Walchand Institute of Technology, Solapur
(An Autonomous Institute)

Affiliated to
Punyashlok Ahilyadevi Holkar Solapur University, Solapur

Choice Based Credit System (CBCS)

Structure and Syllabus
for
T. Y. B.Tech. Electronics and Telecommunication Engineering
W.E.F. 2025-26

HEAD
Electronics & Telecommunication Department
Walchand Institute of Technology
SOLAPUR - 413006

WIT SOLAPUR

Dr. Mrs. N. A. Nirgude
Dean Academics

Department of Electronics and Telecommunication Engineering

Vision

- To be a distinguished center for nurturing the holistic development of competent young engineers in the electronics and allied field.

Mission

- **M1:** To inculcate and stimulate Electronics & allied Engineering proficiency amongst students through quality education and innovative educational practices.
- **M2:** To create engineering professionals with social consciousness.
- **M3:** To foster technical skills of students through creativity and critical thinking.
- **M4:** To enhance soft skill set of students which is crucial for career success through effectual training.

Department of Electronics and Telecommunication Engineering

Program Educational Objectives (PEOs)

- **PEO 1:** Graduates will exhibit strong fundamental knowledge and technical skills in Electronics and Telecommunication Engineering and allied fields.
- **PEO 2:** Graduates will manifest technological progression, hardware & software skills to fabricate sustainable, energy efficient and futuristic solutions to pursue successful professional careers in multidisciplinary fields.
- **PEO 3:** Graduates will demonstrate professional ethics, effective communication, teamwork, leadership qualities and ability to relate engineering issues to broader social context along with lifelong learning.

Knowledge and Attitude Profile (WK)

WK1	A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.
WK2	Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.
WK3	A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.
WK4	Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.
WK5	Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.
WK6	Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.
WK7	Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.
WK8	Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.
WK9	Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

Program Outcomes (POs)	
PO 1	**Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
PO 2	**Problem Analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
PO 3	**Design/Development of Solutions:** Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
PO 4	**Conduct Investigations of Complex Problems:** Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
PO 5	**Engineering Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
PO 6	**The Engineer and The World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
PO 7	**Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
PO 8	**Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
PO 9	**Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning difference
PO 10	**Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
PO 11	**Life-long Learning:** Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

Program Specific Outcomes (PSOs)

- **PSO 1:** Graduates will be able to attain a solid foundation in Electronics and Telecommunication Engineering with an ability to function in multidisciplinary environment.
- **PSO 2:** Graduates will be able to use techniques and skills to design, analyze, synthesize, and simulate Electronics and Telecommunication Engineering components and systems.
- **PSO 3:** Graduate will be capable of developing programs in Assembly, High level and HDL languages using contemporary tools for software development.

Department of Electronics and Telecommunication Engineering

Legends Used	
L	Lecture Hours / week
T	Tutorial Hours / week
P	Practical Hours / week
FA	Formative Assessment
SA	Summative Assessment
ESE	End Semester Examination
ISE	In Semester Evaluation
ICA	Internal Continuous Assessment
POE	Practical and Oral Exam
OE	Oral Exam
MOOC	Massive Open Online Course
HSS	Humanity and Social Science
NPTEL	National Programme on Technology Enhanced Learning
F.Y.	First Year
S.Y.	Second Year
T.Y.	Third Year
B. Tech.	Bachelor of Technology

Department of Electronics and Telecommunication Engineering

Course Code Format

2	3	E	T	U/P	2	C	C	1	T/L
Year of Syllabus revision		Program Code		U-Under Graduate P-Post Graduate	Semester No./ Year 1/2/3/…8	Course Type		Course Serial No 1-9	T-Theory, L-Lab session A-Tutorial P-Programming / Design

Program Code	
ET	Electronics and Telecommunication Engineering
Course Type	
BS	Basic Science
ES	Engineering Science
HU	Humanities & Social Science
MC	Mandatory Course
CC	Program Core Compulsory Course
SN*	Self-Learning (**N*** *indicates the serial number of electives offered in the respective category)*
EN*	Program Core Elective Course (**N*** *indicates the serial number of electives offered in the respective category)*
SK	Skill-Based Course
SM	Seminar
MP	Mini project
PR	Project
IN	Internship
ON*	Open Elective (**N*** *indicates the serial number of electives offered in the respective category)*
MD	Multidisciplinary Minor

EM	Entrepreneurship/Economics/Management Courses
FP	Community Engagement Project / Field Project
AE	Ability Enhancement Course
VE	Value Education Course
IK	Indian Knowledge System
VS	Vocational & Skill Enhancement Course
RM	Research Methodology
HN	Honors' Degree Course
HR	Honors Research

Sample Course Code	
23ETU5CC1T	Control Systems

Department of Electronics and Telecommunication Engineering

B. Tech. Semester V

Course Code	Name of Course	Engagement Hours			Credits	SA		FA		Total
		L	T	P		Theory	OE/ POE	ISE	ICA	
23ETU5CC1T	Control Systems	2	-	-	2	60		40		100
23ETU5CC1A	Control Systems (Tutorial)		1		1	--		--	25	25
23ETU5CC2T	Microcontroller and Applications	3	-	-	3	60		40		100
23ETU5CC3T	Database Management Systems	2	-	-	2	60		40		100
23ETU5EN*4T	Program Elective I	3	-	-	3	60		40	-	100
23ETU5IK5T	Indian Knowledge System II – Vedic Mathematics	2		-	2			50		50
23##U5MD6T	Multidisciplinary Minor III	3		-	3	60		40		100
23MCU5OE7T	Open Elective III (MOOC)				2	50				50
	Subtotal	**15**	**1**	**-**	**18**	**350**		**250**	**25**	**625**
Laboratory Courses										
23ETU5CC2L	Microcontroller and Applications Lab	-	-	2	1		25		25	50
23ETU5CC3L	Database Management Systems Lab	-	-	2	1				25	25
23ETU5EN*4L	Program Elective I Lab	-	-	2	1				25	25
23ETU5CC8P	Java Programming	1	-	2	2		50	25	25	100
	Subtotal	**1**	**-**	**8**	**5**		**75**	**25**	**100**	**200**
	Grand Total	**16**	**1**	**8**	**23**	**425**		**275**	**125**	**825**

Department of Electronics and Telecommunication Engineering

B. Tech. Semester VI

Course Code	Name of Course	Engagement Hours			Credits	SA		FA		Total
		L	T	P		Theory	OE/ POE	ISE	ICA	
23ETU6CC1T	Networking and Security	3		-	3	60		40		100
23ETU6CC2T	Embedded System Design	3		-	3	60		40		100
23ETU6EN*4T	Program Elective II	3		-	3	60		40		100
23ETU6EN*4A	Program Elective II (Tutorial)		1		1				25	25
23ETU6EN*5T	Program Elective III	3	-	-	3	60		40	-	100
23ETU6EN*5A	Program Elective III (Tutorial)	-	1	-	1				25	25
23##U6MD6T	Multidisciplinary Minor IV	2			2	60		40		100
	Subtotal	**14**	**2**	**-**	**16**	**300**		**200**	**50**	**550**
Laboratory Courses										
23ETU6CC1L	Networking and Security Lab	-	-	2	1			-	25	25
23ETU6CC2L	Embedded System Design Lab	-	-	2	1		25	-	25	50
23ETU6CC3P	Verilog HDL Programming	1	-	2	2		50	25	25	100
23##U6MD6L	Multidisciplinary Minor IV Lab	-	-	2	1			-	25	25
23ETU6VS7P	Open-Source Technology	1	-	2	2			-	50	50
	Subtotal	**2**	**0**	**10**	**7**		**75**	**25**	**150**	**250**
	Grand Total	**16**	**2**	**10**	**23**	**375**		**225**	**200**	**800**

Note:

- N* indicates the serial number of electives offered in the respective category
- ## indicates program code of offering Program

- **List of Program Elective I**

List of Program Elective I (Semester –V)	
Course Code	**Course Title**
23ETU5E14T	Data Analytics
23ETU5E24T	Internet of Things
23ETU5E34T	Digital Signal Processing

- **List of Program Elective II**

List of Program Elective II (Semester –VI)	
Course Code	**Course Title**
23ETU6E14T	Machine Learning
23ETU6E24T	IoT Cloud Platforms
23ETU6E34T	Optical Communication

- **List of Program Elective III**

List of Program Elective III (Semester –VI)	
Course Code	**Course Title**
23ETU6E15T	Power Electronics
23ETU6E25T	Image and Video Processing
23ETU6E35T	Electromagnetic field theory

- **For 23MCU5OE7T: Open Elective III (MOOC) in Semester V:**
  1. Students are required to enroll in one of the courses of a minimum duration of 8 weeks offered on the SWAYAM/NPTEL platform. The list of courses will be finalized and released by Board of Studies each year.
  2. List of MOOCs will be provided by the department depending on the availability of the courses in that semester under NPTEL / Swayam or Other recognized MOOC Platforms as per suggestions by the BoS.
  3. Students may enroll for the course in Semester IV or V. They must complete all assignments and appear for the certification examination conducted by SWAYAM/NPTEL.
  4. Students must pass the examination by the end of Semester V. The marks earned by the student in final assessment of this MOOC will be appropriately scaled and transferred to **Open Elective III (MOOC)** in Semester V.

