

D. Y. Patil Education Society, Kolhapur

(Deemed to be University)

**School of Engineering & Management,
Kolhapur**

Kasaba Bawada, Kolhapur



D. Y. PATIL
EDUCATION SOCIETY
(DEEMED TO BE UNIVERSITY)
KOLHAPUR

Final Year B. Tech.

Structure and Curriculum Sem-VII

Department of Electronics & Telecommunication Engineering

w.e.f. A.Y.2026-27





D.Y. Patil Education Society, Kolhapur (Deemed to be University)
School of Engineering & Management
Kasaba Bawada, Kolhapur

Teaching and Evaluation Scheme from Year 2023-27 (as per NEP-2020)

Department of Electronics and Telecommunication Engineering

B.Tech SEMESTER-VII

Course Code	Course Category	Course Type	Course Name	Teaching Scheme				Theory			Practical		Total Marks
				Credits	L	P	T	ISE	MSE	ESE	INT	OE/PoE	
23ETCU7P01	Program Core Courses	PCC	ARM & Embedded systems	3	3	-	-	20	30	50	-	-	100
23ETCU7P02			Digital Image Processing	2	2	-	-			50	-	-	50
23ETCU7P03			ARM & Embedded systems-Lab	1	-	2	-	-	-	-	25	25	50
23ETCU7M04	Multidisciplinary	MDM-5	Mechatronics	2	2	-	-	-	-	50	-	-	50
23ETCU7R05	Research Methodology	RM	Research Methodology (ODL)	4	4	-	-	20	30	50	-	-	100
23ETCU7E06	Professional Elective	PEC-4	Real Time Operating System	3	3	-	-	20	30	50	-	-	100
23ETCU7E07			System on Chip										
23ETCU7E08			Automotive Electronics										
23ETCU7E09	Professional Elective	PEC-5	Radar & Satellite Communication	3	3	-	-	20	30	50	-	-	100
23ETCU7E10			Cyber Security										
23ETCU7E11			Software Networks										
23ETCU7J12	Project	PR	Project	4	-	4	-	-	-	-	100	50	150
23ETCU7C13	Co-Curricular Activities	CCA	Liberal Learning- IX	Audit	2#	-	-	50	-	-	-	-	Grade
23ETCU7C14			Liberal Learning-X										
Total				22	17	6	0	130	120	300	125	75	700
23ETCU7Z07	Honors Courses/Double (Minor)	HC (Optional)	Honors Paper- IV - MEMS Technology	4	4	-	-	20	30	50	-	-	100

*-Values not included in total, #=2 contact hrs per club, Min Marks for passing: 40% of total marks of individual course



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Final Year B. Tech. Curriculum w.e.f. A.Y.2026-2027
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Semester-VII

Class			Final Year B. Tech, Semester- VII
Course Code and Course Title			23ETCU7P01, ARM and Embedded Systems
Prerequisite/s			Digital Electronics, Microprocessors, Microcontroller
Teaching Scheme: Lecture/Tutorial/Practical			03/--/--
Credits			03
Evaluation Scheme	T	ISE / MSE / ESE	20/30/50
	P	INT / OE/POE	--/--/--
	Total		100

Course Description: This fundamental course provides an overview of embedded systems. It provides in-depth information on embedded system design. Additionally, it provides an introduction to embedded C programming for the ARM LPC2148 microcontroller and assembly language programming for the ARM processor. Additionally, it presents the real-time operating system, or RTOS.

Course Objectives:

1	To understand the fundamentals of embedded systems, architecture, and ARM processor basics.
2	To learn and apply ARM instruction set and programming concepts for embedded system development
3	To analyze memory organization, peripheral interfacing, and interrupt handling mechanisms.
4	To understand and implement Real-Time Operating System (RTOS) concepts and applications in embedded systems.

Course Outcomes (COs):

At the end of the course the student will be able to:

1	Explain embedded system fundamentals, architecture, and ARM processor organization.
2	Apply ARM instruction set and programming techniques for solving embedded system problems.
3	Analyze and implement memory interfacing, peripheral communication, and interrupt handling..
4	Understand and utilize RTOS concepts such as scheduling, synchronization, and resource management in embedded applications.





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Department of Electronics & Telecommunication Engineering

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
CO1	3	2	-	-	2	-	-	-	-	1	-	2	3	3	II
CO2	3	3	2	-	3	-	-	-	-	1	-	2	3	3	III
CO3	3	3	3	2	3	-	-	-	1	1	-	2	3	3	III
CO4	2	3	2	2	2	1	-	-	1	2	1	3	3	3	IV

Content	Hrs.
Unit 1: Introduction to Embedded Systems Embedded system overview, An Introduction to Embedded System Architecture, Embedded System Model, Design challenge, Processor Technology, IC Technology, Microprocessors vs. Microcontrollers, memory types, and sensors/actuators.	4
Unit 2: ARM Architecture & Fundamentals Types of computer Architectures, ISA's and ARM History. Embedded System Software and Hardware, Endianness. Processor core VS CPU core, Operational Modes. Instruction Format, ARM 3 stage Pipeline, ARM family attribute comparison. ARM 5 stage Pipeline, Pipeline Hazards, Data forwarding - a hardware solution.	6
Unit 3: ARM Instruction Set & Programming ARM Instruction Set Overview , Data Processing Instructions , Load–Store Instructions (Single & Multiple Register) ,Branch & Software Interrupt Instructions ,Program Status Register & Conditional Execution ,Addressing Modes & Loading Constants ,Thumb Instruction Set , Stack Instructions ,Interfacing with Peripherals & Interrupt Structure, Embedded Development Environment (Cross Development, Simulator, Emulator)	8
Unit 4: Memory & Peripherals Interfacing Features, Block diagram and SFR planning: Pin connect block, GPIO, UART & Architecture, I2C, SPI, Timer, PWM, ADC & DAC, Real time clock, Watchdog timer, , features of on chip USB, Serial Bus communication protocols: RS232 standard, RS485, Serial Peripheral Interface (SPI), Inter Integrated Circuits (I2C), CAN Bus.	8
Unit 5: Exception & Interrupt Handling Vector Table, ISR,,Interrupt handling sequence (request, acknowledgment, execution, return), Context switching , Nested interrupts and priority levels, Introduction to NVIC (Nested Vectored Interrupt Controller) , Interrupt priority management and masking.	6





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Unit 6: Real-Time Operating Systems (RTOS) & Applications

6

Introduction to RTOS, Types of RTOS, Tasks, processes, threads, Scheduling techniques, Context switching, Semaphores, Mutex, Message Queue, Mailboxes and Pipes, Memory management, Sensor interfacing, Actuator and motor control.

Text Books:

1	Embedded System Design – A unified hardware and software introduction: F. Vahid (John Wiley)
2	Embedded Systems-A contemporary Design tool, James K Peckol, John Wiley India Pvt Ltd, 2008.
3	Embedded Systems Fundamentals with ARM Cortex-M Microcontrollers – Alexander G. Dean
4	ARM system developers guide, Sloss, Symes, Wright, Morgan Kaufman (Elsevier) Publication, 2004.

Reference Books:

1	Raj Kamal, “Embedded systems: architecture, programming and design” Tata McGraw-Hill Education, 2003
2	ARM System Developer's Guide: Designing and Optimizing System Software By Andrew Sloss, Dominic Symes, Chris Wright, May 2004 Elsevier
3	ARM assembly language: fundamentals and Technique, William Hohl, Christopher Hinds, CRC Press, Taylor & Francis group, Second edition, 2015
4	LPC214x User Manual, Philips/ NXP semiconductor, 2006





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Final Year B. Tech. Curriculum w.e.f. A.Y.2026-2027
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Semester-VII

Class		B. Tech, Semester- VII	
Course Code and Course Title		23ETCU7P02, Digital Image Processing	
Prerequisite/s		Basic Mathematics, Signals and Systems, Digital Logic	
Teaching Scheme: Lecture/Tutorial/Practical		02/--/--	
Credits		02	
Evaluation Scheme	T	ISE / MSE / ESE	--/--/50
	P	INT / OE/POE	--/--/--
		Total	50

Course Description:

This course covers the fundamentals of Digital Image Processing, including image acquisition, representation, enhancement, compression, restoration, and segmentation. Students will also learn edge detection and digital image security techniques, with practical applications in multimedia, medical imaging, and computer vision.

Course Objectives:

1	Introduce the fundamental principles of digital image processing
2	Explain and demonstrate spatial and frequency domain image enhancement techniques to improve the visual quality of digital images.
3	Present the concepts of digital image compression
4	Explain and illustrate image restoration and segmentation techniques
5	Familiarize students with edge detection techniques and security aspects of digital images.

Course Outcomes (COs):

At the end of the course the student will be able to:

1	Explain the fundamental concepts of digital image processing.
2	Apply spatial and frequency domain image enhancement techniques.
3	Analyze and implement image compression techniques.
4	Apply image restoration and segmentation techniques.
5	Analyze edge detection methods and apply image security techniques.





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Department of Electronics & Telecommunication Engineering

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CO1	3	2	1	2	1	-	-	-	-	-	-	2			II
CO2	3	3	2	2	3	-	-	-	1	1	-	2			III
CO3	3	3	2	2	3	1	-	-	1	1	1	2			IV
CO4	3	3	3	3	3	1	-	-	1	1	-	2			III
CO5	3	2	2	2	3	1	-	1	-	-	-	1			IV

Content	Hrs.
Unit 1: Digital Image Fundamentals: Introduction, Image acquisition, Fundamental steps in digital image processing, pixels. Image sampling and quantization, Two-dimensional sampling theory, reconstruction of images from its samples, Practical limits in sampling reconstruction. Image quantization.	6
Unit 2: Digital Image Enhancement Introduction and importance of digital image enhancement. Image enhancement in the spatial domain. Image enhancement in the frequency domain. Bit-plane slicing. Histogram processing: Histogram representation and Histogram Equalization. Mean and Median filtering in Digital Images, Frequency domain filtering in Digital Images – LPF, HPF and BPF	7
Unit 3: Digital Image Compression Importance of Digital Image Compression, Types of Image Compression, example of lossless and lossy compression, Image compression standards, Compression in spatial domain, compression using Huffman coding, DCT and Wavelet based Digital image compression.	6
Unit 4: Digital Image Restoration and Segmentation Application and Importance of Digital Image Restoration, Reason for Image degradation, Inverse filtering, Segmentation of Digital Images: Importance and applications of Digital Image Segmentation, Detection of discontinuities, Edge linking and Boundary detection, Thresholding, Segmentation based on Region Growing, Watershed algorithm.	7
Unit 5: Edge detection and Security in Digital Image Processing Importance of Edge detection in Digital Image Processing, Types of Edge Detection, Mathematical Equation of each operator, Importance of Digital Image Security, Watermarking, Image encryption in spatial and frequency domain, Steganography	6





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School of Engineering & Management
Kasaba Bawada, Kolhapur
Department of Electronics & Telecommunication Engineering

Text Books:

1	Gonzalez, Rafael C. and Woods, Richard E., "Digital Image Processing", Second Edition, Prentice Hall.
2	Pratt, William K., "Digital Image Processing", John Wiley & Sons, New York.
3	S. Annadurai, R. Shanmugalakshmi, "Fundamentals of Digital Image Processing", Pearson Education, 2006

Reference Books:

1	Jain, Anil K., "Fundamentals of Digital Image Processing", Prentice Hall of India, New Delhi.
2	M Sonka, V Hlavac and R Boyle, Image Processing, Analysis and Machine Vision, PWS.
3	Malay K. Pakhira, "Digital Image Processing and Pattern Recognition", First Edition, PHI Learning Pvt. Ltd., 2011.

