SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.

(An Autonomous Institute Affiliated to RGPV Bhopal)

Department of Electronics Engineering

(Applicable to 2024-25 admitted and later batches)

Name of the course:	B. Tech in Electronics & Instrumentation Engineering
Semester and Year of study	B. Tech 2nd Year 4th Semester
Subject Category	Departmental Course (DC)
Subject Code: EI-402	Subject Name: Analog Circuits

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			**Total Marks**				
End Sem	Mid-Sem	Assignment	Quiz	End Sem	Lab-Work	Quiz		L	T	P	
60	20	10	10	30	10	10	150	3	0	2	4

Prerequisites:

- Basic Electrical Engineering
- Electronic Devices and Circuits
- Network Analysis
- Network Synthesis

Course Objective:

1. To study the behaviour of opamp under open loop and closed loop, and understand its performance.
2. To study the impact of positive and negative feedback on opamp performance..
3. Study how to analyse opamp circuits.
4. Derive various linear and nonlinear circuit applications of opamp.

Course Outcomes:

On successful completion of this course student should be able to:

CO 1: **Acquire** knowledge and demonstrate the basics of Operational Amplifier, filters, oscillators, signal generators and other applications.

CO 2: **Analyze** different op-amp circuits and linear and nonlinear applications of opamp.

CO 3: **Evaluate** the performance of opamp circuits for different applications.

CO 4: **Design** active filters, oscillators and derive opamp circuits for different applications.

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	-	1	1	-	-	-	2	1
CO2	3	3	2	3	3	1	1		2	-	2	1
CO3	3	2	2	3	3	1	1	-	2	-	2	1
CO4	3	2	3	2	3	1	1	-	-	-	2	2
Avg.	3	2.5	2.5	2.75	2.25	1	1	-	1	-	2	1.25

UNITs	Descriptions	Hrs.	CO's
I	Feedback Amplifiers & Oscillators: Concept of feedback, positive and negative feedback, voltage and current feedback, series and shunt feedback, effect of feedback on performance characteristics of an amplifier, stability criterion. Condition for sustained oscillation, Barkhausan criterion.	5	1,2,3,4
II	Operational Amplifier Fundamentals: Introduction to op-amp, Block diagram representation, pin diagram , characteristics of ideal and practical op – amp, Equivalent circuit, open loop op amp, configuration, open loop and closed loop frequency response of opamp, op amp parameters - offset voltage and current, bias current ,drift ,CMRR, slew rate and its effect on frequency response, offset nulling methods, compensated and non compensatedopamp.	5	1,2,3,4

III	Linear Applications: Differential ,inverting and non-inverting , Differential amplifier with one op amp ,two op amp and three op amp, DC and AC amplifiers, summing, scaling and averaging amplifiers, Instrumentation amplifier, integrator, differentiator and comparator. Zero crossing detector, peak detector, window detector, Precision rectifiers.	10	1,2,3,4
IV	Non-linear Op-Amp Circuits: Schmitt trigger and applications, log and antilog amplifier, analog computation, voltage controlled oscillator. phase locked loop, principle and building block of PLL, Lock and capture ranges,capture process and application of PLL.	8	1,2,3,4
V	Analyze and Design Active filters, characteristics ,frequency response and different types of filters ,order and cut off frequency ,Butterworth Low pass filters , high pass filters ,band pass filter ,band stop filter R-C phase shift, Hartley, Colpitts, Crystal and Wein bridge Oscillators, Negative resistance Oscillator, Relaxation Oscillator. Square, triangular and sawtooth wave generator, Timer IC - 555, functional diagram Mono stable.	12	1,2,3,4
Guest Lectures (if any)		Nil	
Total Hours		40	

Suggestive list of experiments:

1. Draw and examine Decibels and Bode Plots—CO2
2. Design of Dual input Balance output Differential Amplifier using Transistor—CO4
3. Design of Comparator circuit using operational amplifier-CO4
4. Design of / Inverting/Non-inverting Voltage Amplifier -CO4
5. Design of Differential Amplifier. Using 741 opamp IC—CO4
6. Analysis of Gain-Bandwidth Product—CO2
7. Analysis of Slew Rate and Power Bandwidth—CO2
8. Analysis of Non-compensated OpAmp—CO2
9. Analysis of DC Offset voltage.—CO2 .
10. Design of Operational Trans-conductance Amplifier—CO4
11. Design of Precision Rectifiers—CO4.
12. Design of Triangle-Square waveform Generator—CO4
13. Design of WienBridge Oscillator—CO4.
14. Design of Integrator/ Differentiator circuit using 741 opamp IC—CO4
15. Design of Bandpass Filter using 741 opamp IC.—CO4