- **For Courses offered during Semester VIII for A.Y. 2026-27**

Sr. No	*Course Code*	*Option I*	*Option -II*
1	23ETU8CC1T	MOOC Certification*	'Programmable ICs and ASIC' course offered by the department during Semester VIII in Self Learning / Online mode and successfully passing ESE for the same.
2	23ETU8EN*2T	MOOC Certification*	'Program Elective VI' course offered by the department during Semester VIII in Self Learning / Online mode and successfully passing ESE for the same. Program Elective VI options: Automotive Electronics Wireless Communication

* Student has to complete this MOOC in any semester of – V, VI, VII or VIII. In semester VIII, the marks earned by the student in final assessment of this MOOC will be appropriately scaled and transferred for 23ETU8CC1T and / or 23ETU8E32T along with the required credits.
The list of approved MOOCs will be finalized and released by Board of Studies each year.

- **Multidisciplinary Minor (MDM) Courses**

Sr. No.	MDM Program	MDM I (Sem III)	MDM II (Sem IV)	MDM III (Sem V)	MDM IV (Sem VI)	MDM V (Sem VII)
1	Computer Science and Engineering	Operating System	UI Technologies	Software Engineering	Big Data Technologies	Software Testing and Quality Assurance
2	Information Technology	Principles Of Operating Systems	Web Technology (UI/ UX)	Software Engineering Principles	DevOps	Cyber Security
3	Mechanical and Automation Engineering	Manufacturing Processes and Mechanisms	Machine Drawing and 3D Modeling	Automotive Engineering and Robotics	Additive Manufacturing	Thermal Engineering
4	Civil Engineering	Smart Buildings	Geoinformatics	Environmental Impact Assessment	Infrastructural Systems	Disaster Preparedness and Planning

WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR
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Third Year B.Tech. (Electronics and Telecommunication Engineering), Semester-V

23ETU5CC1T: Control Systems

Teaching Scheme		**Examination Scheme**	
Lectures	2 Hours/week	**ESE**	60 Marks
Tutorial	1 Hours/week	**ISE**	40 Marks
Credits	3	**ICA**	25 Marks

Introduction:

Control systems are considered one of the major aspects of our growing technology. Every sector of the industry is linked with the control system in some or the other way.
A control system is an interconnection of components forming a system configuration that will provide the desired system response. The basis for the analysis of a system is the foundation provided by a linear system, which assumes a cause-effect relationship for the components of a system.

Course Prerequisite:

This course requires knowledge of the concept of complex variables and Laplace transform.

Course Objectives:

1. To introduce the control system and represent it mathematically.
2. To describe the various control system components used in the feedback control system.
3. To familiarise the time domain and frequency domain analysis.
4. To explain the different methods to determine the system stability.
5. To introduce the different types of compensators & controllers.

Course Outcomes:

At the end of the course, the students will be able to-
1. Classify the control system and represent it mathematically.
2. Explore different control system components of the feedback control system.
3. Analyse system performance using time domain and frequency domain analysis.
4. Apply different techniques to determine the system stability.
5. Describe different compensators and controllers.

Unit – I	**Introduction and Mathematical Modelling**	**5 Hours**

Open loop and Closed loop control systems, examples of control systems: Liquid level control system, missile launching and guidance system, Transfer function of closed loop system, Mathematical modelling of Electrical systems using R, L and C, Transfer function of RLC circuits

Unit – II	**System representation and components**	**6 Hours**
Block diagram representation and reduction techniques, Signal Flow Graph- Construction, Mason's Gain formula, Stepper motor -Working principle, construction, and applications.		
Unit – III	**Time response of systems**	**6 Hours**
Standard test signals, time response of first-order systems to step, ramp, and impulse input. Step response of second order system, time domain specifications, steady-state errors, and error constants of type0, type1, and type2 systems.		
Unit – IV	**Stability analysis & Root locus**	**5 Hours**
Concept of stability, absolute and conditional stability, relative stability, Routh _ Hurwitz criterion for stability. Concept of root locus, construction of root locus, and stability analysis using root locus.		
Unit – V	**Frequency domain analysis**	**5 Hours**
Frequency domain specifications-bode plots, determination of frequency domain specifications and transfer function from the bode plot _ phase margin and gain margin-stability analysis from bode plots.		
Unit – VI	**Compensators & Controllers**	**3 Hours**
Need of compensator, lag compensators, lead compensators and lag-lead compensator and their design in the frequency domain, proportional controllers, PI controllers and PID controllers		
Internal Continuous Assessment (ICA): ICA consists of minimum eight tutorials based on the above syllabus.		
Text Books		
1. Control Systems Engineering I. J. Nagrath & M Gopal New Age Publication (Fifth Edition) 2. Feedback & control systems. Schaum's Outline series McGraw Hill. 3. Automatic Control Systems B. C. Kuo PHI Publication 4. Control Systems Engineering, R. Anandanatrajan, P. Ramesh Babu - Scitech Publication.		
Reference Books		
1. Modern Control Engineering K. Ogata Pearson Education 2. Principles of Control Systems S.C. Goyal & U. A. Bakshi Technical Publication, Pune.		

WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR

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Third Year B.Tech. (Electronics and Telecommunication Engineering), Semester-V

23ETU5CC2T: Microcontroller and Applications

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hours/week	**ESE**	60 Marks
Practical	2 Hours/week	**ISE**	40 Marks
Credits	4	**ICA**	25 Marks
		POE	25 Marks

Introduction:

This course introduces basics of microcontroller's theory which includes internal details of MCS51, PIC and ARM. The course also introduces Assembly Language Programming and Embedded C Level programming of MCS51 and PIC series.

Course Prerequisite:

This course requires knowledge of Digital Electronics and Basics of C Programming.

Course Objectives:

1. To introduce students to the fundamental concepts of microcontrollers, focusing on the internal architecture, instruction set, on-chip peripherals, and programming techniques of the MCS51 microcontroller.
2. To familiarize students with the internal architecture, instruction set, and programming methods of the PIC microcontroller, enabling them to understand its applications in embedded systems.
3. To provide an understanding of the core architecture of ARM microcontrollers, preparing students for advanced embedded system development.
4. To equip students with practical skills in programming and interfacing external peripherals with 8051 and PIC microcontrollers using Embedded C.

Course Outcomes:

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

1. Demonstrate the working of internal architecture, instruction set, on-chip peripherals and programming techniques of the MCS51 microcontroller
2. Demonstrate the internal architecture, instruction set, on-chip peripherals and programming techniques of the PIC microcontroller
3. Describe the internal core architecture of ARM.
4. Implement programming of various external peripherals for 8051 and PIC controllers

Unit – I	**MCS51 and its peripheral programming**	**14 Hours**

MCS51 architecture, its hardware, memory management, Addressing modes and Instruction set, Input / Output ports, Counters and Timers, UART, interrupts, I2C and SPI.

Unit – II	**PIC and its peripheral Programming**	**14 Hours**
Introduction to PIC Architecture, features, Functional pin description, Instruction set, Program memory and data memory organization, Input/ output ports, Interrupts, timers, ADC, DAC, WDT and CCP modules		
Unit – III	**Introduction to ARM fundamentals**	**6 Hours**
Introduction to Embedded System, ARM7TDMI core architecture, ARM extension family, Pipeline architecture, memory management and Bus Architecture.		
Unit – IV	**Introduction to Embedded C and Programming of External Peripherals**	**10 Hours**
Interfacing of LED, Switch, 7 segment display, 16x2 LCD, DC motor, Stepper Motor, relay, buzzer, DS18B20, DS1307.		
Internal Continuous Assessment (ICA): ICA consists of a minimum of eight experiments based on above syllabus.		
Text Books		
1. The 8051 Microcontroller Architecture, programming and Applications by Kenneth Ayala Penram International (Third Edition) 2. The 8051 Microcontroller and Embedded systems by Muhammad Ali Mazidi Pearson Education Asia LPE (Second Edition) 3. PIC Microcontroller & Embedded Systems – Mazidi – Pearson Education 4. Microcontrollers [Theory and Applications] by Ajay V Deshmukh- Tata McGraw Hill Education.		
Reference Books		
1. Data sheets of MCS51 family microcontrollers, PIC Flash microcontrollers and LPC2148 2. 8051 Microcontroller by I Stott, Mackenzie, Rathel & Phan – Fourth Edition – Pearson Publication.		

WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR
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Third Year B.Tech. (Electronics and Telecommunication Engineering), Semester-V

23ETU5CC3T: Database Management Systems

Teaching Scheme		**Examination Scheme**	
Lectures	2 Hours/week	**ESE**	60 Marks
Practical	2 Hours/week	**ISE**	40 Marks
Credits	3	**ICA**	25 Marks

Introduction:

This course introduces a Database Management System, which is the system software for easy, efficient and reliable data processing and management. It covers ER Model, Relational Model, Structured Query Language, Relational Database Design and Concurrency Control techniques.

Course Prerequisite:

This course requires knowledge of programming and data structures, understanding of set theory, logical operations, and basic file handling concepts.

