M. Sc. Electronics and Instrumentation

Syllabus

UNIVERSITY DEPARTMENT

Program Code: ELIA

2026 – 2027 onwards

BHARATHIAR UNIVERSITY

(A State University, Accredited with "A++" Grade by NAAC,
Ranked 15th among Indian Universities by MHRD-NIRF,
World Ranking : Times - 801-1000, Shanghai - 901-1000, URAP - 982)

Coimbatore - 641 046, Tamil Nadu, India

Program Educational Objectives (PEOs)	
The **M. Sc. Electronics and Instrumentation** program describe accomplishments that graduates are expected to attain within five to seven years after graduation	
PEO1	**Professional Competence:** Graduates will establish themselves as successful professionals in academia, industry, or research organizations by applying fundamental and advanced knowledge in Electronics and Instrumentation.
PEO2	**Technical Expertise:** Graduates will demonstrate a strong foundation and advanced technical skills in computational methods, software platforms, and modern tools relevant to Electronics and Instrumentation systems.
PEO3	**Problem Solving and Innovation:** Graduates will analyze complex engineering problems and develop innovative solutions using modern techniques in areas such as control systems, signal processing, embedded systems, and automation.
PEO4	**Lifelong Learning:** Graduates will engage in continuous learning and professional development to keep pace with emerging technologies and advancements in Electronics and Instrumentation.
PEO5	**Professional Ethics and Leadership:** Graduates will exhibit ethical practices, leadership qualities, and effective teamwork in multidisciplinary environments while contributing responsibly to society.

Program Specific Outcomes (PSOs)	
After the successful completion of M. Sc. Electronics and Instrumentation program, the students are expected to	
PSO1	**Instrumentation and Measurement Skills:** Select, install, calibrate, and maintain modern instruments used for measurement and analysis, and accurately interpret experimental data to arrive at meaningful and valid conclusions.
PSO2	**Design and Development of Embedded and Signal Processing Systems:** Analyze, design, and develop signal Processing circuits for sensors and actuators, and select appropriate embedded systems to implement control strategies and smart instrumentation solutions.
PSO3	**Industrial Automation and Control Systems:** Design, develop, and implement control schemes for industrial processes, and demonstrate practical competence in configuring and operating industrial automation systems such as PLC and LabVIEW.

Program Outcomes (POs)	
On successful completion of the M. Sc. Electronics and Instrumentation program	
PO1	**Disciplinary Knowledge:** Demonstrate comprehensive knowledge in core areas of Electronics and Instrumentation, including signal processing, control systems, embedded systems, VLSI design, and industrial instrumentation
PO2	**Communication Skills:** Effectively communicate technical concepts, experimental results, and research findings through oral presentations, technical reports, and scientific publications.
PO3	**Critical Thinking:** Critically evaluate engineering problems, research literature, and emerging technologies to make informed decisions in Electronics and Instrumentation applications.
PO4	**Problem Solving:** Apply appropriate analytical and computational techniques to identify, formulate, and solve complex problems in Electronics and instrumentation systems.
PO5	**Analytical Reasoning**: Utilize mathematical models and simulation tools to interpret system behaviour and derive meaningful conclusions.
PO6	**Research-related Skills:** Design and conduct experiments, analyze data, and contribute to innovative research in areas such as sensor & embedded technology, automation, and signal processing.
PO7	**Cooperation / Teamwork:** Collaborate effectively in multidisciplinary teams to design, develop, and implement Electronics and Instrumentation-based solutions.
PO8	**Scientific Reasoning**: Apply scientific principles and methodologies to validate hypotheses and solve Electronics and Instrumentation-based engineering problems systematically.
PO9	**Reflective Thinking**: Assess personal learning, project outcomes, and professional practices to improve performance and adapt to evolving technological environments.
PO10	**Information / Digital Literacy:** Utilize modern Electronics and Instrumentation tools, software (such as MATLAB, LabVIEW, and simulation platforms), and digital resources for design, analysis, and research.
PO11	**Self-directed Learning:** Demonstrate the ability to independently acquire and apply new knowledge to keep pace with advancements in Electronics and Instrumentation.
PO12	**Multicultural Competence:** Work effectively in diverse environments, respecting cultural differences and adapting to global professional standards.
PO13	**Moral and Ethical Awareness / Reasoning:** Adhere to ethical principles and professional standards in Electronics and Instrumentation-based engineering practices, research activities, and societal responsibilities.
PO14	**Leadership Readiness / Qualities:** Exhibit leadership skills in planning, executing, and managing Electronics and Instrumentation-based engineering research projects and guiding team members effectively.
PO15	**Lifelong Learning:** Recognise the need for continuous learning and engage in professional development to remain competent in a rapidly evolving technological landscape.

BHARATHIAR UNIVERSITY: : COIMBATORE 641 046

M. Sc. Electronics and Instrumentation Curriculum (University Department)

(For the students admitted during the academic year 2026 – 27 and onwards)

Course Code	Title of the Course	Credits	Hours		Maximum Marks		
			Theory	Practical	CIA	ESE	Total
FIRST SEMESTER							
13A	Sensors and Transducers	4	4	--	25	75	100
13B	Signals and systems	4	4	--	25	75	100
13C	Embedded System Design	4	4	--	25	75	100
13D	Electromagnetic Theory	4	4	--	25	75	100
13P	Embedded System Design Laboratory	3	--	3	40	60	100
13Q	Sensor-Based Automation Laboratory	3	--	3	40	60	100
	Elective Subject	4	4	--	25	75	100
	Supportive	2	2	--	12	38	50
1VA*	Disaster Management	--	2	--	50	--	50
	Total	**28**	**24**	**6**	**217**	**533**	**750**
SECOND SEMESTER							
23A	Control Systems	4	4	--	25	75	100
23B	ARM Processor	4	4	--	25	75	100
23C	Intelligent Instrumentation	4	4	--	25	75	100
23D	Introduction to Industry 4.0	4	4	--	25	75	100
23P	ARM Processor Laboratory	3	--	3	40	60	100
23Q	Intelligent Instrumentation Laboratory	3	--	3	40	60	100
	Elective Subject	4	4	--	25	75	100
	Supportive	2	2	--	12	38	50
2CA*	Embedded System Design Using ARM/Cortex Microcontroller	--	2	--	50	--	50
	Total	**28**	**24**	**6**	**217**	**533**	**750**
THIRD SEMESTER							
33A	Process Control	4	4	--	25	75	100
33B	Digital Signal Processing	4	4	--	25	75	100
33C	Digital VLSI Design	4	4	--	25	75	100
33P	Digital Signal Processing Laboratory	3	--	3	40	60	100
33Q	VLSI Design Laboratory	3	--	3	40	60	100
	Elective Subject	4	4	--	25	75	100
	Supportive	2	2	--	12	38	50
3VA*	Health & Wellness	--	2	--	50	--	50
3CA*	DSP Using MATLAB	--	2		50	--	50
	NPTEL online course**	2	--	--	--	--	--

	Total	**26**	**22**	**6**	**192**	**458**	**650**

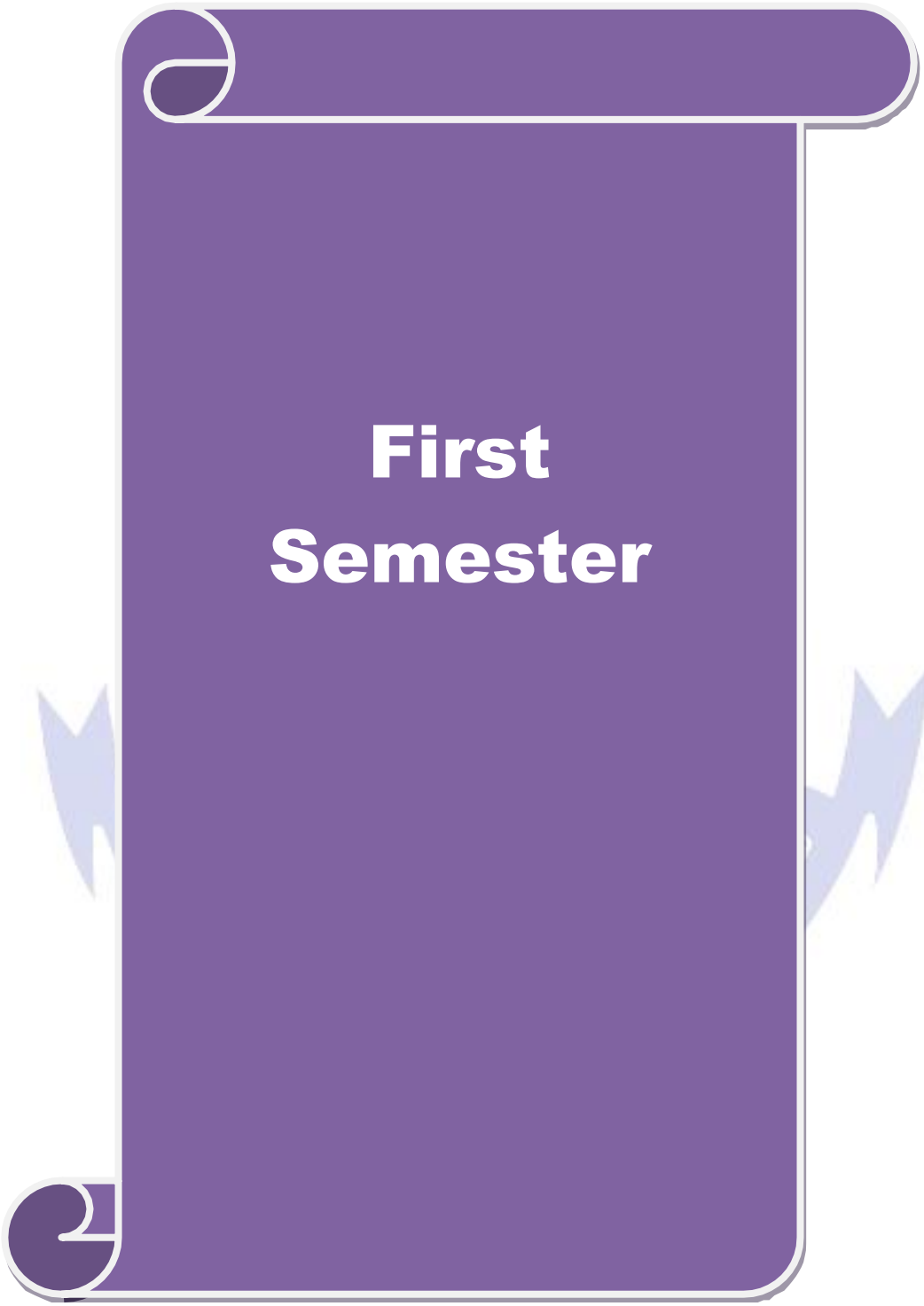
FOURTH SEMESTER							
43A	PLC and Its Applications	4	4	--	25	75	100
43P	PLC, SCADA Laboratory	3	--	3	40	60	100
47V	Project Viva-Voce and Industrial Visit	3	--	3	25	75	100
	Total	**10**	**4**	**6**	**90**	**210**	**300**
	Grand Total	**92**	**74**	**24**	**716**	**1734**	**2450**

ELECTIVE & SUPPORTIVE SUBJECTS

Course Code	Title of the Course	Credits	Hours		Maximum Marks		
			Theory	Practical	CIA	ESE	Total
FIRST SEMESTER							
1EA	Semiconductor Manufacturing	4	4	--	25	75	100
1EB	Bio-Medical Instrumentation	4	4	--	25	75	100
1EC	IoT Concepts and its Applications	4	4	--	25	75	100
SECOND SEMESTER							
2EA	Modern Communication Techniques	4	4	--	25	75	100
2EB	Industrial Instrumentation	4	4	--	25	75	100
2EC	Robotics and Automation	4	4	--	25	75	100
THIRD SEMESTER							
3EA	Analytical Instrumentation	4	4	--	25	75	100
3EB	Medical Imaging Systems	4	4	--	25	75	100
3EC	Microwave Theory and Techniques	4	4	--	25	75	100
SUPPORTIVE SUBJECTS							
GS1	Digital Electronics and Microprocessor	2	2	--	25	25	50
GS2	Medical Electronics and Instrumentation	2	2	--	25	25	50
GS3	Analytical Instrumentation	2	2	--	25	25	50

****NPTEL online courses will have a minimum duration of 8 weeks and will carry a minimum of 2 credits. These courses are mandatory and must be completed during the third semester (before the start of the fourth semester).**

***Final grading and ranking will be determined solely based on scholastic courses. However, to be awarded a degree, students must also complete the mandatory co-scholastic courses.**


First
Semester

Course Code	13A	SENSORS AND TRANSDUCERS	L	T	P	C
Core/Elective/Supportive		Core	4	0	0	4

Pre-requisite	Students should have good knowledge of Basic of Sensors andTransducer	Syllabus Version	2026-27

Course Objectives:

The main objectives of this course are to:

1. Understand the fundamentals of sensors, transducers, and measurement systems.
2. Classify different types of sensors and analyze their characteristics and performance.
3. Explain the working principles and applications of various transducers.
4. Understand signal conditioning techniques and data acquisition systems.
5. Gain knowledge of MEMS devices and microsystems.
6. Understand microsystem fabrication processes and micro-manufacturing techniques.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Explain measurement principles, error analysis, and characteristics of sensors and transducers..	K1,k2
2	Classify and compare different types of sensors and transducers based on their performance and applications	K2,k3
3	Apply the working principles of transducers to solve measurement-related problems	K3,k4
4	nalyze signal conditioning circuits and data acquisition systems used in real-time applications.	K4, k5
5	Evaluate MEMS devices and microsystems for various engineering applications	K5,k6
6	Explain fabrication processes and assess micro-manufacturing techniques in MEMS technology	K2,k5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Sensors and Transducers	12 hours

Basics of Measurement – Classification of errors – Error analysis – Static and dynamic characteristics of transducers – Performance measures of sensors – Classification of sensors – Sensor calibration techniques – Sensor Output Signal Types.

Unit:2	Transducers and its types	12 hours

Principle of operation, construction details, characteristics, and application of resistance potentiometer, Strain Gauge, Resistance Thermometer, Thermistor, hotwire anemometer, piezeoresistive sensor, Piezeoresistive Sensor and Humidity Sensor. Induction potentiometer-Variable Inductance Transducers-EI picks up LVDT-Capacitive transducer and types-Capacitor Microphone Frequency response. Piezoelectric transducer, Magnetostrictive - IC Sensor, Digital Transducers, Smart sensor, Fibre optic sensors, SQUID sensors, Film sensors. Ultrasonic sensors – IR sensors

Unit:3	Signal Conditioning and DAQ Systems	10 hours

Amplification – Filtering – Sample and Hold circuits – Data Acquisition: Single channel and multi-channel data acquisition – Data logging - applications - Automobile, Aerospace, Home appliances, Manufacturing, Environmental monitoring.

Unit:4	MEMS	12 hours
MEMS Overview of MEMS and Microsystems-Working principles of Microsystems: Micro sensors-Microactuation-MEMS with Microactuators- Micro accelerometers		
Unit:5	**MICROSYSTEMS FABRICATION PROCESSES**	**12 hours**
Introduction- Photolithography-Ion Implementation-Diffusion-Oxidation-Chemical vapor deposition- Physical vapour deposition-Deposition by Epitaxy-Etching. Overview of Micro Manufacturing: Bulk Micro Manufacturing, Surface Micromachining, The LIGA Process.		
Unit:6	**Contemporary Issues**	**2 hours**
Biosensor, Nano electronics		

	Total Lecture hours	**60 hours**

Text Book(s)

1	A.K.Sawhney, "A course in Electrical & Electronic Measurement and Instrumentation" Dhanpat Raj and Co (P) Ltd.2015.
2.	E.O.Doebelin, "Measurement Systems-Applications and Design", Tata McGraw Hill, New Work, 2018
3.	D.V.S Murthy, "Transducer and Instrumentation", Prentice Hall of India, 2018.
4.	Tai-Ran Hsu "MEMS and microsystems: design and manufacture "McGraw-Hill, 2012.

Reference Books

1.	John P.Bentley, "Principles of Measurement Systems", III Edition, Pearson Education, 2000.
2.	Hermann K.P.Neubert, "Instrument Transducers", Oxford University Press, 2010.
3.	D.V.S.Murthy, "Transducers and Instrumentation", Prentice Hall of India, 2011.
4.	D.Patranabis, "Sensors and Transducers", Prentice Hall of India, 2019

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1.	https://nptel.ac.in/content/storage2/courses/112103174/pdf/mod2.pdf
2.	https://lecturenotes.in/notes/2143-notes-for-sensors-and-transducers-st-by-anita-mohanty?reading
3.	https://nptel.ac.in/content/storage2/courses/108105063/pdf

Course Designed By: Dr.K.G.Padmasine

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	L	L	M	L	L	M	L	L	M	L	L	L	M
CO2	S	M	M	M	M	L	L	M	L	M	M	L	L	L	M
CO3	S	M	M	S	M	M	L	M	L	M	M	L	L	L	M
CO4	S	M	S	S	S	M	M	M	L	S	M	L	L	L	M
CO5	S	M	S	M	S	S	M	M	M	S	S	L	L	M	S
CO6	S	M	M	M	S	M	L	M	L	M	M	L	L	L	M

*S-Strong; M-Medium; L-Low

Course code	13B	SIGNALS AND SYSTEMS	L	T	P	C
Core/Elective/Supportive		Core	4	0	0	4
Pre-requisite		Basic mathematics knowledge is Essential	Syllabus Version		2026-27	

Course Objectives:

The main objectives of this course are to:

1. Introduce the fundamental concepts and classification of continuous-time and discrete-time signals and systems.
2. Develop the ability to represent and analyze standard signals using mathematical models.
3. Impart knowledge of Fourier series, Fourier transform, and Laplace transform for continuous-time signal analysis.
4. Analyze Linear Time-Invariant (LTI) continuous-time systems using convolution and differential equations.
5. Understand sampling theory and frequency domain analysis of discrete-time signals using DTFT and Z-transform.
6. Design and analyze discrete-time LTI systems using difference equations, convolution sum, and transform techniques

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Describe and classify signals and systems in continuous-time and discrete-time domains	K1, K2
2	Apply mathematical representations to standard signals such as impulse, step, and sinusoidal signals	K2, K3
3	Analyze continuous-time signals using the Fourier series, Fourier transform, and Laplace transform.	K3, K4
4	Evaluate the performance of continuous-time LTI systems using convolution and differential equations.	K4,K5
5	Analyze discrete-time signals using sampling theorem, DTFT, and Z-transform techniques.	K3, K4
6	Design and analyze discrete-time LTI systems using convolution sum, difference equations, and system interconnections.	K5,K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	Classification of Signals and Systems	12 hours

Standard signals - Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids_ Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals - Classification of systems- CT systems and DT systems- Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable.

