



INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

Department of Electrical and Electronics Engineering

TUTORIAL QUESTION BANK

Course Title	POWER PLANT CONTROL AND INSTRUMENTATION				
Course Code	AEE516				
Programme	B.Tech				
Semester	VI	EEE			
Course Type	Professional Elective/Accelerated Course				
Regulation	IARE - R16				
Course Structure	Theory			Practical	
	Lectures	Tutorials	Credits	Laboratory	Credits
	3	-	3	-	-
Chief Coordinator	Mr.P Shivakumar, Assistant Professor, EEE				
Course Faculty	Mr.P Shivakumar, Assistant Professor, EEE				

COURSE OBJECTIVES:

The course should enable the students to:

The course should enable the students to:	
I	Assess different methods of power generation.
II	Discuss measurement of electrical and non-electrical parameters involved in power generation plants
III	Illustrate the different types of devices used for data acquisition and analyze in power plants.
IV	Describe control system and control loops applied in power plants.
V	Integrate monitoring of different parameters like speed, vibration of turbines and their control.

COURSE LEARNING OUTCOMES:

Students, who complete the course, will have demonstrated the ability to do the following:

AEE516.01	Describe power generation from non-renewable and renewable sources: Thermal, Hydel, nuclear, solar and wind power plants.
AEE516.02	Examine the importance of instrumentation in power generation.
AEE516.03	Interpret the importance of cogeneration in power production.
AEE516.04	Discuss the measurement of electrical quantities.
AEE516.05	Discuss the measurement of non-electrical quantities.
AEE516.06	Recognize the environment related factors such as radiation, smoke and dust.
AEE516.07	Examine the concept of gas analyzer.

AEE516.08	Analyze the pH meter and fuel analyzer.
AEE516.09	Illustrate the pollution monitoring instruments.
AEE516.10	Discuss the combustion control.
AEE516.11	Summarize the various methods available for steam temperature control.
AEE516.12	Evaluate the effect of distributed control and interlocks in boiler.
AEE516.13	Analyze the steam pressure control and lubricant oil, temperature control.
AEE516.14	Explore the methods of turbine control.
AEE516.15	Explore the different methods of cooling systems.
AEE516.16	Apply the concepts of non-renewable and renewable generation, measurements and control in power plants to solve real world applications.
AEE516.17	Explore the knowledge and skills of employability to succeed in national and international level competitive examinations.

TUTORIAL QUESTION BANK

S. No.	QUESTION	Blooms Taxonomy Level	Course Outcomes	Course Learning Outcomes
UNIT - I				
OVERVIEW OF POWER GENERATION				
PART – A (SHORT ANSWER QUESTIONS)				
1	State the law of conservation of energy	Remember	CO1	AEE516.01
2	State non-renewable sources of power generation.	Remember	CO1	AEE516.01
3	State renewable sources of power generation.	Remember	CO1	AEE516.01
4	List the products of incomplete combustion.	Remember	CO1	AEE516.01
5	Name the reactor which is the most suitable reactor for India.	Remember	CO1	AEE516.01
6	Give the efficiency of thermal power plants.	Understand	CO1	AEE516.01
7	Mention the different cycles used in thermal power plants.	Understand	CO1	AEE516.01
8	State the purpose of economizer.	Understand	CO1	AEE516.01
9	Give the importance of draught in power plants.	Remember	CO1	AEE516.01
10	What is the purpose of boiler in thermal power plants?	Understand	CO1	AEE516.01
11	Explain the function of turbine in power.	Understand	CO1	AEE516.01
12	Mention the types of boilers in power plants.	Remember	CO1	AEE516.01
13	List the different circuits used in thermal power plants.	Understand	CO1	AEE516.01
14	Define critical pressure ratio of a convergent nozzle.	Remember	CO1	AEE516.01
15	State the different types of turbines.	Remember	CO1	AEE516.01
16	Explain the purpose of cooling towers in power plants.	Understand	CO1	AEE516.01
17	What is meant by piping and instrumentation diagram.	Understand	CO1	AEE516.01
18	Define cogeneration.	Remember	CO1	AEE516.01
19	What are the two major advantages of thermal power plant?	Understand	CO1	AEE516.01
20	State any two major advantages of hydel power plant.	Remember	CO1	AEE516.01
21	State any two applications of the diesel power plant.	Understand	CO1	AEE516.01
22	Write principle of Solar cell	Understand	CO1	AEE516.01
23	Write importance of instrumentation in power plant	Understand	CO1	AEE516.02
24	Define cogeneration	Remember	CO1	AEE516.03
PART – B (LONG ANSWER QUESTIONS)				
1	Explain the block diagram and working of thermal power plant.	Understand	CO1	AEE516.01
2	Explain the block diagram and working of hydel power plant.	Understand	CO1	AEE516.01
3	Explain the block diagram and working of nuclear power plant.	Remember	CO1	AEE516.01
4	Explain the block diagram and working of solar power plant.	Understand	CO1	AEE516.01
5	Explain the working of wind power plant.	Remember	CO1	AEE516.01
6	Write notes on importance of instrumentation in power generation.	Understand	CO1	AEE516.02
7	Compare thermal power plant with nuclear power plant.	Remember	CO1	AEE516.01