Course Objectives:

1. To introduce students to the core concepts of database management systems, including database architectures, data models, and the roles of various database users.
2. To enable students to design and develop Entity-Relationship (E-R) models and translate them into normalized relational schemas while maintaining data integrity.
3. To equip students with practical skills in using SQL commands for efficient data definition, manipulation, and retrieval.
4. To introduce students to database performance optimization techniques, including indexing, hashing, and transaction management for ensuring data consistency and reliability.

Course Outcomes:

At the end of the course, students will be able to

1. Explain the fundamental concepts of database management systems, including database architectures, data models, and database users.
2. Develop Entity-Relationship (E-R) models and convert them into relational schemas while ensuring data integrity and normalization.
3. Apply SQL commands to create, manipulate, and retrieve data efficiently using various query operations, joins, and aggregate functions.
4. Analyze indexing, hashing, and transaction management techniques, including concurrency control mechanisms, to ensure database reliability and performance.

Unit – I	**Introduction to DBMS**	**2 Hours**

Database- System Applications, Purpose of Database Systems, View of data, Database Languages, Database Architectures, Database users and administrators.

Unit – II	**E-R model and Relational Model**	**8 Hours**
Overview of design process, E-R Model, Constraints, E-R diagrams, E-R design issues, Weak Entity Sets, Extended E-R features, Reduction to relational schema. Relational Model: Basic structure of relational databases, Database schema, keys, Schema diagrams, Relational Query languages, Relational algebra - Fundamental, Additional and Extended Relational Algebra Operations.		
Unit – III	**SQL**	**9 Hours**
Overview, SQL data definition, SQL data types, Integrity constraints, Basic structure of SQL Queries, Types of SQL Commands: DDL, DML, DCL and TCL statements, Basic SQL clauses [select, from, where, group by, having, order by etc.]. Additional basic operations, Set operations, NULL values, Aggregate functions, Nested sub queries, Modification of the databases. Join operations, Views, Integrity constraints, Authorization.		
Unit – IV	**Normalization**	**4 Hours**
Features of good Relational Designs, Atomic Domains, First Normal Form, Keys and Functional dependencies, Second Normal Form, Boyce-Codd Normal Form, Third Normal Form, Functional dependency theory		
Unit – V	**Indexing and Hashing**	**4 Hours**
Basic Concepts, Ordered Indices, B+ Tree Index Files, B Tree Index Files, Multiple Key Access, Static and Dynamic Hashing, Comparison of Indexing and Hashing.		
Unit – VI	**Transactions and Concurrency Control**	**3 Hours**
Transaction concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions. Concurrency Control - Lock based protocol: Locks, Granting of Locks, Two-Phase Locking Protocol. Time Stamp-based protocols, Deadlock handling.		
Internal Continuous Assessment (ICA): ICA consists of a Minimum of eight experiments based on the above syllabus.		
Text Books		
1. Database system concepts by Abraham Silberschatz, Henry F. Korth, S. Sudarshan (McGraw Hill International Edition) sixth edition. 2. Database system concepts by Peter Rob, Carlos Coronel (Cengage Learning) ninth edition.		
Reference Books		
1. Fundamentals of Database systems by Ramez El Masri, S. B. Navathe (Pearson Education) 5th edition. 2. Database Management Systems by Ramkrishnan Gehreke (Tata McGraw Hill) third edition. 3. Principles of Database Systems by J. D. Ullman (Galgotia Publications) 4. Advanced Database Management System by Rini Chakrabarti, Shilbhadra Dasgupta (Dreamtech Press Publication).		

WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR

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Third Year B.Tech. (Electronics and Telecommunication Engineering), Semester-V

23ETU5E14T: Program Elective I - Data Analytics

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hours/week	**ESE**	60 Marks
Practical	2 Hours/week	**ISE**	40 Marks
Credits	4	**ICA**	25 Marks

Introduction:

This course provides a comprehensive foundation in data analytics, emphasizing the lifecycle of data analysis, statistical methods, data quality and preprocessing, and big data analytics and visualization. Learners will explore the latest tools and techniques for analyzing diverse types of data—including text, web, and social media—and understand their applications in real-world contexts like recommendation systems and social network analysis.

Course Prerequisite:

This course requires knowledge of mathematics & statistics, basic programming knowledge.

Course Objectives:

1. Introduce data analytics concepts, types of data, and the data analytics lifecycle with real-world case studies.
2. Develop the ability to perform descriptive statistical analysis using univariate and multivariate data.
3. Equip students with knowledge of data preprocessing techniques to ensure data quality and enable effective analysis.
4. Familiarize students with big data ecosystems, visualization techniques, and analytical architectures.
5. Explore practical applications of big data analytics in text, web, and social media domains.

Course Outcomes:

At the end of the course, students will be able to:

1. Describe and apply the data analytics lifecycle, including foundational concepts in big data and descriptive statistical methods and data visualization.
2. Evaluate data quality and apply appropriate preprocessing techniques for data transformation and dimensionality reduction.
3. Analyze big data analytics architectures and apply suitable visualization techniques for large datasets.
4. Apply analytics techniques to text, web, and social media data, including recommender systems and social network analysis.

Unit – I	**Data Analytics Lifecycle and Big Data**	**5 Hours**

What is Data? Big Data, Small Data, Data Science, Big Data Architectures, A Short Taxonomy of Data Analytics, Examples of Data Use. Background and Overview of Data Analytics Lifecycle, Case Study: Global Innovation Network and Analysis (GINA).

Unit – II	**Descriptive statistics and analysis**	**9 Hours**
Scale Types, Descriptive Univariate Analysis, Univariate Frequencies, Univariate Data Visualization, Univariate Statistics, Common Univariate Probability Distributions, Descriptive Bivariate Analysis, Multivariate Frequencies, Multivariate Data Visualization, Multivariate Statistics.		
Unit – III	**Data Quality and Pre-processing**	**8 Hours**
Data Quality, Converting to a Different Scale Type, Converting to a Different Scale, Data Transformation, Dimensionality Reduction.		
Unit – IV	**Big Data Analytics**	**9 Hours**
Definition of Big Data, Big data characteristics & considerations, Data repositories- analyst perspective, Business drivers for analytics, Typical analytical architecture, Business Intelligence Vs Data science, Drivers of Big data analytics, Role of data scientist in Big data ecosystem, Applications of Big data analytics.		
Unit – V	**Big Data Visualization**	**5 Hours**
Introduction to Data visualization, Challenges to Big data visualization, Conventional data visualization tools, Techniques for visual data representations, Types of data visualization, Visualizing Big Data, Tools used in data visualization, Analytical techniques used in Big data visualization.		
Unit – VI	**Applications for Text, Web and Social Media**	**8 Hours**
Working with Texts: Data Acquisition, Feature Extraction, Remaining Phases, Trends. Recommender Systems: Feedback, Recommendation Tasks, Recommendation Techniques. Social Network Analysis: Representing Social Networks, Basic Properties of Nodes, Basic and Structural Properties of Networks		
Internal Continuous Assessment (ICA): ICA shall consist of a minimum eight experiments based on the syllabus and the Various Software tools available.		
Text Books		
1. Data Science and Big Data Analytics, David Dietrich, Barry Hiller, EMC education services, Wiley publications, 2012, ISBN0-07-120413-X 2. A General Introduction to Data Analytics, by Joao Moreira, Andre Carvalho, Tomas Horvath, Wiley Publication. 3. Intelligent Data Analysis, Michael Berthold, David J. Hand, Springer 4. Tableau Data Visualization Codebook, Ashutosh Nandeshwar, Packt Publishing, ISBN 978-1-84968-978-6		
Reference Books		
1. Data Analytics, Maheshwari Anil, Rakshit, Acharya, McGraw Hill, ISBN: 789353160258. 2. Beginning R: The Statistical Programming Language, Mark Gardner, Wrox Publication,ISBN: 978-1-118-16430-3 3. Data Mining with R, Learning with Case Studies, Luís Torgo, CRC Press, Talay and Francis Group, ISBN9781482234893 4. Business Intelligence - Data Mining and Optimization for Decision Making, Carlo Vercellis, Wiley Publications, ISBN: 9780470753866.		

WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR

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Third Year B.Tech. (Electronics and Telecommunication Engineering), Semester-V

23ETU5E24T: Program Elective I - Internet of Things

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hours/week	**ESE**	60 Marks
Practical	2 Hours/week	**ISE**	40 Marks
Credits	4	**ICA**	25 Marks

Introduction:

The Internet of Things (IoT) continues to revolutionize how systems interact, monitor, and make decisions across sectors. With the rapid integration of connected devices in everyday applications, industry now demands professionals who can not only understand IoT concepts but also build and deploy practical solutions. This revised syllabus emphasizes hands-on learning through real-world tools, cloud platforms like AWS and Azure, sensor integration, and protocol implementation. It prepares final-year engineering students to bridge the gap between theory and practice, empowering them to develop secure, scalable, and intelligent IoT applications in domains such as smart homes, agriculture, energy, healthcare, and industrial automation.

Course Prerequisite:

This course requires basic knowledge of electronics and communication principles, Familiarity with programming languages such as Python or C, Understanding of basic networking concepts.

