POWER PLANT CONTROL AND INSTRUMENTATION

VII Semester: EEE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEE516	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

COURSE OBJECTIVES:

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 generationplants.
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 OUTCOMES (COs):

CO 1: Knowledge of the available sources of energy for electricity generation along with the working principle of the different power plants and cogeneration.
CO 2: Describe the measurement of electrical parameters and non-electrical parameters.
CO 3: Determine the importance of analyzers in power plants.
CO 4: Educate on boiler and advanced boiler control techniques.
CO 5: Discuss the turbine control techniques and cooling methods.

COURSE LEARNING OUTCOMES (CLOs):

1. Describe power generation from non-renewable and renewable sources: Thermal, Hydel, nuclear, solar and wind power plants.
2. Examine the importance of instrumentation in power generation.
3. Interpret the importance of cogeneration in power production.
4. Discuss the measurement of electrical quantities.
5. Discuss the measurement of non-electrical quantities.
6. Recognize the environment related factors such as radiation, smoke and dust.
7. Examine the concept of gas analyzer.
8. Analyze the pH meter and fuel analyzer.
9. Illustrate the pollution monitoring instruments.
10. Discuss the combustion control.
11. Summarize the various methods available for steam temperature control.
12. Evaluate the effect of distributed control and interlocks in boiler.
13. Analyze the steam pressure control and lubricant oil, temperature control.
14. Explore the methods of turbine control.
15. Discuss the different methods of cooling systems.

16. Apply the concepts of non-renewable and renewable generation, measurements and control in power plants to solve real world applications.
17. Explore the knowledge and skills of employability to succeed in national and international level competitive examinations.

UNIT-I	**OVERVIEW OF POWER GENERATION**	**Classes: 08**

Brief survey of methods of power generation, hydro, thermal, nuclear, solar and wind power, importance of instrumentation in power generation, thermal power plants, block diagram, details of boiler processes, Piping and Instrumentation diagram of boiler, cogeneration.

UNIT -II	**MEASUREMENTS IN POWER PLANTS**	**Classes: 10**

Electrical measurements, current, voltage, power, frequency, power factor, etc, non-electrical parameters, flow of feed water, fuel, air and steam with correction factor for temperature, steam pressure and steam temperature, drum level measurement, radiation detector, smoke density measurement, dust monitor.

UNIT-III	**ANALYSERS IN POWER PLANTS**	**Classes: 09**

Flue gas oxygen analyzer: Analysis of impurities in feed water and steam, dissolved oxygen analyzer, Chromatography, pH meter, fuel analyzer, pollution monitoring instruments.

UNIT-IV	**CONTROL LOOPS IN BOILER**	**Classes: 10**

Combustion control, air / fuel ratio control, furnace draft control, drum level control, main steam and reheat steam temperature control, super heater control, air temperature, distributed control system in power plants, interlocks in boiler operation.

UNIT-V	**TURBINE MONITORING AND CONTROL**	**Classes: 08**

Speed, vibration, shell temperature monitoring and control, steam pressure control, lubricant oil temperature control, cooling system.

Text Books:

1. Sam G. Dukelow, 'The Control of Boilers', Instrument Society of America, 2nd Edition, 2010.
2. P.K. Nag, 'Power Plant Engineering', Tata McGraw-Hill, 1st Edition, 2001.

Reference Books:

3. S.M. Elonka and A.L. Kohal, "Standard Boiler Operations", Tata McGraw-Hill, 1st Edition, 1994.
4. R K Jain, "Mechanical and Industrial Measurements", Khanna Publishers, 1st Edition, 1995.
5. E Al Wakil, "Power Plant Engineering", Tata McGraw-Hill, 1st Edition, 1984.