Useful Links

1	https://onlinecourses.nptel.ac.in/noc19_ee55/preview
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Final Year B. Tech. Curriculum w.e.f. A.Y.2026-2027
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Semester-VII

Class		Final Year B. Tech, Semester- VII	
Course Code and Course Title		23ETCU7P03, ARM and Embedded Systems- Lab	
Prerequisite/s		Digital Electronics, Microprocessors, Microcontroller	
Teaching Scheme: Lecture/Tutorial/Practical		--/--/02	
Credits		01	
Evaluation Scheme	T	ISE / MSE / ESE	--/--/--
	P	INT / OE/POE	25/--/25
		Total	50

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Course Objectives:

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2	To learn and apply ARM instruction set and programming concepts for embedded system development
3	To analyze memory organization, peripheral interfacing, and interrupt handling mechanisms.
4	To understand and implement Real-Time Operating System (RTOS) concepts and applications in embedded systems.

Course Outcomes (COs):

At the end of the course the student will be able to:

1	Explain embedded system fundamentals, architecture, and ARM processor organization.
2	Apply ARM instruction set and programming techniques for solving embedded system problems.
3	Analyze and implement memory interfacing, peripheral communication, and interrupt handling..
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CO1	3	2	-	-	2	-	-	-	-	1	-	2	3	3	II
CO2	3	3	2	-	3	-	-	-	-	1	-	2	3	3	III
CO3	3	3	3	2	3	-	-	-	1	1	-	2	3	3	III
CO4	2	3	2	2	2	1	-	-	1	2	1	3	3	3	IV

List of Experiments			
Expt.No.	Name of Experiment	Unit	CO
1	Study of ARM Evaluation System (LPC2148/STM32) and ARM assembly language programs (arithmetic, sorting, factorial).	I	1
2	Interfacing of Flashing LEDs, interfacing Switches, Keypads, and 7-segment displays.	I	2
3	Interfacing LCD (16x2), DAC/ADC (analog to digital conversion), and EEPROM.	II	2
4	Generation of time delays using timers and PWM for LED intensity and motor speed control.	II	2
5	Serial communication using UART, I2C, or Zigbee with ARM..	III	2
6	Interfacing and controlling DC motors and stepper motors.	III	3
7	External interrupt handling and switch interfacing using interrupts.	IV	3
8	Implementing tasks, semaphores, and mailboxes using RTOS..	V	4
9	Data logging using Raspberry Pi or uploading sensor data to a cloud platform.	VI	4
10	Implementing watchdog timer and exploring low-power modes (sleep/deep sleep).	VI	4





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3	Embedded Systems Fundamentals with ARM Cortex-M Microcontrollers – Alexander G. Dean
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1	Raj Kamal, “Embedded systems: architecture, programming and design” Tata McGraw-Hill Education, 2003
2	ARM System Developer's Guide: Designing and Optimizing System Software By Andrew Sloss, Dominic Symes, Chris Wright, May 2004 Elsevier
3	ARM assembly language: fundamentals and Technique, William Hohl, Christopher Hinds, CRC Press, Taylor & Francis group, Second edition, 2015
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Final Year B. Tech. Curriculum w.e.f. A.Y.2026-2027
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Semester-VII

Course Code and Course Title			23ETCU7M04, Mechatronics
Prerequisite/s			Basic Electronics & Electrical Circuits, Engineering Mathematics
Teaching Scheme: Lecture/Tutorial/Practical			02/--/--
Credits			02
Evaluation Scheme	T	ISE / MSE / ESE	--/--/50
	P	INT / OE/POE	--/--/--
	Total		50

Course Description: This course introduces the fundamentals of mechatronics, covering system concepts, sensors, actuators, controllers, and microcontroller-based applications through real-world case studies.

Course Objectives:

1	To introduce the fundamental concepts of mechatronics and integrated system design approaches.
2	To provide knowledge of sensors and transducers, their working principles, and selection for mechatronic applications.
3	To familiarize students with drives and actuation systems used in hydraulic, pneumatic, and electrical control.
4	To develop understanding of microcontroller-based mechatronic systems through architecture study and real-world case studies.

Course Outcomes (COs):

At the end of the course the student will be able to:

1	Define and recall basic concepts of mechatronics, system elements, control systems, and design approaches.
2	Explain the working and applications of sensors and transducers used in mechatronic systems.
3	Describe and classify hydraulic, pneumatic, and electrical drives and actuators used in mechatronics.
4	Analyze microcontroller-based mechatronic systems using 8051 architecture and real-world case studies.





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Department of Electronics & Telecommunication Engineering

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CO1	3	1	-	-	-	-	-	-	-	-	-	1	-	-	III
CO2	3	2	1	-	1	-	-	-	-	-	-	1	-	-	III
CO3	3	2	2	-	1	-	-	-	-	-	-	1	-	-	IV
CO4	2	3	2	1	2	-	-	-	-	-	-	2	-	-	IV

Content	Hrs.
UNIT-I: Introduction to Mechatronics & System Concepts Introduction to Mechatronics, Key elements of Mechatronics, Block diagram of mechatronics system, Control systems and Modes of control, Difference between traditional and concurrent design process.	6
Unit- II: Sensors and Transducers: Transducers- classification, Development in Transducer technology Sensors - Introduction, Need of Sensors, Classification, Working and Application of- Potentiometer Sensors, Strain Gauge Elements. Capacitive Elements, Eddy Current, Proximity Sensors, Inductive, Proximity Sensors, Light Sensors, Pressure Sensors, Pneumatic Sensors, Pyro electrical Sensors, Piezoelectric Sensors, Shaft Encoders. Selection of Sensors	10
UNIT-III: Drives and Actuators Introduction and Classification of Actuators. Need and Scope. Hydraulic Actuation systems - Linear, Single and Double Acting system Pneumatic Actuation systems- Gear Motors and Vane Motors. Electrical Actuation Systems - solenoid type Devices, Stepper Motors and Servo Motor. Selection of Actuators.	8
Unit- IV: Controllers and Mechatronic Case Studies Introduction to microcontroller and microprocessor. Comparison between microcontroller and microprocessor. Architecture and pin configuration of 8051 microcontroller. Mechatronic system Case Studies: Case Study 1: Drone Technology Case Study 2: Automated Robotic Arm Case Study 3: Automatic Washing Machine	8

Text Books:

1	Mechatronics by W. Bolton – A widely used foundational textbook covering systems, sensors, actuators, controls, and integration
2	A Textbook of Mechatronics by R.K. Rajput – Comprehensive coverage of mechatronics





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Department of Electronics & Telecommunication Engineering

	topics including sensors, actuators, controllers, and systems.
3	Integrated Mechanical Electronic Systems by K.P. Ramachandran, G.K. Vijayaraghavan & M.S. Balasundaram

Reference Books:

1	Mechatronics: Fundamentals and Applications (Editors: Mizanur Rahman, Farhan Mahbub, Rumana Tasnim, Rezwana Us Saleheen) – Discusses modelling, design, and contemporary applications of mechatronics.
2	Mechatronics by Godfrey C. Onwubolu – A detailed reference offering integrated coverage with examples, case studies, and practical design insights.
3	Mechatronic Components: Roadmap to Design by Faruk Keceli – Focuses on component-level design and integration in mechatronic systems (useful for deeper understanding and projects).

Useful Links	
1	NPTEL 8 weeks Mechatronics By Prof. Pushparaj Mani Pathak





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Final Year B. Tech. Curriculum w.e.f. A.Y.2026-2027
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Semester-VII

Class			Semester- VII
Course Code and Course Title			23ETCU7R05, Research Methodology (ODL)
Prerequisite/s			Basic knowledge of statistics and quantitative methods.
Teaching Scheme: Lecture/Tutorial/Practical			04/--/--
Credits			04
Evaluation Scheme	T	ISE / MSE / ESE	20/30/50
	P	INT / OE/POE	--/--/--
	Total		100

Course Description: This course provides an overview of research methodology, including research design, data collection, analysis, ethics, and report writing, to develop effective research and academic communication skills.

Course Objectives:

1	Understand research concepts, processes, and problem formulation.
2	Apply sampling, data collection, and statistical analysis techniques.
3	Prepare research reports, theses, and present findings effectively.
4	Follow research ethics, avoid plagiarism, and use proper referencing.

Course Outcomes (COs):

At the end of the course the student will be able to:

1	Understand the meaning, objectives, types of research, research process, and formulate research problems with appropriate research designs and hypotheses.
2	Apply various sampling techniques, data collection methods, and analyze research data using appropriate statistical techniques and tests of significance.
3	Prepare research reports, thesis writing, research proposals, and communicate research findings effectively through presentations.
4	Apply research ethics, understand plagiarism issues, and follow proper citation and referencing methods in academic writing.





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CO1	2	3	1	1	1					1	1	1			II,IV
CO2	1	2		3	3						2	2			III
CO3	1				1	3			2	3	3	1			VI
CO4	1		2		1			3		2		2			III,V

Content	Hrs.
Unit I: Introduction to Research and Research Problem Meaning of Research, Objectives of Research, Motivation in Research, Types of Research - Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical. Research Methods vs. Methodology. Research Process - Steps involved in research process. Criteria of Good Research. Problems Encountered by Researchers in India. Defining the Research Problem - Selecting the problem, Necessity of defining the problem, Technique involved in defining a problem.	8
Unit II: Research Design : Meaning of Research Design, Need for Research Design, Features of a Good Design. Important Concepts Relating to Research Design - Dependent and Independent Variables, Extraneous Variable, Control, Confounded Relationship, Research Hypothesis, Different Research Designs - . Basic Principles of Experimental Designs - Principle of Replication, Principle of Randomization, Principle of Local Control.	7
Unit III: Sampling and Data Collection Census and Sample Survey. Implications of a Sample Design. Steps in Sampling Design. Criteria of Selecting a Sampling Procedure. Characteristics of a Good Sample Design. Different Types of Sample Designs - Probability Sampling (Simple Random Sampling, Systematic Sampling, Stratified Sampling, Cluster Sampling, Area Sampling, Multi-stage Sampling) and Non-probability Sampling (Deliberate Sampling, Convenience Sampling, Quota Sampling). Methods of Data Collection - Primary Data - Observation Method, Interview Method, Collection through Questionnaires, Collection through Schedules. Secondary Data - Sources of secondary data, Precautions in using secondary data. Selection of Appropriate Method for Data Collection.	7
Unit IV: Processing and Analysis of Data Processing Operations - Editing, Coding, Classification, Tabulation. Statistics in Research - Measures of Central Tendency (Mean, Median, Mode), Measures of Dispersion (Range, Quartile Deviation, Mean Deviation, Standard Deviation). Measures of Asymmetry (Skewness). Measures of Relationship (Correlation - Karl Pearson's Coefficient of Correlation, Spearman's Rank	8





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Correlation). Testing of Hypotheses - Basic Concepts concerning Testing of Hypotheses (Null Hypothesis and Alternative Hypothesis, Level of Significance, Decision Rule, Type I and Type II Errors). Important Parametric Tests - z-test, t-test, F-test (ANOVA). Chi-square Test as a Non-parametric Test. Computer Software Packages for Data Analysis - SPSS, R, Python basics.	
Unit V: Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation. Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report - Preliminary Pages, Main Text, End Matter. Types of Reports - Technical Report, Popular Report, Thesis/Dissertation format. Writing Research Proposal - Purpose and format of research proposal, Components (Introduction, Review of Literature, Research Methodology, Expected Results, Budget and Time Schedule). Presentation of Research Work - Oral Presentation, Poster Presentation. Mechanics of Writing a Research Report - Layout, Structure and Language of Report, Footnotes, Appendix, Bibliography and References. Precautions for Writing Research Reports.	8
Unit VI: Research Ethics and Citation Methods Ethics in Research - Research involving human subjects, Animal rights and research, Ethical issues in data collection and analysis, Informed consent, Privacy and confidentiality. Academic Integrity - Plagiarism (Types, Detection, Prevention), Fabrication and Falsification of data, Authorship issues. Citation and Referencing - Importance of citations, Different Citation Styles (APA Style, IEEE Style, ACM Style, Harvard Style, Chicago Style). In-text Citations and Reference List preparation. Using Reference Management Software - Mendeley, Zotero, EndNote basics. Intellectual Property Rights in Research - Copyright, Patents in Computer Science context. Publication Ethics - Duplicate publication, Predatory journals, Peer review process.	8

Text Books:

1	C.R. Kothari, "Research Methodology: Methods and Techniques", New Age International Publishers, 4th Edition (2004).
2	Ranjit Kumar, "Research Methodology: A Step-by-Step Guide for Beginners", SAGE Publications, 5th Edition (2019).