Unit:2	Analysis of Continuous Time Signals	12 hours

Fourier series for periodic signals - Fourier Transform – properties- Laplace transforms and Properties

Unit:3	Linear Time Invariant Continuous Time Systems	12 hours

Impulse response - convolution integrals- Differential Equation- Fourier and Laplace transforms in Analysis of CT systems - Systems connected in series / parallel.

Unit:4	Analysis of Discrete Time Signals	10 hours

Baseband signal Sampling – Fourier Transform of discrete time signals (DTFT) – Properties of DTFT - Z Transform & Properties		
Unit:5	**Linear Time Invariant-Discrete Time Systems**	**12 hours**
Impulse response – Difference equations-Convolution sum- Discrete Fourier Transform and Z Transform Analysis of Recursive & Non-Recursive systems-DT systems connected in series and parallel		
Unit:6	**Contemporary Issues**	**2 hours**
Fast Fourier Transform, Inverse Fast Fourier Transform		
	Total Lecture hours	**60 hours**

Text Book(s)	
1	Allan V.Oppenheim, S.Wilsky and S.H.Nawab, Signals and Systems‖, Pearson, 2015
2	John Alan Stuller, An Introduction to Signals and Systems‖, Thomson, 2017.
Reference Books	
1	B. P. Lathi, Principles of Linear Systems and Signals‖, Second Edition, Oxford, 2019.
2	R.E.Zeimer, W.H.Tranter and R.D.Fannin, Signals & Systems - Continuous and Discrete‖, Pearson, 2019.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/117/101/117101055/
2	https://nptel.ac.in/courses/108/104/108104100/
3	https://nptel.ac.in/courses/117/104/117104074/
Course Designed By: Dr.J.Vijayakumar	

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	L	L	M	L	L	M	L	L	M	L	L	L	M
CO2	S	M	M	M	M	L	L	M	L	M	M	L	L	L	M
CO3	S	M	M	S	M	M	L	M	L	M	M	L	L	L	M
CO4	S	M	S	S	S	M	M	M	L	S	M	L	L	L	M
CO5	S	M	S	M	S	S	M	M	M	S	S	L	L	M	S
CO6	S	M	M	M	S	M	L	M	L	M	M	L	L	L	M

*S-Strong; M-Medium; L-Low

Course code	13C	EMBEDDED SYSTEM DESIGN	L	T	P	C
Core/Elective/ Supportive		Core	4	0	0	4
Pre-requisite		Basic knowledge about Digital Electronics	Syllabus Version		2026-27	

Course Objectives:

The main objectives of this course are to:

1. Introduce the fundamentals, architecture, and design methodology of embedded systems.
2. Understand the architecture and features of the PIC16F877 microcontroller.
3. Develop programming skills using PIC assembly language and instruction set.
4. Analyse and utilize PIC microcontroller peripherals such as timers, ADC, and communication modules.
5. Interface external devices like sensors, displays, and motors with PIC microcontrollers.
6. Design and implement real-time embedded system applications using PIC microcontrollers.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Explain the fundamentals, classification, and design process of embedded systems	K1, K2
2	Interpret the architecture and functional features of PIC16F877 microcontroller	K2, K3
3	Apply PIC assembly language instructions to develop simple embedded programs	K3, K4
4	Analyze the working of PIC peripherals such as timers, ADC, and communication interfaces	K4,K5
5	Implement interfacing techniques for external devices like sensors, motors, and displays	K3, K6
6	Design embedded system applications using PIC microcontroller for real-time problems	K5, K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	Introduction to Embedded Systems	12 hours

Embedded systems-processor embedded into a system-Components of Embedded System- Forecasting the scope and development of the embedded system- Selection of Microcontroller- Tuning of embedded system for variant similar application -Design process in embedded system- formalization of system design-design process and design examples- classification of embedded systems- skills required for an embedded system designer- Battery Management-Embedded High-Performance Computing (eHPC). System Integration and Validation – End-to-end integration of hardware and software components, interface compatibility, performance verification, reliability testing, compliance with standards, and deployment of embedded systems in real-world environments.

Unit:2	Introduction to PIC Microcontroller	12 hours

PIC 16F877 – Features – Device overview and Architecture – WREG register – Memory Organisation-File Registers – access bank – Status Register – Data types and directives – I/O Ports-Resets- Sleep mode.

Unit:3	PIC Programming	12 hours

Introduction to PIC assembly programming – Assembling and linking – Program counter and program ROM space – RISC architecture –Instruction set.

Unit:4	PIC Peripherals	11 hours

Timers – Capture/ Compare/PWM Module - MSSP: SPI – I^2C – USART - Analog to Digital Converter Module – CPU Special features – Interrupts – WDT– ADC, DAC

Unit:5	PIC Application	11 hours
7 Segment display interfacing - Stepper motor- Ultrasonic interfacing- Temperature control- DC Motor Speed Control- LCD interface - Keyboard interface-memory interface.		
Unit:6	**Contemporary Issues**	**2 hours**
Servomotor control in robots- IoT devices- case study accelerometer interfacing.		

	Total Lecture hours	**60 hours**
Text Book(s)		
1	Raj Kamal "Embedded Systems Design", TMH. 3 rd Edition 2019	
2	Muhammed Ali Mazidi, "PIC microcontroller and Embedded Systems Using assembly and C for PIC 18", Pearson Education .2018	
Reference Books		
1	John B Peatman, "Design with PIC microcontrollers", Pearson Education 2019	
2	Vahid ,"Embedded System Design: A Unified Hardware / Software Introduction",Wiley,2018.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://nptel.ac.in/courses/108/102/108102045/	
2	https://nptel.ac.in/courses/117/104/117104072/	
3	http://nptel.unipune.ac.in/LocalG/listLectures.php?cid=1d964ef8dd297d44&bid=c6c45d988f670c72	
Course Designed By: Dr.S.Rathinavel		

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	L	L	M	L	L	M	L	L	M	L	L	L	M
CO2	S	M	M	M	S	L	L	M	L	M	M	L	L	L	M
CO3	S	M	S	S	S	M	L	S	L	M	M	L	L	L	M
CO4	S	M	S	S	S	M	M	S	M	M	M	L	L	M	M
CO5	S	M	S	S	S	S	M	S	M	S	S	M	L	M	M
CO6	S	S	S	S	S	S	M	S	M	S	S	M	M	S	S

*S-Strong; M-Medium; L-Low

Course code	13D	ELECTROMAGNETIC THEORY	L	T	P	C
Core/Elective/Supportive		Core	4	0	0	4
Pre-requisite		Basic mathematics	Syllabus Version		2026-27	

Course Objectives:

The main objectives of this course are to:

1. Develop a strong foundation in vector calculus and coordinate transformations for electromagnetic field analysis.
2. Understand the fundamental principles of electrostatics and their applications in engineering problems.
3. Analyse magnetostatic fields and current-related phenomena using fundamental laws.
4. Study time-varying electromagnetic fields and derive Maxwell's equations in different forms.
5. Understand electromagnetic wave propagation and power flow in different media.
6. Introduce antenna fundamentals, radiation mechanisms, and modern RF measurement techniques.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Apply vector calculus concepts such as gradient, divergence, and curl in electromagnetic field problems.	K2, K3
2	Analyze electrostatic fields using Coulomb's law, Gauss's law, and boundary value techniques	K3, K4
3	Evaluate magnetostatic fields and currents using Biot–Savart law, Ampere's law, and related principles	K3, K5
4	Interpret Maxwell's equations and analyze electromagnetic wave propagation in different media	K4, K5
5	Examine electromagnetic energy flow, polarization, and wave behavior using Poynting vector concepts	K4, K6
6	Explain antenna parameters, radiation mechanisms, and measurement techniques used in RF systems.	K2, K3

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Fundamental Mathematics	10 hours

Fundamental vector operations, coordinate systems and transformation, Integrals of vector functions, Gradient of a scalar field, Divergence of a vector field, Divergence theorem, Curl of a vector field, Stokes's theorem, Physical Interpretation of Gradient, divergent and curl.

Unit:2	Electrostatics	12 hours

Electric charge and fields, Postulates of electrostatics, Conductor, Insulator, Triboelectricity, Electric potential, Electric flux, Electrostatic induction, dielectrics, Electric dipole moment, Polarization density, Coulomb's law, Gauss's law and applications, Electrostatic energy and forces, Poisson's and Laplace's equations, Uniqueness theorem, Electrostatic Boundary value problems.

Unit:3	Magnetostatics	12 hours

Electric Currents, current density and ohms law, Electromotive force and Kirchoffs voltage law, Equation of continuity and Kirchhoff's current law, Biot-Savart Law, Gauss and Ampere's Law, Magnetic dipole, Boundary conditions for magnetostatic fields, Magnetic energy, Energy stored in magnetic field.

Unit:4	Electromagnetic Fields And Waves	12 hours
Faraday's law of electromagnetic induction, Inconsistency of Amperes law, Maxwell's equations, Integral and differential forms, conduction current and displacement current, Boundary conditions for Electromagnetic fields, Helmholtz wave equation, Wave polarisation, Poynting vector and power flow in EM field.		
Unit:5	**Antennas & Radiating Systems**	**12 hours**
Radiation fundamentals, Antenna parameters, Hertz dipole, Wire antennas, Loop antennas, Introduction of Antenna arrays. Printed microstrip antennas: Basic characteristics, Introductionto Photolithography, Introduction to EMI and EMC, Anechoic chamber and RF Network Analyzer.		
Unit:6	**Contemporary Issues**	**2 hours**
Horn Antennas, Specific Absorption rate		
	Total Lecture hours	**60 hours**

	Text Book(s)
1	Principles of Electromagnetics, M.N.O.Sadiku & SV Kulkarni,Oxford University Press, 2015.
2	Electromagnetic Field Theory and Transmission Lines, G. S. N. Raju,Pearson Education,2016
3	Electromagnetic Waves, R. K. Shevgaonkar, McGraw Hill, 2017.
4	Electromagnetic Field Theory, U A. Bakshi & A V Bakshi, Technical publication, 2019.

	Reference Books
1	Engineering Electromagnetics, Haytt, McGraw-Hill Education,2010
2	Field and Wave Electromagnetics, D. K. Cheng, Pearson, 2011.
3	Engineering Electromagnetics, N. Ida, Springer, 2010.
4	Introduction to Electrodynamics, J. Griffiths, PHI, 2019.
5	Antenna Theory: Analysis and Design, C. A. Balanis, John Wiley, 2015

	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1	https://www.fcc.gov/consumers/guides/specific-absorption-rate-sar-cell-phones-what-it-means-you
2	https://nptel.ac.in/courses/108/101/108101092/
3	https://nptel.ac.in/courses/108/105/108105114/

Course Designed By: Dr.K.G.Padmasine

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	L	M	M	S	L	L	M	L	M	M	L	L	L	M
CO2	S	M	S	S	M	M	L	S	L	M	M	L	L	L	M
CO3	S	M	S	S	M	M	L	S	L	M	M	L	L	L	M
CO4	S	M	S	S	S	M	L	S	M	S	M	L	L	L	S
CO5	S	M	S	S	S	M	L	S	M	S	M	L	L	L	S
CO6	S	S	M	M	M	M	M	M	L	S	M	L	M	M	M

*S-Strong; M-Medium; L-Low

Course code	13P	EMBEDDED SYSTEM DESIGN LABORATORY	L	T	P	C
			0	0	3	3
Pre-requisite		Basic C Language	Syllabus Version		2026-27	

Course Objectives:

The main objectives of this course are to:

1. Provide hands-on experience in interfacing peripheral devices such as LCD, ADC, DAC, and displays with embedded controllers.
2. Develop skills in controlling actuators, including servo motors, stepper motors, and DC motors using embedded techniques.
3. Understand and implement serial communication protocols such as UART, SPI, and I2C.
4. Enable students to design and implement multi-node and distributed embedded systems.
5. Develop the ability to integrate wireless communication techniques like Bluetooth in embedded applications.
6. Equip students with skills to design embedded system applications involving protocol conversion and external memory interfacing.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Interface input/output devices such as LCD, ADC, DAC, and displays with embedded controllers for basic system design.	K3, K4
2	Implement motor control techniques using servo, stepper, and DC motors with PWM and positioning methods	K3, K5
3	Apply serial communication protocols (UART, SPI, I2C) for data exchange between embedded systems	K3, K4
4	Design and develop distributed embedded systems with multi-node communication using I2C and SPI buses	K4, K5
5	Integrate wireless communication (Bluetooth) and protocol gateways for advanced embedded networking applications.	K4, K6
6	Develop complete embedded network systems involving master-slave architecture and external memory interfacing	K5, K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

LIST OF EXPERIMENTS (any 12 experiments)

1. LCD Interfacing and Display Control using Embedded Controller
2. ADC Interfacing for Sensor Data Acquisition
3. DAC Interfacing for Analog Signal Generation
4. Servo Motor Interfacing and Position Control
5. Stepper Motor Interfacing and Motion Control
6. DC Motor Speed Control using PWM Technique
7. Multiplexed Seven-Segment Display Interfacing
8. I2C Communication between Multiple Slave Devices
9. UART-Based Board-to-Board Communication between Two Microcontrollers
10. SPI-Based Processor-to-Processor Communication (Master–Slave Architecture)
11. I2C Multi-Master Communication for Inter-Processor Data Exchange
12. Wireless Communication using Bluetooth for Device-to-Device Control
13. Implementation of Communication Protocol Gateway (UART ↔ SPI / I2C Bridge)
14. Distributed Embedded System Design: Multi-Node Communication using I2C Bus
15. Interfacing External Memory using SPI/I2C Protocols
16. Embedded Network System: Master Controller Monitoring Multiple Slave Nodes

Total Practical hours **45 hours**

Course Designed By Dr.S.Rathinavel

Mapping with Programme Outcomes															
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PO13**	**PO14**	**PO15**
CO1	S	M	M	M	M	L	M	M	L	S	M	L	L	L	M
CO2	S	M	S	S	S	M	L	S	L	S	M	L	L	L	M
CO3	S	M	S	S	S	M	L	S	M	S	M	L	L	L	M
CO4	S	S	S	S	M	S	M	S	M	S	S	M	M	M	S
CO5	S	M	S	S	M	M	M	S	M	S	S	M	L	L	S
CO6	S	M	S	S	S	S	M	S	M	S	S	M	M	M	S
*S-Strong; M-Medium; L-Low															

Course code	13Q	SENSOR BASED AUTOMATION LABORATORY	L	T	P	C
			0	0	3	3
Pre-requisite		Knowledge gaining and analysing the sensors and transducers using laboratory equipment	Syllabus Version		2026-27	

Course Objectives:

The main objectives of this course are to:

1. Provide practical exposure to interfacing various sensors with the ESP32 for real-time applications.
2. Understand data acquisition, signal conditioning, and measurement techniques using modern sensors.
3. Develop IoT-based monitoring systems using wireless communication and cloud platforms.
4. Design embedded systems for automation and smart applications such as home, agriculture, and health monitoring.
5. Analyse sensor characteristics and implement signal conditioning circuits like instrumentation amplifiers.
6. Build integrated systems combining sensing, processing, communication, and control.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Demonstrate the interfacing of sensors such as IR, PIR, LDR, ultrasonic, and temperature sensors with ESP32.	K2, K3
2	Apply measurement techniques for physical parameters like displacement, strain, temperature, and humidity.	K3, K4
3	Analyze sensor characteristics such as sensitivity, accuracy, and calibration using strain gauges and LVDT.	K4, K5
4	Design IoT-based systems using ESP32 for applications like smart agriculture, home automation, and weather monitoring	K4, K6
5	Implement wireless communication and cloud integration for real-time monitoring systems.	K3, K5
6	Develop signal conditioning circuits, such as instrumentation amplifiers and integrate them with embedded systems.	K5, K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

LIST OF EXPERIMENTS (any 12 experiments)

1. Digital IR Obstacle Sensor with ESP32
2. MQ-2 Gas Sensor for Air Quality Monitoring
3. Vibration Sensor with ESP32 for Structural Monitoring
4. Distance Measurement with Ultrasonic Sensor (HC-SR04)
5. Soil Moisture Sensor for Automated Irrigation
6. PIR Motion Sensor with ESP32 for Home Security
7. Temperature and Humidity Monitoring with DHT11/DHT22
8. Analog Temperature Sensor with ESP32
9. Light Intensity Measurement with LDR and ESP32
10. Bluetooth-Enabled Home Automation with ESP32
11. Cloud-Connected Weather Station with ESP32

12. ESP32 Camera with Face Recognition for Access Control 13. Smart Health Monitoring System with ESP32 and ECG Sensor 14. Displacement measurement using LVDT. 15. Characteristics of Strain Gauges. 16. Design and implementation of an instrumentation amplifier		
	Total Practical hours	**45 hours**
Course Designed By Dr.S.Rathinavel		

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	M	M	M	L	M	M	L	S	M	L	L	L	M
CO2	S	M	S	S	S	M	L	S	L	S	M	L	L	L	M
CO3	S	M	S	S	S	M	L	S	M	S	M	L	L	L	M
CO4	S	S	S	S	M	S	M	S	M	S	S	M	M	M	S
CO5	S	M	S	S	M	M	M	S	M	S	S	M	L	L	S
CO6	S	M	S	S	S	S	M	S	M	S	S	M	M	M	S

*S-Strong; M-Medium; L-Low

Second Semester

Course code	23A	CONTROL SYSTEMS	L	T	P	C
Core/Elective/Supportive		Core	4	0	0	4
Pre-requisite		Mathematics knowledge is Essential	Syllabus Version		2026-27	

Course Objectives:

The main objectives of this course are to:

1. Understand the fundamental concepts and mathematical modeling of control systems.
2. Analyse time-domain response and performance specifications of control systems.
3. Study frequency-domain analysis techniques and their applications.
4. Evaluate the stability of control systems using various analytical methods.
5. Design and analyze different types of compensators for system performance improvement.
6. Develop the ability to model, analyze, and design control systems for real-world applications.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Explain control system components, mathematical models, and block diagram representations.	K2, K3
2	Analyze time-domain response characteristics and steady-state errors of control systems.	K3, K4
3	Evaluate frequency response using Bode plots, polar plots, and Nichols charts.	K4, K5
4	Determine system stability using Routh-Hurwitz, Root Locus, and Nyquist criteria.	K4, K5
5	Design controllers such as P, PI, and PID to meet performance specifications.	K3, K6
6	Design and analyze compensators (lag, lead, lag-lead) using frequency response techniques.	K5, K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Systems and Their Representation	12 hours

Basic elements in control systems – Open and closed loop systems – Mathematical modelling of Physical parameters-Electrical analogy of mechanical and thermal systems – Transfer function – Synchros – AC and DC servomotors – Block diagram reduction techniques – Signal flow graphs.

