressure control in a turbine?	BTL-2	CO5	Understand
15.	State any two methods of controlling steam pressure.	BTL-1	CO5	Remember
16.	Why is lubricant oil temperature control important?	BTL-2	CO5	Understand
17.	Name two components in a lube oil system.	BTL-1	CO5	Remember
18.	What is the effect of high lube oil temperature on machinery?	BTL-2	CO5	Understand
19.	Define the function of a turbine cooling system.	BTL-1	CO5	Remember
20.	Mention two types of turbine cooling methods.	BTL-2	CO5	Understand
21.	Why is continuous monitoring essential in large rotating machines?	BTL-1	CO5	Remember
22.	Point out the significance of oil cooling system.	BTL-1	CO5	Remember
23.	List the types of cooling tower.	BTL-1	CO5	Remember
24.	How does excessive vibration affect the performance of a turbine?	BTL-2	CO5	Understand
PART – B				
1.	Explain the different methods used for speed measurement in steam turbines.	BTL-4	CO5	Analyze

2.	Describe the working of a magnetic pickup sensor for turbine speed measurement.	BTL-3	CO5	Apply
3.	What is rotor dynamic behavior? Explain rotor and casing movement with diagrams.	BTL-3	CO5	Apply
4.	Discuss the measurement techniques for turbine vibrations.	BTL-3	CO5	Apply
5.	Describe how vibration sensors work and how they are applied in condition monitoring.	BTL-4	CO5	Analyze
6.	Describe the methods used to monitor and control shell temperature in steam turbines.	BTL-4	CO5	Analyze
7.	Explain steam pressure control in power plants and the devices used for control.	BTL-4	CO5	Analyze
8.	Explain how is lubricant oil temperature monitored and controlled.	BTL-4	CO5	Analyze
9.	With a neat diagram, describe the closed-loop lube oil cooling system in steam turbines.			
10.	Explain the pressure measurement of steam in Power plant.	BTL-4	CO5	Analyze
11.	Explain steam pressure control with control diagram in detail.			
12.	Mention the various stages of steam turbine. Explain the method of steam pressure control at the various stages of steam turbine.	BTL-3	CO5	Apply
13.	Discuss the need of shell temperature monitoring and control in steam turbine. Also explain the method of shell temperature measurement and control.	BTL-4	CO5	Analyze
14.	Explain the working principle of a dry cooling tower in a thermal power plant with neat sketch.	BTL-4	CO5	Analyze
15.	Explain the working principle of a wet cooling tower in a thermal power plant with neat sketch.	BTL-3	CO5	Apply
16.	With neat sketch explain natural draught cooling towers in power plant.	BTL-4	CO5	Analyze
17.	Explain mechanical draught cooling towers in power plant in detail.	BTL-4	CO5	Analyze