Reference Books:

1	John W. Creswell, "Research Design: Qualitative, Quantitative, and Mixed Methods Approaches", SAGE Publications, 5th Edition.
2	Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction", Juta and Company Ltd, 2nd Edition.
3	Anol Bhattacharjee, "Social Science Research: Principles, Methods, and Practices", University of South Florida, 2nd Edition.
4	Donald H. McBurney and Theresa L. White, "Research Methods", Cengage Learning, 8th Edition.





D.Y. Patil Education Society, Kolhapur
(Deemed to be University)
School of Engineering & Management
Kasaba Bawada, Kolhapur

Department of Electronics & Telecommunication Engineering

Final Year B. Tech. Curriculum w.e.f. A.Y.2026-2027
(As Per National Education Policy 2020)

Semester-VII

Class			B. Tech, Semester- VII
Course Code and Course Title			23ETCU7E06 Real Time Operating Systems
Prerequisite/s			Data Structures ,Basic Embedded Systems Concepts
Teaching Scheme: Lecture/Tutorial/Practical			03/--/--
Credits			03
Evaluation Scheme	T	ISE / MSE / ESE	20/30/50
	P	INT / OE/POE	--/--/--
		Total	100

Course Description: This course introduces the principles and design of Real-Time Operating Systems (RTOS) used in embedded and time-critical applications. It covers the fundamentals of operating systems, including processes, threads, scheduling, and system boot mechanisms, before moving into real-time system concepts and constraints. Students learn RTOS architecture, kernel structure, task management, inter-process communication, synchronization mechanisms, and memory management techniques suitable for deterministic systems.

Course Objectives:

1	Understand the fundamental concepts of operating systems and the specific requirements of real-time systems.
2	Understand the fundamental concepts of operating systems and the specific requirements of real-time systems.
3	Learn RTOS architecture, task management, scheduling techniques, and synchronization mechanisms.
4	Analyze inter-process communication, memory management, and resource-sharing issues in real-time environments.

Course Outcomes (COs):

At the end of the course the student will be able to:

1	Explain the structure and working principles of real-time operating systems and their differences from general-purpose operating systems.
2	Apply real-time scheduling, task management, and synchronization techniques in RTOS-based system design.
3	Analyze inter-process communication methods, memory management strategies, and issues like deadlock and priority inversion in real-time systems.
4	Evaluate and compare different RTOS implementations such as Linux, RTLinux, VxWorks, Windows, and μ ITRON based on kernel design and performance.





D.Y. Patil Education Society, Kolhapur
(Deemed to be University)
School of Engineering & Management
Kasaba Bawada, Kolhapur

Department of Electronics & Telecommunication Engineering

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
CO1	3	2	-	-	-	-	-	-	-	-	1	3	2	-	III
CO2	3	3	2	2	2	-	-	1	-	-	2	3	2	-	III
CO3	3	3	2		2	-	-	1	-	-	2	3	2	-	IV
CO4	3	3	2	2	2	1	-	1	1	-	2	3	2	1	IV

Content	Hrs.
Unit-I Introduction: Introduction to Operating System: Computer Hardware Organization, BIOS and Boot Process, Multi-threading concepts, Processes, Threads, Scheduling	8
Unit-II Basics Of Real-Time Concepts: Terminology: RTOS concepts and definitions, real-time design issues, examples, Hardware Considerations: logic states, CPU, memory, I/O, Architectures, RTOS building blocks, Real-Time Kernel	8
Unit-III Process Management: Concepts, scheduling, IPC, RPC, CPU Scheduling, scheduling criteria, scheduling algorithms Threads: Multi-threading models, threading issues, thread libraries, synchronization Mutex: creating, deleting, prioritizing mutex, mutex internals	8
Unit-IV Inter-Process Communication: Messages, Buffers, mailboxes, queues, semaphores, deadlock, priority inversion, Pipes Memory Management:- Process stack management, run-time buffer size, swapping, overlays, block/page management, replacement algorithms, real-time garbage collection	8
Unit-V Real-Time Scheduling Advanced Topics: Rate Monotonic Scheduling (RMS), Earliest Deadline First (EDF), Deadline Monotonic Scheduling, feasibility analysis, schedulability tests. Resource Management: Priority inversion problem, priority inheritance protocol, priority ceiling protocol, resource access control.	8
Unit-VI Case Studies: Case study Linux POSIX system, RTLinux / RTAI, Windows system, Vxworks, ultron Kernel Design Issues: structure, process states, data structures, inter-task communication mechanism, Linux Scheduling	



D.Y. Patil Education Society, Kolhapur
(Deemed to be University)
School of Engineering & Management
Kasaba Bawada, Kolhapur
Department of Electronics & Telecommunication Engineering

Text Books:

1	J. J Labrosse, " <i>MicroC/OS-II: The Real –Time Kernel</i> ", Newnes, 2002.
2	Jane W. S. Liu, " <i>Real-time systems</i> ", Prentice Hall, 2000.

Reference Books:

1	W. Richard Stevens, " <i>Advanced Programming in the UNIX® Environment</i> ", 2nd Edition, Pearson Education India, 2011.
2	Philips A. Laplante, " <i>Real-Time System Design and Analysis</i> ", 3rd Edition, John Wley& Sons, 2004
3	Doug Abbott, " <i>Linux for Embedded and Real-Time Applications</i> ", Newness, 2nd Edition, 2011.

Useful Links

1	https://onlinecourses.nptel.ac.in/noc26_cs47
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D.Y. Patil Education Society, Kolhapur
(Deemed to be University)
School of Engineering & Management
Kasaba Bawada, Kolhapur

Department of Electronics & Telecommunication Engineering

Final Year B. Tech. Curriculum w.e.f. A.Y.2026-2027
(As Per National Education Policy 2020)

Semester-VII

Class		B. Tech, Semester- VIII	
Course Code and Course Title		23ETCU7E07 System on chip	
Prerequisite/s		Digital Electronics, Basic Electronics	
Teaching Scheme: Lecture/Tutorial/Practical		03/--/--	
Credits		03	
Evaluation Scheme	T	ISE / MSE / ESE	20/30/50
	P	INT / OE/POE	--/--/--
		Total	100

Course Description: This course provides an in-depth understanding of the design and development of System-on-Chip (SoC) architectures used in modern electronic systems. It introduces the evolution of ASIC technologies and the transition toward SoC-based design methodologies. Students learn about integrating logic, memory, and analog cores, along with on-chip communication architectures and design flows. The course covers core-based design approaches, validation techniques including simulation and hardware/software co-verification, and comprehensive SoC testing strategies such as boundary scan and built-in self-test..

Course Objectives:

1	Understand the evolution of ASIC technology and the concepts, components, and challenges involved in System-on-Chip (SoC) design.
2	Learn the design methodologies and flows used for integrating logic, memory, and analog cores into an SoC.
3	Study SoC design validation techniques including simulation, co-simulation, and hardware/software co-verification.
4	Gain knowledge of SoC testing strategies, test methodologies for reusable cores, and built-in self-test techniques.

Course Outcomes (COs):

At the end of the course the student will be able to:

1	Explain SoC architecture, design tradeoffs, and challenges in integrating multiple components on a single chip.
2	Apply appropriate design methodologies for logic, memory, and analog cores within an SoC design flow.
3	Analyze and implement SoC validation techniques including test benches, co-simulation, and hardware/software co-verification.
4	Evaluate SoC testing approaches such as boundary scan, built-in self-test (BIST), and testing of embedded cores and memories.





D.Y. Patil Education Society, Kolhapur
(Deemed to be University)
School of Engineering & Management
Kasaba Bawada, Kolhapur

Department of Electronics & Telecommunication Engineering

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
CO1	3	1	-	-	-	-	-	-	-	-	-	1	-	-	III
CO2	3	2	1	-	1	-	-	-	-	-	-	1	-	-	III
CO3	3	2	2	-	1	-	-	-	-	-	-	1	-	-	IV
CO4	2	3	2	1	2	-	-	-	-	-	-	2	-	-	IV

Content	Hrs.
UNIT – I Introduction to SoC Design and ASIC Evolution Introduction- System tradeoffs and evolution of ASIC Technology- System on chip concepts and methodology- SoC design issues -SoC challenges and components	6
UNIT-II Design Methodologies for Logic Cores and SoC Integration Design Methodological For Logic Cores- SoC Design Flow – On-chip buses – Design process for hard cores – Soft and firm cores – Core and SoC design examples.	6
UNIT-III Design of Memory and Analog Cores in SoC Design Methodology for Memory and Analog Cores- Embedded memories – Simulation modes Specification of analog circuits – A to D converter –Phase locked loops –High I/O.	6
UNIT-IV SoC Design Validation and Verification Techniques Design Validation- Core level validation –Test benches –SoC design validation – Co simulation – hardware/ Software co-verification. Case Study: Validation and test of systems on chip	6
UNIT – V System on Chip Testing and Test Methodologies SoC Testing- SoC Test Issues –Cores with boundary scan –Test methodology for design reuse– Testing of microprocessor cores – Built in self-method –testing of embedded memories	6
UNIT-VI SoC Physical Design, Power Optimization, and Emerging Trends Floorplanning, placement and routing challenges in SoC, clock tree synthesis, signal integrity, timing closure. Power-Aware SoC Design: Sources of power dissipation, dynamic and static power, low-power design techniques, voltage scaling, power gating, multi-voltage domains	6



D.Y. Patil Education Society, Kolhapur
(Deemed to be University)
School of Engineering & Management
Kasaba Bawada, Kolhapur

Department of Electronics & Telecommunication Engineering

Text Books:

1	Rochit Rajsunah, System-on-a-chip: Design and Test, Artech House, 2007.
2	Prakash Raslinkar, Peter Paterson & Leena Singh, System-on-a-chip verification: Methodology and Techniques, Kluwer Academic Publishers, 2000

Reference Books:

1	M. Keating, D. Flynn, R. Aitken, A. Gibbons Shi, Low Power Methodology Manual for System-on-Chip Design Series: Integrated Circuits and Systems, Springer, 2007.
2	L. Balado, E. Lupon, Validation and test of system on chip, IEEE conference on ASIC/SOC, 1999.
3	A. Manzone, P. Bernardi, M. Grosso, M. Rebaudengo, E. Sanchez, M. SReorda, Centro Ricerche Fiat, Integrating BIST techniques for on-line SoC testing, IEEE Symposium on On-Line testing, 2000.