Course Objectives:

1. Provide a comprehensive understanding of the fundamental concepts and definitions of IoT.
2. Explain various industry standards and communication protocols used in IoT through practical exploration.
3. To introduce sensor interfacing and the architecture of IoT systems, including security and data management using hands-on activities.
4. Guide students in designing, implementing, and deploying real-world IoT solutions using AWS IoT and Azure IoT platforms.

Course Outcomes:

At the end of the course, students will be able to:

1. Describe the basic concepts and characteristics of IoT through applied examples.
2. Implement industry standards, IoT communication protocols, and architecture via practical tasks.
3. Demonstrate hands-on knowledge of sensor interfacing, data management, and security in IoT systems.
4. Design end-to-end IoT solutions using AWS IoT and Azure IoT platforms.

Unit – I	**Practical Foundations of IoT and Communication Protocols**	**10 Hours**

Definition and Characteristics of IoT with practical examples, Evolution and Applications of IoT using live case studies, IoT Enabling Technologies, Overview of IoT Standards and Protocols, IoT Reference Architecture and Communication Models, Hands-on with MQTT, HTTP, and CoAP using Mosquitto Broker and Node-RED, Lab: Build a basic Publisher/Subscriber IoT system using Python and MQTT.

Unit – II	Sensor Interfacing and IoT Architecture	10 Hours
Types of Sensors and Actuators with real device handling, Sensor Selection Criteria and Calibration Techniques, Hands-on: Interfacing Sensors digital sensors with microcontrollers, Data Acquisition and Local Storage using Microcontrollers, IoT Architecture Layers: Perception, Network, Middleware, Application Edge, Fog, and Cloud Computing with real-world examples.		
Unit – III	**Security and Data Management in IoT**	**10 Hours**
IoT Data Collection, Cleaning, and Storage – Hands-on using CSV/SQLite, Security Issues in IoT and Real-world Attacks, Authentication, Encryption, and Secure Communication Practices, Privacy and Ethical Considerations in IoT Deployment, Case Studies of IoT Applications in Smart Homes, Health, and Industry.		
Unit – IV	**Practical Implementation using AWS IoT and Azure IoT**	**15 Hours**
Introduction to AWS IoT Core and Azure IoT Hub, Account setup, device provisioning, and policy configuration (AWS/Azure), ESP32 Sensor Data Integration with AWS IoT and Azure IoT, Data Streaming and Visualization using AWS IoT Analytics and Azure IoT Central, Device Shadow, Rules Engine, and Messaging Services, End-to-End Project: IoT Device to Cloud to Dashboard Implementation.		
Internal Continuous Assessment (ICA): ICA consists of minimum eight experiments based on above syllabus and mini project.		
Text Books		
1. Internet of Things: A Hands-On Approach by Arshdeep Bahga and Vijay Madisetti, 1st Edition, VPT 2. Learning Internet of Things by Peter Waher, 1st or 2nd Edition, Packt Publishing		
Reference Books		
1. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things by David Hanes et al., Cisco Press 2. Getting Started with the Internet of Things by Cuno Pfister, O'Reilly Media		
e-Resources		
1. AWS IoT Documentation - https://docs.aws.amazon.com/iot/index.html 2. Azure IoT Documentation - https://learn.microsoft.com/en-us/azure/iot-hub/ 3. Coursera - Introduction to the Internet of Things (IoT)-https://www.coursera.org/learn/iot 4. edX - The Internet of Things (IoT) - https://www.edx.org/course/the-internet-of-things 5. Mosquitto MQTT Broker Documentation- https://mosquitto.org/documentation/ 6. Node-RED Documentation – https://nodered.org/docs/ 7. Udemy - IoT Automation using Raspberry Pi https://www.udemy.com/course/raspberry-pi-and-the-internet-of-things/ 8. LinkedIn Learning - IoT Foundations: Fundamentals - https://www.linkedin.com/learning/iot-foundations-fundamentals/ 9. Tinkercad Circuits – https://www.tinkercad.com/circuits 10. ThingSpeak IoT Platform - https://thingspeak.com/ 11. Edge Impulse (TinyML & Edge AI) - https://www.edgeimpulse.com/		

WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR

(An Autonomous Institute)

Third Year B.Tech. (Electronics and Telecommunication Engineering), Semester-V

23ETU5E34T: Program Elective I - Digital Signal Processing

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hours/week	**ESE**	60 Marks
Practical	2 Hours/week	**ISE**	40 Marks
Credits	4	**ICA**	25 Marks

Introduction:

Digital Signal Processing involves the analysis, modification, and synthesis of signals using digital techniques. It plays a critical role in modern electronics, enabling efficient data compression, filtering, and signal enhancement in applications like audio processing, communications, and biomedical engineering. This subject equips students with foundational knowledge of discrete-time signals and systems, Fourier analysis, digital filters, and real-time signal processing.

Course Prerequisite:

This course requires knowledge of signals and systems, along with a basic understanding of mathematical concepts and transform techniques such as the Laplace transform and Z-transform

Course Objectives:

1. To introduce students the principles of Discrete Fourier Transform (DFT) and evaluate its significance in signal processing.
2. To make students apply DFT/FFT for efficient signal processing and linear filtering.
3. To make students design and realize Infinite Impulse Response (IIR) filters using analog-to-digital transformations
4. To make students design Finite Impulse Response (FIR) filters using windowing and frequency sampling techniques.

Course Outcomes:

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

1. Explore the principles of Discrete Fourier Transform (DFT) and evaluate its significance in signal processing.
2. Apply DFT/FFT for efficient signal processing and linear filtering.
3. Design and realize Infinite Impulse Response (IIR) filters using analog-to-digital transformations
4. Design Finite Impulse Response (FIR) filters using windowing and frequency sampling techniques.

Unit – I	**Discrete Fourier Transform**	**11 Hours**

Introduction to DSP system Frequency domain sampling and Reconstruction of Discrete Time Signals, The Discrete Fourier Transform, DFT as a linear transformation, relation between DFT and Z transform Properties of the DFT Computation of DFT & IDFT, multiplication of two DFTs and Circular Convolution.

Unit – II	**Linear filtering methods based on the DFT**	**11 Hours**
Use of DFT in linear filtering, Filtering of long data sequences such as Overlap-save and Overlap-add method, Fast-Fourier-Transform (FFT) algorithms, Efficient Computation of the DFT: Radix-2 FFT algorithms for the computation of DFT and IDFT, decimation in-time and decimation-in-frequency algorithms.		
Unit – III	**IIR Filter Design**	**7 Hours**
IIR Filter Design by Impulse Invariance, IIR Filter Design by Bilinear Transformation, Characteristic of commonly used Analog Filters (Butterworth Filter up to 3rd order), Some examples of Digital Filter Design Based on above Transformation, IIR implementation technique.		
Unit – IV	**FIR Filter Design**	**8 Hours**
FIR filter design: Introduction to FIR filters, design of FIR filters using -Rectangular, Hamming and Bartlet windows, FIR filter design using frequency sampling technique, finite word length effects in FIR filters, FIR Implementation techniques.		
Unit – V	**Realization of Digital Linear Systems**	**7 Hours**
Structures for realization of Discrete time systems, Structures for FIR Filters: Direct form, Cascade form& Lattice Structure, Structures for IIR Filters: Direct form, Cascade form & parallel form.		
Internal Continuous Assessment (ICA): ICA consists of a minimum of eight experiments based on the above syllabus.		

Text Books

1. Digital Signal Processing – Principles, Algorithms and Applications by John G Proakis-4th edition, Pearson Education.
2. Digital Signal Pro.cessing by S Salivahanan, A Vallavaraj & C Gnanapriya –2nd edition, TMH.
3. Discrete time signal Processing by A.V. Oppenheim & R.W. Schafer. - Low price edition, John Wiley

Reference Books

1. Digital Signal Processing by Ramesh Babu -4th Edition, Scientic Publication.
2. Digital Signal Processing by Dr. Shaila D. Apte, Second edition, Wiley India.
3. Essentials of Digital Signal Processing using MATLAB by Vinay K. Ingle & John G. Proakis, Cengage Learning, 2012.
4. Digital Signal Processing- A Practical Approach, by E. C. Ifleachor and B. W. Jervis, Second Edition, Pearson education.
5. Theory and Application of Digital Signal Processing Digital by Rabiner& Gold-First edition, Prentice Hall.
6. Digital Signal Processing by S. Palani & D. Kalaiyarasi, Ane's Student Edition, Ane Books Pvt. Ltd New Delhi.

WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR

(An Autonomous Institute)

Third Year B.Tech. (Electronics and Telecommunication Engineering), Semester-V

23ETU5IK5T: Indian Knowledge System II – Vedic Mathematics

Teaching Scheme		**Examination Scheme**	
Lectures	2 Hours/week	**ESE**	-
Practical/Tutorial	-	**ISE**	50 Marks
Credits	2	**ICA**	-

Introduction:

Vedic Mathematics is a super-fast way of calculation. There are just 16 Sutras or Word Formulae which solve all known mathematical problems in the branches of Arithmetic, Algebra, Geometry, and Calculus. They are easy to understand, easy to apply, and easy to remember.

Course Prerequisite:

This course requires knowledge of basic mathematics.

