Programme	**:**	**Diploma in ET**/CE/EE//ME/MT/CM/IT/DDGM
Programme Code	**:**	01/02/**03**/04/05/06/07/08/16/**17**/21/22/**23**/24/26
Name of Course	**:**	**Instrumentation & Control**
Course Code	**:**	**ET 486**

Teaching Scheme:

	Hours /Week	**Total Hours**
Theory	**03**	**48**
Practical	**02**	**32**

Evaluation Scheme:

	Progressive Assessment	**Semester End Examination**			
		Theory	**Practical**	**Oral**	**Term work**
Duration	**Two class tests, each of 60 minutes**	**3 Hrs.**	**3 Hrs**	**--**	**--**
Marks	**20**	**80**	**--**	**25**	**25**

Course Rationale:

The advancement of both knowledge and technique has resulted in the development of controls in process industry. The progression of human existence from a primitive state to the present complex technological world was paced by learning new and improved methods to control the environment.
Control means methods to force parameters in the environment to have specific values. Varying the room temperature OR guiding a space craft to Saturn necessities to examine elements of control system.
Nature of controller action for systems with operation and variables is highlighted for continuous values. This subject is beneficial for process control variation in any process control industry which equips the student for maintenance and quality analysis.

Course Objectives:

After studying this course, the student will be able to

- Learn and understand about open loop and closed loop systems.
- Feedback control and transfer function.
- Steady state, time response, and frequency response analysis.
- Study of stability
- Control actions of electronic controllers.
- Servo system and its application.

Course Content:

Chap No	Name of Topic/Sub topic	Hrs	Marks
	SECTION – I		
1.	**Introduction**		
	1.1 Block diagram of general instrumentation system.	**02**	**4**
2.	**Transducers**		
	2.1 Electrical Transducers, Selecting a transducers	**12**	**20**
	2.2 Resistive Transducers & Resistive position Transducers Strain gauges, Resistance Thermometer, Thermister		
	2.3 Inductive Transducers, Differential output Transducers, Linear Variable Differential Transducer (LVDT)		
	2.4 Pressure Inductive Transducer		
	2.5 Capacitive Transducer		
	2.6 Piezo Electrical Transducer, Photo electric transducer, Photo voltaic cell, Semiconductor Photo Diode, Photo - Transistor		
3	**Signal Conditioning & Data Acquisition System**		
	3.1 Introduction	**10**	**16**
	3.2 Operational Amplifier		
	3.3 Basic Instrumentation Amplifier		
	3.4 Application of Instrumentation Amplifier(Specific Bridges)		
	3.5 Introduction, Objectives of DAS		
	3.6 Signal conditioning of the inputs		
	3.7 Single Channel, DAS, Multi channel DAS Computer Based DAS		
	3.8 Digital to Analog(D/A) and Analog to Digital (A/D) Converters		
	3.9 Digital Transducers		

SECTION-II

1.	**Overview of Control System**		
	1.1 System- definition & practical example. Control system – definition and practical example. Open loop & closed loop systems – definition, block diagram, practical example, and Comparison	**08**	**10**
	1.2 Laplace transform – Significance in control system, developing differential equations of R-C and R-L-C electric circuits.		
	1.3 Transfer function – definition, derivation of transfer function for close loop control system.		

	1.4 Order of a system – definition, 0, 1, 2 order system standard equation, practical examples.		
	1.5 Block diagram representation of a system- need, reduction rules, problems.		
2.	**Dynamic Analysis of a System**		
	2.1 Dynamic analysis of measurement systems- definition, time domain and frequency domain analysis.		**8**
	2.2 Time domain analysis – Transient and steady state response, steady state error.		
	2.3 Standard test inputs - step, ramp, parabolic& impulse. Need of them, significance, and corresponding Laplace representation		
	2.4 Poles & zeros – definition.		
	2.5 Time response specifications (no derivations) ; problems on time response specifications		
3.	**Stability & Introduction to servo system**		
	3.1 S-plane – Introduction	**08**	**14**
	3.2 Stability - stable, unstable, critically stable & conditionally stable system; relative stability; Root locations in S-plane for stable and unstable systems		
	3.3 Routh's stability criterion-different cases & conditions (statement method); problems (Time response analysis)		
	3.4 Introduction, advantages & disadvantages of frequency response analysis; frequency response specifications		
	3.5 Servo system –definition, block diagram,		
	3.6 AC & DC servo systems- comparison, practical example, schematic diagram , concept and principle		
4.	**Control actions & process controllers**		
	4.1 Process control system – block diagram , elements	**08**	**8**
	4.2 Control actions: discontinuous & continuous modes;		
	4.3 On off controllers: neutral zone Proportional controllers (offset, proportional band) Integral & derivative controllers;		
	4.4 Composite controllers; PI, PD, PID controllers		
	4.5 Control actions of electronic controllers with circuits & equations (with op amp)		
	Total	**48**	**80**

List of Practical/Experiments/Assignments:

Sr. No.	Name of Experiment/Assignment
1	Resistive Transducers
2	Capacitive Transducer
3	Inductive Transducers
4	DC position control system
5	DC servo motor
6	Characteristics of potentiometer as error detector
7	Signal conditioning
8	Instrumentation Amplifier
9	Proportional mode controller using op-amp
10	Integral controller using op-amp
11	Derivative controller using op-amp
12	PID controller using op-amp

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	Overview of Control system	Class room teaching & Laboratory work
2.	Transducers	Class room teaching & Laboratory work
3.	Stability & frequency response analysis	Class room teaching & Laboratory work
4.	Overview of Control System	Class room teaching & field visit
5.	Stability & Introduction to servo system	Class room teaching & Laboratory work
6.	Dynamic Analysis of a System	Class room teaching & field visit
7.	Control actions & process controllers	Class room teaching & field visit

Text Books:

Sr. No	Author	Title	Publication
1.	M. Gopal	Digital Control System	Tata McGraw-Hill
2.	J.J.Nagrath & M. Gopal	Control system engg	
3.	M.Gopal	Control System	Tata McGraw-Hill
4.	K. Ogata	Modern control engg	
5.	Kumar	Control systems	Tata McGraw-Hill
6.	C. D. Johnson	Process control instrumentation Technology	

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