D.Y. Patil Education Society, Kolhapur
(Deemed to be University)
School of Engineering & Management
Kasaba Bawada, Kolhapur

Department of Electronics & Telecommunication Engineering

Final Year B. Tech. Curriculum w.e.f. A.Y.2026-2027
(As Per National Education Policy 2020)

Semester-VII

Class			B. Tech, Semester- VII
Course Code and Course Title			23ETCU7E08 Automotive Electronics
Prerequisite/s			Basic Electrical and Electronics Engineering, Analog and Digital Electronics, Sensors and Transducer
Teaching Scheme: Lecture/Tutorial/Practical			03/--/--
Credits			03
Evaluation Scheme	T	ISE / MSE / ESE	20/30/50
	P	INT / OE/POE	--/--/--
		Total	100

Course Description: This course provides a comprehensive understanding of electronic systems used in modern automobiles. It covers the architecture of automotive electrical systems, sensors and actuators, electronic control units (ECUs), in-vehicle communication networks, and electronic control of engine, safety, and comfort systems. The course also introduces advanced topics such as electric and hybrid vehicle electronics, battery management systems, and driver-assistance technologies. Students gain both theoretical knowledge and practical insight into diagnosing and analyzing automotive electronic subsystems.

Course Objectives:

1	Understand the structure and operation of automotive electrical and electronic systems
2	Learn the working principles of automotive sensors, actuators, and ECUs.
3	Study electronic control of engine, transmission, emission, safety, and comfort systems.
4	Gain knowledge of in-vehicle communication networks and diagnostic techniques.

Course Outcomes (COs):

At the end of the course the student will be able to:

1	Explain the architecture and operation of automotive electrical and electronic systems.
2	Identify and describe the working of various automotive sensors and actuators.
3	Analyze the role and functioning of ECUs and in-vehicle communication networks...
4	Understand electronic control strategies used in engine management and emission systems





D.Y. Patil Education Society, Kolhapur
(Deemed to be University)
School of Engineering & Management
Kasaba Bawada, Kolhapur

Department of Electronics & Telecommunication Engineering

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
CO1	3	2	-	-	-	1	-	-	-	-	1	3	3	2	III
CO2	3	3	1	1	2	-	-	-	-	-	1	3	3	2	III
CO3	3	3	2	2	2	1	-	1	-	-	2	3	3	2	IV
CO4	3	3	3	2	2	2	1	-	-	-	2	3	3	3	IV

Content	Hrs.
UNIT – I Introduction to Automotive Electronics Evolution of automotive electronics, Overview of automotive electrical systems, Vehicle power supply and battery technologies, Alternator and charging systems, Wiring harness, fuses, and relays	6
UNIT-II Automotive Sensors and Actuators Temperature sensors (NTC/PTC), Pressure and position sensors, Oxygen (Lambda) sensor, Knock and speed sensors, Crankshaft and camshaft position sensors, Actuators: fuel injectors, ignition coils, motors, solenoids	6
UNIT-III Electronic Control Units (ECUs) Need and role of ECUs , Microcontrollers in automotive applications, ECU architecture (input–process–output), In-vehicle communication protocols: CAN, LIN, FlexRay (basics) On-Board Diagnostics (OBD)	6
UNIT-IV Engine and Emission Control Systems Engine and Emission Control Systems, Electronic fuel injection system, Ignition timing control, Air–fuel ratio control, Electronic throttle control, Emission control electronics	6
UNIT – V Automotive Safety and Comfort Systems Anti-lock Braking System (ABS) , Electronic Stability Control (ESC), Airbag control systems , Power windows and central locking, Climate control systems Basics of Advanced Driver Assistance Systems (ADAS)	6
UNIT-VI Advanced Automotive Electronics Electric and hybrid vehicle electronics, Battery Management System (BMS), Automotive lighting systems (LED, adaptive lighting), Infotainment and telematics , Introduction to autonomous vehicle electronics	6





D.Y. Patil Education Society, Kolhapur
(Deemed to be University)
School of Engineering & Management
Kasaba Bawada, Kolhapur

Department of Electronics & Telecommunication Engineering

Text Books:

1	Automobile Electrical and Electronic systems - Tom Denton, SAE publication, 2000.
2	Automotive Electrical Equipment - P.M. Kohli, Tata McGraw Hill, New Delhi

Reference Books:

1	Advanced Engine Technology - Heinz Heisler, SAE Publications, 1995.
2	Automotive Electronic Systems - Ulrich Adler, Robert Bosch, GMBH, 1995.
3	Bosch Technical Instruction Booklets





D.Y. Patil Education Society, Kolhapur
(Deemed to be University)
School of Engineering & Management
Kasaba Bawada, Kolhapur
Department of Electronics & Telecommunication Engineering

Final Year B. Tech. Curriculum w.e.f. A.Y.2026-2027
(As Per National Education Policy 2020)

Semester-VII

Class			B. Tech, Semester- VII
Course Code and Course Title			23ETCU7E09, Radar and Satellite Communication
Prerequisite/s			Signals and Systems, Analog Communication, Digital Communication, Engineering Mathematics
Teaching Scheme: Lecture/Tutorial/Practical			03, 00, 00
Credits			03
Evaluation Scheme	T	ISE / MSE / ESE	20/30/50
	P	INT / OE/POE	--/--/--
		Total	50

Course Description: This course introduces the fundamentals of radar and satellite communication systems, focusing on system architecture, signal processing, orbital mechanics, and link design. It enables students to analyze system performance and understand real-world applications in communication, navigation, and remote sensing.

Course Objectives:

1	Understand fundamentals of radar systems.
2	Learn working principles of different radar types.
3	Study satellite communication systems and subsystems.
4	Analyze satellite link design and applications.

Course Outcomes (COs):

At the end of the course the student will be able to:

1	Explain radar principles and performance parameters.
2	Analyze radar transmitters, receivers, and signal processing.
3	Understand satellite orbits, subsystems, and access techniques.
4	Perform basic satellite link budget analysis.





D.Y. Patil Education Society, Kolhapur
(Deemed to be University)
School of Engineering & Management
Kasaba Bawada, Kolhapur

Department of Electronics & Telecommunication Engineering

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
CO1	3	2	–	–	–	–	–	–	–	–	–	–	–	–	II
CO2	3	3	2	–	2	–	–	–	–	–	–	–	–	–	IV
CO3	3	2	–	–	2	–	–	–	–	–	–	–	–	–	II
CO4	3	3	2	2	2	–	–	–	–	–	–	–	–	–	IV

Content	Hrs.
UNIT-I: Fundamentals of Radar Systems Introduction to radar systems and applications, Basic radar block diagram and principle of operation, Radar frequency bands and classifications, Radar range equation and performance parameters, Minimum detectable signal and receiver noise, Radar cross section (RCS) and its importance	8
Unit- II: Radar Transmitters and Receivers Radar transmitters: Magnetron, Klystron and TWT, Pulse modulators and duplexers, Radar receivers: Super-heterodyne receiver, Noise figure and sensitivity, Radar displays: A-scope, B-scope and PPI, CW and FMCW radar basics	8
UNIT-III: Radar Signal Processing and Tracking Pulse radar concepts, Doppler effect and MTI radar, Pulse compression techniques, Clutter and noise suppression, Tracking radar principles, Automatic tracking and radar accuracy	7
Unit- IV: Introduction to Satellite Communication Evolution and applications of satellite communication, Satellite system block diagram, Orbital mechanics and satellite orbits, GEO, MEO, LEO, Polar orbits, Kepler's laws and satellite look angles, Coverage area and footprint	7
Unit- V: Satellite Subsystems and Multiple Access: Satellite subsystems: Payload, Antenna subsystem, Power subsystem, TT&C subsystem, Uplink and downlink, frequency bands, Multiple access techniques: FDMA, TDMA, CDMA, Satellite transponders	7
Unit- VI: Satellite Link Design and Applications: Link budget analysis, Noise temperature and G/T ratio, C/N ratio and system performance, Earth station components, Satellite communication applications: VSAT, Satellite TV, Navigation (GPS), Weather and remote sensing, Recent trends in satellite communication	8





D.Y. Patil Education Society, Kolhapur
(Deemed to be University)
School of Engineering & Management
Kasaba Bawada, Kolhapur
Department of Electronics & Telecommunication Engineering

Text Books:

1	M. I. Skolnik , <i>Introduction to Radar Systems</i> , McGraw-Hill
2	Dennis Roddy , <i>Satellite Communications</i> , McGraw-Hill

Reference Books:

1	B. R. Mahafza, <i>Radar Systems Analysis and Design</i>
2	Timothy Pratt & Charles Bostian, <i>Satellite Communications</i>

Useful Links	
	Radar Systems – NPTEL (IIT Faculty) https://nptel.ac.in/courses/108/102/108102117 <i>Covers radar equation, MTI radar, Doppler radar</i> Satellite Communication – NPTEL https://nptel.ac.in/courses/108/101/108101092 <i>Excellent for satellite orbits, subsystems, link budget</i>





D.Y. Patil Education Society, Kolhapur
(Deemed to be University)
School of Engineering & Management
Kasaba Bawada, Kolhapur
Department of Electronics & Telecommunication Engineering

Final Year B. Tech. Curriculum w.e.f. A.Y.2026-2027
(As Per National Education Policy 2020)

Semester-VII

Class			B. Tech, Semester- VII
Course Code and Course Title			23ETCU7E10, Cyber Security
Prerequisite/s			Fundamentals of Computers, Basic Operating System Knowledge, Internet & Networking Basics, Awareness of Digital Applications
Teaching Scheme: Lecture/Tutorial/Practical			03/--/--
Credits			03
Evaluation Scheme	T	ISE / MSE / ESE	20/30/50
	P	INT / OE/POE	--/--/--
		Total	50

Course Description: Cyber Security is a professional elective course designed to introduce students to fundamental and advanced concepts of protecting computer systems, networks, and data from cyber threats. The course covers cryptography, network security, cyber attacks, cyber laws, and emerging trends such as IoT and cloud security, enabling students to understand security challenges in modern communication systems.

Course Objectives:

1	Introduce students to the fundamentals of cyber space and cyber security.
2	Create awareness about common cyber threats and safe digital practices.
3	Explain basic concepts of cryptography and secure communication.
4	Familiarize students with basic network and system security concepts.
5	Make students aware of cyber laws, ethics, and responsible online behavior.
6	Provide introductory knowledge of emerging areas in cyber security.