Course Objectives:

1. Introduce students to the foundational principles and principles of Vedic Mathematics.
2. Develop mental calculation skills and enhance number sense.
3. Promote problem-solving abilities through mental and arithmetic techniques.
4. Build confidence in handling mathematical calculations quickly and accurately.
5. Foster interest in mathematics by making it more approachable and engaging.

Course Outcomes:

At the end of the course, the students will be able to:

1. Describe history and evolution of Vedic mathematics
2. Perform Vedic arithmetic calculations with speed and accuracy
3. Apply various Multiplication and Division methods to solve problems
4. Calculate powers and roots of a number
5. Find solutions for simultaneous and quadratic equations

Unit – I	**Introduction of Vedic Mathematics**	**5 Hours**

History and Evolution of Vedic Mathematics, Introduction of Basic Vedic Mathematics Techniques in Multiplication (Special Case, Series of 9, Series of 1 etc), Tables etc., Comparison of Standard Methods with Vedic Methods, sixteen sutras.

Unit – II	**Vedic Arithmetic Operations**	**5 Hours**

Various techniques to carry out basic operations covering Addition, Subtraction, Multiplication, Division, Complements and Bases, Vinculum number, General multiplication (Vertically Cross-wise).

Unit – III	**Multiplication and Division**	**5 Hours**
Multiplications by numbers near base, Verifying answers by use of digital roots, Divisibility tests, Division of numbers near base, Comparison of fractions.		
Unit – IV	**Power and roots**	**10 Hours**
Applications of Vinculum, Different methods of Squares (General method, Base method, Duplex method etc.), Square roots, Cubes, Cube roots, General division		
Unit – V	**Vedic Algebra**	**5 Hours**
Simultaneous Equations, Quadratic Equations		

Text Books

1. Bhatiya Dhaval, Vedic Mathematics Made Easy, Jaico Publishing House
2. Thakur Rajesh Kumar, Vedic Mathematics for students taking Competitive Examinations. Unicorn Books 2015 or Later Edition
3. Gupta Atul, Power of Vedic Mathematics with Trigonometry, Jaico Books
4. V. G. Unkalkar, Magical World of Mathematics (Vedic Mathematics), Vandana Publishers, Bangalore
5. Vedic Math Genius by Kenneth Williams, Inspiration Books, England

Reference Books

1. Vedic Mathematics: Sixteen Simple Mathematical Formulae From The Vedas by Jagadguru Swami Sri Bharati Krishna Tirthaji Maharaja published by Motilal Banarsidass Publishers Pvt. Ltd., Delhi
2. Lilavati: A Treatise Of Mathematics Of Vedic Tradition by Krishnaji Shankara Patwardhan published by Motilal Banarsidass Publishers Pvt. Ltd., Delhi
3. The Power Of Vedic Maths by Atul Gupta, Jaico Publishing house, Mumbai
4. Vertically And Crosswise By A. P. Nicholas, K. R. Williams, J. Pickles, Inspiration Books, Scotland

WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR
(An Autonomous Institute)
Third Year B.Tech. (Electronics and Telecommunication Engineering), Semester-V

23ETU5CC8P: Java Programming

Teaching Scheme		**Examination Scheme**	
Lectures	1 Hours/week	**ISE**	25 Marks
Practical	2 Hours/week	**ICA**	25 Marks
Credits	2	**POE**	50 Marks

Introduction:

This course introduces Java Programming from basics to advanced Java concepts. The importance of Java language cannot be denied as it has already started ruling over the entire Software Industry. The aim of this course is to provide students with an understanding of the object-oriented design and programming techniques. Java, a prime object-oriented programming language, is used to illustrate this programming paradigm.

Course Prerequisite:

This course requires knowledge of basic programming languages

Course Objectives:

1. To make students aware of Object-Oriented features in Java.
2. To introduce students the ability of Java runtime library APIs
3. To make students facilitate error handling exceptions.
4. To make students aware of Java runtime library APIs for designing GUI applications

Course Outcomes:

At the end of the course, students will be able to

1. Implement an Object-oriented concept with its features.
2. Use Java runtime library APIs for implementing functionality of various applications.
3. Implement exceptional handling through Java programming for a given problem.
4. Select appropriate Java runtime library APIs to create GUI and web applications using Java language.

Unit – I	**Basics of Java and Strings in Java**	**4 Hours**

Basics: Java Runtime Environment, Naming Conventions, Language Basics: Variables, Operators, Expressions, Statements, Blocks, Control flow Statements, Input and Output, Data Types, Arrays, Type Casting. Fundamentals: String Class and Methods, Immutability of Strings, String Buffer Class and Methods, StringBuilder class and Methods.

Unit – II	**Introduction to OOPs**	**3 Hours**

Objects and Classes, Fields and Methods, Abstraction, Encapsulation, Inheritance, Polymorphism, Type Compatibility and Conversion, Overriding Methods, Access control, Modifiers, Constructors, Abstract classes, Nested classes, Packages, Wrapper classes, Interfaces, Object Life time & Garbage Collection.

Unit – III	Exceptions, Error Handling and Basic IO	4 Hours
Exceptions and Error Handling: Exceptions and Errors, Catching and Handling Exceptions, The try Block, The catch Blocks, The finally Block, Throwing Exceptions, Chained Exceptions, Custom Exceptions. JUnit Testing Framework. Basic I/O: I/O Streams, Byte Streams, Character Streams, Buffered Streams, Scanning and Formatting, Data Streams, Object Streams, File I/O Classes: Reading, Writing, and Creating Files and Directories.		
Unit – IV	**Java Collections Framework and Multithreading**	**4 Hours**
Introduction, The Arrays Class, Searching and sorting arrays of primitive data types, Sorting Arrays of Objects, The Comparable and Comparator Interfaces, Sorting using Comparable & Comparator, Collections: Lists, Sets, Maps, Trees, Iterators and Collections, The Collection Class. Multithreading: Creating Threads, Thread scheduling and priority, Thread interruptions and Synchronization		
Internal Continuous Assessment (ICA): ICA consists of a minimum of eight experiments based on the above syllabus and a mini-project		
Text Books		
1. Head First Java – Kathy Sierra, Bert Bates, O'Reily Publication 2. The Java TM Programming Language By Ken Arnold, James Gosling, David Holmes, Pearson Publication 3. Core Java for Beginners- Rashmi Kanta Das, Vikas Publishing House Pvt. Ltd 4. Programming with Java, Balaguruswamy, TMH 5. Internet and Java Programming, Tanweer Alam, Khanna Publishing House		
Reference Books		
1. The Java Language Specification, Java SE 8 Edition Book by James Gosling, Oracle Inc. (e-Resource: http://docs.oracle.com/javase/specs/) 2. Java: The Complete Reference 8 Edition - Herbert Schildt, Tata McGraw - Hill Education 3. Head First Servlets and JSP – Bryan Bosham, Kathy Sierra, Bert Bates, O'Reily Publication 4. The Java TM Tutorials. Oracle Inc. (e-Resource: http://docs.oracle.com/javase/tutorial/) 5. Java Server Programming for Professionals - Ivan Bayross, Sharanam Shah, Cynthia Bayross And Vaishali Shah, Shroff Publishers and Distributors Pvt. Ltd, 2nd Edition		

WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR
(An Autonomous Institute)
Third Year B.Tech. (Electronics and Telecommunication Engineering), Semester-VI

23ETU6CC1T: Networking and Security

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hours/week	**ESE**	60 Marks
Practical	2 Hours/week	**ISE**	40 Marks
Credits	4	**ICA**	25 Marks

Introduction:

This course introduces TCP/IP and ISO OSI protocol layers and their functionality. Also, introduces various encryption technologies to secure data.

Course Prerequisite:

This course requires basic understanding of digital signals and fundamentals of networking.

Course Objectives:

1. To introduce fundamental concepts of data communication, network types, architectures, and communication protocols.
2. Develop an understanding of network layers, addressing, error detection/correction, and transport layer protocols.
3. Familiarize students with network security fundamentals, classical encryption techniques, and cryptographic algorithms.
4. Equip students with knowledge of block cipher encryption, public-key cryptography, key management, and secure communication techniques.

Course Outcomes:

At the end of the course, students will be able to-

1. Explain the fundamentals of data communication, networking architectures, and key network protocols.
2. Analyze the functionality of network layers, including addressing schemes, packet switching, and communication protocols.
3. Describe network security concepts, including intrusion defense mechanisms, public-key cryptography, and key management techniques.
4. Implement cryptographic techniques, including block cipher encryption, for secure communication.

Unit – I	**Data Communication and Network**	**7 Hours**

Data Communication, Network- Need, Types (LAN, MAN, WAN), Topologies, Layer communication, OSI model, TCP/IP Suite, Network Devices at each layer (RS232, MODEM, Repeaters, Switches, bridges, routers, gateway).

