GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3171718
Semester – VII
Subject Name: POWER PLANT INSTRUMENTATION

Type of course: Professional Elective Course

Prerequisite: Fundamental of Electrical Engineering, Measurements and Sensors

Rationale: The course is designed to give knowledge of various types of power plants and related instrumentation system.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1.	Introduction: Various sources of Electrical Energy, Non-Conventional and Conventional Energy Sources, Importance of Instrumentation and control in power generation, piping and instrumentation diagrams.	**04**
2	Instrumentation and control in water circuit: boiler feed water circulation, measurements, controls, impurities in water and steam. Instrumentation and control in air-fuel circuit: measurements, controls, analytical measurements.	**08**
3	Turbine monitoring and control: classification of turbines, instrumentation and control points of view, principal parts of turbines, turbine steam inlet system, turbine measurements, turbine control system, lubrication for turbo-alternator, turbo alternator cooling system.	**08**
4	Basic principles of a nuclear plant. Nuclear power plant training simulator project. Design concepts of instrumentation and control of CWR, PWR and BWR reactors (different examples).Operator/Plant communication systems, main control systems, safety and safety related systems.	**08**
5	Role of Instrumentation in hydroelectric power plant. Regulation and monitoring of voltage and frequency of output power. Pollution and effluent monitoring and control. Energy management. Electrical substation controls. Plant safety and	**08**

	redundancies of non-conventional power plants	

Demonstration of various instrumentation system should be given during filed visit of Power Plant.

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
10	**15**	**25**	**10**	**05**	**05**

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:

- K. Krishnaswamy, M. PonniBala, "Power Plant Instrumentation", PHI Learning Private limited, New Delhi, 2011.
- David Lindsley, "Power Plant Control and Instrumentation, The Control of Boilers and HRSG systems", IEE Control Engineering Series 2000.
- Philip Kiameh, "Power Plant Instrumentation and Controls", McGraw Hill Education, 2014.
- Singh S K, "Industrial Instrumentation and control" Tata- McGraw-Hill Publishing Company. 2009.
- Nuclear power plant instrumentation and control, A guidebook, International atomic energy agency Vienna, 1984(online resource).
- Black & Veatch, "Power plant Engineering", CBS Publisher, 2005
- El-Wakil, M.M., "Power plant Technology", McGraw-Hill Book Co, 2002
- Nag, P.K., "Power plant engineering", Tata MacGraw Hill, 2008

Course Outcome:

After learning the course the students should be able to:

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CO 1	Analyze Instrumentation related to various power plants

CO 2	Identify Instrumentation in water circuits and turbine monitoring system in power plants
CO 3	Identify elements and their functions and operations of nuclear power plants.
CO 4	Understand role of Instrumentation in Power plants
CO 5	Design various simulation and sensor control system used in power plant

Suggested Experiments/Tutorial

1. Explain the block diagram and working of thermal power plant.
2. Explain the block diagram and working of hydro power plant.
3. Explain the block diagram and working of nuclear power plant.
4. Explain the block diagram and working of solar power plant.
5. Explain the working of wind power plant.
6. Write notes on importance of instrumentation in power generation.
7. Compare thermal power plant with nuclear power plant.
8. Compare hydel power plant with thermal power plant.
9. What are the factors to be considered while selecting the power plant.
10. What is co-generation? Explain in detail.
11. Brief about analysis of impurities in feed water and steam and design suitable lab experiment using impurities sensor and micro controller
12. Explain about (a) Dissolved oxygen analyzer (b) Flue gas Oxygen analyzer and design system to measure oxygen, Carbon dioxide using Gas sensor and micro controller
13. Explain in detail shell temperature monitoring and control
14. Describe in detail about cooling system used in thermal power plant
15. Describe in detail about interlocks in boiler.
16. Discuss various combustion control systems used in power plants

Design based Problems (DP)/Open Ended Problem:

Simulation and Design of Power plant system on simulation software like SCADA

Design Dust monitoring system using controller and LabVIEW

Design Gas sensing System of various gases like CO2, O2, NO using controller and LabVIEW Simulation of intelligent control strategies in instrumentation, SCADA

Major Equipment/Field Visit

Visit of Thermal and Nuclear Power plant,Hydro Power station,Power distribution System

List of Open Source Software/learning website:

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