Unit:2	Analyze of Time Response	12 hours

Time response – Time domain specifications – Types of test input – I and II order System response –Error coefficients – Generalized error series – Steady state error – P, PI, PID modes of feedback control.

Unit:3	Analyze of Frequency Response	12 hours

Frequency response – Bode plot – Polar plot – Constant M and N circles – Nichols chart – Determination of closed loop response from open loop response – Correlation between frequency domain and time domain specifications

Unit:4	Stability of Control System	12 hours

Characteristics equation – Location of roots in S plane for stability – Routh Hurwitz criterion – Root locus construction – Effect of pole, zero addition – Gain margin and phase margin – Nyquist stability criterion.

Unit:5	Compensator Design	10 hours

Performance criteria- Frequency response- Lag Compensator- lead Compensator- lag-lead Compensator– Compensator design using Bode plots.		
Unit:6	**Contemporary Issues**	**2 hours**
Control systems for industrial process applications (any two applications)		
	Total Lecture hours	**60 hours**
Text Book(s)		

1	Nagrath, I.J., and Gopal, M., "Control Systems Engineering", Wiley Eastern Ltd., 2022.
2	Katsuhiko Ogata, "Modern Control Engineering", Fourth Edition, Pearson Education, First Indian Reprint 2024.
Reference Books	
1	A. Nagoor Kani, "Control Systems", Second Edition, RBA Publications 2024.
2	Richard C.Dorf and Robert H.Bishop, "Modern control systems", Addison - Wesley, Eight Edition 2023.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/107/106/107106081/
2	https://nptel.ac.in/courses/108/106/108106098/
3	https://nptel.ac.in/courses/108/101/108101037/
Course Designed By: Dr.J.Vijayakumar	

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	M	M	M	L	L	M	L	M	M	L	L	L	M
CO2	S	M	S	S	S	M	L	S	L	M	M	L	L	L	M
CO3	S	M	S	S	S	M	L	S	M	S	M	L	L	L	M
CO4	S	M	S	S	S	M	L	S	M	S	M	L	L	L	S
CO5	S	M	S	S	S	M	M	S	M	S	M	L	L	M	S
CO6	S	M	S	S	S	S	M	S	M	S	S	M	M	M	S

*S-Strong; M-Medium; L-Low

Course code	23B	ARM PROCESSOR	L	T	P	C
Core/Elective/Supportive		Core	4	0	0	4
Pre-requisite		Basic 8-bit processor knowledge	Syllabus Version		2026-27	

Course Objectives:

The main objectives of this course are to:

1. Understand the fundamentals of ARM architecture and processor organization.
2. Learn ARM assembly language programming and instruction set usage.
3. Study architectural support for high-level language constructs in ARM systems.
4. Analyse memory hierarchy, cache design, and memory management techniques.
5. Understand ARM support for operating systems, including MMU and protection units.
6. Develop skills for designing and optimizing embedded applications using ARM processors.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Explain ARM architecture, pipeline organization, and processor design concepts.	K2, K3
2	Apply ARM assembly instructions for data processing, data transfer, and control flow operations.	K3, K4
3	Analyze the implementation of high-level language constructs such as loops, functions, and conditionals in the ARM architecture	K3, K5
4	Evaluate memory hierarchy, cache mechanisms, and memory management techniques in ARM systems	K4, K5
5	Interpret ARM architectural support for operating systems, including MMU, protection units, and synchronization	K2, K4
6	Design and optimize ARM-based embedded applications for efficient performance.	K5, K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Introduction to ARM	12 hours

Abstraction in hardware design- MUO a simple processor - Processor Design -Acorn RISC Machine - Architecture Inheritance - ARM Programming Model- ARM Development Tools - 3 and 5 Stage Pipeline ARM Organization - ARM Instruction Execution and Implementation - ARM Co-Processor Interface-ARM

Unit:2	ARM ASSEMBLY LANGUAGE PROGRAMMING	11 hours

ARM Instruction Types - Data Transfer, Data Processing and Control Flow Instructions - ARM Instruction Set

Unit:3	ARCHITECTURAL SUPPORT FOR HIGH-LEVEL LANGUAGE	12 hours

Data Types Expressions - Loops - Functions and Procedures - Conditional Statements - Abstraction in Software Design

Unit:4	MEMORY HIERARCHY	12 hours

Memory Size and Speed - On-Chip Memory - Caches - Cache Design an Example- Memory management.

Unit:5	ARCHITECTURAL SUPPORT FOR OPERATING SYSTEM	11 hours

An Introduction to Operating Systems Control Coprocessor- CP15 Protection Unit Registers ARM Protection Unit Architecture - Synchronization -Context CP15 MMU Registers ARM System ARM MMU

Unit:6	**Contemporary Issues**	**2 hours**
Introduction to IoT and its related security issues		
	Total Lecture hours	**60 hours**

Text Book(s)	
1	Steve Furber, "ARM System on Chip Architecture" Addison-Wesley Professional Second Edition, Aug 2010.
2	2. Andrew Sloss, Dominic Symes, Chris Wright, "ARM System Developer's Guide, Designing and Optimizing System Software, Morgan Kaufmann Publishers, Elsevier, 2014.
Reference Books	
1	ARM7TDMI-S Technical Reference Manual, 2019.
2	Larry D. Pyeatt , "Modern Assembly Language Programming with the ARM Processor", Newnes,2016.
3	David Seal, "ARM Architecture Reference Manual", Addison Wesley, 2nd Edition,2010.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/117/106/117106111/
2	https://nptel.ac.in/courses/106/105/106105193/
Course Designed By: Dr. S. Rathinavel	

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	M	M	M	L	L	M	L	M	M	L	L	L	M
CO2	S	M	S	S	M	M	L	S	L	M	M	L	L	L	M
CO3	S	M	S	S	S	M	L	S	M	S	M	L	L	L	M
CO4	S	M	S	S	S	M	L	S	M	S	M	L	L	L	S
CO5	S	M	M	S	S	M	M	S	M	S	M	L	M	M	S
CO6	S	S	S	S	S	S	M	S	M	S	S	M	M	M	S

*S-Strong; M-Medium; L-Low

Course Code	23C	INTELLIGENT INSTRUMENTATION	L	T	P	C
Core/Elective/Supportive		Core	4	0	0	4
Pre-requisite		Student with adequate knowledge on Basic Computer Systems	Syllabus Version		2026-27	

Course Objectives:

The main objectives of this course are to:

1. Understand the fundamentals of virtual instrumentation and graphical system design.
2. Develop proficiency in LabVIEW programming, including front panel and block diagram design.
3. Implement modular programming using VIs, loops, arrays, and data structures.
4. Design efficient programs using file handling, data communication, and design patterns.
5. Understand PC-based data acquisition systems and signal conditioning techniques.
6. Apply analysis tools, image processing, and communication techniques in LabVIEW-based systems.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Explain virtual instrumentation concepts and the LabVIEW programming environment, including data flow execution.	K2, K3
2	Develop LabVIEW programs using loops, structures, arrays, clusters, and modular VIs.	K3, K4
3	Apply file handling techniques and implement design patterns such as state machine and producer-consumer.	K3, K5
4	Analyze PC-based data acquisition systems, including ADC, DAC, and signal conditioning	K4, K5
5	Design data acquisition and control applications using DAQ hardware and LabVIEW tools.	K4, K6
6	Utilize advanced LabVIEW tools for data communication, simulation, and image processing.	K5, K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Introduction	12 hours

Introduction to Virtual Instrumentation – Hardware and Software – Virtual Instrumentation for Test, Control & Design – Graphical System Design using LabVIEW - comparison with conventional programming. Introduction to LabVIEW Software Environment – Front Panel: Control & Indicators – Block diagram: Data types and Data Flow programming.

Unit:2	Graphical Programming and LabVIEW	12 hours

Concept of VIs and sub VI – Case Structures - Loops: For Loop – While Loop – Structure Tunnels – Shift Registers – Feedback Nodes – Communication between parallel loops - Chart and Graphs – Arrays and Clusters

Unit:3	Managing Files & Design Patterns	12 hours

Implementing file I/O functions to read and write data to files – Binary Files – TDMS – sequential programming – Stata machine programming – Understanding and avoiding race conditions – Notifiers & Queues – Producer Consumer design patterns

Unit:4	PC Based Data Acquisition	12 hours

Introduction to signal conditioning – Sampling fundamentals, ADCs, DACs, Resolution, - analog inputs and outputs - Single-ended and differential inputs - Digital I/O, counters and timers, DMA, Data acquisition interface requirements - Issues involved in selection of Data acquisition cards - Use of timer-counter and analog outputs on the universal DAQ card.

Unit:5	**Analysis Tools in Virtual Instrumentation**	**10 hours**
Channel wire communication – Control design and simulation toolkit – Data Communication – Image Acquisition and processing using Vision Assistant Module – Introduction to LabVIEW NXG.		

Unit:6	**Contemporary Issues**	**2 hours**
Tank level control using LabVIEW, Implementation of Mathematical equations in LabVIEW		
	Total Lecture hours	**60 hours**

Text Book(s)

1	Jovitha Jerome, “Virtual Instrumentation Using LabVIEW”, Eastern Economy Edition, PHI Learning private ltd, 2010.

Reference Books

1.	Lisa, K.Wells & Jeffery Travis," Lab VIEW For everyone", Prentice Hall, Publication,2010
2.	S.Gupta and J.P.Gupta, “PC Interfacing for Data Acquisition and Process Control”Instrument society of America, 2018.
3.	Kevin James, PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control, Newnes, 2019.
4.	Robert H.Bishop, “Learning with LabVIEW” Prentice Hall, 2019.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	http://www.ni.com/pdf/manuals/373427j.pdf
2	www.Itrpub.com
3	http://ece-research.unm.edu/jimp/415/labview/LV_Intro_Six_Hours.pdf

Course Designed By: Dr.K.G.Padmasine

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	M	M	M	L	L	M	L	S	M	L	L	L	M
CO2	S	M	S	S	M	M	M	S	L	S	M	L	L	L	M
CO3	S	M	S	S	S	M	M	S	M	S	M	L	L	L	M
CO4	S	M	S	S	S	M	L	S	M	S	M	L	L	L	S
CO5	S	M	S	S	S	S	M	S	M	S	S	M	L	M	S
CO6	S	S	S	S	S	S	M	S	M	S	S	M	M	M	S

*S-Strong; M-Medium; L-Low

Course code	23D	INTRODUCTION TO INDUSTRY 4.0	L	T	P	C
Core/Elective/Supportive		Core	4	0	0	4
Pre-requisite		Basic mathematics and programming automation knowledge is Essential	Syllabus Version		2026-27	

Course Objectives:

The main objectives of this course are to:

1. Understand the concept, need, and design principles of Industry 4.0.
2. Gain knowledge of enabling technologies such as AI, IoT, Big Data, and Cloud computing.
3. Study machine learning techniques and their applications in industrial systems.
4. Explore artificial intelligence concepts, tools, and societal implications.
5. Understand Robotic Process Automation (RPA) and its industrial applications.
6. Analyse real-world applications and impacts of Industry 4.0 across various sectors.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Explain the concepts, principles, and technologies of Industry 4.0.	K2, K3
2	Apply machine learning techniques and identify suitable algorithms for real-world problems.	K3, K4
3	Analyze artificial intelligence concepts, tools, and their impact on society and industry.	K4, K5
4	Evaluate RPA architecture, methodologies, and applications in automation processes	K3, K5
5	Assess applications of Industry 4.0 technologies in sectors like manufacturing, healthcare, and agriculture.	K4, K6
6	Develop integrated solutions using Industry 4.0 tools such as IoT, AI, and data analytics	K5, K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Industry 4.0	12 hours

Need – Reason for Adopting Industry 4.0 - Definition – Goals and Design Principles - Technologies of Industry 4.0 – Big Data – Artificial Intelligence (AI) – Industrial Internet of Things - Cyber Security – Cloud – Augmented Reality.

Unit:2	Machine Learning	12 hours

Machine Learning - Introduction – Definition – Types of Machine Learning –Supervised, Unsupervised, Reinforcement Learning – Algorithms for Machine Learning – Problems solved by Machine Learning - Tools for Machine Learning - Applications areas of Machine Learning.

Unit:3	Artificial Intelligence	12 hours

Artificial Intelligence (AI) – What & Why? - History of AI - Foundations of AI -The AI - environment - Societal Influences of AI - Application Domains and Tools - Associated Technologies of AI - Future Prospects of AI - Challenges of AI

Unit:4	Robotic Process Automation (RPA)	12 hours

Robotic Process Automation (RPA): Introduction to RPA – Need for automation – Programming constructs in RPA – Robots and Softbots – RPA architecture and process methodologies - Industries best suited for RPA - Risks & Challenges with RPA.

Unit:5	Applications and Tools of Industry 4.0	10 hours

Applications of IoT – Manufacturing – Healthcare – Education – Aerospace and Defense – Agriculture – Transportation and Logistics – Impact of Industry 4.0 on Society: Impact on Business, Government, People. Tools for Artificial Intelligence, Big Data and Data Analytics, Virtual Reality, Augmented Reality, IoT, Robotics.		
Unit:6	**Contemporary Issues**	**2 hours**
Applications of Industrial Automation Systems using Machine Learning & Artificial Intelligence		
	Total Lecture hours	**60 hours**
Text Book(s)		

1	P. Kaliraj, T. Devi, Higher Education for Industry 4.0 and Transformation to Education 5.0, 2020
Reference Books	
1	Stuart J. Russell, Peter Norvig, "Artificial Intelligence - A Modern Approach", Third Edition, Pearson Publishers, 2025
2	S.N. Sivanandam, S.N. Deepa, "Principles of Soft Computing", Second Edition, Wiley-India, 2024
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/106/105/106105195/
2	https://nptel.ac.in/courses/106/106/106106139/
3	https://nptel.ac.in/courses/106/105/106105077/
4	https://nptel.ac.in/courses/112/101/112101098/
Course Designed By: Dr.J.Vijayakumar	

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	M	M	M	L	L	M	L	S	M	L	L	L	M
CO2	S	M	S	S	S	M	M	S	L	S	M	L	L	L	M
CO3	S	M	S	S	S	M	M	S	M	S	M	L	M	L	S
CO4	S	M	S	S	M	M	M	S	M	S	M	L	M	M	S
CO5	S	M	S	S	S	S	M	S	M	S	S	M	M	M	S
CO6	S	S	S	S	S	S	M	S	M	S	S	M	M	M	S

*S-Strong; M-Medium; L-Low

Course code	23P	ARM PROCESSOR LABORATORY	L	T	P	C
			0	0	3	3
Pre-requisite		Basic C Language	Syllabus Version		2026-27	

Course Objectives:

The main objectives of this course are to:

1. Understand the fundamentals of embedded systems and microcontroller-based interfacing techniques.
2. Develop practical skills in interfacing sensors, actuators, and communication modules.
3. Implement real-time applications using interrupts, timers, and communication protocols.
4. Design and analyze embedded solutions for industrial and automation applications.
5. Enhance programming skills for hardware control using embedded C/assembly.
6. Encourage teamwork, experimentation, and problem-solving through laboratory practice.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Demonstrate the interfacing of basic input/output devices such as a keypad, GLCD, and rotary encoder.	K2, K3
2	Apply interrupt handling and timing techniques for real-time embedded system applications.	K3, K4
3	Design and implement sensor-based applications using temperature and ultrasonic sensors.	K4, K5
4	Analyze and develop motor control systems using PWM techniques for DC motors, stepper motors, and servo motors.	K4, K5
5	Implement serial communication protocols such as SPI and UART for data exchange between devices.	K3, K4
6	Develop integrated embedded and IoT-based systems for monitoring and control using ZigBee/Wi-Fi technologies.	K5, K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

List of Experiments (Any 12 experiments)

1. Temperature controller application.
2. External interrupt and interrupt latency
3. GLCD interface for an application
4. Ultrasonic interface for an application.
5. DAC interface for an application
6. Solenoid valve interface for an application.
7. Servomotor interfacing for an application
8. Stepper motor control for an application
9. Speed control of DC motor using PWM
10. 4X4 matrix Keypad interfacing
11. SPI communication
12. UART communication
13. Time delay utility
14. Rotary encoder interfacing
15. ZigBee based Wi-Fi node for monitoring devices

	Total Lecture hours	**45 hours**

Course Designed By: Dr.S.Rathinavel

Mapping with Programme Outcomes															
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PO13**	**PO14**	**PO15**
CO1	S	M	L	M	M	L	M	L	L	S	M	L	L	L	M
CO2	S	M	M	S	M	L	M	M	L	S	M	L	L	L	M
CO3	S	M	S	S	S	M	M	M	L	S	M	L	L	L	M
CO4	S	M	S	S	S	M	M	M	L	S	M	L	L	L	M
CO5	S	M	M	S	M	L	M	L	L	S	M	L	L	L	M
CO6	S	S	S	S	S	S	S	M	M	S	S	M	M	M	S
*S-Strong; M-Medium; L-Low															

Course code	23Q	INTELLIGENT INSTRUMENTATION LABORATORY	L	T	P	C
			0	0	3	3
Pre-requisite		Student should have the basic knowledge on circuit design	Syllabus Version		2026-27	

Course Objectives:

The main objectives of this course are to:

1. Understand the fundamentals of graphical programming using LabVIEW for engineering applications.
2. Design and implement basic digital systems such as counters, multiplexers, encoders, and decoders using LabVIEW.
3. Develop modular and structured programs using SubVIs and state machine architectures.
4. Analyse and avoid common programming issues such as race conditions in LabVIEW.
5. Interface hardware components like DAQ, ADC, DAC, sensors, and displays with LabVIEW.
6. Design real-time industrial applications such as control systems and monitoring systems using LabVIEW.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Demonstrate the use of LabVIEW environment to create simple virtual instruments and implement basic logic systems.	K1, K2
2	Design and implement digital systems such as a multiplexer, encoder, decoder, and counters using LabVIEW.	K3, K4
3	Develop modular programs using SubVIs and apply structured programming techniques like state machine architecture.	K4, K5
4	Analyze LabVIEW programs to identify and eliminate race conditions and ensure reliable execution.	K4, K5
5	Interface DAQ systems with sensors and actuators to implement ADC, DAC, and real-time data acquisition systems.	K3, K6
6	Design and implement real-time applications such as temperature control, tank level monitoring, and traffic light systems.	K5, K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