Unit – II	**Physical and Data Link Layer**	**8 Hours**

Physical Layer- Circuit Switched network, packet switching.
Data Link Layer- Introduction, Framing, Link layer addressing, Error detection - parity check, checksum, CRC; Error correction - Hamming code

Unit – III	Network Layer & Transport Layer	9 Hours
Network Layer – Network layer services, packet switching, IPv4 addresses, Routing protocols-distance vector, link state routing; Network layer protocols-IP, ICMPv4 Transport Layer- Introduction, Transport Layer protocols, UDP, TCP; Sliding window protocols-Go back N, selective repeat protocols; Piggybacking		
Unit – IV	**Security Fundamentals**	**7 Hours**
Computer Security Concepts: The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security. Classical Encryption Techniques: Symmetric Cipher Model, Cryptography. Substitution Techniques: Caesar Cipher, Mono alphabetic Ciphers, Play fair Cipher, Hill Cipher, Poly alphabetic Ciphers, Transposition Techniques, Rotor Machines, Steganography.		
Unit – V	**Block Ciphers and the Data Encryption Standard**	**8 Hours**
Traditional Block Cipher Structure: Stream Ciphers and Block Ciphers, Motivation for the Feistel Cipher Structure, Feistel Cipher. Data Encryption Standard: DES Encryption, DES Decryption, The Strength of DES. Public-Key Cryptography and RSA: Principles of Public Key Cryptosystem, RSA: Description of the Algorithm, Computational Aspects, Security of RSA.		
Unit – VI	**Key Distribution and Intrusion Defense**	**6 Hours**
Symmetric Key Distribution Using Symmetric Encryption, Symmetric Key Distribution Using Asymmetric Encryption, Distribution of Public Keys, X.509 Certificates, Public-Key Infrastructure. Introduction to IDS, IPS, honeypots and firewalls.		

Internal Continuous Assessment (ICA):
ICA consists of minimum eight experiments based upon above syllabus.

Text Books

1. Data communication and Networking 5E - B.A. Forouzan, 5th Edition McGraw Hill Education.
2. TCP/IP protocol suit- B.A. Forouzan, 4th Edition Tata McGraw hill Publication.
3. Computer networks- Andrew S. Tanenbaum.
4. Computer Security: Principles and Practices- Willaim Stallings, Pearson Publication
5. Cryptography and Network Security- Atul Kahate, TataMcGrawhill.
6. Network Security and Cryptography- Bernard Menezes, Cengage Learning

Reference Books

1. Internetworking TCP/IP Principal, Protocol and Architecture -Douglas Comer- Wesley
2. TCP/IP Illustrated, The Protocols – W. Richard Slevens, G.Gabrani –PE pub.
3. Data and computer communication – William Stallings. - PE pub.
4. Cryptography and Network Security, Behrouz A Forouzan, , McGraw Hill Publications
5. Cyber Security Understanding Cyber crimes Computer Forensics and Legal Perspectives - Nina Godbole.
6. Cisco: Fundamentals of Network Security Companion Guide (Cisco Networking Academy Program).

WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR

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Third Year B.Tech. (Electronics and Telecommunication Engineering), Semester-VI

23ETU6CC2T: Embedded System Design

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hours/week	**ESE**	60 Marks
Practical	2 Hours/week	**ISE**	40 Marks
Credits	4	**ICA**	25 Marks
		POE	25 Marks

Introduction:

This course provides foundational knowledge and practical skills in designing and developing computer systems integrated within other devices or machines. These systems are designed for specific tasks, unlike general-purpose computers.

Course Prerequisite:

This course requires knowledge of digital circuits, basic C programming, and Microcontroller fundamentals.

Course Objectives:

1. To make students understand different on-chip peripherals.
2. To make students understand interfacing of different IO devices.
3. To introduce students to the NVIDIA Jetson development board.
4. To introduce students to the concepts of Real time operating system

Course Outcomes:

At the end of the course, students will be able to-

1. Demonstrate working of on-chip peripherals of ARM Controller.
2. Design interfacing of different devices with ARM Controller.
3. Describe NVIDIA Jetson Orin Nano board and implement object detection program.
4. Describe Concept of Real Time Operating System for Embedded System.

Unit – I	**Introduction to ARM7 On Chip Peripherals**	**10 Hours**

Study of on-chip peripherals like I/O ports, Timers, Interrupts, ADC, DAC, CAN

Unit – II	**ARM7 External Peripheral Interfacing**	**12 Hours**

Interfacing of devices – LED & Switches (buttons), 7-segment display, LCD display, DC motor, Stepper Motor, Interfacing with sensors and actuators.

Unit – III	**Introduction to NVIDIA Development Board**	**10 Hours**

NVIDIA development board family, Introduction to NVIDIA Jetson Orin Nano development board and its setup, object detection using MIPI CSI Camera

Unit – IV	RTOS Fundamentals	12 Hours

Architecture of kernel, task states, task scheduler and scheduling algorithms, ISR, mutual exclusion and binary semaphore programming, inter task communication programming.

Internal Continuous Assessment (ICA):
ICA consists of a minimum eight experiments based on the above syllabus and a mini project.

Text Books

1. Embedded/real time system–Dr. K. V. K. K. Prasad -Dreamtech
2. Embedded Systems-Frank Vahid-Wiley India
3. Introduction to Embedded Systems-Shibu K V-McGraw Hill Education

Reference Books

1. Embedded real systems Programming–Iyer, Gupta-TMH

e-Resources for LPC2148 NVIDIA Jetson Orin Nano

1. LPC2148 Datasheet - https://www.nxp.com/docs/en/data-sheet/LPC2141_42_44_46_48.pdf
2. NVIDIA Jetson Orin Nano development board information - https://developer.nvidia.com/embedded/learn/get-started-jetson-nano-devkit#intro
3. NVIDIA Jetson Orin Nano Development board OS installation and setup - https://docs.nvidia.com/jetson/archives/r35.3.1/DeveloperGuide/text/IN/QuickStart.html
4. Projects that can be built using NVIDIA Jetson Orin Nano board - https://all3dp.com/2/best-jetson-nano-projects/ Nano Projects of 2023 | All3DP

WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR
(An Autonomous Institute)
Third Year B.Tech. (Electronics and Telecommunication Engineering), Semester-VI

23ETU6E14T: Program Elective II - Machine Learning

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hours/week	**ESE**	60 Marks
Tutorial	1 Hours/week	**ISE**	40 Marks
Credits	4	**ICA**	25 Marks

Introduction:

Machine Learning is a branch of artificial intelligence that enables systems to learn and make decisions from data without explicit programming. This course introduces foundational concepts, algorithms, and practical techniques in supervised, unsupervised, and reinforcement learning. Students will gain both theoretical understanding and hands-on experience through real-world applications and projects.

Course Prerequisite:

This course requires knowledge of programming language like python / R, also fundamentals of probability and Statistics.

Course Objectives:

1. To make student learn necessity and different aspects of Machine Learning.
2. To make student understand Machine Learning Models.
3. To make student understand Classification and Regression.
4. To introduce to student real world applications of Machine Learning.

Course Outcomes:

At the end of this course, student will be able to –

1. Describe fundamental aspects of Machine Learning.
2. Explore classification and regression algorithm
3. Design neural network for classification
4. Design and implement different Machine Learning models
5. Apply Machine learning techniques that enable to solve real world problems.

Unit – I	**Introduction to Machine Learning**	**8 Hours**

Basics of Statistics, what is Machine learning? Examples of Machine Learning Problems, Learning versus Designing, Training versus Testing, Characteristics of Machine learning tasks, Predictive and descriptive tasks, database and data processing for ML.

Unit – II	**Theory of Machine Learning**	**5 Hours**

Definition of learning systems, Types: Supervised, Unsupervised, Semi Supervised, Reinforcement learning with examples. hypothesis space and inductive bias, evaluation, cross-validation, what is a feature? feature construction, feature extraction.

Unit – III	Supervised Learning	8 Hours
Classification: Binary Classification- Assessing Classification performance. Common classification algorithms: K Nearest Neighbour, Decision Tree, Random Forest model, Support vector machines. Probabilistic Models: Naïve Bayes Classifier. Regression: Assessing performance of Regression- Error measures, Overfitting, underfitting, linear regression, logistic Regression. Multivariate Linear Regression.		
Unit – IV	**Unsupervised Learning**	**8 Hours**
Unsupervised Vs supervised learning, Applications of unsupervised learning, Clustering, clustering as ML task, Different clustering techniques, partitioning methods, K-Medoids, Hierarchical clustering, DBSCAN, Finding pattern using association rule, Association rule, apriori algorithm for association rule learning, Build the apriori principle rules.		
Unit – V	**Artificial Neural Networks**	**8 Hours**
Introduction, Exploring Artificial Neuron, Types of activation functions, Early implementations of ANN, Architectures of Neural Network, Learning process in ANN, Backpropagation, Deep learning		
Unit – VI	**Applications of Machine Learning**	**5 Hours**
Email Spam and Malware Filtering, Image recognition, Speech Recognition, Traffic Prediction, Self-driving Cars, Virtual Personal Assistant, Medical Diagnosis.		
Internal Continuous Assessment (ICA): ICA consists of minimum eight tutorials based upon above syllabus		
Text Books		
1. Machine Learning, Tom Mitchell, McGraw Hill, 3rdEdition, 1997. 2. Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Peter Flach, Cambridge University Press, Edition 2012. 3. Introduction to Machine Learning, Ethem Alpaydin, MIT Press, Prentice Hall of India,3rd Edition2014. 4. Machine Learning, Dutt, Chandramouli, Das, Pearson publication, Eighth Impression, 2022.		
Reference Books		
1. Foundations of Machine Learning, Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, MIT Press,2012. 2. Introduction to Statistical Machine Learning with Applications in R, Hastie, Tibshirani, Friedman, Springer, 2nd Edition-2012. 3. Machine Learning: A Probabilistic Perspective, Kevin P. Murphy, The MIT Press, 2012 4. MACHINE LEARNING - An Algorithmic Perspective, Second Edition, Stephen Marsland, 2015. 5. Data Classification Algorithms and Applications, Charu C. Aggarwal, CRCPress,2014. 6. Data Clustering Algorithms and Applications, Charu C. Aggarwal, CRC Press,2014. 7. Machine Learning Mastery With Python 2016 by Jason Brownlee.		

WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR
(An Autonomous Institute)
Third Year B.Tech. (Electronics and Telecommunication Engineering), Semester-VI

23ETU6E24T: Program Elective II - IoT Cloud Platforms

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hours/week	**ESE**	60 Marks
Tutorial	1 Hours/week	**ISE**	40 Marks
Credits	4	**ICA**	25 Marks

Introduction:

This course explores IoT cloud platforms that enable device connectivity, data management, and remote monitoring at scale. Students will learn how to integrate IoT devices with leading cloud services to build smart, data-driven applications.

Course Prerequisite:

This course requires basic understanding of computer networks, programming (preferably in Python or C), and fundamental IoT concepts. Familiarity with cloud computing and embedded systems is recommended but not mandatory.

Course Objectives:

1. The introduce students to the architecture and services of AWS IoT Core and Azure IoT Hub using live demos.
2. To demonstrate practical techniques for connecting and managing real IoT devices using cloud endpoints.
3. To apply device registry, grouping, and cloud-based security practices in real-world IoT settings.
4. To develop, deploy, and monitor an end-to-end IoT solution using AWS and Azure tools in lab environments.

Course Outcomes:

At the end of this course, student will be able to –
1. Demonstrate the provisioning and configuration of AWS and Azure IoT services.
2. Establish device-to-cloud communication using MQTT and HTTPS protocols.
3. Implement secure device management and access control policies.
4. Design and implement a fully functional cloud-monitored IoT prototype using cloud logs.

Unit – I	**Cloud IoT Foundations: AWS & Azure Hands-on Setup**	**10 Hours**

Creation of AWS and Azure student accounts (Free Tier), Navigation of AWS IoT Core and Azure IoT Hub portals, Installation and usage of MQTT clients, Simulation of device messages using MQTT.fx or Mosquitto, Exploration of AWS IoT and Azure IoT dashboards

Unit – II	**Device Communication & Endpoints: Live Configuration**	**10 Hours**

Connection of devices/emulators to AWS IoT Core and Azure IoT Hub, Testing of MQTT communication using Python or Node.js, Configuration of control/data plane endpoints, Exploration of Device Twins and Shadow States, Demonstration of LoRaWAN and Azure IoT Central

Unit – III	**Device Registry, Grouping & Security**	**10 Hours**
Registration and management of IoT devices, Grouping and tagging of cloud resources, Configuration of IAM policies and Azure RBAC, Implementation of device certificates and VPC endpoints, Logging and security monitoring with AWS CloudTrail and Azure Security Center		
Unit – IV	**End-to-End IoT Deployment & Monitoring**	**14 Hours**
Development of an IoT pipeline from device to cloud, Configuration of AWS IoT Rules and Azure Functions, Monitoring of device activity with CloudWatch and Azure Monitor, Visualization of IoT metrics, Deployment of a complete IoT prototype		
Internal Continuous Assessment (ICA): ICA consists of minimum eight tutorials based upon above syllabus		
Text Books		
1. Internet of Things: A Hands-On Approach by Arshdeep Bahga and Vijay Madisetti A comprehensive book covering IoT architecture, protocols, cloud integration, and hands-on projects. 2. Architecting the Internet of Things by Dieter Uckelmann, Mark Harrison, and Florian Michahelles Covers architecture, platforms, and services related to IoT and cloud infrastructure. 3. Designing the Internet of Things by Adrian McEwen and Hakim Cassimally Focuses on IoT system design, including how cloud services fit into the IoT ecosystem.		
Reference Books		
1. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things by David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, and Jerome Henry, 1st Edition, Cisco Press. 2. Cloud Computing: Concepts, Technology & Architecture by Thomas Erl, 1st Edition, Prentice Hall.		
e-Resources		
1. AWS IoT Core Documentation 2. Microsoft Azure IoT Hub Documentation 3. Google Cloud IoT Core Documentation (now legacy support)		

WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR
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Third Year B.Tech. (Electronics and Telecommunication Engineering), Semester-VI

23ETU6E34T: Program Elective II - Optical Communication

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hours/week	**ESE**	60 Marks
Tutorial	1 Hours/week	**ISE**	40 Marks
Credits	4	**ICA**	25 Marks

Introduction:

This course introduces the principles and technologies behind optical communication systems used for high-speed data transmission. It covers fiber optics, light sources, detectors, modulation techniques, and system design for modern telecommunication networks.

Course Prerequisite:

This course requires knowledge of basic communication systems, light reflection, and the refraction process.

Course Objectives:

1. To enable students to understand the fundamental working principles of optical fibers.
2. To introduce students to the basic types of losses in optical fibers and their underlying causes.
3. To provide students with a foundational understanding of optical sources such as LASERs and LEDs.
4. To familiarize students with the basic concepts of optical detectors and optical networks.

Course Outcomes:

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

1. Explicate the fundamental working principle of optical fibers.
2. Analyze various types of transmission losses in optical fibers along with their causes.
3. Compare the characteristics and operation of different optical sources, including LASERs and LEDs.
4. Differentiate between various types of optical detectors and explain their role within optical networks.

Unit – I	**Introduction**	**6 Hours**

Introduction, Historical development, general optical communication system, advantages, disadvantages, optical fiber waveguides, ray theory, mode theory, Types of optical fibers, single mode, multimode fiber, step index & graded index fibers, applications of optical fiber communication.

Unit – II	**Optical Fiber losses and Joints**	**7 Hours**

Introduction, Attenuation, absorption- intrinsic & extrinsic, linear & nonlinear scattering losses, bending loss, dispersion- intermodal & intramodal, Fiber's alignment and joint loss, fiber splices, connectors, fiber couplers & its types.

Unit – III	**Optical Sources**	**8 Hours**
LASER: Requirements of optical source, basic concept of LASER, optical emission from semiconductors, double heterojunction (DH) structure, Semiconductor injection laser and structures, Injection laser characteristics. LED: LED structures, LED characteristics. Introduction of Light Modulation.		
Unit – IV	**Optical Detectors**	**8 Hours**
Introduction, requirements of optical detector, optical detection principles, performance parameters of detector- absorption, quantum efficiency, responsivity, cut off wavelength. Semiconductor photo diodes with and without internal gain: - PN, PIN, Avalanche Photo diodes, Phototransistors.		
Unit – V	**Optical Networks**	**6 Hours**
Optical Networks: Introduction, networking terminology, optical network modes, SONET / SDH, Optical Ethernet, Fiber Distributed Data Interface (FDDI), data buses.		
Unit – VI	**Fiber Optical Communication Systems**	**7 Hours**
Introduction, Transmitter Design, Receiver Design, Noise equivalent model of receiver, Link Design, Wavelength Division Multiplexing (WDM), DWDM, Optical Time Division Multiplexing (OTDM).		
Internal Continuous Assessment (ICA): ICA consists of a minimum of eight tutorials based on the above syllabus.		
Text Books		
1. Optical Fiber Communications, John M. Senior, Pearson Education. 3rd Impression, 2007 2. Optical Fiber Communications, Gerd Keiser, 4th Ed., MGH, 2008 3. Optical Fiber Communications, D.C. Agarwal - S. Chand and company		
Reference Books		
1. Optical Communications, David Gover – PHI 2. Fiber Optics communication, Hozold Kolimbiris - Pearson Education. 3. Fiber Optics Communication – 5th Edition, Palais-Pear		

WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR
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23ETU6E15T: Program Elective III - Power Electronics

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hours/week	**ESE**	60 Marks
Tutorial	1 Hours/week	**ISE**	40 Marks
Credits	4	**ICA**	25 Marks

Introduction:

This course introduces construction, characteristics of power electronics devices and its applications. It provides applications such as single Phase & Three-phase controlled rectifiers, choppers inverters and cycloconverters. This course also covers design of industrial controllers and aspects of PLC & automation.

Course Prerequisite:

This course requires knowledge of Analog Electronics circuit and ability to analyze circuits containing semiconductor devices. Student also has knowledge of circuit analysis different equation and linear algebra.

Course Objectives:

1. To introduce the different types of power electronic devices and applications.
2. To explain the single-phase and three-phase controlled rectifiers.
3. To familiarise the choppers, single phase AC voltage controllers
4. To describe switching behavior and analysis of single phase and three phase voltage source inverters
5. To introduce the AC, DC drives and PLC.

Course Outcomes:

At the end of the course student will be able to

1. Illustrate the characteristics of different types of power electronic devices.
2. Analyze Single-phase and Three-phase controlled rectifiers.
3. Analyze different type of choppers and single phase and AC voltage Controllers.
4. Analyze different types of inverters.
5. Evaluate PLC and power electronics applications to control AC & DC drives.