8	Compare hydel power plant with thermal power plant.	Understand	CO1	AEE516.01
9	What are the factors to be considered while selecting the power plant?	Remember	CO1	AEE516.01
10	What is co-generation? Explain in detail.	Understand	CO1	AEE516.03
PART – C (ANALYTICAL QUESTIONS)				
1	Explain PI diagram of boiler process.	Remember	CO1	AEE516.01
2	Explain the differences between conventional sources and Non-conventional sources of energy.	Understand	CO1	AEE516.01
3	Explain about thermal power plants building blocks	Understand	CO1	AEE516.01
4	Briefly explain about details of the boiler process ?	Remember	CO1	AEE516.01
5	Briefly explain about survey of methods of power generation in hydel, nuclear and wind power plant	Understand	CO1	AEE516.01
6	What are the factors to be considered while selecting a site for hydroelectric power plant?	Remember	CO1	AEE516.01
7	What are the advantages of high pressure boilers?()	Remember	CO1	AEE516.01
8	What are the factors to be considered while selecting a site for thermal power plant?	Understand	CO1	AEE516.01
9	What is the purpose of surge tank in a hydroelectric power plant?	Understand	CO1	AEE516.01
10	What are the main units in a gas turbine power plant?	Remember	CO1	AEE516.01
UNIT – II				
MEASUREMENTS IN POWER PLANTS				
PART – A (SHORT ANSWER QUESTIONS)				
1	Define the terms ‘accuracy’ and ‘precision’.	Remember	CO2	AEE516.04
2	Define error.	Remember	CO2	AEE516.04
3	What is meant by calibration?	Understand	CO2	AEE516.04
4	Define damping torque.	Remember	CO2	AEE516.04
5	Explain deflecting torque.	Understand	CO2	AEE516.04
6	List the measurements carried out in power plants	Understand	CO2	AEE516.04
7	Give the importance of measurement in power plants.	Remember	CO2	AEE516.04
8	Name the instruments used to measure pressure.	Remember	CO2	AEE516.05
9	What is the purpose of flow meters in power plants?	Understand	CO2	AEE516.05
10	Define power. List out the instruments used to measure power.	Remember	CO2	AEE516.04
11	Explain the importance of frequency in power systems.	Understand	CO2	AEE516.04
12	Define power factor.	Remember	CO2	AEE516.04
13	Mention some devices which are used to improve power factor.	Understand	CO2	AEE516.04
14	State the operating principle of Bicolor level gauges used for drum level measurement.	Remember	CO2	AEE516.05
15	How to measure speed of a turbine?	Understand	CO2	AEE516.05
16	Name the sensors used in measuring vibration	Remember	CO2	AEE516.05
17	List out the methods to measure smoke and radiation.	Understand	CO2	AEE516.06
PART – B (LONG ANSWER QUESTIONS)				
1	Write briefly about a) Voltage measurement b) Current measurement	Understand	CO2	AEE516.04
2	Write briefly about a) power measurement b) pressure measurement	Remember	CO2	AEE516.05
3	Write short notes on a) Drum level measurement b) Pressure and temperature compensation techniques	Understand	CO2	AEE516.05
4	Explain in detail the function of smoke density measurement and dust monitor	Understand	CO2	AEE516.06
5	Describe about flow measurements involved in power plants	Remember	CO2	AEE516.05
6	Describe temperature measurements in power plants in detail	Understand	CO2	AEE516.05
7	Describe air flow control system.	Understand	CO2	AEE516.05
8	Explain in detail about Steam temperature Measurement	Remember	CO2	AEE516.05
9	Write notes on a) power factor measurement b) frequency measurement	Understand	CO2	AEE516.04
10	Explain about various types of radiation detectors.	Understand	CO2	AEE516.06
PART – C (ANALYTICAL QUESTIONS)				
1	PMMC instruments are useful only for D.C measurement,	Remember	CO2	AEE516.04