Text Book-

- Linear integrated circuit- RamakantGayakwad (PHI)
- OP-Amps their Design and Application- Tobbyet all. (Tata Mcgraw Hill)
- Linear integrated circuit- D. Roychowdhary and Shail B. Jain (New Age International)
- Integrated Electronics- MillmanHalkias (Tata Mcgraw Hill)

Reference Books-

- Analog Integrated Circuit Design - Ken Martin and David Johns
- Op Amps for Everyone- Texas Instruments

List and Links of e-learning resources:

- NPTEL Course.
- MOOC, IIT Bombay.

Modes of Evaluation and Rubric

The evaluation modes consist of performance in Two mid-semester Tests, Quiz/ Assignments, term work, end-semester examinations, and end-semester practical examinations.

Recommendation by Board of studies on	19.12.2024
Approval by Academic council on	
Compiled and designed by	Dr.Jyotsna.V.Ogale

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE (DEGREE) VIDISHA
DEPARTMENT OF ELECTRONICS
ELECTRONICS & INSTRUMENTATION Engg.
(Applicable to 2024-25 admitted and later batches)

Category of Course	Course Title	Course Code	Credits -4			Theory Paper
			L	T	P	
Departmental Course (DC)	Process Instrumentation-II	EI-403	3	-	2	Max.Marks-60 Min.Marks-19 Duration-3 Hrs.
Name of the course:		B. Tech in Electronics & Instrumentation Engineering				
Semester and Year of study		B. Tech 2ndYear 4th Semester				

Sub. Code	Subject Name & Title	Maximum Marks Allotted							Total Marks
		Theory Paper				Practical			
		End Sem.	Mid Sem. MST	Assignment	Quiz	End Sem.	LW	Quiz	
EI-403	Process Instrumentation-II	60	20	10	10	30	10	10	150

Course Description	This course introduces the concepts of modern sensors and actuators which are used for the measurement of physical variables in industries. The subject aims are to explain some of the most important physical principles applied in sensors and actuators & to highlight performance limitations which arise in the installation of these devices.
Prerequisite Knowledge	Basic of fundamentals of Instrumentation & Transducers
Course Objectives	Upon completion of this course, the student will be able to: 1. To understand the working principle and construction of contact & non-c0ntact type temperature sensors 2. To understand the working principle and construction of various pressure sensors, gauges & devices. 3. To understand the working principle and construction of quantity flow meters, area flow meters, mass flow meters 4. To understand the various methods of level measurement. 5. To understand the various methods of humidity and moisture measurement
Course Outcomes	This course primarily contributes to EI program outcomes that develop students abilities to: **CO1** Analyze & measure Industrial Temperature, Pressure, Flow, and Liquid Level with different transducers. **CO2** Analyze & Calibrate variety of electronic instruments, troubleshoot instrument problems and provide proper maintenance. **CO3** Describe safety standards of Industry sensors, devices and controls

Syllabus

Unit-I
Temperature Measurement:-Temperature scales,, temperature calibrators and simulators. Different types of thermometers: liquid in glass, bimetal, filled system, thermocouple, RTD, thermistors, IC temperature sensors, radiation thermometers, temperature switches, and thermostats.

Unit-II
Pressure Scale and Standards: - Manometers: U-tube, well type, inclined tube, ring balance and digital manometer. Elastic pressure sensors: Bellows, bourdon tubes, diaphragm, (types, materials, range,

construction, resonant frequency, advantages and limitations). Sensitivity, Secondary pressure sensors, Differential pressure measurements: Force balance type, ring balance, Knudsen Gauge. High-pressure sensors: Dead weight tester,. Vacuum sensors: McLeod gauge, thermal conductivity (Pirani, Thermocouple gage) ionization types,
Unit-III Flow Measurement: - Fluid properties, turbulent & laminar flow, Reynolds number, velocity profile, flow conditioners, influence of pressure & temperature on volume flow-rate,. Different flow measurement techniques: differential pressure flow meters, variable area flow meters, magnetic flow meter, vortex shedding flow meter, positive displacement flow meter, turbine flow meter, ultrasonic flow meter, target flow meter, Criteria for selection of flow meters.
Unit-IV Level Measurement: - Review of different level measurement methods and application considerations. Various level measurement devices: gauge glass, float & displacer type level sensors, D/P type level sensors, capacitive level sensors, ultrasonic & microwave level sensors, tape level gauges, servo level gauges, conductivity level sensors, radiation level sensors, vibrating level switches.
Unit-V Measurement of Humidity And Moisture:- Humidity terms – dry and wet bulb psychrometers – hot wire electrode type hygrometer – dew cell – electrolysis type hygrometer – commercial type dew point meter – moisture terms – different methods of moisture measurement – moisture measurement in granular materials, solid penetrable materials like wood, web type material. Suitable signal conditioner.