INTELLIGENT INSTRUMENTATION LAB: (USING LabVIEW) (Any 12 Experiments)

1. Design and Implementation of a Four-Function Calculator using LabVIEW
2. Implementation of Seven Segment Display using Case Structure in LabVIEW
3. Design and Implementation of Multiplexer and Demultiplexer using LabVIEW
4. Design and Implementation of Up/Down Counter using LabVIEW
5. Design and Implementation of Encoder and Decoder using LabVIEW
6. Conversion of a VI into SubVI for Modular Programming
7. Analysis and Avoidance of Race Conditions in LabVIEW Programs
8. Design and Implementation of Producer–Consumer Architecture using Queues in LabVIEW
9. Implementation of Analog-to-Digital Conversion (ADC) using DAQ Interface. Implementation of Digital-to-Analog Conversion (DAC) using DAQ Interface
10. Design and Implementation of Temperature Control System using Wireless Sensor Network (WSN)
11. Implementation of Digital Filters using LabVIEW DSP Module
12. Interfacing of ADC and LCD using LabVIEW ARM Module
13. Design and Implementation of Tank Level Monitoring System using DAQ Interface

14. Design and Implementation of Traffic Light Control System using DAQ Interface 15. Design and Implementation of State Machine Architecture in LabVIEW 16. Design and Implementation of State Machine Architecture in LabVIEW		
	Total Lecture hours	**45 hours**
Course Designed By: Dr.K.G.Padmasine		

Mapping with Programme Outcomes															
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PO13**	**PO14**	**PO15**
O1	S	M	L	M	L	L	L	L	L	S	M	L	L	L	M
CO2	S	M	M	S	M	L	M	M	L	S	M	L	L	L	M
CO3	S	M	M	S	M	M	M	M	L	S	M	L	L	M	M
CO4	M	L	S	S	S	M	L	S	M	M	M	L	L	L	M
CO5	S	M	M	S	S	S	M	M	L	S	M	L	L	L	M
CO6	S	S	M	S	S	S	S	M	M	S	M	M	M	M	S
*S-Strong; M-Medium; L-Low															

Third Semester

Course code	33A	PROCESS CONTROL	L	T	P	C
Core/Elective/Supportive		Core	4	0	0	4
Pre-requisite		Basic understanding on Industrial Automations	Syllabus Version		2025-26	

Course Objectives:

The main objectives of this course are to:

1. Understand the principles and operation of final control elements and actuators used in industrial control systems.
2. Analyse discrete state process control systems and various controller modes.
3. Study analogue, pneumatic, relay, and programmable logic controllers (PLC).
4. Explore computer-based control systems, including digital controllers and industrial networks.
5. Evaluate control loop characteristics, system stability, and performance measures.
6. Apply tuning techniques for achieving optimal control system performance.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Explain the working principles of final control elements, actuators, and signal conversion techniques.	K2, K3
2	Analyze discrete state process control systems and compare different controller modes (ON-OFF, PID, etc.).	K3, K4
3	Illustrate the operation and design of analog, pneumatic, relay, and PLC-based controllers	K2, K3
4	Apply computer-based control strategies, including digital controllers, data acquisition, and industrial communication networks.	K3, K5
5	Evaluate control loop performance, stability criteria, and quality measures of control systems	K4, K5
6	Design and implement tuning methods (Ziegler-Nichols, frequency response, etc.) for optimal control performance	K5, K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Final Control Elements	12 hours

Final control operation: Signal conversion, actuators, control element- signal conversions: analog electrical signals, digital electrical signals, pneumatic signals- power electronics, switching devices, controlling devices – actuators: electrical actuators, pneumatic actuators – control elements: mechanical, electrical, fluid walls .

Unit:2	Discrete State Process Control	12 hours

Definition of Discrete state process control – characteristics of the system: Discrete state variables, process specification, event sequence description –Controller modes- Discontinuous Controller Modes: Two-position Mode, Multiposition Mode, Floating control Mode – Continuous control Modes: Proportional control Mode, Integral control Mode, Derivative – control Mode- Composite Control Mode: Proportional –Integral Control, Proportional – Derivative Control Mode, Three Mode controller (PID) .

Unit:3	Analog and Logic Controllers	12 hours

General features of analog controllers: Physical layout, front panel, side panel – Electronic controllers: Error detector, Single mode, composite controller mode – Pneumatic Controllers: General features, Mode Implementation – Relay controllers: Background, Ladder diagrams- Programme Logic Controllers: Relay sequences, Programmable Logic Controller Design, PLC operation, Programming, Functions of PLC software.

Unit:4	Computer Based Control	12 hours
Digital applications: Single and multivariable alarms, Two position control – Computer based controllers: Hardware configuration, Smart sensors, multiloop controllers- Software requirements- algorithms to implement the control equations: errors, proportional mode, integral mode, derivative mode, PID Control mode – Data Loggers – Supervisory control – Process control system networks, field bus operations, General characteristics of buses		
Unit:5	**Control Loop Characteristics**	**10 hours**
Control System configurations: Single variable, Cascade Control – Multivariable control system: analog control, supervisory and direct digital control – Control system quality: definition of quality, measure of quality – Stability: Transfer function frequency dependence, stability criteria- Process Loop Tuning: Open Loop Transient Response Method, Ziegler- Nichols Method, Frequency Response Method.		

Unit:6	**Contemporary Issues**	**2 hours**
Mixing, Drying Process in industry		
	Total Lecture hours	**60 hours**

Text Book(s)

1	Curtis D. Johnson, "Process control instrumentation Technology", Eight editions, Prentice Hall of India, 2016.

Reference Books

1	Stephanopoulos G, "Chemical Process Control", Prentice Hall of India, New Delhi, 2018.
2	Donald R Coughanowr, "Process Systems Analysis and Control", Tata McGraw Hill Inc., 2016.
3	Wayne Bequette B. "Process Dynamics Modeling, Analysis and Simulation", Prentice Hall, 2013.
4	Liptak B G, "Process Control", Chilton Book Company, 2015.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	www.nptel.in
2	http://www.pc-education.mcmaster.ca/Lecture_Slides/Chap_01_Marlin_2002.pdf
3	www.lecturenotes.com
4	https://sites.google.com/a/nirmauni.ac.in/process-instrumentation-and-control---1ecd03/course-contents/lecture-notes

Course Designed By: Dr.K.G.Padmasine

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	L	M	M	M	L	L	M	L	M	L	L	L	L	L
CO2	S	L	S	S	M	L	L	M	L	M	L	L	L	L	L
CO3	S	M	M	M	M	L	M	M	L	S	L	L	L	L	L
CO4	S	M	M	S	S	M	M	M	L	S	M	L	L	M	M
CO5	S	L	S	S	S	M	L	S	M	M	M	L	L	L	M
CO6	S	M	S	S	S	S	M	S	M	S	S	L	M	M	S

*S-Strong; M-Medium; L-Low

Course code	33B	DIGITAL SIGNAL PROCESSING	L	T	P	C
Core/Elective/Supportive		Core	4	0	0	4
Pre-requisite		The mathematics, signals & systems knowledge is most Important	Syllabus Version		2025-26	

Course Objectives:

The main objectives of this course are to:

1. Understand the principles of the Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT) algorithms.
2. Design and analyse Infinite Impulse Response (IIR) digital filters from analog prototypes.
3. Study the design and realisation of Finite Impulse Response (FIR) filters using various techniques.
4. Explore applications of digital signal processing in speech and audio systems.
5. Understand the architecture and programming of digital signal processors (DSPs).
6. Develop skills in implementing DSP algorithms using modern computational tools.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Explain the concepts of DFT and implement FFT algorithms for efficient spectral analysis.	K2, K3
2	Analyze and design IIR filters using Butterworth and Chebyshev approximations.	K3, K4
3	Design FIR filters using windowing and frequency sampling methods.	K3, K5
4	Apply DSP techniques in speech and audio signal processing applications.	K3, K4
5	Illustrate the architecture and instruction set of DSP processors and develop simple programs	K2, K3
6	Evaluate and implement DSP algorithms using appropriate hardware/software tools.	K5, K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	The Fast Fourier Transform	12 hours

Introduction- Direct Evaluation of the DFT-The Fast Fourier Transform-Decimation-in-Time Algorithm-Decimation-in-Frequency Algorithm-IDFT using FFT Algorithm

Unit:2	Infinite Impulse Response Filters	12 hours

Introduction - Analog Lowpass Filter Design - Steps to Design an Analog Butterworth Low pass Filter-Steps to Design an Analog Chebyshev Lowpass Filter- Comparison between Butterworth Filter and Chebyshev Filter-Frequency Transformation in Analog Domain -Design of Highpass, Bandpass and Bandstop Filters- Design of IIR Filters from Analog Filters-Frequency Transformation in Digital Domain -Realization of Digital Filters

Unit:3	Finite Impulse Response Filters	12 hours

Introduction- Linear Phase FIR Filters-Frequency Response of Linear Phase FIR Filters-Location of the Zeros of Linear Phase FIR Filters-Design of FIR Filters using Windows-Digital Differentiator-Frequency Sampling Method of Designing FIR Filters-Realization of FIR Filters.

Unit:4	Applications of Digital Signal Processing	10 hours

Introduction-Speech Processing - Speech Analysis-Speech Coding - Subband coding-Channel Vocoder - Homomorphic Vocoder - Digital Processing of Audio Signals.		
Unit:5	**Digital Signal Processors**	**12 hours**
Overview of Digital Signal Processors-Selecting Digital Signal Processors-Applications of DSPs-Architecture of TMS320C50-Addressing modes-Instruction Set-Simple Assembly Language Programs-Architecture of TMS320C54x-Accumulators.		
Unit:6	**Contemporary Issues**	**2 hours**
DSP Based Measurement System, Radar Signal Processing		
	Total Lecture hours	**60 hours**

Text Book(s)	
1	John G. Proakis & Dimitris G.Manolakis, Digital Signal Processing – Principles, Algorithms & Applications‖, Fourth Edition, Pearson Education / Prentice Hall, 2023.
2	Dr. P. Ramesh Babu, Digital Signal Processing, Seventh Edition SciTech publications (India) pvt. Ltd., 2024.
Reference Books	
1	Emmanuel C. Ifeachor & Barrie. W. Jervis, Digital Signal Processing‖, Second Edition, Pearson Education / Prentice Hall, 2020.
2	A. V. Oppenheim, R.W. Schafer and J.R. Buck, Discrete-Time Signal Processing‖, 8th Indian Reprint, Pearson, 2024.
3	Sanjit K. Mitra, Digital Signal Processing – A Computer Based Approach‖, Tata Mc Graw Hill, 2020.
4	Andreas Antoniou, Digital Signal Processing‖, Tata Mc Graw Hill, 2025.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/117/104/117104070/
2	https://nptel.ac.in/courses/117/102/117102060/
3	https://nptel.ac.in/courses/108/105/108105055/
Course Designed By: Dr.J.Vijayakumar	

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	L	M	M	M	L	L	M	L	M	L	L	L	L	L
CO2	S	L	S	S	S	M	L	M	L	M	L	L	L	L	M
CO3	S	L	S	S	S	M	L	M	L	M	M	L	L	L	M
CO4	S	M	M	M	M	M	M	M	L	S	M	L	L	M	M
CO5	S	M	M	M	M	L	M	M	L	S	L	L	L	L	L
CO6	S	M	S	S	S	S	M	S	M	S	S	L	M	M	S

*S-Strong; M-Medium; L-Low

Course code	33C	DIGITAL VLSI DESIGN	L	T	P	C
Core/Elective/Supportive		Core	4	0	0	4
Pre-requisite		An overall study of the fabrication of the MOS transistor	Syllabus Version		2026-27	

Course Objectives:

The main objectives of this course are to:

1. Understand the fundamentals of CMOS technology, fabrication process, and logic gate design.
2. Analyse various combinational logic design styles and low-power circuit techniques.
3. Study sequential logic circuits, timing issues, and clocking methodologies in digital systems.
4. Develop VHDL programming skills for modelling and simulation of digital systems.
5. Design arithmetic circuits and understand programmable logic devices and memory architectures.
6. Apply design, simulation, and verification techniques for digital VLSI systems using modern tools.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Explain CMOS logic, fabrication process, and performance parameters such as delay and power.	K1, K2
2	Analyse different combinational circuit design techniques and identify design trade-offs.	K3, K4
3	Apply concepts of sequential circuits and timing analysis in digital system design.	K3, K5
4	Develop and simulate digital systems using VHDL for behavioural and structural modelling.	K3, K6
5	Design arithmetic circuits and evaluate memory architectures and programmable logic devices.	K4, K5
6	Validate and optimise digital VLSI designs using simulation tools and modern design methodologies.	K5, K6

K1 – Remember; **K2** – Understand; **K3** – Apply; **K4** – Analyze; **K5** – Evaluate; **K6** – Create

Unit:1	VHDL Programming	12 hours

Introduction to VHDL – Design flow – Basic structure of a VHDL program – Entity, architecture, Configuration – Data types and Objects: Scalar types, Composite types, Signals, Variables, Constants –Operators and Expressions – Sequential and Concurrent statements –Behavioral Modeling – Structural Modeling –Subprograms: Functions and Procedures – Packages and Libraries –File handling in VHDL –Testbench design – Simulation and Verification using VHDL.

Unit:2	CMOS Logic	12 hours

CMOS Inverter, Logic Gates, Design of Compound Gates, Pass Transistor Gates and Transmission Gates, CMOS Fabrication Process, Layout Design Rules, Gate layout, Stick Diagrams, Propagation Delays, Elmore's constant, Logical Effort, Power Dissipation.

Unit:3	Combinational Logic Circuits	12 hours

Circuit Families: Static CMOS, Ratioed Circuits, CVSL, Dynamic Circuits, Pass Transistor Circuits, Examples of combinational logic design, Circuit pitfalls, Low Power Design principles.

Unit:4	Sequential Logic Circuits and Clocking Strategies	10 hours

Static Latches and Registers, Dynamic Latches and Registers, Pipelines, Non-bistable Sequential Circuits, Timing classification of Digital Systems, Synchronous Design, Self Timed Circuit Design.		
Unit:5	**VHDL Programming Circuits and Memory Architecture**	**12 hours**
Adders-Binary adder, Ripple carry adder, Carry look ahead adder, Multiplier-array multiplier, Carry save multiplier, Booth Multiplier, Wallace tree multiplier, Shifters-Barrel shifter, Logarithmic shifter, Logic Implementation using Programmable Devices (PROM, PLA, PAL, FPGA), Memory Classification, Memory Architecture and Building Blocks.		
Unit:6	**Contemporary Issues**	**2 hours**
Application Specific Internet of Things – sensor specific to the application		
	Total Lecture hours	**60 hours**

Text Book(s)	
1	Neil H E Weste, Kamran Eshranghian, "Principles of CMOS VLSI Design: A System Perspective," Addison Wesley, 2009
2	Jan D Rabaey, Anantha Chandrakasan, "Digital Integrated Circuits: A Design Perspective", PHI, 2016
3	Volnei A. Pedroni , "Circuit Design with VHDL" The MIT Press, 2020
Reference Books	
1	Sung-Mo (Steve) Kang, Yusuf Leblebici, CMOS Digital Integrated Circuits: Analysis and Design, 4th edition, McGraw Hill 2022
2	Neil Weste & Kamran Eshraghian, " Principles of CMOS VLSI design" Addision Wesley, 2nd Edition, 2020
3	Jacob Baker, Harry, David E.Boyce, " CMOS circuit design, layout and simulation" Prentice Hall India, 2021
4	Bhasker J. " A VHDL Primer" Pearson Eduction, 3rd Edition, 2017
5	John Wakerly, " Digital Design Priciples & Practices", 3rd Edition, Pearson Education, 2012
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/108/107/108107129/
2	https://nptel.ac.in/courses/117/101/117101105/
3	https://nptel.ac.in/courses/117/101/117101004/
Course Designed By: Dr.J.Vijayakumar	

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	L	M	L	M	L	L	M	L	L	L	L	L	L	L
CO2	S	L	S	S	M	L	L	M	L	L	L	L	L	L	L
CO3	S	L	S	S	S	M	L	M	L	L	L	L	L	L	L
CO4	S	M	M	S	M	S	M	M	L	S	M	L	L	L	M
CO5	S	L	S	S	S	M	L	M	L	M	L	L	L	L	M
CO6	S	M	S	S	S	S	M	M	M	S	M	L	M	M	S
*S-Strong; M-Medium; L-Low															

Course code	33P	DIGITAL SIGNAL PROCESSING LABORATORY	L	T	P	C
			0	0	3	3
Pre-requisite		The mathematics, signals & systems and programming knowledge is most Important	Syllabus Version		2026-27	

Course Objectives:

The main objectives of this course are to:

1. Familiarise students with the MATLAB environment for signal processing, modelling, and visualization.
2. Understand and implement fundamental signal processing operations in time and frequency domains.
3. Design and analyze digital filters (FIR and IIR) using MATLAB and DSP processors.
4. Develop skills in signal sampling, reconstruction, and spectral analysis using FFT techniques.
5. Apply DSP concepts in image, audio, and video processing applications.
6. Implement DSP algorithms using dedicated processors (TMS320 series) and Simulink models

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Demonstrate proficiency in the MATLAB environment for signal generation, matrix operations, and visualization.	K1, K2
2	Apply signal processing techniques such as convolution, correlation, and sampling for discrete-time signals.	K3, K4
3	Analyze signals in the frequency domain using FFT and interpret spectral characteristics.	K4, K5
4	Design and implement FIR and IIR digital filters using MATLAB and DSP processors.	K4, K5
5	Develop applications in image, audio, and video processing including enhancement and feature extraction.	K3, K6
6	Implement DSP algorithms using Simulink models and TMS320 DSP processors for real-time applications.	K5, K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

SIMULATION USING MATLAB (Any 10Experiments)

1. MATLAB Environment, Matrix Operations, and Programming
2. Mathematical Modelling, Plotting, and Data Visualisation
3. Generation and Analysis of Continuous and Discrete Signals
4. Signal Operations: Convolution and Correlation
5. Frequency Domain Analysis using FFT
6. Sampling, Aliasing, and Signal Reconstruction
7. Design and Implementation of Digital Filters (FIR and IIR)
8. Image Representation and Enhancement Techniques
9. Edge Detection, Image Segmentation, and Morphological Operations
10. Audio and Video Processing: Analysis, Noise Reduction, and Motion Detection
11. Simulink Modelling: Basic Blocks and Signal Flow
12. Simulink Modelling of Dynamic Systems and PID Control
13. Machine Learning and Feature Extraction using MATLAB