	Justify your answer.			
2	Derive the general torque equation of moving iron instrument.	Understand	CO2	AEE516.04
3	Explain the special features incorporated in an electro-dynamometer type of wattmeter so that it can be used for low power factor applications.	Remember	CO2	AEE516.04
4	What is a low power factor wattmeter? Explain the salient features of it with a neat diagram.	Understand	CO2	AEE516.04
5	Explain the principle of a basic potentiometer used for the measurement of DC voltage. What is meant by standardization?	Remember	CO2	AEE516.05
6	Explain briefly about Wien bridge circuit for the measurement of frequency	Understand	CO2	AEE516.05
7	Explain briefly about Trivector meter .	Remember	CO2	AEE516.05
8	What are the digital methods of speed measurement?	Understand	CO2	AEE516.05
9	List all the major temperature measurement points in a thermal power plant and also suggest suitable sensor for each points.	Remember	CO2	AEE516.04
10	Specify the need of drum level measurement. Also explain the differential pressure method to measure the drum level in high pressure boiler	Understand	CO2	AEE516.06
UNIT – III				
ANALYSERS IN POWER PLANTS				
PART – A (SHORT ANSWER QUESTIONS)				
1	What is fuel analyzer?	Remember	CO3	AEE516.06
2	What is flue gas analyzer?	Remember	CO3	AEE516.06
3	What are the constituents of flue gas?	Understand	CO3	AEE516.06
4	What are the different methods to measure pH?	Understand	CO3	AEE516.07
5	What are the different types of gas analyzers?	Remember	CO3	AEE516.07
6	Why do we need to analyze oxygen content in flue gas?	Understand	CO3	AEE516.07
7	What do you mean by deaerated water.	Remember	CO3	AEE516.07
8	Name any two instruments to find CO in flue gas.	Understand	CO3	AEE516.07
9	What are the different types of chromatography?	Understand	CO3	AEE516.07
10	State the importance of pollution monitoring instruments.	Understand	CO3	AEE516.08
11	What is the indication of incomplete combustion in boiler?	Remember	CO3	AEE516.09
12	Explain the term alkaline	Understand	CO3	AEE516.08
13	Explain the term acidic	Remember	CO3	AEE516.08
14	Discuss the method of desulphurization	Understand	CO3	AEE516.09
PART – B (LONG ANSWER QUESTIONS)				
1	Explain the necessity of flue gas analyzer in power plants.	Understand	CO3	AEE516.06
2	Brief about analysis of impurities in feed water and steam.	Understand	CO3	AEE516.07
3	Explain about (a) Dissolved oxygen analyzer (b) Flue gas Oxygen analyzer	Remember	CO3	AEE516.07
4	Explain the methods of chromatography used in power plants.	Understand	CO3	AEE516.08
5	Explain about (a) liquid chromatography (b) gas chromatography	Remember	CO3	AEE516.08
6	Explain about different types of detectors in chromatography.	Understand	CO3	AEE516.08
7	Describe in detail about flue gas analysis.	Remember	CO3	AEE516.08
8	Explain about steam purity measurement and basic steaming process.	Understand	CO3	AEE516.08
9	Brief about different methods of pH measurements.	Understand	CO3	AEE516.08
10	Explain the various methods about measurement of Oxidants(Ozone)	Remember	CO3	AEE516.09
11	Brief about carbon dioxide recorders and flame condition.	Understand	CO3	AEE516.09
12	Explain the various methods about measurement of nitrogen oxide.	Understand	CO3	AEE516.09
13	Explain the different methods to improve the efficiency of boiler with respect to fuel desulphurization.	Understand	CO3	AEE516.09
14	What are the different pollutants available in flue gases? Explain the methods to remove these pollutants in power plants.	Understand	CO3	AEE516.09
PART – C (ANALYTICAL QUESTIONS)				
1	Explain how the air flow rate is measured in a power plant	Understand	CO3	AEE516.06