Textbooks:

1. H.N. Norton-Handbook of Transducers, Prentice Hall; Facsimile Edition
2. D. Patranabis -Principle of industrial Instrumentation, McGraw Hill Education; 3 Edition
3. E.O. Doebelin-Measurement Systems Applications and Design, Tata McGraw Hill Education; 5th Edition
4. Nakra and Chaudhary-Instrumentation Measurement and Analysis, McGraw Hill Education India Private Limited; Fourth edition.
5. A. K. Sawhney -Electronic Instruments & Measurement, Dhanpat Rai Publications.

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Department Electronics Engineering
Program Electronics & Instrumentation Engineering
(Applicable to 2024-25 admitted and later batches)

Semester/Year		IVth/IInd		Program	B.Tech.
Subject Category	DC	Subject Code	EI-404	Subject Name:	Digital Communication

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
End Sem	Mid-Sem	Assignment	Quiz	End Sem	Lab-Work	Quiz		L	T	P	
60	20	10	10	30	10	10	150	3	0	2	4

Prerequisites: Analog Communication

Course Objective:

This course provides an introduction to the basic principles and techniques used in digital communications. The course will help us to understand the principles of sampling & quantization techniques, waveform coding schemes, multiplexing and different digital modulation techniques. The course also introduces analytical techniques to evaluate the performance of communication systems.

Course Outcomes:

After completion of the course, students would be able to -

CO 1: Acquire knowledge, understand and demonstrate about the elements of digital communication system, sampling, quantization, waveform coding, multiplexing, different digital modulation and demodulation techniques. (BL1,BL2)

CO 2: Conduct analysis of baseband signals in time domain and frequency domain.(BL3,BL4)

CO 3: Design communication systems to meet desired needs.(BL3,BL6)

CO4: Evaluate the performance of modulation and demodulation techniques in various transmission environments. And evaluate fundamental communication system parameters such as bandwidth, power and signal to noise ratio.(BL3,BL5)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	2	2	-	-	-	-	-	-	-
CO3	3	2	3	2	2	-	-	-	-	-	-	-
CO4	3	2	-	2	2	-	-	-	-	-	-	-

Contents:

UNITs		Descriptions	Hrs.	CO's
I		**Elements of Digital Communication system with its block diagram:** source, channel, transmitter, receiver; Communication channel characteristics: bit rate, baud rate, bandwidth, repeaters; Concept of Entropy and Information rate; Channel capacity: Hartley's law, Shannon Hartley's theorem; Source coding; Channel coding; Classification of line codes.	09	1, 2, 3, 4
II		**Sampling and quantization process:** types of sampling; Nyquist sampling theorem (only statement); Aliasing effect; Quantization process; Quantization error/noise; Companding; Pulse code modulation (PCM); Differential pulse code modulation (DPCM); Delta modulation (DM); Adaptive Delta modulation (ADM); Intersymbol interference (ISI).	10	1, 2, 3, 4