USING TMS320C5X/TMS320C54XX/TMS320C67XX

14. Arithmetic operations.
15. Design and demonstration of FIR Filter for Low pass, High pass, Band pass and Band stop filtering
16. Design and demonstration of Butterworth and Chebyshev IIR Filters for Low pass, High pass, Band pass and Band stop filtering

	Total Lecture hours	**45 hours**

Course Designed By: Dr.J.Vijayakumar

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	L	M	M	L	L	L	L	S	M	L	L	L	M
CO2	S	M	M	S	S	L	M	M	L	S	M	L	L	L	M
CO3	S	M	S	M	S	M	L	S	M	S	M	L	L	L	M
CO4	S	M	M	S	S	S	M	M	-	S	M	L	L	L	M
CO5	M	M	S	M	S	M	M	M	M	S	M	M	L	L	M
CO6	S	S	M	S	S	S	S	M	M	S	M	M	M	M	S

*S-Strong; M-Medium; L-Low

Course code	33Q	VLSI LABORATORY	L	T	P	C
			0	0	3	3
Pre-requisite		Making students to understand, execute his knowledge in the VLSI work bench, FPGA kit with cadence and xilinix software	Syllabus Version		2026-27	

Course Objectives:

The main objectives of this course are to:

1. Understand the VLSI design flow and familiarize with Cadence design tools.
2. Develop digital circuits using Verilog and perform simulation using Cadence tools.
3. Design and simulate combinational and sequential digital circuits.
4. Analyse and design analog circuits using schematic simulation techniques.
5. Implement layout design and verify circuits using design rules and layout simulation.
6. Integrate digital and analog design concepts for complete VLSI system realization.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Explain the VLSI design flow and demonstrate the use of Cadence tools for simulation	K2, K3
2	Develop and simulate basic digital circuits (logic gates, flip-flops, counters, adders) using Verilog	K3, K4
3	Analyze and implement sequential and combinational digital systems using Cadence digital tools	K4, K5
4	Design and simulate analog circuits such as amplifiers and operational amplifiers using schematic tools.	K3, K4
5	Construct layout designs and verify them using design rules and layout simulation techniques.	K2, K3
6	Integrate digital and analog design methodologies to realize complete VLSI subsystems.	K5, K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

LIST OF EXPERIMENTS (any 12 experiments)

1. Study of Xilinx ISE Design Flow and Simulation Tools
2. Design and Implementation of Basic Logic Gates using VHDL/Verilog
3. Design and Simulation of Half Adder and Full Adder
4. Design and Implementation of Multiplexer and Demultiplexer
5. Design and Implementation of Encoder and Decoder
6. Design and Implementation of Binary and BCD Counters
7. Design and Implementation of Shift Registers
8. Design and Implementation of ALU (Arithmetic Logic Unit)
9. Interfacing LED& Switch with FPGA
10. Interfacing Seven Segment with FPGA
11. Interfacing LCD with FPGA
12. Design and Implementation of UART
13. Interfacing DAC with FPGA
14. Interfacing SPI ADC with FPGA
15. FPGA Implementation of Digital Clock using Xilinx
16. Design and Implementation of Traffic Light Controller using FPGA

	Total Practical hours	**45 hours**

Course Designed By: Dr.J.Vijayakumar

Mapping with Programme Outcomes															
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PO13**	**PO14**	**PO15**
CO1	S	L	M	M	M	L	L	M	L	S	L	L	L	L	L
CO2	S	M	M	S	M	L	M	M	L	S	M	L	L	L	M
CO3	S	M	S	S	S	M	M	M	L	S	M	L	L	L	M
CO4	S	M	M	S	S	M	M	M	L	S	M	L	L	M	M
CO5	S	L	S	S	S	M	M	S	M	S	M	L	M	M	S
CO6	S	M	S	S	S	S	M	S	M	S	S	L	M	M	S
*S-Strong; M-Medium; L-Low															

Fourth Semester

Course code	43A	PLC AND ITS APPLICATIONS	L	T	P	C
Core/Elective/Supportive		Core	4	0	0	4
Pre-requisite		Basic Electrical and Electronics equipment operation knowledge is Necessary	Syllabus Version		2026-27	

Course Objectives:

The main objectives of this course are to:

1. Understand the fundamentals of PLC architecture, programming concepts, and ladder logic design.
2. Develop PLC programs using timers, counters, and arithmetic functions for industrial automation.
3. Apply data handling, sequencing, and bit manipulation techniques in PLC-based systems.
4. Gain knowledge of PLC installation practices, troubleshooting, and maintenance procedures.
5. Introduce SCADA systems, architecture, and their role in industrial monitoring and control.
6. Integrate PLC and SCADA concepts for real-time automation applications.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Explain PLC architecture, programming methods, and ladder logic representation.	K1, K2
2	Develop PLC programs using timers, counters, and arithmetic instructions for control applications	K3, K4
3	Apply data handling, sequencing, and bit-level operations in PLC systems.	K3, K5
4	Analyze PLC system performance and troubleshoot industrial automation problems.	K4, K5
5	Describe SCADA architecture, components, and communication systems.	K2, K3
6	Design and implement PLC–SCADA based automation solutions for industrial applications.	K5, K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Basic PLC Programming	12 hours

General PLC programming procedures - Programming on/off inputs and outputs: Relation of digital gate logic to contact/ coil logic - Creating ladder diagrams from process control descriptions - Logic gates. PLC Register Basics.

Unit:2	PLC Function and Intermediate Function	12 hours

Programming Timers - On Delay Timer Instruction - Off Delay Timer Instruction. Programming Counters - Up Counter - Down Counter. Math Instruction - Addition - Subtraction - Multiplication - Division. Number comparison functions - Numbering systems and PLC number conversion functions.

Unit:3	Data Handling Functions and PLC Functions Working With Bits	10 hours

The PLC SKIP and MASTER CONTROL RELAY functions - JUMP Functions - Data Move Systems - Other PLC Data Handling Functions - Digital Bit Functions and Applications - Sequencer functions - Controlling Robot with a PLC - Matrix functions.

Unit:4	PLC Installation Practices, Editing and Troubleshooting	12 hours

PLC Enclosures - Electrical Noise - Leaky Inputs and Outputs - Grounding - Voltage Variations and Surges - Program Editing - Programming and Monitoring - Preventive Maintenance - Troubleshooting - Connecting your Personal Computer and Your Programmable Logic Controller.

Unit:5	**Introduction to SCADA**	**12 hours**
SCADA definitions, SCADA Functional requirements and components, SCADA Hierarchical concept, SCADA architecture, General features, SCADA Applications, Benefits. Remote Terminal Unit (RTU), Interface units, Human- Machine Interface Units (HMI), Display Monitors/Data Logger Systems, Intelligent Electronic Devices (IED). Introduction - Communication Network, SCADA Server, SCADA Control systems and Control panels. Introduction to DCS - Difference between DCS and SCADA.		

Unit:6	**Contemporary Issues**	**2 hours**
Introduction to Industrial Automation, Architecture of Industrial Automation Systems		
	Total Lecture hours	**60 hours**

	Text Book(s)
1	John W. Webb &Ronald A., Reis, “Programmable Logic Controllers Principles and Applications”, Fifth Edition, Prentice Hall Publication, New Delhi, 2015.
2	Frank D. Petruzella, “Programmable Logic Controllers”, Third Edition, Tata McGraw Hill Education Private Limited, 2018.
3	Stuart A. Boyer: “SCADA-Supervisory Control and Data Acquisition”, Instrument Society of America Publications,USA,2017
4	David Bailey, Edwin Wright, Practical SCADA for industry, Newnes, 2018

	Reference Books
1	Michael P.Lukas, “Distributed Control Systems”, Van Nostrand Reinfold Company,2020
2	Gordon Clarke, Deon Reynders: “Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems”, Newnes Publications, Oxford, UK, 2019.

	Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]
1	https://nptel.ac.in/courses/108/105/108105088/
2	https://nptel.ac.in/courses/108/105/108105063/
3	http://www.nptelvideos.in/2012/11/industrial-automation-and-control.html

Course Designed By: Dr. J. Vijayakumar

Mapping with Programme Outcomes															
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PO13**	**PO14**	**PO15**
CO1	S	M	L	L	L	L	L	M	L	L	M	L	L	L	M
CO2	S	M	M	S	M	L	M	M	L	S	M	L	L	L	M
CO3	S	M	S	S	S	M	M	M	L	S	M	L	L	L	M
CO4	S	M	S	S	S	M	M	S	M	S	M	L	M	L	M
CO5	S	M	M	M	M	L	L	M	L	S	M	L	L	L	M
CO6	S	S	S	S	S	S	S	S	M	S	S	M	M	S	S
*S-Strong; M-Medium; L-Low															

Course code	43P	PLC, SCADA LABORATORY	L	T	P	C
			0	0	3	3
Pre-requisite		Basic Electrical and Electronics equipment operation knowledge is Necessary	Syllabus Version		2026-27	

Course Objectives:

The main objectives of this course are to:

1. Understand the architecture and programming of PLC systems using ladder logic.
2. Implement basic logic operations, timers, counters, and arithmetic functions using PLC.
3. Design industrial control applications such as motor control, traffic systems, and conveyor automation.
4. Develop HMI screens for real-time industrial process monitoring and control.
5. Understand SCADA systems for data acquisition, visualization, alarm handling, and logging.
6. Integrate PLC with SCADA using industrial communication protocols like Modbus.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Explain PLC hardware architecture and develop ladder logic programs for basic control operations.	K1, K2
2	Implement timers, counters, and arithmetic operations using PLC for industrial applications	K3, K4
3	Design and implement industrial automation systems such as motor control and conveyor systems using PLC	K3, K5
4	Develop HMI interfaces for monitoring and controlling industrial processes	K4, K5
5	Design and implement SCADA systems for real-time data acquisition, alarm handling, and data logging.	K3, K6
6	Integrate PLC and SCADA systems using communication protocols such as Modbus for process control.	K5, K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

LIST OF EXPERIMENTS(any 12 experiments)

1. Study of PLC Hardware and Programming using Ladder Logic
2. Implementation of Basic Logic Gates using PLC
3. Design and Implementation of Start/Stop Motor Control using PLC
4. Implementation of Timer and Counter Operations using PLC
5. Design and Implementation of Motor Control using PLC
6. Design and Implementation of Traffic Light Control using PLC
7. Implementation of Water Level Control System using PLC
8. Implementation of Arithmetic operations
9. Design and Implementation of Conveyor Belt Control System using PLC
10. Design and Development of HMI Screens for Industrial Process Monitoring
11. Implementation of PLC–HMI Communication for Process Control
12. Development of SCADA System for Real-Time Data Monitoring
13. Implementation of Alarm Handling and Event Logging in SCADA
14. Design and Implementation of PID Control using PLC and SCADA
15. Development of Data Logging and Trend Analysis in SCADA Systems
16. Implementation of PLC–SCADA Communication using Modbus Protocol

	Total Lecture hours	**45 hours**

Course Designed By: Dr.J.Vijayakumar

Mapping with Programme Outcomes															
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PO13**	**PO14**	**PO15**
CO1	S	M	L	M	M	L	L	L	L	S	M	L	L	L	M
CO2	S	M	M	S	S	L	M	M	L	S	M	L	L	L	M
CO3	S	M	M	S	S	M	S	M	L	S	M	L	L	M	M
CO4	M	S	M	M	M	M	M	M	M	S	M	M	L	M	M
CO5	S	M	S	S	S	S	M	S	M	S	M	L	M	M	M
CO6	S	S	M	S	S	S	S	M	M	S	M	M	M	M	S
*S-Strong; M-Medium; L-Low															

Elective Courses

Course Code	1EA	SEMICONDUCTOR MANUFACTURING	L	T	P	C
Core/Elective/Supportive		Elective	4	0	0	4
Pre-requisite:		Needed knowledge about working of semiconductors	Syllabus Version		2026-27	

Course Objectives:

The main objectives of this course are to:

1. Understand the fundamentals of semiconductor materials, devices, and fabrication processes.
2. Study crystal growth techniques and wafer preparation for IC manufacturing.
3. Analyze key fabrication processes such as oxidation, photolithography, etching, diffusion, and ion implantation.
4. Understand thin film deposition techniques, epitaxy, and metallization processes.
5. Study process integration for MOSFET, bipolar devices, and passive components.
6. Understand IC manufacturing aspects, including testing, packaging, and process control techniques.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Explain semiconductor materials, devices, and basic fabrication steps involved in IC manufacturing.	K1, K2
2	Describe crystal growth, wafer preparation, and oxidation processes used in semiconductor manufacturing.	K2, K3
3	Analyze fabrication techniques such as photolithography, etching, diffusion, and ion implantation.	K3, K4
4	Evaluate thin film deposition, epitaxial growth, and metallization processes in IC fabrication	K4, K5
5	Apply process integration concepts for MOSFET, bipolar devices, and passive component fabrication	K5, K6
6	Assess IC manufacturing processes including testing, packaging, and statistical process control.	K5, K6

K1 - Remember; **K2 -** Understand; **K3 -** Apply; **K4 -** Analyze; **K5 -** Evaluate; **K6 -** Create

Unit:1	Introduction To Semiconductor Manufacturing	12 hours

Historical perspective, processing overview, semiconductor materials, semiconductor devices, process technology, fabrication steps.

Unit:2	Manufacturing Process: Crystal Growth, Silicon 9 Oxidation, Photolithography	12 hours

Silicon crystal growth, material characterization, thermal oxidation process, impurity redistribution, masking properties of silicon dioxide, oxidation thickness characteristics

Unit:3	Manufacturing Process: Etching, Diffusion, Ion Implantation, Film Deposition	12 hours

Wet chemical etching, Dry etching, basic diffusion process, extrinsic diffusion, lateral diffusion, Photolithography, Ion Implantation, implanted damage and annealing, epitaxial growth techniques, structures and defects, dielectric deposition, metallization.

Unit:4	Process Integration	10 hours

Passive components, bipolar technology, MOSFET Technology.

Unit:5	**IC Manufacturing**	**12 hours**
Electrical testing, packing, statistical process control, computer integrated manufacturing, challenges for integration, system-on-a-chip		
Unit:6	**Contemporary Issues**	**2 hours**
MESFET Technology, MEMS Technology.		
	Total Lecture hours	**60 hours**

Text Book(s)	
1	G. S. May and S. M. Sze, Fundamentals of Semiconductor Fabrication, Wiley India, 2014.
2	2. Hong Xiao, Introduction to Semiconductor Manufacturing Technology – Second Edition, SPIE Press, 2018.
3	

Reference Books	
1	W. R. Runyan and K. E. Bean, Semiconductor Integrated Circuit Processing Technology, Addison Wesley Publishing Company, 2018
2	S. A. Campbell, The Science and Engineering of Microelectronic Fabrication, Oxford University Press, 2017.
3	M. J. Madou, Fundamentals of Micro fabrication, 2nd Edition, CRC Press, 2019.
4	S. M. Sze, Semiconductor Devices: Physics and Technology, 2nd Ed., Wiley India, 2018

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/108106181
2	https://nptel.ac.in/courses/117102061
3	https://www.hitachi-hightech.com/global/products/device/semiconductor/process.html
4	https://nptel.ac.in/courses/108108112
5	https://www.semiconductors.org/turning-the-tide-for-semiconductor-manufacturing-in- the-u-s/

Course Designed By: Dr. J.Vijayakumar

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	L	M	M	L	L	L	L	M	M	L	L	L	M
CO2	S	M	M	M	S	L	L	M	L	M	M	L	L	L	M
CO3	S	M	S	S	S	M	L	S	L	M	M	L	L	L	M
CO4	S	M	S	M	S	M	L	S	M	M	M	L	L	L	M
CO5	S	M	M	S	S	S	M	M	L	M	M	L	L	M	M
CO6	S	S	M	S	S	S	M	M	M	S	M	M	M	M	S

*S-Strong; M-Medium; L-Low

Course code	1EB	BIO MEDICAL INSTRUMENTATION	L	T	P	C
Core/Elective/Supportive		Elective	4	0	0	4
Pre-requisite		Making knowledge about the physiology, study of medical equipments, knowing the patient and his safety measures.	Syllabus Version		2026-27	

Course Objectives:

The main objectives of this course are

1. Understand human physiological systems and the role of biomedical transducers and electrodes.
2. Study electrophysiological signal acquisition systems such as ECG, EEG, EMG, and related lead configurations.
3. Understand measurement techniques for non-electrical physiological parameters like blood pressure, flow, and respiratory variables.
4. Gain knowledge of medical imaging techniques and biomedical telemetry systems.
5. Study the principles and applications of assisting and therapeutic biomedical devices.
6. Analyse recent advancements and research trends in biomedical instrumentation.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Explain physiological systems and the working principles of biomedical transducers and electrodes.	K1, K2
2	Interpret electrophysiological signals such as ECG, EEG, EMG, and analyze their acquisition methods.	K2, K4
3	Apply techniques to measure non-electrical physiological parameters like blood pressure, flow, and respiratory variables.	K3, K4
4	Analyse medical imaging systems such as X-ray, MRI, CT, ultrasound, and biomedical telemetry systems	K4, K5
5	Evaluate the operation of therapeutic and assisting devices such as pacemakers, ventilators, and defibrillators	K5, K6
6	Assess recent research developments and applications in biomedical instrumentation.	K5, K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Physiology and transducers	12 hours

Man instrument system, problems encountered in measuring a living system, transducers for biomedical applications, Cell and its structure, resting and action potential, propagation of action potentials, the heart and cardiovascular system, electrophysiology of cardiovascular system, physiology of the respiratory system, nervous system, Electrode theory, biopotential electrodes

Unit:2	Electrophysiological measurement	12 hours

Lead system, recording methods and typical waveforms of ECG, Vector cardiography, EEG Lead system, recording and methods and typical waveforms of EMG,ERG,EOG

Unit:3	Non electrical parameter measurements	12 hours

Measurement of blood pressure, blood flow and cardiac output, plethysmography Measurement of heart sounds, Gas Analyzers, Blood gas analyzers, Oximeters

Unit:4	Medical Imaging and Telemetry	10 hours

X-ray machine, Echocardiography, computer tomography, MRI, Diagnostic ultrasound, PET, SPECT, Electrical impedance tomography, thermography, biotelemetry		
Unit:5	**Assisting and therapeutic device**	**12 hours**
Pacemakers, Defibrillators, Ventilator, Heart lung machine, Kidney machine, Diathermy endoscopes, Lasers in biomedicine, Discussion of research papers on the applications of biomedical instruments in various aspects.		
Unit:6	**Contemporary Issues**	**2 hours**
Robotics in medical industry: Industrial and non-industrial robots, remote controlled robots, typical examples of automated industries.		
	Total Lecture hours	**60 hours**