Course Outcomes (COs):

At the end of the course the student will be able to:

CO1	Understand basic concepts of cyber space, cyber security, and security challenges
CO2	Identify common cyber threats and cyber attacks affecting individuals and organizations
CO3	Explain basic cryptographic concepts used for data protection
CO4	Apply safe computing and internet practices to enhance personal and system security
CO5	Understand cyber laws, cyber ethics, and the role of government agencies in cyber security
CO6	Describe emerging trends and career opportunities in the field of cyber security





D.Y. Patil Education Society, Kolhapur
(Deemed to be University)
School of Engineering & Management
Kasaba Bawada, Kolhapur

Department of Electronics & Telecommunication Engineering

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
CO1	2	1	-	-	-	-	-	-	-	-	-	1	-	-	I
CO2	2	2	-	-	-	1	-	-	-	-	-	1	-	-	II
CO3	2	1	-	-	-	-	-	-	-	-	-	1	-	-	II
CO4	1	2	1	-	1	2	-	-	-	-	-	2	-	-	III
CO5	-	-	-	-	-	3	-	3	-	1	-	1	-	-	II
CO6	1	-	-	-	1	-	-	-	-	-	-	3	-	-	I/II

Content	Hrs.
UNIT-I: Basics of Cyber Security Introduction to Cyber Space, What is Cyber Security ?, Importance of Cyber Security in daily life, Basic Cyber Threats, Introduction to CIA Triad.	8
UNIT- II: Introduction to Cryptography Need of Cryptography, Basic terms: Plaintext, Ciphertext, Encryption, Decryption, Symmetric and Asymmetric Cryptography, Introduction to Hashing, Applications of Cryptography.	8
Unit-III: Basic Network Security Introduction to Computer Networks, Network Security Basics, Firewalls – concept and types, Secure Password Practices, Introduction to Secure Communication	7
UNIT - IV: Common Cyber Attacks: Introduction to Malware, Virus, Worm, Trojan (basic understanding), Phishing and Email Attacks, Password Attacks, Safe Browsing Practices	7
UNIT – V: Cyber Laws and Ethics: Introduction to Cyber Laws, IT Act 2000 (Overview), Common Cyber Crimes, Cyber Ethics, Role of Government in Cyber Security.	7
UNIT – VI: Awareness and Emerging Areas: Cyber Security Awareness, Cyber Safety on Social Media, Introduction to Cloud and Mobile Security, Basics of IoT Security, Career Opportunities in Cyber Security.	8





D.Y. Patil Education Society, Kolhapur
(Deemed to be University)
School of Engineering & Management
Kasaba Bawada, Kolhapur
Department of Electronics & Telecommunication Engineering

Reference Books:

1	William Stallings, <i>Cryptography and Network Security</i> , Pearson
2	Charles P. Pfleeger, <i>Security in Computing</i> , Pearson
3	Nina Godbole, <i>Information Systems Security</i> , Wiley

Useful Links	
1	NPTEL – Cyber Security Courses (IITs/IISc) https://nptel.ac.in/courses/106/105/106105217/
2	NPTEL – Cryptography & Network Security- https://nptel.ac.in/courses/106/105/106105031/





D.Y. Patil Education Society, Kolhapur
(Deemed to be University)
School of Engineering & Management
Kasaba Bawada, Kolhapur
Department of Electronics & Telecommunication Engineering

Final Year B. Tech. Curriculum w.e.f. A.Y.2026-2027
(As Per National Education Policy 2020)

Semester-VII

Class		B. Tech, Semester- VII	
Course Code and Course Title		23ETCU7E11, Software Networks	
Prerequisite/s		Basic knowledge of computer fundamentals, Elementary understanding of computer networks.	
Teaching Scheme: Lecture/Tutorial/Practical		03/--/--	
Credits		03	
Evaluation Scheme	T	ISE / MSE / ESE	20/30/50
	P	INT / OE/POE	--/--/--
	Total		50

Course Description: This course introduces Electronics and Telecommunication Engineering students to the fundamentals of software-based networking. It begins with a revision of basic computer networking concepts and gradually introduces the idea of software control in networks. The course is designed at a basic level for students, focusing on conceptual understanding.

Course Objectives:

1	Enable students to understand and revise fundamental concepts of computer networks and identify limitations of traditional networking approaches.
2	Introduce the concept of software-based networking and explain the need, features, and basic operation of Software Defined Networking (SDN).
3	Familiarize students with introductory concepts of network virtualization and its role in modern communication networks.
4	Develop awareness of applications, basic security aspects, and future trends of software networks in areas such as cloud computing, IoT, and enterprise networks.

Course Outcomes (COs):

At the end of the course the student will be able to:

CO1	Explain fundamental computer networking concepts and limitations of traditional networks
CO2	Describe the concept, need, and basic architecture of software-based networks and Software Defined Networking (SDN)
CO3	Understand basic principles of network virtualization and its role in modern communication networks
CO4	Identify applications, basic security aspects, and future scope of software networks in emerging technologies





D.Y. Patil Education Society, Kolhapur
(Deemed to be University)
School of Engineering & Management
Kasaba Bawada, Kolhapur

Department of Electronics & Telecommunication Engineering

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
CO1	3	2	-	-	-	-	-	-	-	-	-	2	-	2	I
CO2	3	2	1	-	1	-	-	-	-	-	-	2	-	2	II
CO3	2	1	-	-	1	-	-	-	-	-	-	2	-	2	II & III
CO4	2	1	-	-	1	1	-	1	-	-	-	2	-	2	II & III

Content	Hrs.
UNIT-I : Fundamentals of Computer Networks Basics of data communication, Network components: nodes, links, transmission media, Types of networks: LAN, MAN, WAN, Network topologies and their characteristics, OSI and TCP/IP reference models (overview only), Functions of network devices: hub, switch, router, gateway	7
Unit- II: Traditional Networking and Its Limitations Traditional network architecture, Control plane vs data plane (basic idea), Static vs dynamic network configuration, Issues in traditional networks: Complexity, Scalability, Vendor dependency, Need for programmable and flexible networks	7
UNIT-III: Introduction to Software Defined Networking (SDN) Concept and definition of SDN, SDN architecture: (Application plane, Control plane, Data plane), Role of SDN controller (logical view), Comparison: Traditional networks vs SDN, Advantages of SDN in modern networks, Basic SDN use case: traffic control in enterprise networks.	8
Unit- IV: SDN Operation and OpenFlow Basics Flow-based networking concept, Introduction to OpenFlow, OpenFlow components :- Flow table, Match fields and Actions, Communication between controller and switches (conceptual), Basic packet flow in SDN, Simple analysis of packet forwarding using flow rules.	8
Unit- V: Network Virtualization Concepts Meaning of network virtualization, Difference between physical and virtual networks, Virtual switches and virtual links (introductory), Role of virtualization in:- Cloud computing and Data centers, Relationship between SDN and network virtualization. Simple application scenario: virtual network for cloud users.	8
Unit VI: Applications, Security, and Future Trends Applications of software networks in: Cloud computing, IoT and Enterprise networks, Basic security concerns in software networks, Advantages and challenges of SDN deployment, Future trends in software networking, Case discussion: SDN in smart cities / 5G networks.	7





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Department of Electronics & Telecommunication Engineering

Text Books:

1	Thomas D. Nadeau, Ken Gray , <i>SDN: Software Defined Networks</i> , O'Reilly Media, First Edition.
2	Paul Goransson, Chuck Black , <i>Software Defined Networks: A Comprehensive Approach</i> , Morgan Kaufmann Publishers.
3	Andrew S. Tanenbaum, David J. Wetherall , <i>Computer Networks</i> , Pearson Education, 5th Edition.

Reference Books:

1	Feamster, Rexford, Zegura , <i>The Road to SDN: An Intellectual History of Programmable Networks</i> , ACM Queue.
2	Jim Metzler , <i>Cloud Networking: Understanding Cloud-Based Data Center Networks</i> , Cisco Press.
3	Larry Peterson, Bruce Davie , <i>Computer Networks: A Systems Approach</i> , Morgan Kaufmann.

Useful Links	
1	NPTEL Courses 1. Computer Networks – Prof. Bhaskaran Raman (IIT Bombay) (Strong base for Units I & II) 2. Software Defined Networking – IIT Madras / IIT Hyderabad (Introductory SDN concepts suitable for beginners) https://nptel.ac.in
2	Video & Tutorial Resources 1. Cisco Networking Academy – SDN Basics https://www.netacad.com





D.Y. Patil Education Society, Kolhapur
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School of Engineering & Management
Kasaba Bawada, Kolhapur
Department of Electronics & Telecommunication Engineering

Final Year B. Tech. Curriculum w.e.f. A.Y.2026-2027
(As Per National Education Policy 2020)

Semester-VII

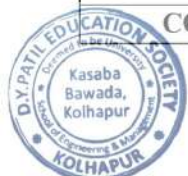
Class			B. Tech, Semester- VII
Course Code and Course Title			23ETCU7J12, Project
Prerequisite/s			Knowledge of core Electrical Engineering subjects
Teaching Scheme: Lecture/Tutorial/Practical			--/--/04
Credits			04
Evaluation Scheme	T	ISE / MSE / ESE	--/--/--
	P	INT / OE/POE	100/--/50
		Total	150

Course Description: The aim of this course is to provide a platform for design & development of a System as per the needs & requirement of a society/Industry. The project phase I work can be a design project / experimental project/ research based and or computer simulation project on Electrical engineering or any of the topics relevant to the discipline.

Course Outcome (Cos):	
After Successful completion of this course, the students will able to:	
C01	Identify a problem related to society, industry, individual.
C02	Analyse the problem by using basic engineering knowledge and modern Engineering tools.
C03	Design & Implement a system as per the needs of industry, society & individuals.
C04	Understand professional and ethical responsibilities to work in a peer & multidisciplinary team.
C05	Develop effective presentation and communication skills.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
CO1	3	-	-	-		2	1	-	1	-	-	-	3	2	II
CO2	3	3		2	2	-	-	-	-	-	-	-	1	3	IV





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School of Engineering & Management
Kasaba Bawada, Kolhapur

Department of Electronics & Telecommunication Engineering

CO3	-	-	3	-	-	1	1	3	3	-	-	-	2	2	VI
CO4	-	-	-	-	-	-	-	2	3	-	-	-	-	-	II
CO5	-	-	-	-	-	-	-	-	-	3	-	-	-	-	VI

General Guidelines

- Project work shall be carried out in **groups of maximum 5 students**.
- Each group shall work under the **guidance of an assigned faculty member**.
- The project must include:
 - Literature survey
 - Methodology development
 - Design work (block diagram/circuit/schematic)
 - Simulation and/or hardware implementation
 - Testing and validation
 - Result analysis
 - Documentation and presentation
- Each group must maintain a **Project Work Diary**, signed weekly by the guide.
- Students must deliver **two presentations before DRC**:
 - Mid-semester progress presentation
 - End-semester final presentation
- One copy of the report must be submitted to:
 - Department
 - Guide
 - Each student (personal copy)

Project Documentation Requirements

1. Project Work Diary

The diary must include weekly records of:

- Project topic selection process
- Literature survey (journals, IEEE papers, books, conference papers)
- Design calculations and methodology
- Simulation work completed
- Hardware/software development
- Testing performed
- Computer work done





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School of Engineering & Management
Kasaba Bawada, Kolhapur

Department of Electronics & Telecommunication Engineering

- Company visits (if any)
- Experts consulted
- Papers referred
- Creative ideas and improvements

Diary must be **countersigned weekly by the guide.**

2. Project Synopsis

Synopsis must contain:

1. Title of Project
2. Names of Students
3. Name of Guide
4. Relevance of Project
5. Literature Review
6. Proposed Work
7. Estimated Expenditure
8. References

Synopsis must be:

- Signed by students
- Approved by guide
- Endorsed by HoD

3. Seminar / Presentation Before DRC

Each group must present:

Mid-Semester Presentation

Include:

- Project title and objectives
- Literature review
- Problem statement
- Methodology
- Block diagram / system architecture
- Work completed till date

End-Semester Presentation

Include:

- Design implementation





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School of Engineering & Management
Kasaba Bawada, Kolhapur

Department of Electronics & Telecommunication Engineering

- Simulation/hardware results
- Testing outcomes
- Performance analysis
- Conclusion and future scope

Time Line of Project Implementation (Duration :12 Weeks)

Week	Activities	Expected Output
Week 1	Formation of group, discussion with guide, selection of project domain	Project area finalized
Week 2	Finalization of project title, scope and objectives	Approved title & objectives
Week 3	Literature survey (journals, IEEE papers, books)	Literature review draft
Week 4	Study of existing techniques and problem identification	Problem statement finalized
Week 5	Methodology preparation and system planning	Methodology framework
Week 6	Selection of components, tools, and software (MATLAB, Simulink, PSCAD, Proteus, etc.)	Tools finalized
Week 7	Block diagram and architecture development	System design ready
Week 8	Circuit design / simulation model / coding development	Initial implementation completed
Week 9	Hardware assembly or simulation testing	Preliminary results obtained
Week 10	Experimental testing and performance analysis	Observations recorded
Week 11	Preparation of graphs, tables, report writing, and diary completion	Draft project report
Week 12	Final seminar presentation, demonstration, and submission of report & diary	Final evaluation completed