III		**Digital modulation techniques:** Types and their advantages; Amplitude Shift Keying (ASK); Frequency shift keying (FSK); Phase shift keying (PSK); Differential Phase shift keying (DPSK); Quadrature Phase shift keying(QPSK); M-ary encoding: Need, M-ary FSK and M-ary PSK; Quadrature amplitude Modulation(QAM).	09	1, 2, 3, 4
IV		**Multiplexing techniques:** definition, block diagram and comparison of Time Division Multiplexing (TDM), Frequency Division Multiplexing (FDM), Code Division multiplexing (CDM); **Access techniques:** Need and methods of Time division multiple access (TDMA), Frequency division multiple access (FDMA), Code division multiple access (CDMA).	06	1, 2, 3, 4
V		**Introduction to spread spectrum (SS) modulation:** advantages over fixed frequency; application of SS modulation; Types of SS modulation: Direct sequence spread spectrum (DSSS) and Frequency hopped spread spectrum (FHSS).	06	1, 2, 3, 4
		Guest Lectures (if any)	Nil	
		Total Hours	40	
		Suggestive list of experiments:		
		Text Books- 1. B.P. Lathi: Modern Analog and Digital Communication System, Oxford University Press. 2. J.G Proakis, ―Digital Communication‖, 4th Edition, Tata Mc Graw Hill Company, 2001.		
		Reference Books- 1. Simon Haykins: Communication Systems, 4th Edition, John Wiley. 2. B. Sklar, ―Digital Communication Fundamentals and Applications, 2nd Edition, Pearson Education, 2009. 3. Singh and Sapre: Communication System, TMH		
		Modes of Evaluation and Rubric		
		There will be continuous evaluation for during the semester for 40 sessional marks and 60 semester End term Marks. Out of 40 sessional marks, 20 shall be awarded for Mid semester, 20 marks to be awarded for day to day performance and Quiz/Assignments. For the 60 Marks, there will be a semester – End examination as per the norms of AICTE.		
		Recommendation by Board of studies on	Date: 19/12/24	
		Approval by Academic council on	Date:	
		Compiled and designed by	Dr. Neelesh Mehra	
		Checked and approved by		

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Department Electronics Engineering
Program Electronics & Instrumentation Engineering

Syllabus applicable to July 2024 admitted

Semester/Year		IVth/IInd		Program		B.Tech.
Subject Category	DC	Subject Code:	EI 405	Subject Name:		Control System

Maximum Marks Allotted							Contact Hours			Total Credits
Theory				Practical		Total Marks				
End Sem	Mid-Sem	Assignment	Quiz	End Sem	Lab-Work		L	T	P	
60	20	10	10	-	-	100	3	0	0	3

Prerequisites:

- Signal & System
- Basic Mathematics

Course Objective:

1) To make the students capable understanding the fundamental concept of control system and mathematical modelling of the system
2) To make the students capable analyzing the time response, frequency response and stability of system.

Course Outcomes:

After completion of the course, students would be able to -

CO 1: Acquire knowledge and understanding of different type of system and their representation stability time domain and frequency behaviour controller and compensators to obtain mathematics. (BL1,BL2)

CO 2: Apply knowledge to obtain mathematical modelling of different systems, find out transfer function and obtain knowledge about the signal flow graph. (BL2,BL3)

CO 3: Analyze the time domain and frequency domain behaviour of different types of signal and system stability .(BL3,BL4)

CO4: Design feedback controller and compensation circuits. (BL3,BL5)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	2	2	-	-	-	-	-	-	-
CO3	3	3	3	2	2	-	-	-	-	-	-	-
CO4	3	2	3	2	2	2	-	-	-	-	-	-

Contents:

UNITs	Descriptions	Hrs.	CO's
I	**Introduction:** Control system, Mathematical modeling of physical system, Differential equation representation of physical system, Transfer function concepts, Block diagram representation, Signal flow graph.	08	1, 2, 3, 4
II	**Feedback characteristics of control system:** Introduction Reduction of parameter variation by use of feedback, control system dynamics by use of feedback, control of effects of disturbance signals by use of feedback, Regenerative feedback, Illustrative examples.	08	1, 2, 3, 4
III	**Time Response Analysis:** Introduction, standard test signal, performance indicator, Time response of first order system, Time response of second order system, Design specification of second order system, compensation scheme, design specification of higher order system.	07	1, 2, 3, 4
IV	**Stability Analysis in Time domain:** The concept of stability from pole position, Necessary condition for stability, Routh Stability Criteria, Relative stability analysis, Root locus technique: Introduction, root locus concept, root locus construction rules, Root contours.	07	1, 2, 3, 4
V	**Frequency Response Analysis:** Introduction, performance indices Frequency	10	1, 2, 3, 4

	response of second order system, Polar plot, Nyquist plot, Bode plot, All pass system, minimum phase and non minimum phase system, Design problem, Concept of cascade and feedback compensation, Realisation of basic compensators, case study. Concept of state, state variable and state model, State model of linear continuous time system, Concept of controllability and Observability Illustrative examples.		
Guest Lectures (if any)		Nil	
Total Hours		40	

Suggestive list of experiments:

Text Books-

4. B.C. Kuo and F. Golnaraghi, Automatic control System.
5. J. NagrathMadan Gopal, Control system Engineering, NEW AGE INTERNATION PUBLISHERS LTD-NEW DELHI.
6. B.S. Manke, Linear Control System.