Text Book(s)	
1	Leslie Cromwell, Fred, J.Weibell and Erich A. Pleiffer, " Biomedical Instrumentation and Measurements" 2nd Edition, Prentice Hall of India, 2014
2	Kandpur, R.S. " Handbook of Biomedical Instrumentation" 2nd Edition, Tata Mc Graw Hill, 2011
3	K.S.Fu,R.C. Gonazlez, CSG, Lee Robotics, Control sensing vision and intelligence, Tata Mc Graw Hill 2018
4	M.Arumugam, " Biomedical Instrumentation" Anuradha Publications, 2015
Reference Books	
1	John G.Webster, Editor, " Medical Instrumentation, Application and Design" John Wiley and Sons Inc. 2019
2	Morelli S Salerno S , Ahmed H, Piscioneri A, DeBartolo L, " Recent strategies combining biomaterials and Stem cells for bone, liver and skin Regenerations" Current stem cell Research & therapy, 2016
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/127/106/127106134/
2	https://nptel.ac.in/courses/108/105/108105101/
3	https://swayam.gov.in/nd1_noc19_ge33/preview
4	https://swayam.gov.in/nd1_noc19_bt28/preview

Course Designed By: Dr.S.Rathinavel

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	M	L	M	M	L	L	M	-L	M	M	L	L	L	M
CO2	S	M	S	M	S	L	L	S	M	M	M	L	L	L	M
CO3	S	M	M	S	S	M	L	M	L	M	M	L	L	L	M
CO4	S	M	S	M	S	M	L	S	M	S	M	L	L	L	M
CO5	S	M	M	S	S	S	M	M	M	M	M	L	M	M	M
CO6	S	S	S	S	S	S	M	S	M	S	M	M	M	M	S

*S-Strong; M-Medium; L-Low

Course Code	1EC	IoT CONCEPTS AND ITS APPLICATIONS	L	T	P	C
Core/Elective/Supportive		Elective	4	0	0	4
Pre-requisite:		Required basic programming knowledge for microcontrollers	Syllabus Version		2026-27	

Course Objectives:

The main objectives of this course are to:

1. Understand the evolution, architecture, and enabling technologies of the Internet of Things.
2. Study IoT components including sensors, actuators, control units, and communication modules.
3. Understand IoT communication protocols and networking technologies.
4. Develop IoT applications using open platforms such as Arduino and Raspberry Pi.
5. Analyze cloud integration and data handling in IoT systems.
6. Explore real-world IoT applications in smart environments and industrial systems.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Explain IoT architecture, evolution, and enabling technologies.	K1, K2
2	Describe the components of IoT systems including sensors, actuators, and communication modules.	K2, K3
3	Apply IoT communication protocols such as MQTT, CoAP, and IPv6 in system design.	K3, K4
4	Develop IoT-based applications using platforms like Arduino and Raspberry Pi with cloud connectivity.	K4, K5
5	Analyze IoT data handling using cloud computing and big data technologies	K4, K5
6	Design IoT solutions for real-world applications such as smart cities, healthcare, and industrial automation.	K4, K5

K1 - Remember; **K2 -** Understand; **K3 -** Apply; **K4 -** Analyze; **K5 -** Evaluate; **K6 -** Create

Unit:1	Introduction to Internet of Things	12 hours

Evolution of Internet of Things – Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT Models

Unit:2	Components in Internet of Things	12 hours

Functional Blocks of an IoT Ecosystem – Sensors, Actuators, and Smart Objects – Control Units - Communication modules (Bluetooth, Zigbee,Wifi, GPS, GSM Modules)

Unit:3	Protocols and Technologies Behind IoT	12 hours

IOT Protocols - IPv6, 6LoWPAN, MQTT, CoAP - RFID, Wireless Sensor Networks, BigData Analytics, Cloud Computing, Embedded Systems.

Unit:4	Open Platforms and Programming	12 hours

IOT deployment for Raspberry Pi /Arduino platform-Architecture –Programming – Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins – Connecting to the Cloud.

Unit:5	IoT Applications	10 hours

Business models for the internet of things, Smart city, Smart mobility and transport, Industrial IoT, Smart health, Environment monitoring and surveillance – Home Automation – Smart Agriculture.

Unit:6	Contemporary Issues	2 hours

Simplified IoT Architecture and Core IoT Functional Stack – Fog, Edge and Cloud in IoT.

	Total Lecture hours	**60 hours**
Text Book(s)		
1	Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017	
2	Samuel Greengard, The Internet of Things, The MIT Press, 2015	
Reference Books		
1	Perry Lea, "Internet of things for architects", Packt, 2018	
2	Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012	
3	IOT (Internet of Things) Programming: A Simple and Fast Way of Learning, IOT Kindle Edition.	
4	Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet of Things", Springer, 2011.	
5	ArshdeepBahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015	
6	https://www.arduino.cc/https://www.ibm.com/smarterplanet/us/en/?ca=v_smarterplanet	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://www.youtube.com/watch?v=DqM28rIhi9o&themeRefresh=1	
2	https://www.youtube.com/watch?v=h0gWfVCSGQQ	
3	https://www.youtube.com/watch?v=udXmbDGPrug	
4	youtube.com/watch?v=y0nnYfMVdDQ	
5	https://onlinecourses.nptel.ac.in/noc20_cs69/preview	
Course Designed By: Dr. J.Vijayakumar		

Mapping with Programme Outcomes															
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PO13**	**PO14**	**PO15**
O1	S	M	L	M	M	L	L	L	L	S	M	L	L	L	M
CO2	S	M	M	M	S	L	L	M	L	S	M	L	L	L	M
CO3	S	M	S	S	S	M	L	S	L	S	M	L	L	L	M
CO4	S	M	M	S	S	S	M	M	L	S	M	L	L	M	M
CO5	M	M	S	M	S	M	M	M	M	S	M	M	L	L	M
CO6	S	S	S	S	S	S	S	M	M	S	M	M	M	M	S
*S-Strong; M-Medium; L-Low															

Course code	2EB	MODERN COMMUNICATION TECHNIQUES	L	T	P	C
Core/Elective/Supportive		Elective	4	0	0	4
Pre-requisite		Basic knowledge in Communication	Syllabus Version		2026-27	

Course Objectives:

The main objectives of this course are to:

1. Understand the fundamental principles of analog communication systems and modulation techniques.
2. Analyze pulse communication methods and their performance characteristics.
3. Study digital communication techniques and compare modulation schemes.
4. Gain knowledge of optical fiber communication and signal propagation mechanisms.
5. Understand multi-user communication systems and wireless communication concepts.
6. Develop analytical and problem-solving skills in communication system design and evaluation..

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Explain the basic concepts of analog modulation techniques such as AM, FM, and PM.	K1, K2
2	Analyze pulse communication systems including PAM, PTM, and PCM	K2, K3
3	Compare digital modulation techniques like ASK, FSK, PSK, and QAM in terms of performance.	K3, K4
4	Interpret the working principles of optical fiber communication and associated losses.	K4, K5
5	Evaluate multi-user communication systems such as GSM, CDMA, and satellite communication.	K4, K5
6	Design and analyze communication systems using appropriate tools and techniques.	K4, K5

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	Analog Communication Techniques	12 hours

Introduction to Communication Systems - Modulation – Types - Need for Modulation. Theory of Amplitude Modulation - Evolution and Description of SSB Techniques - Theory of Frequency and Phase Modulation – Comparison of Analog Communication Systems (AM – FM – PM).

Unit:2	Pulse Communication Techniques	10 hours

Pulse Amplitude Modulation (PAM) – Pulse Time Modulation (PTM) – Pulse code Modulation (PCM) - Comparison of various Pulse Communication System (PAM – PTM – PCM).

Unit:3	Digital Communication Techniques	12 hours

Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK)–Phase Shift Keying (PSK) – BPSK – QPSK – Quadrature Amplitude Modulation (QAM) – 8 QAM – 16 QAM – Bandwidth Efficiency– Comparison of various Digital Communication System (ASK – FSK – PSK – QAM).

Unit:4	Optical Fiber Communication Techniques	12 hours

Structure of Fibres– Refractive index – Snell‟s Law – Total internal reflection, Signal degradation in optical fibers: Overview of attenuation - Attenuation units - scattering and absorption losses - core & cladding losses - Bending losses.

Unit:5	**Multi-User Radio Communication Techniques**	**12 hours**
Global System for Mobile Communications (GSM) - Code division multiple access (CDMA) – Cellular Concept and Frequency Reuse - Channel Assignment and Handover Techniques - Overview of Multiple Access Schemes - Satellite Communication - Bluetooth.		
Unit:6	**Contemporary Issues**	**2 hours**
Source encoding theorem, Error Control Coding		

	Total Lecture hours	**60 hours**

Text Book(s)

1	Wayne Tomasi, "Advanced Electronic Communication Systems", 6th Edition, Pearson Education, 2020.
2	Optical Fiber Communications, Gerd Keiser, McGraw Hill, 2017
3.	Martin S.Roden, "Analog and Digital Communication System", 3 rd Edition, Prentice Hall of India, 2012.
4.	B.Sklar, "Digital Communication Fundamentals and Applications" 2 nd Edition Pearson Education 2020.

Reference Books

1	Communication systems, Simon S. Haykin, Wiley Publication, 2019
2	Optical Fiber Communication, J M Senior, Principles & Practice by–Prentice Hall of India-2010

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://nptel.ac.in/courses/108/104/108104113/
2	https://nptel.ac.in/courses/117/105/117105143/

Course Designed By: Dr. K. G. Padmasine

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	L	M	M	L	L	L	M	L	L	L	L	L	L	L
CO2	S	L	M	S	M	L	L	M	L	M	L	L	L	L	L
CO3	S	M	S	S	M	L	L	M	L	M	L	L	L	L	L
CO4	S	L	M	M	S	M	L	S	L	M	L	L	L	L	L
CO5	S	M	S	S	M	M	M	M	L	M	L	M	L	L	M
CO6	S	M	S	S	S	S	M	S	M	S	S	L	L	M	S

*S-Strong; M-Medium; L-Low

Course Code	2EB	INDUSTRIAL INSTRUMENTATION	L	T	P	C
Core/Elective/Supportive		Elective	4	0	0	4
Pre-requisite:		Needed knowledge about equipment's used in industries	Syllabus Version		2026-27	

Course Objectives:

The main objectives of this course are to:

1. Understand the principles and methods of measuring viscosity and humidity using various instruments.
2. Study temperature and pressure measurement techniques and their industrial applications.
3. Analyse different flow measurement methods and their characteristics.
4. Explore advanced electrical type flow meters and their working principles.
5. Understand level measurement techniques and the operation of industrial transmitters.
6. Develop skills in the selection, calibration, and installation of instrumentation systems.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Explain the working principles of viscosity and humidity measurement instruments.	K2, K3
2	Analyze temperature and pressure measurement techniques and select suitable sensors for industrial applications	K3, K4
3	Evaluate various flow measurement devices and their performance characteristics.	K4, K5
4	Apply the principles of electrical type flow meters in real-time measurement systems	K3, K4
5	Analyze level measurement techniques and the operation of smart transmitters.	K3, K4
6	Design and implement appropriate calibration and installation procedures for industrial instruments	K5, K6

K1 - Remember; **K2 -** Understand; **K3 -** Apply; **K4 -** Analyze; **K5 -** Evaluate; **K6 -** Create

Unit:1	Measurement Of Viscosity & Humidity	12 hours

Viscosity: Saybolt viscometer - Rotameter type and Torque type viscometers. Humidity: Dry and wet bulb psychrometers – Resistive and capacitive type hygrometers – Dew cell – Commercial type dew meter.

Unit:2	Temperature & Pressure Measurement	12 hours

Definitions and standards –Different types of filled in system thermometers – Bimetallic thermometers – IC sensors – Thermocouples, Signal conditioning for thermocouple, Commercial circuits for cold junction compensation,, Special techniques for measuring high temperature using thermocouple –- Radiation methods of temperature measurement – Total radiation pyrometers – Optical pyrometers – Fiber optic sensor for temperature measurement – Thermograph – Temperature sensor selection, Installation and Calibration, Manometers: Different types, Bourdon tube, Bellows, Diaphragms and Capsules, Pressure gauge selection, installation and calibration using dead weight tester.

Unit:3	Flow Measurement	12 hours

Orifice plate: different types of orifice plates – Cd variation – pressure tapping– Venturi tube – Flow nozzle – Dall tube – Pitot tube, Installation and applications of head flowmeters, Positive displacement flow meters, Rotameter –theory, characteristics, installation and applications, Mass flow meter, Calibration of flow meters: – Dynamic weighing method.

Unit:4	**Electrical Type Flow Meters**	**10 hours**
Principle and constructional details of Electromagnetic flow meter – Ultrasonic flow meters – Laser Doppler anemometer – Vortex shedding flow meter – Target flow meter – Guidelines for selection of flow meter – Open channel flow measurement – Solid flow rate measurement.		
Unit:5	**Level Measurement And Transmitter**	**12 hours**
Level measurement: Float gauges - Displacer type, Ultrasonic gauge – Boiler drum level measurement :– Differential pressure method and Hydrastep method - Solid level measurement, Operation of Electronics and Smart transmitters – Principle of operation of flow, level, temperature and pressure transmitters.		
Unit:6	**Contemporary Issues**	**2 hours**
Moisture: Different methods of moisture measurements, Application of moisture measurement - Moisture measurement in solids.		
	Total Lecture hours	**60 hours**

Text Book(s)	
1	Doebelin, E.O. and Manik, D.N., "Measurement systems Application and Design", 6thMcGraw-Hill Education Pvt. Ltd,2011.
2	A.K. Sawhney and PuneetSawhney, "Mechanical Measurements and Instrumentation and Control", DhanpatRai& Co. (P) Limited, 2015.
Reference Books	
1	Liptak, B.G., "Instrumentation Engineers Handbook (Measurement)", CRC Press,2015.
2	Patranabis, D., "Principles of Industrial Instrumentation", 3rd Edition, McGraw-Hill Education,2017.
3	Eckman D.P., "Industrial Instrumentation", Wiley Eastern Limited,2020.
4	Singh,S.K., "Industrial Instrumentation and Control", Tata Mc-Graw-Hill Education Pvt. Ltd., New Delhi,2019.
5	https://swayam.gov.in/ Principles of Industrial Engineering
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	http://instrumentationtoolbox.com
2	Our instrumentation.com
3	https://www.youtube.com/watch?v=p23u0HLOkwU
4	Home Instrumentation Tools

Course Designed By: Dr. J.Vijayakumar

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	L	M	M	L	L	L	M	L	L	L	L	L	L	L
CO2	S	M	M	S	M	L	L	M	L	M	L	L	L	L	L
CO3	S	M	S	S	M	L	L	M	L	M	L	L	L	L	L
CO4	S	M	M	S	M	M	L	M	L	S	L	L	L	L	L
CO5	S	M	M	S	M	M	L	M	L	S	L	L	L	L	L
CO6	S	S	M	S	S	S	M	M	M	S	M	L	M	M	S

*S-Strong; M-Medium; L-Low

Course code	2EB	ROBOTICS AND AUTOMATION	L	T	P	C
Core/Elective/Supportive		Elective	4	0	0	4
Pre-requisite		Basic mathematics, mechanical knowledge is Important	Syllabus Version		2026-27	

Course Objectives:

The main objectives of this course are to:

1. Understand the basic concepts, classifications, and evolution of robotic systems.
2. Study different power sources, sensors, and actuators used in robotics.
3. Analyse the construction and control of manipulators and end effectors.
4. Understand robot kinematics and path planning techniques.
5. Study robot dynamics and control strategies.
6. Explore industrial and non-industrial applications of robots and their selection criteria.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Explain the fundamental concepts, classifications, and laws governing robotic systems.	K2, K3
2	Analyze the working of power sources, sensors, and actuators used in robotic systems	K3, K4
3	Evaluate manipulator design, grippers, and control mechanisms for robotic applications.	K4, K5
4	Apply kinematic models and path planning techniques to solve robotic motion problems	K3, K4
5	Analyze dynamic models and implement control strategies such as PID for robotic systems.	K3, K4
6	Design and select suitable robotic systems for industrial and real-world applications	K5, K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Basic Concepts	12 hours

Definition and origin of robotics – different types of robotics – various generations of robots – degrees of freedom – Robot classifications and specifications- Asimov's laws of robotics – dynamic stabilization of robots

Unit:2	Power Sources, Sensors and Actuators	12 hours

Hydraulic, pneumatic and electric drives: Design and control issues – determination of HP of motor and gearing ratio – variable speed arrangements – path determination – micro machines in robotics – machine vision – ranging – laser – acoustic – magnetic, fiber optic and tactile sensors.

Unit:3	Manipulators and Grippers Differential Motion	12 hours

Construction of manipulators – manipulator dynamics and force control – electronic and pneumatic manipulator control circuits – end effectors – U various types of grippers – design considerations.

Unit:4	Kinematics and Path Planning	12 hours

Linear and angular velocities-Manipulator Jacobian-Prismatic and rotary joints–Inverse -Wrist and arm singularity - Static analysis - Force and moment Balance Solution kinematics problem – robot programming languages.

Unit:5	Dynamics and Control and Applications	10 hours

Lagrangian mechanics-2DOF Manipulator-Lagrange Euler formulation - Dynamic model – Manipulator control problem-Linear control schemes-PID control scheme-Force control of robotic manipulator. Multiple robots – machine interface – robots in manufacturing and non-manufacturing applications – robot cell design – selection of robot.		
Unit:6	**Contemporary Issues**	**2 hours**
application of Robotic Painting, application of part transfer and machine tending		

	Total Lecture hours	**60 hours**
Text Book(s)		
1	Mikell P. Weiss G.M., Nagel R.N., Odraj N.G., Industrial Robotics, McGraw-Hill Singapore, 2015.	
2	Saeed B Niku, Introduction to Robotics, Analysis, Systems, Applications Prentice Hall, 3 edition 2014.	
Reference Books		
1	Deb.S.R., Robotics technology and flexible Automation, John Wiley, USA 2022.	
2	Asfahl C.R., Robots and manufacturing Automation, John Wiley, USA 2020.	
3	Klafter R.D., Chimielewski T.A., Negin M., Robotic Engineering – An integrated approach, Prentice Hall of India, New Delhi, 2019.	
4	R.K.Mittal and I.J.Nagrath, Robotics and Control, Tata McGraw Hill, New Delhi,4th Reprint, 2015	
5	JohnJ.Craig ,Introduction to Robotics Mechanics and Control, Third edition, Pearson Education,2019.	
6	Issac Asimov I Robot, Ballantine Books, New York, 2018.	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://nptel.ac.in/courses/112/101/112101098/	
2	https://nptel.ac.in/courses/112/105/112105249/	
3	https://nptel.ac.in/courses/112/101/112101099/	
Course Designed By: Dr.J.Vijayakumar		

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	L	M	M	L	L	L	M	L	L	L	L	L	L	L
CO2	S	M	M	S	M	L	L	M	L	M	L	L	L	L	L
CO3	S	M	S	S	M	M	L	M	L	M	L	L	L	L	L
CO4	S	M	S	S	S	M	L	M	L	S	L	L	L	L	L
CO5	S	M	S	S	S	S	L	M	L	S	L	L	L	L	L
CO6	S	S	M	S	S	S	M	M	M	S	M	L	M	L	L

*S-Strong; M-Medium; L-Low

Course code	3EA	ANALYTICAL INSTRUMENTATION	L	T	P	C
Core/Elective/Supportive		Elective	4	0	0	4
Pre-requisite		Student should have the basic knowledge on Instrumentation	Syllabus Version		2026-27	

Course Objectives:

The main objectives of this course are to:

1. Understand the principles and operation of colourimetry and spectrophotometric analysis techniques.
2. Study various chromatographic techniques and their industrial applications.
3. analyze industrial gas analyzers and pollution monitoring instruments.
4. Understand pH measurement and dissolved component analyzers.
5. Study radiochemical and magnetic resonance analytical techniques.
6. Develop skills in selecting and applying analytical instruments for industrial and research applications.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Explain the principles and working of colourimeters and spectrophotometers.	K2, K3
2	Analyze chromatographic techniques and their applications in chemical analysis	K3, K4
3	Evaluate the performance of industrial gas analyzers and pollution monitoring instruments	K4, K5
4	Apply principles of pH measurement and dissolved component analysis using appropriate sensors	K3, K4
5	Analyze radio chemical and magnetic resonance techniques for advanced material analysis	K4, K5
6	Design and select suitable analytical instruments for industrial and research applications	K5, K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	Colorimetry and Spectrophotometry	12 hours

Special methods of analysis- Beer-Lambert law-colorimeters-UV-ViS Spectrophotometers-Single and double beam Instruments-Sources and detectors-IR Spectrophotometers-Types-Attenuated total reflectance flame photometers- Atomic absorption spectrophotometers-sources and detectors-FTIR Spectrophotometers-Flame emission photometers.

Unit:2	Chromotography	10 hours

Different techniques - Gas chromatography – Detectors - Liquid chromatographs – Applications - High pressure liquid chromatographs - Applications.

Unit:3	Industrial Gas Analyzers and Pollution Monitoring Instruments	12 hours

Types of gas Analyzers-Oxygen, NO2 and H2S types, IR analyzers, thermal conductivity analyzers, analysis based on ionization of gases. Air pollution due to carbon monoxide, hydrocarbons, nitrogen oxides, sulphur dioxide estimation-dust and smoke measurements. .

Unit:4	pH Meters And Dissolve Component Analyzers	12 hours

Principle of pH measurement, glass electrodes, hydrogen electrodes, reference electrodes, selective ion electrodes, ammonia electrodes, biosensors, dissolved oxygen analyzer-sodium analyzer-silicon analyzer.

Unit:5	Radiochemical and Magnetic Resonance Techniques	12 hours
Nuclear radiations Detectors-GM Counter-Proportional Counter-Solid state Detector-Gamma cameras X-ray spectroscopy-Detectors-Diffract meters-Absorption meters-Detectors NMR-Basic principles NMR spectrometer-Applications. Mass Spectrometers-Different Types-Applications.		
Unit:6	**Contemporary Issues**	**2 hours**
Blood Gas Analysers, Blood Cell Counters,		

	Total Lecture hours	**60 hours**

Text Book(s)

1	R.S. Khandpur, "Handbook of Analytical Instruments" Tata Mc Graw Hill publishing Co.Ltd.2017.
2	H.H.Willard, L.L.Merrit, J.A.Dean, F.A.Settle, "Instrumental methods of analysis" CBS publishing & distribution, 2018.

Reference Books

1	Robert D.Braun, "Introduction to Instrumental Analysis" Mc Graw Hill, Singapore, 2011.
2	G.W. Ewing, "Instrumental Methods of Analysis" Mc Graw Hill 2016.
3	DA Skoog and D.M.West, "Principles of Instrumental Analysis" Harper and Row publishers, 2018.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	Academy-Online/pdf
2	lecturenotes.in/instrumentation.pdf
3	https://nptel.ac.in/courses/103/108/103108100/

Course Designed By: Dr.K.G.Padmasine

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	L	M	M	L	L	L	M	L	L	L	L	L	L	L
CO2	S	M	M	S	M	L	L	M	L	M	L	L	L	L	L
CO3	S	M	S	S	M	M	L	M	L	M	L	L	M	L	L
CO4	S	M	M	S	M	M	L	M	L	S	L	L	L	L	L
CO5	S	M	S	S	S	S	L	M	L	S	L	L	L	L	L
CO6	S	S	M	S	S	S	M	M	M	S	M	L	M	M	S

*S-Strong; M-Medium; L-Low

Course Code	3EB	MEDICAL IMAGING SYSTEMS	L	T	P	C
Core/Elective/Supportive		Elective	4	0	0	4
Pre-requisite:		Basic knowledge about medical equipment's	Syllabus Version		2026-27	

Course Objectives:

The main objectives of this course are to:

1. Understand the fundamentals of X-ray generation, imaging systems, and radiographic techniques.
2. Study the principles and image reconstruction techniques in Computed Tomography (CT).
3. Understand the physics and system components of Magnetic Resonance Imaging (MRI).
4. Analyze nuclear imaging techniques and radiation detection methods.
5. Study radiation therapy techniques and safety measures in medical applications.
6. Develop the ability to select appropriate medical imaging and radiation instruments for clinical applications.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Explain the principles and components of X-ray imaging systems and radiographic techniques.	K2, K3
2	Analyze CT imaging systems and reconstruction techniques such as back projection and iterative methods	K3, K4
3	Apply the principles of magnetic resonance to explain MRI system operation and image formation	K3, K5
4	Evaluate nuclear imaging techniques and radiation detectors used in medical diagnostics.	K4, K5
5	Analyze radiation therapy techniques and radiation safety measures in medical practice	K4, K5
6	Design and select suitable imaging modalities and radiation instruments for specific clinical applications	K5, K6

K1 - Remember; **K2 -** Understand; **K3 -** Apply; **K4 -** Analyze; **K5 -** Evaluate; **K6 -** Create

Unit:1	X Rays	12 hours

Nature of X-rays- X-Ray absorption – Tissue contrast. X- Ray Equipment (Block Diagram) – X-Ray Tube, the collimator, Bucky Grid, power supply, Digital Radiography - discrete digital detectors, storage phosphor and film scanning, X-ray Image Intensifier tubes – Fluoroscopy – Digital Fluoroscopy. Angiography, cine Angiography. Digital subtraction Angiography. Mammography.

Unit:2	Computed Tomography	12 hours

Principles of tomography, CT Generations, X- Ray sources- collimation- X- Ray detectors – Viewing systems – spiral CT scanning – Ultra fast CT scanners. Image reconstruction techniques – back projection and iterative method.

Unit:3	Magnetic Resonance Imaging	12 hours

Fundamentals of magnetic resonance- properties of electromagnetic waves : speed , amplitude, phase, orientation and waves in matter - Interaction of Nuclei with static magnetic field and Radio frequency wave- rotation and precession – Induction of magnetic resonance signals – bulk magnetization – Relaxation processes T1 and T2. Block Diagram approach of MRI system – system magnet (Permanent, Electromagnet and Superconductors), generations of gradient magnetic fields, Radio Frequency coils (sending and receiving), shim coils, Electronic components, fMRI.

Unit:4	Nuclear Imaging	10 hours
Radioisotopes- alpha, beta, and gamma radiations. Radio Pharmaceuticals. Radiation detectors – gas filled, ionization chambers, proportional counter, GM counter and scintillation Detectors, Gamma camera – Principle of operation, collimator, photomultiplier tube, X-Y positioning circuit, pulse height analyzer. Principles of SPECT and PET		
Unit:5	**Radiation Therapy and Radiation Safety**	**12 hours**
Radiation therapy – linear accelerator, Telegamma Machine. SRS – SRT – Recent Techniques in radiation therapy – 3D CRT – IMRT – IGRT and Cyber knife – radiation measuring instruments Dosimeter, film badges, Thermo Luminescent dosimeters – electronic dosimeter – Radiation protection in medicine – radiation protection principles		
Unit:6	**Contemporary Issues**	**2 hours**
Gamma camera – Principle of operation, collimator, photomultiplier tube, X-Y positioning circuit, pulse height analyzer. Principles of SPECT and PET		
	Total Lecture hours	**60 hours**

Text Book(s)

1	Isaac Bankman, I. N. Bankman , Handbook Of Medical Imaging: Processing and Analysis(Biomedical Engineering),Academic Press,2010
2	Jacob Beutel (Editor), M. Sonka (Editor), Handbook of Medical Imaging, Volume 2. Medical Image Processing and Analysis , SPIE Press 2010
3	Khin Wee Lai, DyahEkashantiOctorinaDewi "Medical Imaging Technology", Springer Singapore, 2015

Reference Books

1	Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw – Hill, New Delhi, 2003.
2	Dougherty, Geoff (Ed.), "Medical Image Processing - Techniques and Applications ",Springer-Verlag New York, 2011

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://www.britannica.com/science/X-ray/Production-and-detection-of-X-rays
2	https://www.cancer.gov/about-cancer/diagnosis-staging/ct-scans-fact-sheet
3	https://www.hopkinsmedicine.org/health/treatment-tests-and-therapies/magnetic-resonance-imaging-mri#:~:text=What%20is%20MRI%3F,large%20magnet%20and%20radio%20waves.
4	https://stanfordhealthcare.org/medical-tests/n/nuclear-imaging.html
5	https://www.dana-farber.org/radiation-oncology/safety/

Course Designed By: Dr. J.Vijayakumar

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	L	M	M	L	L	L	M	L	L	L	L	M	L	L
CO2	S	M	M	S	M	L	L	M	L	M	L	L	L	L	L
CO3	S	M	S	S	M	M	L	M	L	S	L	L	L	L	L
CO4	S	M	S	S	M	S	L	M	L	S	L	L	M	L	L
CO5	S	M	S	S	S	S	L	M	L	M	L	L	S	L	L
CO6	S	S	M	S	S	S	M	M	M	S	M	L	S	M	S

*S-Strong; M-Medium; L-Low

Course code	3EC	MICROWAVE THEORY AND TECHNIQUES	L	T	P	C
Core/Elective/Supportive		Elective	4	0	0	4
Pre-requisite		Basic mathematics	Syllabus Version		2026-27	

Course Objectives:

The main objectives of this course are to:

1. Understand the fundamentals of microwave frequency spectrum and wave propagation.
2. Analyze microwave transmission lines and impedance matching techniques.
3. Study waveguides, their characteristics, and microwave passive devices.
4. Understand the operation of microwave tubes and beam devices.
5. Explore semiconductor microwave devices and their working principles.
6. Apply microwave concepts in practical communication and instrumentation systems

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Explain microwave fundamentals, wave propagation, and frequency spectrum.	K2, K3
2	Analyze transmission line parameters and impedance matching techniques in microwave systems.	K3, K4
3	Evaluate waveguide structures and microwave passive components.	K4, K5
4	Analyze the operation of microwave tubes such as klystron and magnetron.	K3, K4
5	Evaluate the characteristics of microwave semiconductor devices such as Gunn and IMPATT diodes	K4, K5
6	Design and analyze microwave systems for communication and industrial applications.	K5, K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Introduction To Microwaves	8 hours

History of Microwaves, Frequency spectrum, Microwave frequency bands, Applications of microwaves in different fields , Plane waves and free space propagation, TE and TM waves, TEM (Transverse electromagnetic) waves, group and phase velocities

Unit:2	Microwave Transmission Lines And Analysis	12 hours

Review of transmission lines, characteristic impedance-open circuit, closed circuit, quarter wavelength and half wavelength lines, Standing wave ratio, VSWR, Reflection coefficient, Impedance matching, coaxial, strip and microstrip transmission lines (introduction).

Unit:3	Waveguides And Devices	13 hours

Introduction to waveguides, Propagation through wave guides, Guided waves slow waves and fast waves, rectangular and circular wave guides, cut off frequency, group velocity, Waveguide Tees, Magic Tees, Rat Race, Directional couplers, Isolators, attenuators, resonator and circulators.

Unit:4	Microwave Linear Beam Tubes And Cross Field Devices	13 hours

Introduction, Microwave tubes, limitations of conventional tubes, Transit time effects, Multi cavity Klystron, re-entrant cavities, Velocity modulation and beam bunching, bunching diagrams, reflex klystron, magnetron, working of magnetron, travelling wave tubes-slow wave structures-amplification mechanism.		
Unit:5	**Transferred Electron Devices And Transit Time Devices**	**12 hours**
Gunn Effect and Gunn diode-modes of operation, Microwave Semiconductor devices, Tunnel diodes- negative resistance-band theory for forward and reverse biasing, Schottky diodes, Point contact diodes, Varactor diodes, IMPATTT diode-structure-negative resistance-efficiency and output power, TRAPATT diode-principle of operation and performance.		
Unit:6	**Contemporary Issues**	**2 hours**
Smith chart, Impedance matching		
	Total Lecture hours	**60 hours**

Text Book(s)

1	Microwave Engineering, D. M. Pozar, John Wiley & Sons Inc, 2013.
2	Foundations for Microwave Engineering-2nd Edition, R. E. Collin, Wiley-IEEE Press, 2017.
3	Microwave Engineering, A. Das and S. K. Das, Tata McGraw-Hill, 2017

Reference Books

1	Microwave devices and circuits, Samuel Y. Lio, (Prentice Hall)-2013
2	Electronic communication systems, Kennedy and Davis, – (Tata Mc Graw Hill) - 2011
3	Microwave Engineering Passive Circuits, P. A. Rizzi, Pearson, 2010.

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1	https://nptel.ac.in/courses/108/103/108103141/
2	https://nptel.ac.in/courses/117/105/117105122/
3	https://nptel.ac.in/courses/108/101/108101112/

Course Designed By: Dr.K.G.Padmasine

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
O1	S	L	M	M	L	L	L	M	L	L	L	L	L	L	L
CO2	S	M	M	S	M	L	L	M	L	M	L	L	L	L	L
CO3	S	M	S	S	M	M	L	M	L	M	L	L	L	L	L
CO4	S	M	M	S	M	M	L	M	L	M	L	L	L	L	L
CO5	S	M	S	S	S	M	L	M	L	S	L	L	L	L	L
CO6	S	S	M	S	S	S	M	M	M	S	M	L	M	M	S

*S-Strong; M-Medium; L-Low

Supportive Course

Course code	GS1	DIGITAL ELECTRONICS AND MICROPROCESSOR	L	T	P	C
Core/Elective/Supportive		Supportive	2	0	0	2
Pre-requisite		Graduate level Electronics knowledge	Syllabus Version		2026-27	

Course Objectives:

The main objectives of this course are to:

1. Understand the fundamentals of digital logic gates and combinational circuits.
2. Study number systems, codes, and their interconversions.
3. Analyze arithmetic and logic circuits used in digital systems.
4. Understand sequential circuits such as shift registers.
5. Study the architecture and instruction set of the 8085 microprocessor.
6. Develop basic programming and interfacing skills using the 8085 microprocessor

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Explain logic gates, Boolean theorems, and basic combinational circuits.	K2, K3
2	Apply number system conversions and coding techniques in digital systems	K3, K4
3	Analyse arithmetic circuits such as adders and subtractors	K4, K5
4	Explain the operation of sequential circuits like shift registers.	K3, K4
5	Analyze the architecture and instruction set of the 8085 microprocessor.	K4, K5
6	Develop assembly language programs and interface memory with the 8085 microprocessor.	K5, K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Logic Gates	6 hours

Different Logic gates such as AND, OR, NOT, NAND, NOR, EXOR, Symbol and Truth Table, De Morgan‟s Theorems: Statement, verification and applications, Half-adder. Full adder, Half Subtractor and full subtractor, Shift register

Unit:2	Number Systems	6 hours

Introduction to Decimal, Binary, Octal, Hexadecimal Number Systems, BCD Codes, Inter conversions of Decimal, Binary, and BCD Numbers, Parity, Excess-3.

Unit:3	Microprocessor	6 hours

Architecture and Programming of 8085 - functional Block diagrams, bus systems, Instruction set and addressing modes- timing diagram and assembly level programme- Interfacing RAM and ROM sections.

Unit:4	Contemporary Issues	2 hours

Introduction to ARM, Introduction to 8086

	Total Lecture hours	20 hours

Text Book(s)

1	Microprocessor Architecture Programming and applications with 8085, Ramesh Gaonkar, Penram International Publishing house,-2013
2	Digital Principles and Applications, Donald P. Leach, Albert Paul Malvino, TataMcGraw Hill Company – 2010

Reference Books

1	Electronic Devices and Circuits, Salivahanan ,Tata-McGraw Hill Company-2011

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	https://nptel.ac.in/courses/108/105/108105102/
2	https://nptel.ac.in/courses/106/108/106108100/
3	https://nptel.ac.in/courses/108/103/108103157/
Course Designed By: Dr. J.Vijayakumar	

Mapping with Programme Outcomes															
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PO13**	**PO14**	**PO15**
CO1	S	L	M	M	L	L	L	M	L	L	L	L	L	L	L
CO2	S	L	M	S	M	L	L	M	L	M	L	L	L	L	L
CO3	S	M	M	S	M	L	L	M	L	M	L	L	L	L	L
CO4	S	L	M	M	L	L	L	M	L	L	L	L	L	L	L
CO5	S	M	S	S	M	M	L	M	L	S	L	L	L	L	L
CO6	S	M	M	S	S	M	M	M	M	S	M	L	M	M	S
*S-Strong; M-Medium; L-Low															

Course code	GS2	MEDICAL ELECTRONICS AND INSTRUMENTATION	L	T	P	C
Core/Elective/Supportive		Supportive	2	0	0	2
Pre-requisite		Awareness study of the instruments related with the medical field to the other department students	Syllabus Version	2026-27		

Course Objectives:

The main objectives of this course are to:

1. Understand the structure and functioning of biological cells and bioelectric phenomena.
2. Explain the principles of bioelectric potentials and their role in medical instrumentation.
3. Study the design and components of biomedical instrumentation systems.
4. analyze the working principles of biopotential recording instruments such as ECG, EEG, and EMG.
5. Gain knowledge of specialized medical diagnostic equipment, like CT and ultrasound systems.
6. Develop the ability to apply instrumentation concepts in medical diagnostics and healthcare applications.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Explain cell structure, ion transport mechanisms, and bioelectric potentials.	K1, K2
2	Interpret resting and action potentials and their significance in biomedical systems.	K2, K3
3	Analyze the design and functional components of biomedical instrumentation systems.	K3, K4
4	Evaluate the principles and applications of biopotential recorders such as ECG, EEG, and EMG	K4, K5
5	Assess the working and applications of advanced medical equipment like CT and ultrasonic imaging systems	K5, K6
6	Develop solutions using biomedical instrumentation concepts for healthcare applications	K3, K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit:1	Medical Instrumentation Basics	6 hours

Cells and their structure – Transport of ions through the cell membrane – Resting and action potentials Characteristics of Resting potential - Bio-electric potentials – Design of Medical Instruments – Components of the Bio-Medical Instrument System.

Unit:2	Biopotential Recorders	6 hours

Electrocardiography (ECG) - Electroencephalography (EEG)–Electromyography (EMG) - Electroretinography (ERG) – Electrooculography (EOG)

Unit:3	Specialized Medical Equipment	6 hours

Angiography – Endoscopes – Different types of endoscopes -Computer tomography – Application of Computer tomography - Ultrasonic imaging systems.

Unit:4	Contemporary Issues	2 hours

X-ray machine- Magnetic resonance imaging

	Total Lecture hours	**20 hours**
Text Book(s)		
1	M.Arumugam, " Biomedical Instrumentation" Anuradha Publications,	
2	R.Anandanatarajan, " Biomedical Instrumentation" PHI learning, 2017	
Reference Books		
1	R.S.Khandpur, " Handbook of Biomedical Instrumentation" Tata Mc Graw Hill, New Delhi, 2nd Edition, 2013	
2	Ason, "Principles of Biomedical Instrumentation and measurements" Mc Graw Hill publishing Co. 2010	
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]		
1	https://nptel.ac.in/courses/127/106/127106134/	
2	https://nptel.ac.in/courses/108/105/108105101/	
3	https://swayam.gov.in/nd1_noc19_ge33/preview	
4	https://swayam.gov.in/nd1_noc19_bt28/preview	
Course Designed By: Dr.S.Rathinavel		

Mapping with Programme Outcomes															
Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PO13**	**PO14**	**PO15**
CO1	S	L	M	L	M	L	L	M	L	L	M	L	L	L	M
CO2	S	L	M	M	M	L	L	M	L	L	M	L	L	L	M
CO3	S	M	M	S	S	M	L	M	L	M	M	L	L	L	M
CO4	S	M	S	S	M	M	L	M	L	M	M	L	L	L	M
CO5	S	M	S	S	S	M	L	M	L	M	M	L	L	L	M
CO6	S	S	S	S	M	S	M	M	M	S	S	L	M	M	S
*S-Strong; M-Medium; L-Low															

Course code	GS3	ANALYTICAL INSTRUMENTATION	L	T	P	C
Core/Elective/Supportive		Supportive	2	0	0	2
Pre-requisite		Student should have the basic knowledge on Instrumentation	Syllabus Version		2026-27	

Course Objectives:

The main objectives of this course are to:

1. Understand the fundamentals of electromagnetic radiation and its interaction with matter.
2. Study the principles and working of spectrophotometric and calorimetric instruments.
3. Analyse different types of spectrophotometers and their applications.
4. Gain knowledge of chromatographic techniques and instrumentation.
5. Understand the operation of industrial gas analyzers and pollution monitoring instruments.
6. Apply analytical instrumentation techniques for environmental and industrial measurements.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Explain electromagnetic radiation, spectrum, and interaction with matter.	K1, K2
2	Interpret the working principles of spectrophotometers based on Beer-Lambert law	K2, K3
3	Analyze different spectrophotometric instruments such as UV-Vis, IR, and atomic absorption systems	K3, K4
4	Evaluate chromatographic techniques including gas and liquid chromatography.	K4, K5
5	Assess the performance of industrial gas analyzers and pollution monitoring instruments.	K5, K6
6	Apply analytical instrumentation techniques for industrial and environmental problem solving	K3, K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	Calorimetry and Spectrophotometry	8 hours

Electromagnetic Radiation-Electromagnetic Spectrum-Interaction of radiation with Matter-Beer Lambert Law-Absorption instruments-UV-ViS spectrophotometers- Single beam null type (Beckman model), Spectronic 21 Spectrophotometer- IR Spectrophotometers-Block diagram of double beam IR Spectrophotometer- Atomic absorption spectrophotometers-FTIR Spectrophotometers-Flame Photometers-Principle- Essential Parts- Block Diagram- Emission System.

Unit:2	Chromatography	5 hours

Gas chromatography-Block diagram-Basic parts-Sample injection system chromatography columnsThermal conductivity detector - Liquid chromatographs-Types of liquid chromatography- High pressure liquid chromatographs

Unit:3	Industrial Gas Analyzers and Pollution Monitoring Instruments	5 hours

Types of gas Analyzers-Oxygen, NO2 and H2S types, IR analyzers, thermal conductivity analyzers, analysis based on ionization of gases. Air pollution due to carbon monoxide, hydrocarbons, nitrogen oxides, sulphur dioxide estimation-dust and smoke measurements. .

Unit:4	Contemporary Issues	2 hours

Blood Gas Analysers, Blood Cell Counters,

	Total Lecture hours	20 hours

Text Book(s)	
	R.S. Khandpur, "Handbook of Analytical Instruments" Tata Mc Graw Hill publishing Co.Ltd.2016.
Reference Books	
1	Robert D.Braun, "Introduction to Instrumental Analysis" Mc Graw Hill, Singapore, 2010.
2	G.W. Ewing, "Instrumental Methods of Analysis" Mc Graw Hill 2015.
3	DA Skoog and D.M.West, "Principles of Instrumental Analysis" Harper and Row publishers, 2017.
Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]	
1	Academy-Online/pdf
2	lecturenotes.in/instrumentation.pdf
3	https://nptel.ac.in/courses/103/108/103108100/
Course Designed By: Dr. K. G. Padmasine	

Mapping with Programme Outcomes

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15
CO1	S	L	M	L	M	L	L	M	L	L	M	L	L	L	M
CO2	S	L	M	M	M	L	L	M	L	M	M	L	L	L	M
CO3	S	M	M	S	S	M	L	M	L	M	M	L	L	L	M
CO4	S	M	S	S	M	M	L	M	L	M	M	L	L	L	M
CO5	S	M	S	S	S	M	L	M	L	M	M	L	L	L	M
CO6	S	S	S	S	M	S	M	M	M	S	S	L	L	L	L

*S-Strong; M-Medium; L-Low

Value Added & Certificate Course

Course code	1VA	DISASTER MANAGEMENT	L	T	P	C
Core/Elective/Supportive		Value Added Course	2	0	0	2
Pre-requisite		Exposure to the languages of Hazard and Disaster	Syllabus Version		2026-27	

Course Objectives:

The main objectives of this course are to:

1. Introduce the fundamental concepts of disasters, hazards, and their classifications.
2. Understand various disaster-prone regions in India and their characteristics.
3. Analyse the environmental, economic, and societal impacts of disasters.
4. Study different types of natural and man-made disasters and their consequences.
5. Develop knowledge on disaster risk assessment and mitigation strategies.
6. Promote awareness on disaster preparedness, management, and survival strategies.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Explain the concepts of disasters, hazards, and their classifications	K1, K2
2	Identify disaster-prone regions in India and describe their vulnerability.	K2, K3
3	Analyze the impacts of natural and man-made disasters on society and environment.	K3, K4
4	Evaluate different types of disasters and their repercussions.	K4, K5
5	Apply risk assessment techniques to disaster management scenarios	K5, K6
6	Propose strategies for disaster preparedness, mitigation, and survival.	K3, K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	Introduction	6 hours

Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Unit:2	Disaster Prone Areas in India	6 hours

Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides and Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics

Unit:3	Repercussions of Disasters and Hazards	6 hours

Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

Unit:4	Risk Assessment	6 hours

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival

	Total Lecture hours	25 hours

Text Book(s)

1	Goel S. L., Disaster Administration And Management Text And Case Studies",Deep& Deep Publication Pvt. Ltd., New Delhi,2009.
2	NishithaRai, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal

	book Company, 2007.
3	Sahni, PardeepEt.Al. ," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi, 2001.
Course Designed By: Dr. K. G. Padmasine	

Mapping with Programme Outcomes															
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PO13**	**PO14**	**PO15**
CO1	M	L	M	L	L	L	L	M	L	L	L	L	M	L	L
CO2	M	L	M	M	L	L	L	M	L	L	M	L	M	L	L
CO3	M	M	S	M	M	L	L	S	L	L	M	L	M	L	M
CO4	M	M	S	S	M	M	L	S	L	L	M	L	M	L	M
CO5	M	L	S	S	S	M	M	S	M	M	M	L	M	L	M
CO6	M	S	M	S	M	S	M	S	M	M	S	M	S	M	S
*S-Strong; M-Medium; L-Low															

Course code	2CA	EMBEDDED SYSTEM DESIGN USING ARM/ CORTEX MICROCONTROLLER	L	T	P	C
Core/Elective/Supportive		Certificate course	2	0	0	2
Pre-requisite		Students should have basic knowledgeof C	Syllabus Version	2026-27		

Course Objectives:

The main objectives of this course are to:

1. Introduce Embedded C programming concepts using the KEIL development environment.
2. Understand the architecture of ARM/Cortex microcontrollers.
3. Develop knowledge on memory organisation and register configuration.
4. Learn the configuration and operation of ARM/Cortex peripherals.
5. Acquire skills in interfacing microcontrollers with external devices.
6. Enable the design and implementation of embedded system applications.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Explain Embedded C programming concepts and implement basic programs using KEIL	K1, K3
2	Describe ARM/Cortex architecture, memory mapping, and register configuration.	K2, K3
3	Apply configuration techniques for timers, interrupts, and serial communication	K3, K4
4	Analyze the functioning of ARM/Cortex peripherals in embedded applications.	K4, K5
5	Interface ARM/Cortex microcontrollers with external devices such as LCD, keyboard, and stepper motor.	K3, K6
6	Design and develop embedded system solutions using ARM/Cortex microcontrollers.	K3, K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	Introduction to Embedded C	5 hours

Solve Embedded C Programming with KEIL

Unit:2	ARM/Cortex Architecture	5 hours

Identify the Architecture of ARM/Cortex Family of Microcontrollers, Memory map peripherals Register Configuration

Unit:3	Generalize ARM/Cortex Peripherals	4hours

Configure Timers on ARM/Cortex Family of Microcontrollers-Configure Interrupts on ARM/Cortex Family of Microcontrollers-Configure Serial port on ARM/Cortex Family of Microcontrollers

Unit:4	Interfacing ARM/ Cortex to peripheral devices	4 hours

Interpret ARM/Cortex Family of Microcontrollers with LCD - Interfacing ARM/Cortex Family of Microcontrollers with keyboard - Interpret ARM/Cortex Family of Microcontrollers with stepper motor

	Total Lecture hours	18 hours

Text Book(s)

1	https://nptel.ac.in/courses/117/106/117106111/
2	https://nptel.ac.in/courses/106/105/106105193/

Course Designed By: Dr. S. Rathinavel

Mapping with Programme Outcomes															
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PO13**	**PO14**	**PO15**
CO1	S	M	M	M	L	L	L	M	L	S	M	L	L	L	M
CO2	S	L	M	M	M	L	L	M	L	M	M	L	L	L	M
CO3	S	M	S	S	M	M	L	S	L	S	M	L	L	L	M
CO4	S	M	S	S	S	M	L	S	M	S	M	L	M	L	M
CO5	S	M	S	S	M	S	M	S	M	S	M	L	M	M	M
CO6	S	S	S	S	S	S	M	S	M	S	S	L	L	L	L
*S-Strong; M-Medium; L-Low															

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Course code	3VA	HEALTH AND WELLNESS	L	T	P	C
Core/Elective/Supportive		Value added	2	0	0	1
Pre-requisite		Students should have basic knowledge of health and wellness	Syllabus Version	2026-27		

Course Objectives:

The main objectives of this course are to:

1. Understand the concepts of health, wellness, and physical fitness.
2. Create awareness about body systems, immunity, and common lifestyle diseases.
3. Impart knowledge on food, nutrition, and balanced diet planning.
4. Introduce yoga practices for physical and mental well-being.
5. Develop understanding of fitness activities and exercise routines.
6. Promote healthy lifestyle habits and stress management techniques.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Explain the concepts of health, wellness, fitness, and their determinants.	K1, K2
2	Describe body systems, immunity, and the impact of lifestyle diseases.	K2, K3
3	Apply nutritional principles to plan a balanced diet for different age groups.	K3, K4
4	Analyse the role of yoga and meditation in maintaining physical and mental health.	K4, K5
5	Demonstrate various fitness activities, exercises, and movement patterns.	K3, K6
6	Evaluate lifestyle practices and propose strategies for stress management and well-being.	K3, K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	Introduction of Health and Wellness	5 hours

Concepts of health and fitness, importance of health and wellness education; Dimensions and determinants of health and fitness; Body system and basic concept of immunity; Common diseases, Sedentary Lifestyle and its risk of diseases; Body mass index, hypokinetc disease and importance of exercise and sports; Stress, anxiety and depression-factors affecting mental health; Substance abuse-Drugs, Tobacco, Alcohol-De-addiction-Counselling and rehabilitation.

Unit:2	Basic of Food and Nutrition	5 hours

Definition of terms used in Food and nutrition. Food, Nutrient, Nutrition, malnutrition, over and under nutrition, Food, Energy, Balanced diet, Health, Fitness and Hygiene. Food, its classification and functions- types of food, sources of food, Food groups and nutrient suppliers. Concept and components of a balanced diet. Balance diet recommended- a balanced diet for different ages, functions of nutrients- macronutrients, carbohydrates, Proteins, Fats; micronutrients- vitamins and minerals. Nutritional deficiency, a disorder of macro and micro nutrients. Diet and health management. Traditional knowledge- Use of herbs.

Unit:3	Yoga Practices	4hours

Types and limbs of yoga - Yoga postures - Asana - Breathing Practices - Pranayama - Relaxation- Meditation - Mudra.

Unit:4	Fitness Activities	4 hours

Types of fitness activities - Outdoor activities - Basic movement patterns. Indoor activity - Aerobics/Dance Fitness, Resistance Training for fitness.

	Total Lecture hours	18 hours

Text Book(s)	
1	Iyengar B. K. S., Light on Yoga, 67th Impression, Harper Collins 2. Roday S., Food Science and Nutrition, 3rd Ed, OXFORD
2	Mental Health Workbook for Women: Exercises to Transform Negative Thoughts and Improve Well Being by Nashay Lorick, 2022.
3	Lifestyle Diseases: Lifestyle Disease Management, by C. Nyambichu & Jeff Lumiri, 2018.
4	Physical Activity and Mental Health by Angela Clow & Sarah Edmunds, 2013.
5	Health Promotion: Mobilizing Strengths to Enhance Health, Wellness, and Well- being [1 ed.] F.A. Davis Company.
Course Designed By: Dr. J.Vijayakumar	

Mapping with Programme Outcomes															
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PO13**	**PO14**	**PO15**
CO1	L	M	M	L	L	L	L	M	L	L	M	M	M	L	M
CO2	L	M	M	M	L	L	L	M	M	L	M	M	M	L	M
CO3	L	M	M	M	M	L	L	M	M	L	M	M	M	L	M
CO4	L	M	S	M	M	L	L	S	M	L	M	M	M	L	M
CO5	L	M	M	M	L	L	M	M	M	L	M	M	M	L	M
CO6	L	S	S	M	M	M	M	S	S	M	S	M	S	M	S
*S-Strong; M-Medium; L-Low															

Course code	3CA	DSP USING MATLAB	L	T	P	C
Core/Elective/Supportive		Certificate course	2	0	0	2
Pre-requisite		Students should have basic knowledgeof MATLAB	Syllabus Version	2026-27		

Course Objectives:

The main objectives of this course are to:

1. Introduce the MATLAB environment and its applications in signal processing.
2. Develop programming skills using MATLAB scripting and logic operations.
3. Understand graphical representation and analysis of signals using MATLAB.
4. Explore image processing techniques using MATLAB toolbox.
5. Learn modelling and simulation of systems using Simulink.
6. Enable development of signal and image processing applications using MATLAB tools.

Expected Course Outcomes:

On the successful completion of the course, student will be able to:

1	Explain the MATLAB environment and develop basic signal processing applications.	K1, K3
2	Apply MATLAB scripting and logical operations for solving engineering problems.	K3, K4
3	Analyse signals using graphical tools and MATLAB functions.	K3, K4
4	Analyse the image processing toolbox for implementing image enhancement and filtering techniques.	K3, K5
5	Interpret and model signal processing systems using Simulink.	K2, K4
6	Design and develop signal and image processing applications using MATLAB and Simulink.	K5, K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** – Create

Unit:1	**Introduction to MATLAB**	**5 hours**

Develop a digital signal processing application using MATLAB

Unit:2	**Logic Operations & Graph Using MATLAB**	**5 hours**

Implement a digital signal processing application with MATLAB Scripting

Unit:3	**Image Processing & Colour Filtering**	**4hours**

Image Processing toolbox for developing various image processing applications

Unit:4	**MATLAB Simulink**	**4 hours**

Distinguish model signal processing algorithms with Simulink modeling

	Total Lecture hours	**18 hours**

Text Book(s)

1.	https://www.scribd.com/document/327854397/Matlab-Tool-Box-List

Course Designed By: Dr. J.Vijayakumar

Mapping with Programme Outcomes															
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PO13**	**PO14**	**PO15**
CO1	S	M	M	M	M	L	L	M	L	S	M	L	L	L	M
CO2	S	M	S	S	M	M	L	S	L	S	M	L	L	L	M
CO3	S	M	S	S	S	M	L	S	M	S	M	L	L	L	M
CO4	S	M	S	S	S	S	L	S	M	S	M	L	M	L	M
CO5	S	M	M	M	S	M	L	S	M	S	M	L	M	L	M
CO6	S	S	S	S	S	S	M	S	M	S	S	M	S	S	S
*S-Strong; M-Medium; L-Low															