	with a relevant diagram.			
2	Explain about the level radiation detectors in brief.	Understand	CO3	AEE516.07
3	Why steam generator outlet temperature is to be measured and controlled?	Remember	CO3	AEE516.07
4	What is the role of dust monitor in thermal power plants?	Understand	CO3	AEE516.08
5	Explain how steam temperature and feed water temperature measurements are performed. What are the sources of error in measurement?	Remember	CO3	AEE516.08
1	Explain in detail the working of Orsat flue gas analyzer	Understand	CO3	AEE516.08
2	Discuss in detail the method of monitoring Hydro carbons and Oxidants present in flue gases with neat sketches?	Remember	CO3	AEE516.09
3	Write a short notes on: (a) Infrared type analyzer (b) Thermal conductive analyzer	Understand	CO3	AEE516.09
4	List the different types of detectors used in chromatography. Explain the principle of thermionic emission type of detector with a neat schematic?	Understand	CO3	AEE516.09
5	Discuss in detail the method of monitoring Hydro carbons and Oxidants present in flue gases with neat sketches	Understand	CO3	AEE516.09
6	Write brief notes on water pollution monitoring instruments?	Understand	CO3	AEE516.09
UNIT – IV				
CONTROL LOOPS IN BOILER				
PART – A (SHORT ANSWER QUESTIONS)				
1	Where is the steam pressure measured?	Understand	CO4	AEE516.11
2	What is the effect of high electrical conductivity in boiler water?	Remember	CO4	AEE516.10
3	What is the difference between forced draft and induced draft fans?	Understand	CO4	AEE516.11
4	What is reheat control?	Remember	CO4	AEE516.10
5	What are the types of feed water control	Understand	CO4	AEE516.11
6	What are the types of super heater?	Understand	CO4	AEE516.11
7	What are the methods used for steam temperature control?	Remember	CO4	AEE516.11
8	What are the methods used for drum level measurement?	Understand	CO4	AEE516.11
9	Explain boiler interlocks	Remember	CO4	AEE516.12
10	What is meant by distributed control?	Remember	CO4	AEE516.12
PART – B (LONG ANSWER QUESTIONS)				
1	Describe in detail about interlocks in boiler.	Remember	CO4	AEE516.12
2	Discuss various combustion control systems used in power plants.	Understand	CO4	AEE516.10
3	Describe three element feed water control system in boiler.	Understand	CO4	AEE516.11
4	Explain single element and two element drum level control.	Remember	CO4	AEE516.11
5	Write about control loop interactions.	Understand	CO4	AEE516.12
6	Describe distributed control systems in power plants.	Understand	CO4	AEE516.12
7	Describe single element and two element feed water control system in boiler.	Remember	CO4	AEE516.11
8	Describe various methods of controlling reheated steam temperature.	Understand	CO4	AEE516.10
9	Explain the instrumentation diagram using feedback controller for boilers.	Remember	CO4	AEE516.12
10	Describe fire side control mechanism of steam temperature control in detail.	Understand	CO4	AEE516.12
PART – C (ANALYTICAL QUESTIONS)				
1	Explain how turbine speed is controlled by Pressure compounding	Understand	CO4	AEE516.11
2	Explain the necessity of combustion system?	Remember	CO4	AEE516.10
3	Explain the spray and gas recirculation control system used in power plants?	Understand	CO4	AEE516.11
4	Discuss the importance of computers in power plants?	Remember	CO4	AEE516.10
5	Differentiate between the Pulverizer control and deaerator level controls?	Understand	CO4	AEE516.11
6	With the help of neat sketch clearly explain about furnace control systems	Understand	CO4	AEE516.11