Reference Books-

3. S. Hasan Saced, Control System 7th Edition, S K Kataria & Sons.
4. Narasimham R. L., Analysis of Linear Control System.
5. Padmanabhank, Control System.
7. Bhattacharya, Control System Engineering.

Modes of Evaluation and Rubric

There will be continuous evaluation for during the semester for 40 sessional marks and 60 semester End term Marks. Out of 40 sessional marks, 20 shall be awarded for Mid semester, 20 marks to be awarded for day to day performance and Quiz/Assignments. For the 60 Marks, there will be a semester – End examination as per the norms of AICTE.

Recommendation by Board of studies on	Date: 19/12/24
Approval by Academic council on	Date:
Compiled and designed by	Prof. Niraj Kumar
Checked and approved by	

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
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Department of Electronics Engineering
Syllabus applicable to July 2024 admitted and later batches

Name of the course:	B. Tech in Electronics & Instrumentation Engineering
Semester and Year of study	B. Tech 2nd Year 4th Semester
Subject Category	Departmental Laboratory (DLC)
SubjectCode:EI-406	Subject Name: Simulation Lab-I

Maximum Marks Allotted							Contact Hours			Total Credits
Theory			Practical			**Total Marks**				
End Sem	Mid-Sem	Quiz	End Sem	Lab-Work	Quiz		L	T	P	
-	-	-	60	20	20	100	0	2	2	3

Prerequisites:

Basic Electrical Concepts, Mathematics (Matrices, Laplace Transform, Differential Equations and Complex Variables).

Course Objective:

The primary objective of this course is to introduce students to the fundamental concepts and techniques of programming in the MATLAB language. This course helps students understand programming concepts and understand how to use them in a variety of engineering, scientific and mathematical applications. It is a mathematics-oriented language suitable for solving engineering problems and creation of graphical user interfaces (GUIs). This course covers topics like creating scripts, developing functions, executing programs, debugging, visualizing and creating plot, creating Simulation and GUI and more. By successfully completing this course, students will be able to write programs for various calculations and simulations in MATLAB. This course is highly recommended for engineering students who are interested in solving the mathematical problems and programming with MATLAB.

Course Outcomes:

Upon completion of the course, student will be able to

CO1: Ability to know about the syntax of the language used to solve engineering problems.
CO2: Ability to understand the concept of programming.
CO3: Ability to write programs, visualize and plot data and simulate engineering applications.
CO4**:** Ability to use programming skill required for the development of projects at higher semester.

CO- PO Mapping

PO COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**
CO2	**2**	**3**	**-**	**2**	**3**	**1**	**-**	**-**	**3**	**-**	**3**	**3**
CO3	**2**	**-**	**3**	**-**	**3**	**3**	**2**	**-**	**3**	**-**	**3**	**3**
CO4	**3**	**2**	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**3**	**3**
CO5	**3**	**2**	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**

UNITs	Descriptions	Hrs.	CO's
I	Introduction of MATLAB and history, MATLAB Windows, Elementary Math built in Functions.	4	CO1
II	Mathematical operations including Arrays, Mathematical Operations with arrays, Matrices, Matrix algebra with MATLAB. Curve Plotting with MATLAB,	4	CO2

III	Control Structures -Conditional statements, loops, Branch control structure,		CO3
IV	Input/output Functions,Script Files, Functions and Function files, Cell Arrays, Structure Arrays.	4	CO3, CO4
V	Basics of Toolboxes, Simulink and GUI.	4	CO4
Guest Lectures (if any)		Nil	
Total Hours		20	

Text Books -

1. Getting Started With Matlab: A Quick Introduction For Scientists And Engineers by RudraPratap, Oxford University Press
2. MATLAB and its applications in Engineering, R.K. Bansal, A. K. Goel, M. K. Sharma
3. MATLAB - An Introduction with Applications, Amos Gilat ,Wiley India.

Reference Books

1. MATLAB Programming for Engineers S.J.Chapman, Thomson Learning
2. Essential MATLAB for Engineers and Scientists, B.H.Hahn, D.T.Valentine, Elsevier

Modes of Evaluation and Rubric

The evaluation modes consist of performance in term work, end-semester examinations, and end-semester practical examinations.

Recommendation by Board of studies on	19/12/24
Approval by Academic council on	
Compiled and designed by	Dr.D.K.Shakya