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EDUCATION SOCIETY
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KOLHAPUR

Final Year B. Tech.
Structure and Curriculum Sem-VIII

Department of Electronics & Telecommunication Engineering

w.e.f. A.Y.2026-27





D.Y. Patil Education Society, Kolhapur (Deemed to be University)
School of Engineering & Management
Kasaba Bawada, Kolhapur

Teaching and Evaluation Scheme from Year 2023-27 (as per NEP-2020)

Department of Electronics and Telecommunication Engineering

B.Tech SEMESTER-VIII

Course Code	Course Category	Course Type	Course Name	Teaching Scheme				Theory			Practical		Total Marks
				Credits	L	P	T	ISE	MSE	ESE	INT	OE/PoE	
23ETCU8P01	Program Core Courses	PCC	Introduction to Adaptive Signal Processing (ODL)	4	4	-	-	20	30	50	-	-	100
23ETCU8E02	Professional Elective	PEC-6	1.Basics of Machine learning (ODL)	2	1	-	-	-	-	50	-	-	50
23ETCU8E03			2.Internet of Things (ODL)										
23ETCU8E04			3.Introduction to Artificial Intelligence (ODL)										
23ETCU8I05	Internship	INT	Internship	12	-	8	-	-	-	-	100	100	200
23ETCU8M06	Multidisciplinary Minor	MDM-6	Industrial Automation and Control (ODL)	2	2	-	-	-	-	50	-	-	50
Total				20	7	8	-	20	30	150	100	100	400
23ETCU8Z07	Honors Courses/Double (Minor)	HC (Optional)	ODL- Honors Paper- V Design and Analysis of VLSI Subsystems (ODL)	2	2	-	-	-	-	50	-	-	50

*- Values not included in total, # - 2 contact hrs per club, Min Marks for passing: 40% of total marks of individual course



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Kasaba Bawada, Kolhapur

Department of Electronics & Telecommunication Engineering

B. Tech. Curriculum w.e.f.A.Y.2026-27
(As Per National Education Policy 2020)

Semester-VIII

Class			B. Tech, Semester- VIII
Course Code and Course Title			23ETCU8P01 Introduction to Adaptive Signal Processing (ODL)
Prerequisite/s			Signals and Systems, Digital Signal Processing (DSP)
Teaching Scheme: Lecture/Tutorial/Practical			04/--/--
Credits			04
Evaluation Scheme	T	ISE / MSE / ESE	20/30/50
	P	INT / OE/POE	--/--/--
	Total		100

Course Description: This course introduces the fundamentals of mechatronics, covering system concepts, sensors, actuators, controllers, and microcontroller-based applications through real-world case studies.

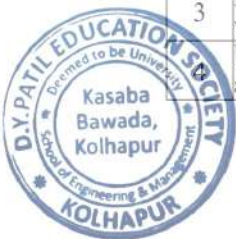
Course Objectives:

1	Understand the need for adaptive signal processing in environments where signal characteristics vary with time.
2	Learn the fundamentals of adaptation algorithms and evaluate them based on convergence rate, computational complexity, numerical stability, and robustness to noise.
3	Analyze and design important classes of adaptive filters such as the Least Mean Squares (LMS) and Recursive Least Squares (RLS) algorithms.
4	Understand the principles and applications of Kalman filtering for adaptive estimation and tracking in dynamic systems.

Course Outcomes (COs):

At the end of the course the student will be able to:

1	Explain the concept of adaptive signal processing and its importance in time-varying and non-stationary environments..
2	Analyze the performance of adaptive algorithms using criteria such as convergence rate, stability, computational complexity, and robustness to noise
3	Derive and implement the Least Mean Squares (LMS) adaptive filtering algorithm and its variants.
	Understand and apply the Recursive Least Squares (RLS) algorithm for fast-converging adaptive filtering applications.world case studies.





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School of Engineering & Management
Kasaba Bawada, Kolhapur

Department of Electronics & Telecommunication Engineering

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
CO1	3	2	-	-	-	-	-	-	-	-	1	2	2	-	III
CO2	3	3	1	2	1	-	-	-	-	-	2		2	-	III
CO3	3	3	2	2	3	-	-	1	-	-	2		3	1	IV
CO4	3	3	2	2	3	-	-	1	-	-	2	3	3	1	IV

Content	Hrs.
UNIT . I : Introduction: The filtering problem, Adaptive filters, linear filter structures, approaches to the development of linear adaptive filter algorithms, real and complex forms of adaptive filters, non-linear adaptive filters, Applications. stationary processes and models: Partial characterization of a discrete time stochastic process, mean ergodic theorem, correlation matrix, correlation matrix of sine wave plus noise, stochastic models, wold decomposition, asymptotic stationarity of an auto regressive process. Yule-Walker equations. Selecting the model order. Complex Gaussian process	8
UNIT. II: Wiener Filters: Linear optimum filtering problem statement, principle of orthogonality, minimum mean squared error, wiener. hopf equations, error. performance surface. Channel equalization. Linearly constrained minimum variance filter , generalized side lobe cancellers	8
UNIT. III :Linear Prediction: Forward Linear Prediction, backward Linear Prediction, Levinson-Durbin algorithm, properties of prediction error filters, Schur- Cohn test, auto regressive modeling of a stationary stochastic process, Cholesky factorization, lattice predictors, joint process estimation, block estimation. Method of steepest descent: Steepest descent algorithm, stability of the Steepest descent algorithm.	8
UNIT. IV : Least Mean Square (Lms) Algorithm: Over view of the structure and operation of the Least Mean square Algorithm, Least Mean square adaptation Algorithm, stability and performance analysis of the LMS algorithm. Normalized Least Mean Square (NLMS) Algorithm, Concept of method of least squares, recursive least squares (rls) algorithm: The matrix inversion lemma, the exponentially weighted RLS algorithm, update recursion for the sum of weighted error squares, Convergence analysis of the RLS algorithm.	8
UNIT V :Kalman Filters: Recursive minimum mean square estimation for scalar random variables, statement of the Kalman filtering problem, the innovations process, estimation of the state using the innovations process, filtering, initial conditions, variants of the Kalman filter, extended Kalman filtering.	8





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School of Engineering & Management
Kasaba Bawada, Kolhapur

Department of Electronics & Telecommunication Engineering

UNIT VI: Subband and Multirate Adaptive Filters:	8
Subband adaptive filtering structure, Advantages in convergence and complexity, Applications in echo cancellation.	

Text Books:

1	Adaptive Filter Theory, S. Haykin, Prentice-Hall, 4-th edition, 2001.
2	Fundamentals of Adaptive Filtering, Ali H. Sayed, John Wiley, 2003.

Reference Books:

1	Monson H. Hayes, .Statistical Digital Signal Processing And Modeling., Wiley India, 2008.
2	John G. Proakis, Dimitris G. Manolakis, .Digital Signal Processing, Principles, Algorithms and Applications., Pearson Education / PHI, 2007.
3	B. Farhang-Boroujen, .Adaptive Filters: Theory and Applications., John Wiley and Sons, 2013.

Useful Links

https://onlinecourses.nptel.ac.in/noc26_ee50/





D.Y. Patil Education Society, Kolhapur
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School of Engineering & Management
Kasaba Bawada, Kolhapur

Department of Electronics & Telecommunication Engineering

B. Tech. Curriculum w.e.f.A.Y.2026-27
(As Per National Education Policy 2020)

Semester-VIII

Class		B. Tech, Semester- VIII	
Course Code and Course Title		23ETCU8E02, Basics of Machine learning (ODL)	
Prerequisite/s		Linear Algebra and Probability Basics	
Teaching Scheme: Lecture/Tutorial/Practical		01/--/--	
Credits		02	
Evaluation Scheme	T	ISE / MSE / ESE	--/--/50
	P	INT / OE/POE	--/--/--
		Total	50

Course Description: This course introduces the fundamental concepts of Machine Learning, covering mathematical foundations, supervised learning, deep learning, and advanced machine learning algorithms. Students will learn to build and evaluate intelligent models for solving real-world prediction, classification, and pattern recognition problems.

Course Objectives:

1	To understand the fundamental concepts and mathematical foundations of Machine Learning.
2	To learn supervised machine learning algorithms for prediction and classification.
3	To explore deep learning models and convolutional neural networks for intelligent applications.
4	To study advanced machine learning algorithms and recurrent neural networks for real-world problems.

Course Outcomes (COs):

At the end of the course the student will be able to:

1	Explain the fundamentals and mathematical concepts of Machine Learning.
2	Apply supervised learning algorithms for regression and classification problems.
3	Illustrate deep learning concepts using ANN and CNN models.
4	Explain advanced machine learning algorithms and RNN-based models for data analysis.





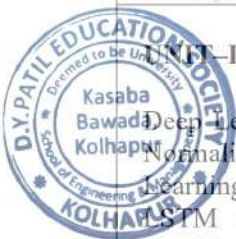
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Department of Electronics & Telecommunication Engineering

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
CO1	3	3	–	–	1	–	–	–	–	–	–	2	3	2	II
CO2	2	3	3	2	3	–	–	–	–	1	–	2	2	3	III
CO3	2	3	3	2	3	–	–	–	–	1	–	2	2	3	III
CO4	2	3	3	3	2	–	–	–	–	2	–	3	2	3	IV

Content	Hrs.
UNIT-I: Mathematical Foundations for Machine Learning Introduction to AI and Machine Learning: History, Applications and Learning Paradigms. Linear Algebra: Scalars, Vectors, Tensors, Matrix Operations, Norms and Matrix Decompositions. Probability and Statistics: Random Variables, Bayes' Theorem, Expectation, Variance and Covariance. Optimization Basics: Derivatives, Gradient, Matrix Calculus and Gradient Descent.	4
UNIT-II: Supervised Machine Learning Learning Paradigm: Types of Machine Learning, Linear Regression, Least Squares Method, Gradient Descent, Goodness of Fit, Bias-Variance Trade-off. Classification: Logistic Regression, Binary Cross-Entropy Loss, Sigmoid Function, Gradient Computation, Multiclass Classification, One-Hot Encoding, Softmax Function, Performance Evaluation.	4
UNIT-III: Deep Learning Fundamentals Introduction to Deep Learning: Artificial Neural Networks, Perceptron, Activation Functions, Binary Classification using Logic Gates (AND, OR, NAND, NOR, XOR). Convolutional Neural Networks (CNN): Introduction, Types of Convolution, CNN Layers, Pooling, Feature Extraction, CNN Architectures – LeNet, AlexNet, VGGNet, GoogleNet, ResNet, DenseNet, Applications of CNN.	4
UNIT-IV: Advanced Machine Learning Deep Learning Techniques: Weight Initialization, Data Normalization and Batch Normalization. Recurrent Neural Networks (RNN): Introduction, Sequence Learning, Backpropagation Through Time (BPTT), Vanishing Gradient Problem, LSTM and Bidirectional RNNs. Machine Learning Algorithms: K-Nearest Neighbors (KNN), Decision Trees, Random Forest and K-Means Clustering.	4





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School of Engineering & Management

Kasaba Bawada, Kolhapur

Department of Electronics & Telecommunication Engineering

Text Books:

1	Machine Learning, Saikar Dutt, Subramanian Chandramouli, Amit Kumar Das, pearson India Learning, Tom M. Mitchell, McGraw-Hill Education
2	Machine Learning, Tom M. Mitchell, McGraw-Hill Education

Reference Books:

1	Ethem Alpaydin, Introduction to Machine Learning, MIT Press.
2	Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning, MIT Press.

Useful Links

Machine Learning for Engineering and Science Applications, NPTEL, [IIT Madras Course Page](#), Prof. Balaji Srinivasan and Prof. Ganapathy Krishnamurthi. <https://nptel.ac.in/courses/106106198>





D.Y. Patil Education Society, Kolhapur
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School of Engineering & Management
Kasaba Bawada, Kolhapur

Department of Electronics & Telecommunication Engineering

B. Tech. Curriculum w.e.f. A.Y.2026-27
(As Per National Education Policy 2020)

Semester-VIII

Class			B. Tech, Semester- VIII
Course Code and Course Title			23ETCU8E03, Internet of Things (IoT)
Prerequisite/s			Basic Electronics, Fundamentals of Microcontrollers, Basics of Communication Systems
Teaching Scheme: Lecture/Tutorial/Practical			01/--/--
Credits			02
Evaluation Scheme	T	ISE / MSE / ESE	--/--/50
	P	INT / OE/POE	--/--/--
		Total	50

Course Description: The Internet of Things (IoT) course introduces the fundamental concepts, architecture, and enabling technologies of IoT systems with a focus on electronics and communication aspects. The course emphasizes sensors, embedded devices, communication technologies, and system-level design rather than intensive programming.

Course Objectives:

1	To understand the fundamentals, architecture, and networking concepts of IoT.
2	To learn IoT connectivity technologies and interoperability concepts.
3	To develop basic IoT applications using Arduino and Raspberry Pi.
4	To explore SDN, Cloud Computing, and Sensor-Cloud for IoT solutions.

Course Outcomes (COs):

At the end of the course the student will be able to:

CO1	Explain the fundamentals of IoT, its architecture, components, sensing, and networking.
CO2	Describe IoT connectivity technologies and their applications.
CO3	Illustrate IoT interoperability and develop basic IoT applications using Arduino and Raspberry Pi.
CO4	Explain SDN, Cloud Computing, and Sensor-Cloud concepts for IoT applications.





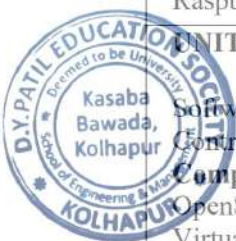
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Department of Electronics & Telecommunication Engineering

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
CO1	3	3	-	-	-	-	-	-	-	-	-	1	2	1	II, III
CO2	2	3	2	-	2	-	-	-	-	-	-	1	3	2	II, III
CO3	2	3	2	-	2	-	-	-	-	-	-	1	3	2	II, III
CO4	2	3	3	2	3	-	-	-	-	-	-	2	3	3	III, IV

Content	Hrs.
UNIT-I: Fundamentals of Internet of Things Introduction to IoT: Definition, Evolution, Characteristics, IoT Architecture, Components and Ecosystem, IoT Applications, Sensing and Actuation: Types and Role of Sensors and Actuators, Basics of IoT Networking: IoT Communication Models, OSI and TCP/IP Models, IP Addressing.	8
UNIT-II: IoT Connectivity Technologies Bluetooth: Architecture, Protocol Stack, Connection Establishment, Piconet and Scatternet. NFC: Types, Working Principle, Modes of Operation and Applications. WirelessHART: Architecture, Protocol Stack, Network Management and Applications. Z-Wave: Architecture, Network Topology, Routing Mechanism and Applications.	7
Unit- III : IoT Interoperability and IoT Development Platforms IoT Interoperability: Introduction, Need and Challenges of Interoperability, Types of Interoperability (User and Device Interoperability), Device Identification and Discovery, Syntactic and Semantic Interoperability, Middleware, Universal Middleware Bridge (UMB). IoT Development Platforms: Introduction to Arduino and Raspberry Pi, Architecture, GPIO, Arduino IDE, Raspberry Pi OS, Sensor Interfacing, IoT Applications.	7
UNIT-IV: Software Defined Networking and Cloud-based IoT Software Defined Networking (SDN): Introduction, SDN Architecture, SDN Controller, OpenFlow, Network Virtualization and IoT Applications. Cloud Computing : Characteristics, Virtualization, Service Models (IaaS, PaaS, SaaS), OpenStack Architecture, Sensor-Cloud, Sensor-as-a-Service (SeaaS), Sensor Virtualization and Cloud-based IoT Applications.	8





D.Y. Patil Education Society, Kolhapur

(Deemed to be University)

School of Engineering & Management

Kasaba Bawada, Kolhapur

Department of Electronics & Telecommunication Engineering

Text Books:

1	Arshdeep Bahga & Vijay Madisetti, Internet of Things: A Hands-On Approach Universally used textbook covering IoT fundamentals, architecture, sensors, protocols, and cloud.
2	Raj Kamal, Internet of Things: Architecture and Protocols Good for architecture, communication technologies, and IoT system design — electronics focus.
3	H. Chaudhary, Internet of Things and Sensors: Principles, Algorithms, and Applications Useful for sensor interfacing and system level overview (moderate level).

Reference Books:

1	Pradeep Singh, Internet of Things: Concepts and Applications Student-friendly, good for quick topic understanding and applications.
2	Vibha Srivastava & R.S. Chauhan, Internet of Things: Technologies & Applications Extra examples and case studies — useful for assignments and concept clarity.
3	uno Pfister, Getting Started with the Internet of Things A beginner-oriented book especially useful for Arduino/ESP8266 basics.

Useful Links

1

IoT course offered on NPTEL/SWAYAM platform by Prof. Sudip Misra, IIT Kharagpur — ideal for fundamentals, sensors, networking, protocols, and applications.

Course Page (with videos & materials):

https://onlinecourses.nptel.ac.in/noc26_cs37/preview





D.Y. Patil Education Society, Kolhapur
(Deemed to be University)
School of Engineering & Management
Kasaba Bawada, Kolhapur

Department of Electronics & Telecommunication Engineering

B. Tech. Curriculum w.e.f. A.Y.2026-27
(As Per National Education Policy 2020)

Semester-VIII

Class		B. Tech, Semester- VIII	
Course Code and Course Title		23ETCU8E04, Introduction to Artificial Intelligence (AI) (ODL)	
Prerequisite/s		Basic programming fundamentals, Basic Data structures, Discrete mathematics, Basic mathematical of algebra and elementary statistics.	
Teaching Scheme: Lecture/Tutorial/Practical		01/--/--	
Credits		02	
Evaluation Scheme	T	ISE / MSE / ESE	--/--/50
	P	INT / OE/POE	--/--/--
		Total	50

Course Description:

This course introduces the fundamental concepts of Artificial Intelligence, including intelligent agents, search techniques, knowledge representation, reasoning, machine learning, deep learning, and emerging AI technologies for solving real-world problems.

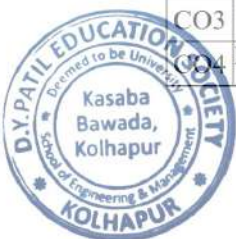
Course Objectives:

1	To understand the fundamentals of Artificial Intelligence and intelligent problem-solving techniques.
2	To learn knowledge representation, logical reasoning, and planning methods.
3	To explore probabilistic reasoning and machine learning concepts.
4	To study deep learning models and emerging AI technologies.

Course Outcomes (COs):

At the end of the course the student will be able to:

CO1	Explain the fundamentals of Artificial Intelligence and search techniques.
CO2	Apply knowledge representation, reasoning, and planning methods to AI problems.
CO3	Illustrate probabilistic reasoning and machine learning concepts.
CO4	Explain deep learning models and emerging AI technologies for intelligent applications.



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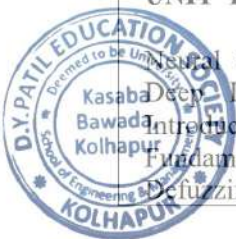
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Department of Electronics & Telecommunication Engineering

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
CO1	3	2	-	-	-	-	-	-	-	-	-	1	2	1	I, II
CO2	3	3	2	1	2	1	-	-	-	-	-	1	2	2	II, III
CO3	2	3	2	1	1	1	-	-	-	-	-	1	2	2	II, III
CO4	2	3	2	2	2	2	-	-	1	1	-	2	1	3	I, II

Content	Hrs.
UNIT-I: Fundamentals of Artificial Intelligence Introduction to AI: History, Applications, Intelligent Agents and Environment. Problem Solving: State Space Representation, Problem Formulation, Search Strategies. Uninformed Search: Breadth-First Search (BFS), Depth-First Search (DFS), Uniform Cost Search. Informed Search: Heuristic Search, Best-First Search, A* Search. Adversarial Search: Game Playing and Minimax Algorithm.	8
UNIT-II: Knowledge Representation and Planning Knowledge Representation: Knowledge-Based Agents, Propositional Logic, Predicate Logic, Inference Techniques. Expert Systems: Architecture and Applications. Reasoning: Non-monotonic Reasoning and Knowledge Representation Schemes. Planning: Planning, Planning Graphs and Scheduling.	8
UNIT-III: Reasoning under Uncertainty and Machine Learning Uncertainty in AI: Probabilistic Reasoning, Bayesian Networks, Dynamic Bayesian Networks, Utility Theory and Decision Making. Introduction to Machine Learning: Learning Paradigms, Learning Algorithms, Hypothesis Learning, Ensemble Learning. Evolutionary Computing: Genetic Algorithms and Genetic Programming.	7
UNIT-IV: Deep Learning and Emerging AI Technologies Artificial Neural Networks: Artificial Neural Networks, Multilayer Perceptron (MLP). Deep Learning: CNN, RNN and LSTM Architectures. Generative AI: Introduction and Applications. Natural Language Processing (NLP): Fundamentals and Applications. Fuzzy Systems: Fuzzy Sets, Fuzzification and Defuzzification.	7





D.Y. Patil Education Society, Kolhapur
(Deemed to be University)
School of Engineering & Management
Kasaba Bawada, Kolhapur

Department of Electronics & Telecommunication Engineering

Text Books:

1	Artificial Intelligence: A Modern Approach – Stuart Russell & Peter Norvig, Pearson Education.
2	Artificial Intelligence – Elaine Rich & Kevin Knight, Tata McGraw Hill.

Reference Books:

1	Introduction to Artificial Intelligence and Expert Systems – Dan W. Patterson, PHI Learning.
2	Artificial Intelligence: Foundations of Computational Agents – David L. Poole & Alan K. Mackworth, Cambridge University Press.

Useful Links

NPTEL: [Artificial Intelligence: Concepts and Techniques](https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_cs159), Indian Institute of Science, Prof. V. Susheela Devi. https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_cs159





D.Y. Patil Education Society, Kolhapur
(Deemed to be University)
School of Engineering & Management
Kasaba Bawada, Kolhapur
Department of Electronics & Telecommunication Engineering

B. Tech. Curriculum w.e.f.A.Y.2026-27
(As Per National Education Policy 2020)

Semester-VIII

Class			B. Tech, Semester- VIII
Course Code and Course Title			23ETCU8I05, Internship
Prerequisite/s			
Teaching Scheme: Lecture/Tutorial/Practical			--/--/08
Credits			12
Evaluation Scheme	T	ISE / MSE / ESE	--/--/--
	P	INT / OE/POE	100/100/--
		Total	200

Course Description: This course provides an internship experience that integrates academic learning with **industry, research, or on-the-job training (OJT)** exposure, enabling students to gain practical skills, professional experience, and industry readiness.

Course Objectives:

1	To expose students to real-world professional environments in industry, research, or entrepreneurial settings.
2	To develop the ability to identify, analyze, and solve practical engineering or business problems using technical knowledge.
3	To cultivate effective communication skills and teamwork required in professional work environments.
4	To enable students to apply academic learning in real-world contexts through industry practices or entrepreneurial execution.

Course Outcomes (COs):

At the end of the course the student will be able to:

1	Demonstrate understanding of real-world professional practices in industry, research, or startup environments.
2	Identify, analyze, and solve practical engineering or business problems using appropriate tools and techniques.
3	Exhibit effective communication and teamwork skills in professional settings.
4	Apply academic knowledge to execute industry-oriented tasks or entrepreneurial solutions in real-world scenarios.





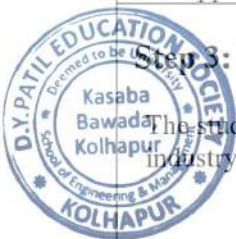
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School of Engineering & Management
Kasaba Bawada, Kolhapur

Department of Electronics & Telecommunication Engineering

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
CO1	3	2	-	2	2	-	-	-	1	-	-	-			III
CO2	2	3	2	2	2	-	-	-	1	-	-	-			IV
CO3	-	-	-	-	-	1	1	3	3	2	-	-			III
CO4	-	-	-	-	-	-	-	2	2	3	1	2			VI

Content	Timeline	Deliverables / Records
Step 1: Domain Selection The student shall select a suitable internship domain based on interest and relevance to the program. The domain options include: • Industry Internship (Offline): Working physically in a company on real-time projects. • Research Internship: Working under faculty/research labs focusing on innovation, analysis, or publications. • Entrepreneurship & Startup Internship (ESI): Students (individually or in teams of 2–3) shall create a new startup OR execute a business expansion project for an existing startup/MSME, with measurable outcomes, under faculty and external mentor guidance. • On-the-Job Training (OJT): Structured hands-on training in industry The selected domain must align with learning outcomes and be approved by the department.	In the First Week of last month of 7th Semester	
Step 2: Approval & Registration The student shall obtain an offer letter or confirmation and submit internship details (domain, duration: 3–4 months, Industry mentor details) for approval and registration.	In the First Two Week of last month of 7th Semester	Offer letter, approval form
Step 3: Pre-Internship Preparation The student shall prepare a work plan in consultation with the faculty and industry/research mentor.	In the 3 rd and 4 th Week of last month of 7th Sem	Internship plan document Logbook, task records





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School of Engineering & Management
Kasaba Bawada, Kolhapur

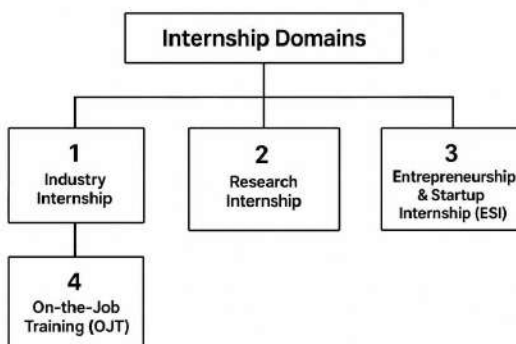
Department of Electronics & Telecommunication Engineering

Step 4: Internship Execution During the 3–4 months internship , the student shall perform assigned tasks, follow professional and safety norms, and maintain a regular logbook with periodic updates.	Week 3–12/16 (start of 8 th Semester)	Logbook, Progress reports
Step 6: Report Submission & Evaluation The student shall submit the final report, logbook, and certificate, followed by presentation and viva-voce for final assessment.	Final 2 Weeks (Within Last week of 8 th semester)	Final report, PPT, certificate

Assessment Scheme (Total: 200 Marks) :

Assessment Type	Attendance / Discipline	Logbook / Records	Industry Evaluation	Presentation	Report	Viva	Total
Internal (100 Marks) by Institute Mentor + Industry Mentor	10	20	50	20	-	-	100
External (100 Marks) by External Examiner	-	-	-	30	40	30	100

Internship Domain Details :





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School of Engineering & Management
Kasaba Bawada, Kolhapur

Department of Electronics & Telecommunication Engineering

Industry Internship (Offline)

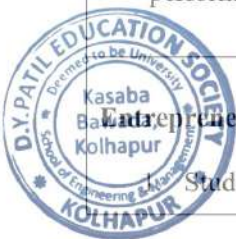
1. Student works physically in an industry/organization, preferably in domains such as software development, networking, embedded systems, or IT services.
2. Involves real-time tasks including design, development, testing, maintenance, deployment, and troubleshooting.
3. Provides hands-on exposure to industrial processes, tools, technologies, and professional work culture.
4. Student shall work under the supervision of an industry mentor, ensuring tasks are aligned with course objectives and learning outcomes.
5. Proper documentation such as logbook, task reports, and performance feedback must be maintained throughout the internship.

Research Internship

1. Working under faculty/research labs or recognized R&D organizations focusing on innovation, analysis, and development.
2. The student shall undertake a research-oriented problem relevant to their discipline.
3. The work should involve literature review, problem formulation, methodology design, implementation, and result analysis.
4. The student is expected to produce research outcomes in the form of: Research paper publication in a reputed journal/conference (Scopus/UGC/peer-reviewed preferred), or Patent filing, or Copyright/Intellectual Property (IPR) submission
5. The student shall work under the guidance of a faculty/research mentor and follow proper research ethics (no plagiarism).
6. A research report/documentation must be prepared in standard format.
7. Publication/IPR submission proof shall be considered as strong evidence of completion and performance.

Entrepreneurship & Startup Internship (ESI)

Students shall work individually or in teams (2–3 members) to develop a startup idea or execute a





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(Deemed to be University)
School of Engineering & Management
Kasaba Bawada, Kolhapur

Department of Electronics & Telecommunication Engineering

business expansion project in collaboration with a startup, MSME, or local enterprise.

2. The student/team shall identify a real-world problem or business opportunity relevant to their discipline and propose an innovative and feasible solution.
3. The work should involve idea validation, market research, business model development (such as Business Model Canvas), planning, implementation, and performance analysis.
4. The student is expected to develop a tangible outcome in the form of:
 1. A functional prototype/product/service, or
 2. A deployed solution (website/app/system), or
 3. A business expansion activity with measurable impact.
5. The project must include real-world validation through user/customer feedback, pilot testing, or interaction with stakeholders (minimum evidence required).
6. Students shall work under the guidance of a faculty mentor and, preferably, an external mentor (startup founder/industry expert), ensuring alignment with learning outcomes and professional practices.
7. The work should demonstrate integration of technical knowledge with entrepreneurial skills such as innovation, problem-solving, decision-making, and teamwork.
8. Students must maintain proper documentation including proposal, business model, execution records, validation evidence, and weekly logbook.
9. A final report and presentation (startup pitch/demo) must be submitted, clearly highlighting implementation, outcomes, and impact.
10. Proof of execution (such as prototype, deployment, user feedback, or measurable business impact) shall be considered as strong evidence of completion and performance. Mere conceptual ideas without implementation will not be accepted.





D.Y. Patil Education Society, Kolhapur
(Deemed to be University)
School of Engineering & Management
Kasaba Bawada, Kolhapur

Department of Electronics & Telecommunication Engineering

On-the-Job Training (OJT)

1. Students can complete OJT in industries engaged in electronics and electrical domains, particularly in manufacturing, production, testing, maintenance, and operations.
2. The training may be carried out in departments such as production lines, quality control, assembly, research & development (R&D), testing laboratories, and maintenance units.
3. Students gain hands-on experience in electronic systems, electrical equipment, industrial processes, and production workflows.
4. The OJT shall be aligned with real job roles, enabling students to understand industrial practices, standards, and quality procedures.
5. Training is conducted under the supervision of an industry mentor and must be relevant to the program outcomes.
6. Students are required to maintain logbook, task records, and submit performance reports as part of evaluation.





D.Y. Patil Education Society, Kolhapur
(Deemed to be University)
School of Engineering & Management
Kasaba Bawada, Kolhapur
Department of Electronics & Telecommunication Engineering

Final Year B. Tech. Curriculum w.e.f.A.Y.2026-27
(As Per National Education Policy 2020)

Semester-VIII

Class		B. Tech, Semester- VIII	
Course Code and Course Title		23ETCU8M06, Industrial Automation & Control (MDM-6) (ODL)	
Prerequisite/s		Knowledge of Digital Electronics and Mechatronics	
Teaching Scheme: Lecture/Tutorial/Practical		02/--/--	
Credits		02	
Evaluation Scheme	T	ISE / MSE / ESE	--/--/50
	P	INT / OE/POE	--/--/--
		Total	50

Course Description: To provide a clear view on Programmable Logic Controllers (PLC) & to learn the various methods involved in automatic control and monitoring & to familiarize with the communication protocol this course has been inducted.

Course Objectives:

1	To understand the architecture and working of PLC and its role in industrial automation.
2	To learn PLC programming using different instructions and logical operations.
3	To design and develop PLC-based automation solutions for industrial applications.
4	To introduce SCADA systems and develop basic SCADA applications integrated with PLC.

Course Outcomes (COs):

At the end of the course the student will be able to:

1	Explore the architecture of PLC and its functions.
2	Execute the various instructions and logic in PLC.
3	Develop the PLC program for various applications.
4	Design and develop the SCADA for various applications.





D.Y. Patil Education Society, Kolhapur
(Deemed to be University)
School of Engineering & Management
Kasaba Bawada, Kolhapur

Department of Electronics & Telecommunication Engineering

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	BTL
CO1	3	2	-	-	2	-	-	-	-	-	-	1			II
CO2	3	3	2	-	3	-	-	-	-	-	-	1			III
CO3	3	3	3	2	3	-	-	-	-	-	-	2			VI
CO4	3	3	3	2	3	-	-	-	-	-	-	2			VI

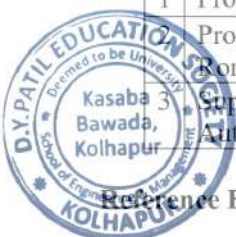
Content	Hrs.
UNIT- I: Programmable Logic Controllers Introduction - Parts of PLC - Principles of operation - PLC sizes - PLC hardware components - I/O section - Analog I/O modules - digital I/O modules CPU processor memory module - PLC programming Simple instructions - Output control devices - Latching relays PLC ladder diagram.	6
Unit- II: Instructions: Timer instructions ON Delay, OFF Delay and Retentive Timers-UP Counter, DOWN Counter and UP down Counters, program control instructions - Data manipulating instructions-math instructions	6
UNIT-III: Application of PLC Traffic light control, 24-hour clock design, Automatic stacking process, temperature control, Automatic control of warehouse door, Automatic lubrication of supplier Conveyor belt, Motor Control.	6
Unit- IV: Networking of PLC and SCADA Networking of PLCs-Data Communication-Fieldbus, PROFI bus, and Mod bus-OSI Model types-OPC function. Supervisory Control and Data Acquisition-Architecture-Remote terminal unit-Master terminal unit-Data Storage	6

Text Books:

1	Programmable Logic Controllers by, Frank D. Petruzella, McGraw-Hill Education
2	Programmable Logic Controllers: Principles and Applications by, John W. Webb & Ronald A. Reis, Pearson Education
3	Supervisory Control and Data Acquisition Stuart A. Boyer ISA (International Society of Automation)

Reference Books:

1	Programmable Logic Controllers by, Petruzella Frank D, Tata McGraw-Hill Publishing
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	Co. Ltd., New Delhi.
2	Programmable Logic Controllers: Principles and Application by, Webb, John W., Fifth edition, Prentice Hall of India, New Delhi
3	SCADA: Supervisory Control and Data Acquisition by, Stuart A. Boyer, ISA Publication.

Useful Links

NPTEL 12 weeks Industrial Automation and Control By Prof. Siddhartha Mukhopadhyay



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