7	Describe with a neat sketch the magnetic float type mechanism employed in boiler feed water control.	Remember	CO4	AEE516.11
8	Explain in detail with neat sketches control system of main header pressure used in power plants.	Understand	CO4	AEE516.11
9	What are the mountings fitted for boiler safely operation?	Remember	CO4	AEE516.12
10	Discuss the boiler inspection and safety regulations.	Remember	CO4	AEE516.12
UNIT – V				
TURBINE MONITORING AND CONTROL				
PART – A (SHORT ANSWER QUESTIONS)				
1	How to control the shell temperature?	Understand	CO5	AEE516.14
2	How to control the speed of turbine?	Understand	CO5	AEE516.14
3	How sulphur oxides enter into the atmosphere?	Remember	CO5	AEE516.14
4	How nitrogen oxides enter into the atmosphere	Understand	CO5	AEE516.14
5	What are the advantages and disadvantages of wet cooling?	Understand	CO5	AEE516.15
6	What are the different methods of dry cooling?	Remember	CO5	AEE516.15
7	How to control the vibration of turbine blades?	Understand	CO5	AEE516.14
8	Why do we need to control lubricant oil?	Understand	CO5	AEE516.13
9	Define turbine efficiency.	Remember	CO5	AEE516.14
10	What are the types of gas turbine?	Understand	CO5	AEE516.14
11	Name the sensors used in measuring vibration.	Remember	CO5	AEE516.14
PART – B (LONG ANSWER QUESTIONS)				
1	Describe in detail steam pressure control	Understand	CO5	AEE516.13
2	Write short notes on speed and vibration monitoring and control	Understand	CO5	AEE516.14
3	Explain in detail shell temperature monitoring and control	Understand	CO5	AEE516.14
4	Describe in detail about cooling system used in thermal power plant	Remember	CO5	AEE516.15
5	Explain any two control methods used in monitoring turbine.	Understand	CO5	AEE516.13
6	Detail the methods of lubricant oil control and temperature control	Understand	CO5	AEE516.13
7	Explain the need of monitoring and control of turbine in power plants	Remember	CO5	AEE516.14
8	Write briefly on speed and vibration monitoring and shell temperature monitoring	Understand	CO5	AEE516.14
9	Discuss the different cooling systems used in power plants	Remember	CO5	AEE516.15
10	Explain the need of various turbine control methods in power plants	Understand	CO5	AEE516.14
PART – C (ANALYTICAL QUESTIONS)				
1	What is the necessity of cooling of generator?	Understand	CO5	AEE516.14
2	Discuss about the lubricating oil temperature control	Understand	CO5	AEE516.14
3	Explain in detail about the Generator cooling system in power plants	Remember	CO5	AEE516.14
4	Describe with a neat sketch, the principle and constructional details of B.F.P recirculation control?	Understand	CO5	AEE516.14
5	What is the role and importance of a Generator in turbine monitoring and control with schematic representation?	Understand	CO5	AEE516.15
6	Why is vibration measurement essential in Turbine control? Also explain the method of vibration measurement in steam turbine.	Remember	CO5	AEE516.15
7	List the various parameters need for Turbine Supervisory system. Also explain the technique for the measurement of the parameters.	Understand	CO5	AEE516.14
8	What are the main units in a gas turbine power plant?	Understand	CO5	AEE516.13
9	Explain how turbine speed is controlled by Pressure compounding	Remember	CO5	AEE516.14
10	How the performance of turbine is monitored?	Understand	CO5	AEE516.14
11	What is lubricating oil system? Explain its controls	Understand	CO5	AEE516.14

Prepared by: