SCHEME & SYLLABUS OF UNDERGRADUATE DEGREE COURSE

Electronic Instrumentation & Control Engineering

III & IV Semester

Effective for the students admitted in year 2021-22 and onwards.

B. Tech. Electronic Instrumentation & Control
2nd Year – III Semester

THEORY												
S.No.	Category	Course		Contact hrs/week			Marks				Cr
		Code	Title	L	T	P	Exam Hrs.	IA	ETE	Total	
1	UCB	3EI1-01	Advanced Engineering Mathematics-I	3	0	0	3	30	70	**100**	**3**
2	DC	3EI4-02	Sensors and Transducers	3	0	0	3	30	70	**100**	**3**
3		3EI4-03	Electronic Devices and Circuits	3	0	0	3	30	70	**100**	**3**
4		3EI4-04	Digital Electronics	3	0	0	3	30	70	**100**	**3**
5		3EI4-05	Circuit Theory	3	0	0	3	30	70	**100**	**3**
6		3EI4-06	Electronics Measurement & Instrumentation	2	0	0	2	30	70	**100**	**2**
		Sub Total		**17**	**0**	**0**	**-**	**180**	**420**	**600**	**17**
PRACTICAL & SESSIONAL											
7	DC	3EI4-20	Transducers Lab	0	0	3	3	60	40	**100**	**1.5**
8		3EI4-21	Electronic Devices and Circuits Lab	0	0	3	3	60	40	**100**	**1.5**
9		3EI4-22	Digital Electronics Lab	0	0	3	3	60	40	**100**	**1.5**
10		3EI4-23	Computer Programming Lab	0	0	3	3	60	40	**100**	**1.5**
11	UI	3EI7-30	Industrial Training (15 Days)	0	0	2	-	60	40	**100**	**1**
12	CCA	3EI8-00	Co-Curricular Activities	0	0	2	-	60	40	**100**	**1**
		Sub- Total		**0**	**0**	**16**	**-**	**360**	**240**	**600**	**8**
		TOTAL OF III SEMESTER		**17**	**0**	**16**	**-**	**540**	**660**	**1200**	**25**

L: Lecture, **T**: Tutorial, **P**: Practical, **C**r: Credits
ETE: End Term Exam, **IA**: Internal Assessment

B. Tech. Electronic Instrumentation & Control
2nd Year – IV Semester

S.No.	Category	Course Code	Course Title	Contact hrs/ week L	T	P	Marks Exam Hrs.	IA	ETE	Total	Cr
THEORY											
1	**UCB**	**4EI1-01**	Advanced Engineering Mathematics-II	3	0	0	3	30	70	**100**	**3**
2	**DC**	**4EI4-02**	Signals & Systems	3	0	0	3	30	70	**100**	**3**
3		**4EI4-03**	Linear Integrated Circuits	3	0	0	3	30	70	**100**	**3**
4		**4EI4-04**	Controls System Engineering	3	0	0	3	30	70	**100**	**3**
5		**4EI4-05**	Electrical Measurements	3	0	0	3	30	70	**100**	**3**
6		**4EI4-06**	Industrial Measurements	3	0	0	3	30	70	**100**	**3**
		Sub-Total		**18**	**0**	**0**		**180**	**420**	**600**	**18**
PRACTICAL & SESSIONAL											
7	**DC**	**4EI4-20**	Signal Processing Lab	0	0	3	3	60	40	**100**	**1.5**
8		**4EI4-21**	Linear Integrated Circuits Lab	0	0	3	3	60	40	**100**	**1.5**
9		**4EI4-22**	Control System Lab	0	0	3	3	60	40	**100**	**1.5**
10		**4EI4-23**	Electrical Measurement Lab	0	0	3	3	60	40	**100**	**1.5**
11	**CCA**	**4EI8-00**	Co-Curricular Activities	0	0	2	-	60	40	**100**	**1**
		Sub- Total		**0**	**0**	**14**		**300**	**200**	**500**	**7**
		TOTAL OF IV SEMESTER		**18**	**0**	**14**		**480**	**620**	**1100**	**25**

L: Lecture, **T**: Tutorial, **P**: Practical, **C**r: Credits
ETE: End Term Exam, **IA**: Internal Assessment

SYLLABUS
2nd Year- III Semester: B.Tech. (Electronic Instrumentation & Control Engineering)

3EI1-01: Advanced Engineering Mathematics-I

Credits: 03
3L:0T:0P

Max. Marks: 100 (IA:30, ETE:70)
End Term Exam: 3 Hours

Course Objectives: This course aims to impart knowledge of fundamental concepts of numerical analysis, probability & statistics and an introduction to partial differential equations and Fourier series.

Course Outcomes: Upon successful completion of the course the students will be able to

CO-1: To study the numerical interpolations for equal and unequal intervals, numerical differentiation, integration and solving ordinary differential equations by numerical methods.

CO-2: To study the solution of polynomials, algebraic and transcendental by numerical methods including linear equations.

CO-3: Compute the discrete and continuous random variables, probability distributions, expectations, moments, MGF, mean and variances.

CO-4: Define and explain the different statistical distributions like Binomial, Poisson, Normal, Uniform, and Exponential distributions and compute the method of least squares, correlation and regression.

CO-5: To study the theory of partial differential equations by using the separation of variables.

CO-6: To study and understand the Fourier series, half range Fourier sine and cosine series

Se. No.	Contents	Hours
1	**Numerical Analysis–**1: Finite differences and operators, interpolation by using Newton's forward and backward difference formula. Gauss's forward and backward interpolation formula. Stirling's formula. Newton's divided difference and Lagrange's interpolation for unequal intervals. Numerical differentiation. Numerical integration by Trapezoidal rule and Simpson's 1/3 and 3/8 rules. Numerical solution of ordinary differential equations by Euler's method modified Euler's methods, Runge- Kutta method and Milne's PC methods.	**10**
2	**Numerical Analysis–2**: Solution of polynomials, algebraic and transcendental equations by using the Bisection method, Newton-Raphson method and Regula-Falsi method. Solution of systems of linear equations by using LU decomposition and Gauss elimination method.	**7**
3	**Probability and Statistics-1:** Discrete and continuous random variables, probability distribution function, mathematical expectations, moments, moment generating functions, mean and variance, cumulant generating function.	**6**
4	**Probability and Statistics-2:** Binomial distribution, Poisson distribution, Normal distribution, curve fitting, correlation and regression.	**9**
5	**Fourier Series**: Periodic functions, Fourier series, change of intervals, half range Fourier sine and cosine series, Parseval's theorem. **Partial Differential Equations:** Classification of second order partial differential equations, separation of variables: One dimensional Heat and Wave equations, Two dimensional Laplace equations.	**8**
	Total	**40**

Suggested Books:

1. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Fifth Edition, Narosa Publishing House, (2016).
2. H.K. Dass, Advanced Engineering Mathematics, 22nd Edition, S. Chand, (2018).
3. Erwin O. Kreyszig, Advanced Engineering Mathematics,, Tenth Edition, Wiley India Pvt. Ltd, (2015)
4. Sheldon M. Ross, Introduction to Probability and Statistics for Engineers and Scientists, Academic Press, (2009).
5. K. E. Atkinson, An Introduction to Numerical Analysis (2nd edition), Wiley-India, (1989).

SYLLABUS
2nd Year- III Semester: B.Tech. (Electronic Instrumentation & Control Engineering)

3EI4-02: Sensors and Transducers

Credits: 03 **Max. Marks: 100 (IA:30, ETE:70)**
3L:0T:0P **End Term Exam: 3 Hours**

Course Objectives: This course aims to impart the knowledge of transducers, sensors used in various instrumentation systems

Course Outcomes: Upon Successful completion of the course, the student will be able to

CO-1: Understand the constructions and working principle of different types of sensors and transducers.

CO-2: Learn the Industrial applications of the transducers.

CO-3: Understand the working and characteristics of signal conditioning circuits.

Se. No.	Contents	Hours
1	**Introduction:** Objective, Scope and Outcome of the course	01
2	**Characteristics of Transducers:** General concepts and terminology of measurement system, Classification of transducers, Selection criteria of transducers, Static and dynamic characteristics of a measurement system, sources of errors and their statistical analysis, standards and calibration.	06
3	**Resistive Transducers:** Working, Construction and applications of resistive potentiometers, Metal and semiconductor strain gauges and signal conditioning circuits, Types of strain gauges, Strain gauge applications: Load and torque measurement	08
4	**Inductive and Capacitive Transducers:** Self and mutual inductive transducers, Eddy current transducers, LVDT, RVDT, Working and types of capacitive transducers, Proximity sensors, Tacho-generators and stroboscope	08
5	**Displacement Transducers:** Displacement transducers, Translation and rotary encoders, Ultrasonic transducers, Digital transducers, Velocity and Acceleration transducers, Vibration pickups,	08
6	**Miscellaneous Transducers:** Piezoelectric transducers and their signal conditioning, Seismic transducer and its dynamic response, photoelectric transducers, Hall effect sensors, Magnetostrictive transducers. Smart sensors	09
	Total	40

Suggested Books:

1. Transducers and Instrumentation by Murthy D. V. S, Prentice Hall, 2nd Edition, 2011
2. Electrical and Electronics Measurement and Instrumentation by A.K. Sawhney, Dhanpat Rai & Co, 2nd Edition
3. Principle of Industrial Instrumentation by D. Patranabis, Tata McGraw Hill, 2nd Edition
4. Mechanical and Industrial Measurements by R. K. Jain, Khanna Publishers, 02nd Edition
5. Measurement Systems by E.O. Doebelin, McGraw Hill, 06th Edition
6. Process Measurement & Analysis by B.G. Liptak, CRC press, 04th Edition
7. Sensors and Signal Conditioning, John G.Webster, Wiley Inter Science, 2nd Edition, 2008
8. Sensors and Transducers, Patranabis, Prentice Hall, 2nd Edition, 2003.
9. Instrument Transducers - An Introduction to their Performance and Design, Neubert H.K.P, Oxford University Press, 2nd Edition, 1999.

SYLLABUS
2nd Year- III Semester: B.Tech. (Electronic Instrumentation & Control Engineering)

3EI4-03: Electronic Devices and Circuits

Credits: 03 **Max. Marks: 100 (IA:30, ETE:70)**
3L:0T:0P **End Term Exam: 3 Hours**

Course Objectives: This course aims to introduce basic semiconductor devices, their characteristics and application, their role in the operation of active devices.

Course Outcomes: Upon Successful completion of the course, the student will be able to
CO-1: To analyze PN junctions in semiconductor devices under various conditions.
CO-2: To Design and analyze simple rectifiers and voltage regulators using diodes.
CO-3: To design and analyze simple BJT and MOSFET circuits.

Se. No.	Contents	Hours
1	**Introduction**: Objective, Scope and Outcome of the course	01
2	**Fundamental of Semiconductor Physics:** General Material Properties & Crystal Structures, Classifications of Semiconductors, Fermi-Dirac Distribution Function, Density of State, Equilibrium Carrier Concentration Of Holes/Electrons in Intrinsic/Extrinsic Semiconductors, Drift/Diffusion Equations, Generation/ Recombination, Carrier Lifetime, Continuity Equation, Elements of Quantum Mechanics,	07
3	**PN Junction Diode & its Applications:** Junction Terminologies, Qualitative and Quantitative Analysis of Diode (Poisson Equation, space charge, built-in potential, depletion width), ideal diode volt-ampere equation, Avalanche and Zener breakdown, diode capacitances, reverse recovery transients, Diode based circuits, clippers, clampers, voltage multipliers, half/full wave rectifiers, diode as gate, Zener diode voltage regulators, Small Signal Model of Diode.	08
4	**Bipolar Junction Transistors:** Terminology, Simplified Structure, Electrostatics, General Operation Considerations, Performance Parameters, I-V characteristics of CE/CB/CC configuration, Ebers-Moll Model, base width modulation, Load Line Analysis, DC Operating Points, Need of Biasing, Fixed Bias Circuits, Self-Bias Circuits, Voltage Divider Bias Circuits, Stability Factor, Thermal Runaway, Thermal Stability.	08
5	**Field Effect Transistors:** Introduction to FET, Bias stability in FET, Different FET Configuration, Analysis of CS, CG and CD Configuration, Voltage Biasing Techniques, MOS capacitor, Depletion Mode and Inversion, MOSFET Operation and Enhancement Mode of MOSFET, derivation of I-V Characteristics of MOSFETs.	08
6	**Low Frequency Small Signal Amplifiers:** BJT as an amplifier, small signal models of BJT, CE/CC/CB amplifiers, emitter degeneration, multistage amplifiers, low frequency analysis of amplifiers, Miller Theorem, JFET/MOSFET as an amplifier, small signal models of JFET/MOSFET, CS/CD/CG amplifiers, source degeneration.	08
	Total	40

Suggested Books:

1. J. Millman and C. Halkias, Integrated Electronics, TMH
2. R. L. Boylestad & L. Nashelsky, Electronic Devices and Circuit Theory, Pearson Education
3. A. Sedra and K. Smith, Microelectronic Circuits, Oxford University Press
4. B. Razavi, Fundamentals of Microelectronics, Wiley
5. B. G. Streetman and S. K. Banarjee, Solid State Electronic Devices, Pearson/PHI
6. Donald Neamen, Semiconductor Physics & Devices, TMH
7. D. A Neaman, Microelectronics: Circuit Analysis & Design, TMH

SYLLABUS
2nd Year- III Semester: B.Tech. (Electronic Instrumentation & Control Engineering)

3EI4-04: Digital Electronics

Credits: 03 **Max. Marks: 100 (IA:30, ETE:70)**
3L:0T:0P **End Term Exam: 3 Hours**

Course Objectives: This course aims to introduce digital systems, different types of logic families and their characteristics.

Course Outcomes: Upon Successful completion of the course, the student will be able to

CO-1: Understand number systems, codes and their conversions.

CO-2: Reduce Boolean expression using K-map and tabular methods

CO-3: Design and analyze combinational and sequential logic circuits

Se. No.	Contents	Hours
1	**Introduction:** Objective, Scope and Outcome of the course	01
2	**Number System, Codes and Logic Gates:** Arithmetic of Nonconventional Number System, Weighted Codes, Binary codes, Code Conversion, Error Correction/Detection Codes, BCD codes, Fixed point & floating point Number System. Basic, Exclusive and Universal Gates.	06
3	**Logic Simplification and Minimization Techniques:** Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Karnaugh maps up to 6 variables, Tabulation Method.	08
4	**Combinational Logic Circuits Design:** Half and Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Magnitude Comparators, Multiplexers, Encoder, Decoder, Driver & Multiplexed Display, Logic Implementation using combination blocks.	08
5	**Sequential Logic Circuits Design:** Building blocks like S-R, JK and Master-Slave JK FF, Edge triggered FF, Ripple and Synchronous counters, Shift registers, Finite state machines, Design of Synchronous FSM, Algorithmic State Machines charts. Designing synchronous circuits like Pulse train generator, Pseudo Random Binary Sequence generator, Clock generation	08
6	**Logic Families:** TTL NAND gate, Specifications, Noise margin, Propagation delay, fan-in, fan-out, Tristate TTL, ECL, CMOS families and their interfacing.	09
	Total	40

Suggested Books:

1. Moris Mano: Digital Design, Pearson Education.
2. R. P. Jain: Digital Electronics, Tata McGraw Hill.
3. Thomas L. Floyd: Digital Fundamentals, Pearson Education.
4. Malvino and Leech: Digital Principles & Applications, Tata McGraw Hill
5. Taub and Schilling: Digital Integrated Electronics, McGraw Hill
6. Sandige: Digital concept Using standard ICs
7. R. J. Tocci: Digital Systems: Principles and Applications, Fourth Edition, Prentice Hall

SYLLABUS
2nd Year- III Semester: B.Tech. (Electronic Instrumentation & Control Engineering)

3EI4-05: Circuit Theory

Credits: 03 **Max. Marks: 100 (IA:30, ETE:70)**
3L:0T:0P **End Term Exam: 3 Hours**

Course Objectives: To develop an understanding of fundamental laws of electrical circuits, analyze AC and DC circuits and understand transient responses.

Course Outcomes: Upon Successful completion of the course, the student will be able to

CO-1: Construct a circuit to suit the need and apply nodal and mesh methods to analyze the circuit.

CO-2: Learn the importance of circuit and networks and its applications in Electrical Engineering using theorems.

CO-3: Apply linearity/superposition concepts to analyze RL, RC and RLC circuits in time and frequency domains.

CO4: Understand the concept of Laplace Transform and its application for the transient analysis of the circuits.

Se. No.	Contents	Hours
1	**Introduction:** Objective, Scope and Outcome of the course	01
2	**Basic Concepts**: Active and passive elements, Concept of ideal and practical sources, Ohm's law, Source transformation, Kirchoff's laws, Analysis of networks by Mesh and Node voltage methods with independent and dependent sources. **Graph Theory:** Graph of network, Tree, Incidence matrix, Cut-sets, f-circuits analysis and f-cut set analysis, Duality, Methods of obtaining dual network.	09
3	**Network Theorems:** Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem and Tellegen's theorem. Analysis of networks with and without dependent AC and DC sources.	09
4	**1-phase and 3-phase AC Circuits:** 1-phase series and parallel AC circuits, Analysis of series and parallel resonant circuits. Bandwidth and Quality factor at resonance. 3-phase Star and Delta connection, Balanced and unbalanced 3-phase voltages, currents and impedances. Powers in 3-phase AC system, Power triangle, Complex Power. Analysis of three phase AC circuits.	08
5	**Transient Analysis:** Transient analysis of RL and RC circuits under DC excitations, Behavior of circuit elements under switching action, Response of networks under step, ramp, impulse, pulse and sinusoidal inputs. Time domain and frequency domain analysis of circuits.	08
6	**Transient Analysis using Laplace Transformation:** Laplace transformation, Laplace transformation of impulse, step, ramp, sinusoidal signals and shifted functions. Initial and Final value theorems. Special signal waveforms with Laplace transform and applications to circuit operations.	07
	Total	42

Suggested Books:

1. Engineering Circuit Analysis, William H. Hayt et al, Mc Graw Hill Publications.
2. Network Analysis, M. E. Vanvalkenburg, Pearson Publications.
3. Fundamentals of Electric Circuits, Charles K. et al, Mc Graw Hill Publications.
4. Circuit Theory, A. Chakarvorty, Dhanpat Rai & Co. (Pvt.) Ltd.
5. Engineering Circuit Analysis, J David Irwin et al, Wiley India.
6. Electric Circuits, Mahmood Nahvi, Mc Graw Hill.
7. Introduction to Electric Circuits, Richard C Dorf and James A Svoboda Wiley.
8. Circuit Analysis: Theory and Practice, Allan H Robbins et al, Cengage.
9. Basic Electrical Engineering, V. K. Mehta, Rohit Mehta, S. Chand Publications.
10. Network & Systems, D. Roy Choudhury, Wiley Eastern Ltd.

SYLLABUS
2nd Year- III Semester: B.Tech. (Electronic Instrumentation & Control Engineering)

3EI4-06: Electronics Measurement & Instrumentation

Credits: 02 **Max. Marks: 100 (IA:30, ETE:70)**
2L:0T:0P **End Term Exam: 2 Hours**

Course Objectives: This course aims to impart knowledge about measuring and recording instruments and their characteristics.

Course Outcomes: Upon Successful completion of the course, the student will be able to

CO-1: Learn about types of errors and their analysis in the measurement.

CO-2: Understand the characteristics of CRO and other analog and digital instruments.

CO-3: Understand the working, construction and types of recorders.

Se. No.	Contents	Hours
1.	**Introduction:** Objective, Scope and Outcome of the course	01
2.	**Fundamentals of Measurement:** Need of Instrumentation, General Measurement System, Classification of Instruments, Static and Dynamic characteristics of instruments, Error: limiting error, Types of Errors. Loading effect: Input impedance and admittance of load & output impedance and admittance of source, loading effects of series and shunt connected instruments, Calibration.	05
3.	**Electronic Measuring Instruments:** Electronic Voltmeter, Electronic Multimeters, Component Measuring Instruments: Q meter, Vector Voltmeter, Vector Impedance meter, RF Power & Voltage Measurements, Introduction to shielding & grounding	05
4.	**Oscilloscope:** Introduction, General purpose oscilloscope Block Diagram, Cathode Ray Tube, deflection sensitivity, front panel controls, Oscilloscope Probes, Dual trace CRO, ALT and CHOP modes, measurement of electrical parameters like voltage, current, frequency and phase, frequency measurement by Lissajous pattern and Z-modulation. Digital Storage oscilloscope block diagram, sampling rate, bandwidth, roll mode.	06
5.	**Digital Instruments:** Introduction to digital instruments, Advantages of Digital instruments over Analog instruments, Block diagram, principle of operation, Accuracy of digital instruments, Need of ADC, ADC types like Flash, Counter, SAR and Dual-Slope, ADC Specifications, Need of DAC, DAC types like Weighted-Resistor and R-2R ladder, DAC Specifications, Its applications in digital instruments like Digital Multimeter, Digital Kilo Watt Hour meter, Digital Clamp meter.	07
6.	**Recording Instruments:** Concept and classification of recorder, Basic Strip chart recorder, Operating mechanism, Chart drive mechanism, Types of Strip chart recorder-XY Recorder, Magnetic Tape recorder, Different marking mechanism in recorder, Application of recorders	06
	Total	30

Suggested Books:

1. Sawhney A. K., Electrical and Electronics Measurements and Instruments, Dhanpat Rai & Co. 02nd Ed..
2. W. D. Cooper & A. D. Helfrick, 'Electronic Instrumentation and Measurement Techniques', PHI, 4th e/d, 1987.
3. David Bell, 'Electronic Instrumentation and Measurements', PHI, 2e/d
4. Anand M. M. S., 'Electronic Instruments and Instrumentation Technology', PHI, 2004, 02nd Ed.
5. Kalsi H. S., 'Electronic Instrumentation', TMH, 2nd or 3rd e/d, 2004/2010.
6. R. Subburaj, ' Calibration the Foundation for ISO 9000 and TQM
7. Bouwens A. J., 'Digital Instrumentation', McGraw-Hill, second edition

SYLLABUS
2nd Year- III Semester: B.Tech. (Electronic Instrumentation & Control Engineering)

3EI4-20: Transducers Lab

Credits: 1.5 **Max. Marks: 100 (IA:60, ETE:40)**
0L:0T:3P

Course Outcomes:
Upon successful completion of the course, the students will be able to:

CO-1: Understand the characteristics of temperature transducers.
CO-2: Examine the characteristics of photo transducers, Displacement transducers etc.
CO-3: Design signal conditioning circuits for transducers.

Se. No.	Name of Experiments
1.	To draw the characteristics of following temperature transducers: RTD, Thermistors, Thermocouples
2.	To draw characteristics of LVDT for displacement measurement.
3.	To draw characteristics of Photovoltaic sensors.
4.	To draw characteristics of LDR.
5.	Determine temperature using LM35 IC Sensor.
6.	Determine characteristics of strain gauge load cell for weight measurement.
7.	Determine characteristics of different proximity sensors.
8.	Design a signal conditioning circuit for temperature measurement using Thermocouple.
9.	Design of Opto-coupler using photoelectric transducers.
10.	Design a signal conditioning circuit for temperature measurement using RTD.

SYLLABUS
2nd Year- III Semester: B.Tech. (Electronic Instrumentation & Control Engineering)

3EI4-21: Electronic Devices and Circuits Lab

Credits: 1.5 **Max. Marks: 100 (IA:60, ETE:40)**
0L:0T:3P

Course Outcomes:

Upon successful completion of the course, the students will be able to:

CO-1: Understand the working of diodes, special purpose diodes, their characteristics and circuits.
CO-2: Analyze the transistor circuits and their characteristics.
CO-3: Application of diodes and transistors, working on mini projects.

Se. No.	Name of Experiments Practical are to be performed on the bread-boards only.
1.	Study of Active/Passive Components
2.	Study of Oscilloscope, Function Generator, Multimeter, Power Supply
3.	To draw Diode Characteristic
4.	To draw Zener Diode Characteristics
5.	Use Diode as Clipper/Clamper and draw the response
6.	Design the Rectifiers and Filters circuits using diodes
7.	Use Zener as a voltage Regulator
8.	Draw the BJT Characteristics and show cut off, active and saturation region
9.	To draw the input and output characteristics of FET.
10.	Draw the characteristics of Common Emitter amplifier
11.	Draw the characteristics of Common source amplifier
12.	Mini Project

SYLLABUS
2nd Year- III Semester: B.Tech. (Electronic Instrumentation & Control Engineering)

3EI4-22: Digital Electronics Lab

Credits: 1.5 **Max. Marks: 100 (IA:60, ETE:40)**
0L:0T:3P

Course Outcomes:
Upon successful completion of the course, the students will be able to:

CO-1: Define different types of logic gates, identify their ICs and also verify their truth table.
CO-2: Derive basic logic gates, adder, and subtractor using universal gates.
CO-3: Realization of Boolean expression in SOP and POS form and design it using logic gates.
CO-4: Design and test combinational circuits.
CO-5: Design and develop sequential circuits.

Se. No.	Name of Experiments
1.	Realization of Basic/ Exclusive Logic Gates using Universal Logic Gate.
2.	Verification of operation of Full Adder and Full Subtractor.
3.	Design & verification of 4-bit binary adder/subtractor using binary adder IC.
4.	Realization of operation of full adder and full subtractor using IC 74151/74153 MUX.
5.	Design & verification of full adder and full subtractor using an inverted output 3 to 8 line decoder.
6.	Design and verification of operation of a BCD Adder using IC 7483.
7.	Realization of 4 X 1 MUX using basic gates.
8.	Realization of 4 X 1 MUX using basic gates.
9.	Verification of operation of BCD to Seven segment code conversion using IC 7447.
10.	Verification of Truth Tables of SR & D Flip flops.
11.	Verification of Truth Tables of Master Slave JK Flip-Flop.
12.	Design of BCD ripple counter.
13.	Design of Universal Shift Register.

SYLLABUS
2nd Year- III Semester: B.Tech. (Electronic Instrumentation & Control Engineering)

3EI4-23: Computer Programming Lab

Credits: 1.5 **Max. Marks: 100 (IA:60, ETE:40)**
0L:0T:3P

Course Objectives:

1. To implement an algorithm for a problem and analyze its time and space complexity.
2. To implement the algorithm for Searching (Linear and Binary).
3. To implement the algorithms for the different types of sorting.
4. To implement algorithms for different type of sorting and compare their performance in terms of the space and time complexity

Prerequisites: Computer Programming knowledge

Course Outcomes: Upon successful completion of the course/Lab the students will be able to
CO1: Design and analyze the time and space efficiency of the data structure.
CO2: Understand the concept of static & dynamic memory management
CO3: Identity the appropriate data structure for given problem.
CO4: Have practical knowledge on the applications of data structures.

Se. No.	Name of Experiments
1.	Write a program to find the mean and the median of the numbers stored in an array.
2.	Write a program to insert one element in an array and delete an element from an- array.
3.	Write a program to Linear & Binary search for a number in an array.
4.	Write a program to store the marks obtained by 10 students in 5 courses in a two-dimensional array.
5.	Write a Program for Matrix Multiplications.
6.	Write a program to implement single linked list, including insertion, deletion and searching in the linked list.
7.	Write a program to print the elements of a linked list in reverse order without disturbing the linked list.
8.	Write a program to reverse a linked list.
9.	Write a program to implement a doubly linked list including insertion, deletion and searching in the linked list.
10.	Write a program to prepare students marksheet using linked list.
11.	Write a program to implement a stack using an array and linked list.
12.	Write a program to implement a queue using an array and linked list.
13.	Write a program to implement a circular queue using an array.
14.	Write a program to implement a priority queue using a linked list.
15.	Write a program to implement a double-ended queue using a linked list.
16.	Write a program to implement different types of sorting (Bubble, Insertion, Quick, Selection, Merge, Heap).

Suggested Books:

- Thomas H. Cormen, C.E. Leiserson, R L.Rivest and C. Stein, Introduction to Algorithms , Third edition, MIT Press, 2009.
- Ellis Horowitz, S. Sahni, Freed, "Fundamentals of Data Structures in C",2nd edition,2015.
- Y. Langsam, M. J. Augenstein & A. M. Tanenbaum, Data Structures using C, Pearson Edu. Asia, 2004. Data Structures – Lipshutz TMH

SYLLABUS
2nd Year- IV Semester: B.Tech. (Electronic Instrumentation & Control Engineering)

4EI1-01: Advanced Engineering Mathematics-II

Credits: 03
3L:0T:0P

Max. Marks: 100 (IA:30, ETE:70)
End Term Exam: 3 Hours

Course Objectives: This course aims to impart knowledge of fundamental concepts of Laplace transform, Fourier transform, Z-transform and introduction to the theory of functions of complex variables.

Course Outcomes: Upon successful completion of the course the students will be able to

CO-1: To understand the concepts and to solve the problems of Laplace transform along with their properties and applications to ODE and PDE. .

CO-2: To understand the concepts and to solve the problems of Fourier transform along with their properties.

CO-3: To study and understand the concepts of Z- transform along with their properties.

CO-4: To study the techniques of complex variables together with other concepts and properties of an analytic function, complex integration, classification of singularities, calculus of residues and evaluation of integrals .

Se. No.	Contents	Hours
1.	**Laplace Transform**: Definition of Laplace transform, properties of Laplace transform and examples, Laplace transform of Unit step, Dirac delta and periodic functions, inverse Laplace transforms, properties of inverse Laplace transform, inverse Laplace transform by partial fraction method, convolution theorem, solving ODEs and PDEs by Laplace transforms method.	12
2.	**Fourier Transform**: Fourier transform, Fourier sine and cosine transform, properties and formulae, inverse Fourier transform, convolution theorem, application of Fourier transforms to one-dimensional heat and wave equations only.	8
3.	**Z-Transform:** Introduction, definition of the Z-transform and examples, basic operational properties of Z-Transform, inverse Z-transform and examples	8
4.	**Complex Analysis-I**: Analytic functions, Cauchy-Riemann equations, harmonic functions, construction of analytic function, complex line integral, Cauchy theorem, Cauchy integral formula.	6
5.	**Complex Analysis-2**: Taylor and Laurent's theorem, zeros and singularities, residues at poles and infinity, Cauchy residue theorem, evaluation of definite integrals	6
	Total	40

Suggested Books:

1. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Fifth Edition, Narosa Publishing House, (2016).
2. H.K. Dass, Advanced Engineering Mathematics, 22nd Edition, S. Chand, (2018).
3. Erwin O. Kreyszig, Advanced Engineering Mathematics,, Tenth Edition, Wiley India Pvt. Ltd, (2015)
4. Lokenath Debnath and Dambaru Bhatta, Integral Transforms and Their Applications, Third Edition, CRC Press, Taylor and Francis Group, A Chapman and Hall Book, (2015).
5. M.R. Spiegel et.al., Complex Variables-Schaum's Outline series 2ed., The Mc-Graw Hill, (2009).
6. E.T. Copson, An introduction to the theory of a complex variables, Oxford University Press,(1935).

SYLLABUS
2nd Year- IV Semester: B.Tech. (Electronic Instrumentation & Control Engineering)

4EI4-02: Signals and Systems

Credits: 03 **Max. Marks: 100 (IA:30, ETE:70)**
3L:0T:0P **End Term Exam: 3 Hours**

Course Objectives: The aim of the course is to introduce various types of signals and systems used in digital signal processing

Course Outcomes: Upon Successful completion of the course, the student will be able to

CO-1: Learn mathematical representation of continuous and discrete time signals and systems

CO-2: Understand the behavior of linear shift invariant systems

CO-3: Analyze the system in s- domain and z- domain

Se. No.	Contents	Hours
1	**Introduction:** Objective, Scope and Outcome of the course	01
2	**Energy and Power Signals:** Continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability.	07
3	**Linear Shift-Invariant (LSI) Systems:** Impulse response and step response, convolution, input output behavior with aperiodic convergent inputs. Characterization of causality and stability of linear shift-invariant systems. System representation through differential equations and difference equations	08
4	**Periodic and Semi-Periodic Inputs to an LSI System:** The notion of a frequency response and its relation to the impulse response, Fourier series representation, the Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem. The idea of signal space and orthogonal bases	08
5	**The Laplace and z-Transform:** Notion of eigen functions of LSI systems, a basis of eigen functions, region of convergence, poles and zeros of system, Laplace domain analysis, solution to differential equations and system behavior. The z-Transform for discrete time signals and systems- eigen functions, region of convergence, z-domain analysis.	09
6	**State-space analysis**: State space analysis and multi-input, multi-output representation. The state-transition matrix and its role. The Sampling Theorem and its implications- Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold, and so on. Aliasing and its effects. Relation between continuous and discrete time systems.	07
	Total	40

Suggested Books:

1. Signals and Systems, A. Nagoor Kanni, Mc Graw Hill. 2nd Edition.
2. A Practical Approach to Signals and Systems, D Sundarrajan, Wiley Publishers, 1st edition
3. Signals and Systems, Ramesh Babu, Sci-Tech Publications, 2nd Edition.
4. Signals and Systems by Alan V. Oppenheim, Alan S. Willsky S. Hamid , 2nd Edition ,Prentice Hall Inc
5. Theory and Problems of Signals and Systems - SIE Hwei P. Hsu, McGraw Hill, 2nd Editions.

SYLLABUS
2nd Year- IV Semester: B.Tech. (Electronic Instrumentation & Control Engineering)

4EI4-03: Linear Integrated Circuits

Credits: 03 **Max. Marks: 100 (IA:30, ETE:70)**
3L:0T:0P **End Term Exam: 3 Hours**

Course Objectives: The aim of the course is to impart knowledge about design and analysis of various electronic circuits using operational amplifier

Course Outcomes: Upon Successful completion of the course, the student will be able to
CO-1: Analyze op-amp characteristics and their significance
CO-2: Evaluate the performance of linear and nonlinear circuits using op-amp.
CO-3: Design of active filter circuits and voltage regulators using special ICs

Se. No.	Contents	Hours
1	**Introduction:** Objective, Scope and Outcome of the course	01
2	**Fundamentals of Operational Amplifier:** Block diagram and Characteristics of Operational amplifier, Measurement of Slew rate (SR), Common Mode Rejection Ratio (CMRR), Power Supply Rejection ratio (PSRR/SVRR), Frequency response, Offset nullification techniques. Introduction to Open and Closed Loop configurations of Op-Amplifier	06
3	**Closed Loop Operational Amplifier Circuits:** Introduction to feedback amplifiers, Loading effect. Voltage series feedback (Non-inverting amplifier with feedback): deriving close loop gain, input impedance, output impedance and bandwidth; Voltage follower and its applications, Voltage shunt feedback (Inverting amplifier with feedback): deriving close loop gain, input impedance, output impedance and bandwidth; Inverter circuit, Differential amplifier with one op-amp.	08
4	**Operational Amplifier - Linear Applications:** Voltage summing and substracter, Integrator and practical integrator, Differentiator and practical differentiator, Instrumentation amplifier with three Op-amps, Current to Voltage converter, Voltage to current converter, Current booster , Isolation amplifiers.	07
5	**Operational Amplifier - Nonlinear Applications:** Comparator and its characteristics, Zero Crossing Detector and its use, Schmitt trigger with external bias, Precision half wave and full wave rectifiers. Sine wave oscillators using op-amp.: Barkhausen criteria, Wein bridge oscillator, RC phase shift oscillator.	05
6	**Timers and Special purpose ICs:** Design and applications of Astable, Monostable and Bistable Multivibrators using LM555. Voltage controlled oscillator (LM 566), Phase locked Loop (LM 565), V to F and F to V converter (LM331), Analog Multiplexer/Demultiplexer (CD 4051).	05
7	**Active filters and Regulators:** Filters: Definition, types and Difference between active and passive filters. Filter terminology: Pass band, Stop band, cut off, Ripple, Q and order of the filter. Butterworth approximations, Low pass (LP), High pass (HP), Band pass(BP), Narrow band pass, Band reject, Notch filter, First and second order filters, (Design of LP, HP and BP filter). Regulators: Performance parameters (line regulation, load regulation, ripple rejection), Fixed volt regulators (IC78xx, 79xx), Linear voltage regulator IC 723 (High voltage, low voltage regulator circuits)	08
	Total	40

Suggested Books:

1. Ramakant Gaikwad, " Operational Amplifiers" PHI, 3 rd ed., 1992.
2. William D. Stanley, "Operational Amplifiers With Linear Integrated Circuits", 4th ed., Pearson Education India, 2002.
3. D. Roy Choudhury, "Linear Integrated Circuits" New Age International, 4th edition.
4. Paul Horowitz, Winfield Hill, "The Art of Electronics", 2 nd Ed., Cambridge University press, 2008.

SYLLABUS
2nd Year- IV Semester: B.Tech. (Electronic Instrumentation & Control Engineering)

4EI4-04: Control System Engineering

Credits: 03 **Max. Marks: 100 (IA:30, ETE:70)**
3L:0T:0P **End Term Exam: 3 Hours**

Course Objectives: The aim of the course is to impart knowledge about control systems, their modeling and time domain and frequency domain analysis.

Course Outcomes: Upon Successful completion of the course, the student will be able to

CO-1: Develop mathematical models of LTI (Linear Time Invariant) systems
CO-2: Analyze the LTI system in time domain and frequency domain
CO-3: Test the stability of LTI system using conventional methods

Se. No.	Contents	Hours
1	**Introduction:** Objective, Scope and Outcome of the course	01
2	**Introduction to Control Systems:** Introduction, Concepts of control systems, Classification of systems-Linear and Non-linear Systems, Time-invariant and Time variant systems, Static and Dynamic systems, Causal and Non-causal Systems, Open loop and closed loop. Laplace transform and Inverse Laplace transform with their properties. Solving the differential equations.	06
3	**Modeling of Systems:** Representation of electrical, mechanical, electromechanical systems with differential equations. Concept of transfer function. Properties of transfer function. Representation of transfer functions for electrical, mechanical with force to voltage and force to current analogies.	06
4	**Block Diagram and Signal Flow Graph:** System in canonical form. Introduction to block diagram, block diagram reduction rules. Introduction to Signal flow graph, terminologies used in signal flow graph, conversion of block diagrams to signal flow graph, Mason's gain formula.	07
5	**Time Domain Analysis of Control Systems:** Standard test signals. First order, second order systems and their response. Time domain specifications of first order and second order systems. Derivations of time domain specifications. Static error constants (kp, kv, ka,) and steady state error (ess)	07
6	**Stability Analysis:** Concept of Stability in s domain, Classification of Stability (BIBO stability and asymptotic stability), stability analysis by Hurwitz criterion and Routh array, concept of relative stability and its analysis using Routh array. Root locus: Definition, construction rules, determination of system gain.	07
7	**Frequency Domain Analysis:** Fundamentals of frequency response. Polar Plots, Bode plot, Nyquist plot. Bode plot – gain margin and phase margin, Nyquist stability criterion	06
	Total	40

Suggested Books:

1. I. J. Nagrath, M. Gopal, "Control System Engineering", New Age International Publishers, 05th Ed.
2. B. S. Manke, "Linear Control Systems", Khanna Publishers, New Delhi, 02nd Ed.
3. A. K. Jairath, "Problems and Solutions of Control Systems", CBS Publishes, New Delhi, 06th Ed.
4. S. K. Bhattacharya, "Control System Engineering", Pearson India, 02nd Ed.
5. K. Ogata, "Modern Control Engineering", PHI, New Delhi, 06th Ed..
6. Norman S. Nise, "Control System Engineering", John Wiley and Sons, 07th Ed.
7. B. C. Kuo, "Automatic Control Systems", PHI, New Delhi, 07th Ed.

SYLLABUS

2nd Year- IV Semester: B.Tech. (Electronic Instrumentation & Control Engineering)

4EI4-05: Electrical Measurements

Credits: 03 **Max. Marks: 100 (IA:30, ETE:70)**

3L:0T:0P **End Term Exam: 3 Hours**

Course Objectives: The aim of the course is to impart knowledge about measuring instruments, their construction, working, and applications.

Course Outcomes: Upon Successful completion of the course, the student will be able to

CO-1: Understand the common electrical measuring instruments and their use in field.

CO-2: Learn about the instrument transformers for the measurement of high voltage and current along with the testing of CTs and PTs.

CO-3: Know the categories of various resistances and their measurement techniques along with the potentiometer.

CO4: Understand the concept AC bridges for the measurement of electrical circuit parameters.

SNo	Contents	Hours
1	**Introduction:** Objective, Scope and Outcome of the course	01
2	**Electrical Measuring Instruments:** Deflecting, control and damping torques in instruments, moving coil, moving iron, electrodynamic and induction type instruments-construction, operation, torque equation and errors. Applications of instruments for measurement of current, voltage, 1-phase power and energy. Induction type of energy meter: driving and braking torques, Errors in wattmeter and energy meter and their compensation. Testing and calibration of energy meter by phantom loading.	06
3	**3-phase Metering:** Blondel's Theorem for n-phase, p-wire system. Measurement of power and reactive kVA in 3-phase balanced and unbalanced systems: One-wattmeter, two- wattmeter and three-wattmeter methods. 3-phase induction type energy meter. Instrument Transformers: Construction and operation of current and potential transformers. Errors and their minimization in CT and PT. Testing of CTs and PTs. Applications of CTs and PTs for the measurement of current, voltage, power and energy.	07
4	**Resistance Measurement:** Method of measuring low, medium and high resistances. Measurement of medium resistances: ammeter and voltmeter method, substitution method, Wheatstone bridge method. Measurement of low resistances: Potentiometer method and Kelvin's double bridge method. Measurement of high resistance: Loss of charge method, Price's Guard wire method. Measurement of earth resistance.	08
5	**Potentiometers:** Construction, operation and standardization of DC potentiometers: Slide wire and Crompton potentiometers. Use of potentiometer for measurement of resistance and calibration of voltmeter and ammeter. AC potentiometer: Volt ratio boxes. Construction, operation and standardization of AC potentiometer: in-phase and quadrature potentiometers. Applications of AC potentiometers.	08
6	**AC Bridges:** Four-arm AC bridges. Sources and detectors in bridges. Maxwell's bridge, Hay's bridge and Anderson bridge for self-inductance measurement. Heaviside's bridge for mutual inductance measurement. De-Sauty Bridge for capacitance measurement. Wien's bridge for capacitance and frequency measurements. Errors in measurements through AC bridge and precautions. Screening of bridge components. Wagner earth device.	10
	Total	40

Suggested Books:

1. Electrical Measurements and measuring Instruments, E.W. Golding and F.C. Widdis, Wheeler Publishing.
2. Electrical and Electronic Measurement and Instruments, A.K. Sawhney, Dhanpat Rai and Co.
3. Electrical Measurements, Buckingham and Price, Prentice – Hall.
4. Electrical Measurements: Fundamentals, Concepts, Applications, Reissland, M.U, New Age International (P) Limited Publishers.

SYLLABUS
2nd Year- IV Semester: B.Tech. (Electronic Instrumentation & Control Engineering)

4EI4-06: Industrial Measurements

Credits: 03 **Max. Marks: 100 (IA:30, ETE:70)**
3L:0T:0P **End Term Exam: 3 Hours**

Course Objectives: The aim of the course is to impart knowledge about various physical parameters and their measurement techniques, signal conditioning circuits etc.

Course Outcomes: Upon Successful completion of the course, the student will be able to

CO-1: Understand the importance of process variable measurements.

CO-2: Learn and compare various measurement techniques for process variables.

CO-3: Design, Installation and trouble shooting of process instruments.

Se. No.	Contents	Hours
1.	**Introduction:** Objective, scope and outcome of the course.	01
2.	**Temperature Measurement:** Temperature scales, units and their relations, Classification of temperature sensors, Thermocouples, Types of thermocouples, Cold junction compensation techniques, Therompiles, Resistance Temperature detectors (RTD): 2-wire, 3-wire systems, Lead wire compensation, Thermistors, Radiation and optical pyrometers, Infrared pyrometers, Temperature IC sensor LM35, Calibration of temperature sensors.	08
3.	**Pressure Measurements:** Units and their relations, Manometers and their types, Electric pressure transducers: LVDT, strain gauge, Capacitive pressure transducers, Piezoelectric pressure transducers, Potentiometric pressure transducer, Low pressure measurement: McLeod gauge, Thermal conductivity: Thermocouple type, Differential pressure transmitters, Calibration of pressure gauge: Dead weight tester.	09
4.	**Flow Measurements:** Units, Reynold's number, Laminar and Turbulent flows, Bernoulli's equation for incompressible flow, Head type flow meters: Orifice, Venturi tube, Flow nozzles and Pitot tubes, Variable area type flowmeter: Rotameters, Vortex flow meters, Turbine flow meter, Electromagnetic flow meters, Ultrasonic flow meter, Thermal flow meter, Mass flow type meters, Shunt flow meters.	09
5.	**Level Measurements:** Float gauge, Bubbler (Purge) system, Hydrostatic pressure type in open vessels and closed vessels, Differential pressure method, Electrical conductivity method, Capacitance type, Radioactive type, Ultrasonic type.	07
6.	**Miscellaneous Measurements:** **Density:** Hydrometer (Buoyancy type), U tube type, Hydrostatic type (Air bubbler, DP cell), Float type, Impulse wheel methods. **Viscosity:** Saybolt, Searle's rotating cylinder, Cone and plate, Falling and rolling ball, Rotameter. **Humidity:** resistive and capacitive type sensors	06
	Total	40

Suggested Books:

1. Principle of Industrial Instrumentation by D. Patranabis, Tata McGraw Hill, 2nd Ed.
2. Instrumentation and Measurement Principles by . D.V.S. Murty, PHI, New Delhi, 2nd Ed.
3. Electrical and Electronics Measurement and Instrumentation by A.K. Sawhney, Dhanpat Rai & Co, 2nd Ed.
4. Process control instrumentation technology by Curtis D. Johnson, PHI learning Pvt. Ltd, 07th Ed.
5. Measurement Systems by E.O. Doebelin, McGraw Hill, 06th Ed.
6. Process Measurement & Analysis by B.G. Liptak, CRC press, 04th Ed.
8. Instrumentation Devices and Systems by C. S. Rangan, G. R. Sharma and V. S. Mani, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 02nd Ed.
9. Mechanical and Industrial Measurements by R. K. Jain, Khanna Publishers, 02nd Ed.

SYLLABUS
2nd Year- IV Semester: B.Tech. (Electronic Instrumentation & Control Engineering)

4EI4-20: Signal Processing Lab

Credits: 1.5 **Max. Marks: 100 (IA:60, ETE:40)**
0L:0T:3P

Course Outcomes:
Upon successful completion of the course, the students will be able to:

CO-1: Illustrate digital signals, systems and their significance.
CO-2: Generate basic signals in continuous and discrete domain.
CO-3: To learn Fourier series and Fourier Transform concepts.

Se. No.	Name of Experiment (Simulate using MATLAB environment)
1.	Generation of continuous and discrete elementary signals (periodic and non periodic) using mathematical expression.
2.	Generation of Continuous and Discrete Unit Step Signal.
3.	Generation of Exponential and Ramp signals in Continuous & Discrete domain.
4.	Continuous and discrete time Convolution (using basic definition)
5.	Adding and subtracting two given signals. (Continuous as well as Discrete signals)
6.	To generate uniform random numbers between (0, 1).
7.	To generate a random binary wave.
8.	To generate and verify random sequences with arbitrary distributions, means and variances for following: (a) Rayleigh distribution (b) Normal distributions: N(0,1). (c) Gaussion distributions: N (m, x)
9.	To plot the probability density functions. Find mean and variance for the above distributions
10.	Write a Program to obtain Fourier Series Coefficient.
11.	Write a program to find Fourier transform of continuous time signals.
12.	Write program to solve differential equation using Laplace Transform

SYLLABUS
2nd Year- IV Semester: B.Tech. (Electronic Instrumentation & Control Engineering)

4EI4-21: Linear Integrated Circuits Lab

Credits: 1.5 **Max. Marks: 100 (IA:60, ETE:40)**
0L:0T:3P

Course Outcomes:
Upon successful completion of the course, the students will be able to:

CO-1: Understand and analyze the IC 741 operational amplifier and its characteristics.
CO-2: To apply operational amplifiers in linear and nonlinear applications.
CO-3: To acquire knowledge of special function ICs.

Se. No.	Name of Experiment
1.	Bandwidth measurement of inverting and non- inverting amplifier using LM 741.
2.	Measurement of CMRR, Slew rate and output offset voltage of LM 741.
3.	Designing and implementation of Instrumentation amplifier using LM324
4.	Designing and implementation of Integrator using LM 741.
5.	Designing and implementation of Differentiator using LM 741.
6.	Designing and implementation of Wien bridge oscillator using LM 741.
7.	Designing and implementation of Comparator, Schmitt trigger and Zero Crossing Detector using LM 741.
8.	Design and implementation of Astable and Monostable multivibrator using LM 555.
9.	Design and implement V to F and V to F converter using LM331.
10.	Design and implement first/second order Butterworth High Pass/ Low Pass/ Band Pass Filter using LM 741.

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4EI4-22: Control System Lab

Credits: 1.5 **Max. Marks: 100 (IA:60, ETE:40)**
0L:0T:3P

Course Outcomes:
Upon successful completion of the course, the students will be able to:

CO-1: Demonstrate the time domain and frequency domain analysis for linear time invariant systems.
CO-2: Understand the stability analysis of control systems
CO-3: Get the basic knowledge on practical control system applications.

Se. No.	Name of Experiment
1.	To design I order system on R-C circuit and observe its response with the following inputs and trace the curve. (a) Step (b) Ramp (c) Impulse.
2.	To design II order electrical network and study its transient response for step input for following cases:- (a) Under damped System (b) Over damped System (c) Critically damped System.
3.	Study of first and second order system response and find its time constant and verify It.
4.	Find steady state error of Type 0, 1, 2 systems.
5.	Stability analysis using root locus approach.
6.	Stability analysis using frequency response approach (Bode plot approach)
7.	To perform experiment on stepper motor (finding step angle and frequency response etc.)
8.	To perform experiment on Potentiometer error detector.
9.	a) To draw the error Vs angle characteristics of Synchro transmitter. b) To draw the characteristics of Synchro transmitter and control transformer.
10.	To identify a system T.F. using its frequency response.

SYLLABUS
2nd Year- IV Semester: B.Tech. (Electronic Instrumentation & Control Engineering)

4EI4-23: Electrical Measurement Lab

Credits: 1.5 **Max. Marks:100 (IA:60, ETE:40)**
0L:0T:3P

Course Outcomes:

Upon successful completion of the course, the students will be able to:

CO-1: Operate and take the measurements from CRO, DSO and various other meters.

CO-2: Measure the active power, reactive power and power factor of three-phase load using two-wattmeter and one-wattmeter method.

CO-3: Operate the Crompton's Potentiometer and DC slide wire potentiometer for the measurement of low resistance, unknown EMF and calibration of voltmeter and ammeter.

CO-4: Perform the experiments on Kelvin's double bridge and Anderson's bridge.

CO-5: Know about the real time use of LVDT and Strain Gauge.

Se. No.	Name of Experiment
1.	Measure the low resistance by Kelvin's double bridge
2.	Calibrate an ammeter using D.C. slide wire potentiometer.
3.	Calibrate a wattmeter using Crompton's potentiometer
4.	Measure the power in 3-phase star connected load by two-wattmeter method at different values of load power factor.
5.	Calibrate a single-phase energy meter (Analog and Digital) by phantom loading at different power factor by a) Phase shifting transformer b) Auto transformer.
6.	Measure earth resistance using fall of potential method
7.	Plot the V-I characteristics of a solar panel.
8.	Measure low resistance using Crompton's potentiometer
9.	Measure unknown inductance using Anderson's bridge.
10.	Measure unknown frequency using Wein's Bridge
11.	Measure unknown capacitance using DeSauty Bridge.
12.	a) To see the burden effect on the performance of CT b) To measure phase angle and ratio error of CT.