Unit – I	**Introduction to Power Devices**	**8 Hours**

SCR-Construction, Working Operation, VI Characteristics, Commutation Techniques (Class A, B, C, D, E, F). Power MOSFET: Construction, Operation, Static & Switching characteristics, Breakdown Voltage Safe Operating Area. IGBT: Construction, Operation, Switching characteristics, Safe Operating area, application

Unit – II	**Single-Phase and Three-Phase Controlled Rectifiers**	**12 Hours**
Half Wave and full wave Controlled rectifier half controlled and fully controlled bridge rectifiers with R, R-L load, dual converter, microcontroller / DSP based firing scheme for single-phase controlled rectifiers. Analysis of three-phase half-wave controlled rectifier with R and RL load, expressions for average output voltage, RMS output voltage; bridge converters: microcontroller/DSP based firing scheme for three-phase controlled rectifiers		
Unit – III	**Choppers & AC Voltage Controllers**	**6 Hours**
Introduction, Step down chopper for R/RL load, Step up chopper. Control Strategies 2-quadrant & 4 Quadrant choppers, Performance Parameters, -JOHN'S & Morgans Chopper. AC Voltage Controllers: Single phase AC Voltage Controller for R Load.		
Unit – IV	**Inverters**	**10 Hours**
Classification of inverters, single-phase voltage source inverter: half bridge & full bridge inverter with R and RL load; Fourier analysis of single-phase inverter output voltage; three-phase bridge inverters – 180 & 120 degree conduction modes, voltage control in single phase inverters; PWM techniques-Single, multiple and sinusoidal PWM; reduction of harmonics in inverter output voltage: PWM, transformer connection and stepped wave inverters; basic series inverter, basic parallel inverter		
Unit – V	**AC & DC Drives (PLC) Control**	**8 Hours**
PLC Architecture and Applications Types of PLC & Programming Language, Closed loop speed control of AC drive: single quadrant, four quadrants, speed control using microcontroller / DSP controller, fuzzy logic control of ac drive, closed loop control of DC drive - voltage and current feedback with microcontroller / DSP controller, fuzzy logic control of DC drive.		
Internal Continuous Assessment (ICA): ICA consists of a minimum of eight tutorials based on the above syllabus.		
Text Books		
1. Power Electronics; M.H. Rashid; 3rd Edition; Pearson Education 2. Power Electronics; M. D. Singh & K.B Khanchandani; 2nd Edition; Tata McGraw Hill 3. Power Electronics; Dr. P. S. Bimbra; Khanna Publishers		
Reference Books		
1. Industrial and Power Electronics; Dr. Maneesha Gupta and G.K. Mithal; Khanna Publishers 2. Power Electronics; P.C. Sen; Tata McGraw Hill 3. Power Electronics; Vedam Subrahmanyam; New Age International Publishers 4. Power Electronics; Mohan, Undeland, Riobbins; 3rd Edition; Wiley 5. Power Electronics and its Applications; Alok Jain; Penram International Publishing Pvt. Ltd. 6. Programmable Logic Controllers by Job den Otter, Prentice Hall International Editions 7. Programmable Logic Controllers by John Web & Ronald Reis, PHI Publications 5th Edition		

WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR
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23ETU6E25T: Program Elective III - Image and Video Processing

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hours/week	**ESE**	60 Marks
Tutorial	1 Hours/week	**ISE**	40 Marks
Credits	4	**ICA**	25 Marks

Introduction:

This course covers fundamental notions in image and video processing, as well as covers most popular techniques used, such as edge detection, motion estimation, segmentation, and case studies.

Course Prerequisite:

This course requires knowledge of Digital Signal Processing

Course Objectives:

1. To describe basic operations on image and video.
2. To introduce filters on images in spatial and frequency domain.
3. To familiarize algorithm for image and video processing application
4. To explain appropriate technique for preprocessing, segmentation and feature extraction of images and videos in real time applications.

Course Outcomes:

At the end of the course, the students will be able to:

1. Perform basic operations on image and video.
2. Apply filter on images in spatial and frequency domain.
3. Realize algorithms for image and video processing applications.
4. Apply appropriate technique for preprocessing, segmentation and feature extraction of images and videos in real time applications.

Unit – I	**Image fundamentals**	**6 Hours**

Image acquisition, sampling and quantization, image resolution, basic relationship between pixels, color model: RGB, HIS and CMY, Discrete Fourier Transform, Discrete Cosine Transform, KL Transform

Unit – II	**Image Enhancement**	**8 Hours**

Spatial Domain: Point Processing: Digital Negative, contrast stretching, thresholding, gray level slicing, log transform and power law transform. Neighborhood Processing: Averaging filters, order statistics filters, high pass filters and high boost filters.
Frequency Domain: DFT for filtering, Ideal, Gaussian and Butterworth filters for smoothening and sharpening, Histogram Modeling: Histogram equalization and histogram specification.

Unit – III	**Image segmentation and Morphology**	**7 Hours**
Point, line and edge detection, edge linking using Hough transform and graph theoretic approach, thresholding and region-based segmentation. Dilation, erosion, opening, closing, hit or miss transform, thinning and thickening and boundary extraction on binary images		
Unit – IV	**Image Restoration**	**6 Hours**
Degradation model, noise models, estimation of degradation function by modeling, restoration using spatial filters.		
Unit – V	**Video Formation, Perception and Representation**	**7 Hours**
Digital Video Sampling: Video Frame classifications, I, P and B frames, Notation,. Video Capture and display: Principle of color video camera, digital video. Sampling of video Signals: Required sampling rates, progressive versus interlaced scans.		
Unit – VI	**Two-Dimensional Motion Estimation**	**8 Hours**
Optical Flow: 2-D motion Vs Apparent Motion, optical flow equations, motion representation, motion estimation criteria, optimization method.		
Internal Continuous Assessment (ICA): ICA consists of minimum eight tutorial based upon above syllabus.		
Text Books		
1. Digital Image Processing by Gonzales and Woods, Pearson Education, India, Third Edition 2. Digital Video Processing by Murat Tekalp, Pearson, 2010. 3. Handbook on Image and Video Processing by A. I. Bovik, Academic Press.		
Reference Books		
1. Fundamentals of Image Processing by Anil K. Jain, Prentice Hall of India, First Edition,1989. 2. Multidimensional Signal, Image and Video Processing by John W. Woods , Academic Press 2012 3. Multimedia Communication Technology by J. R. Ohm, Springer Publication		

WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR
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23ETU6E35T: Program Elective III - Electromagnetic Field Theory

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hours/week	**ESE**	60 Marks
Tutorial	1 Hours/week	**ISE**	40 Marks
Credits	4	**ICA**	25 Marks

Introduction:

This course introduces electromagnetic field theory which deals with electric and magnetic field vectors. The course introduces theoretical and analytical aspects of electromagnetic field, electromagnetic wave propagation and antennas.

Course Prerequisite:

This course requires knowledge of vector operations.

Course Objectives:

1. To identify different co-ordinate systems and use it for EM fields.
2. To introduce basic laws of electrostatic and magnetostatic fields.
3. To find electric and magnetic fields produced at a given point due to different sources.
4. To introduce Maxwell's equations and analysis of wave propagation.
5. To familiarize with antenna radiation principle and types of antennas.

Course Outcomes:

At the end of the course, students will be able to-

1. Recognize different co-ordinate systems and apply divergence, gradient, curl to EM waves.
2. Derive the laws of electrostatic, magneto static fields and electromagnetic wave equation.
3. Apply boundary conditions to different media for wave propagation and Maxwell's equations for analysis of wave propagation.
4. Describe different types of antennas and basic principle of radiation.

Unit – I	**Vector calculus**	**6 Hours**

Vector analysis, Coordinate systems, point conversion and transformation of vector, differential length, surface and volume integral, DEL operator - gradient, divergence and curl

Unit – II	**Electrostatic Field**	**8 Hours**

Coulomb's law & electric field intensity, electric field intensity due to distributed charges, Electric flux density, Gauss's law, divergence theorem, work done, electric potential, relation between E & V, electric dipole and dipole moment, electrostatic energy density, boundary conditions for electrostatic field.

Unit – III	**Magnetostatic field**	**8 Hours**
Biot Savart's law, magnetic field intensity due to distributed charges, Ampere's circuital law, Stroke's theorem, magnetic flux density, boundary condition for magneto static field, energy stored in magnetic field.		
Unit – IV	**Maxwell's equations**	**8 Hours**
Maxwell's equation in point form & integral form for static field, Time varying field and harmonically varying fields		
Unit – V	**Electromagnetic wave propagation**	**8 Hours**
Wave propagation in lossy dielectric media and free space, Helmholtz wave equation, skin depth, Poynting theorem, power flow in uniform plane wave		
Unit – VI	**Antennas**	**7 Hours**
Basic principle of radiation, basic antenna parameters, Antenna field Zones, short dipole antenna and it's radiation resistance, slot antenna, Micro strip Patch antenna, parabolic reflector antenna. Antenna Array-Pattern multiplication, Broad side array, End-fire array		
Internal Continuous Assessment: ICA consists of minimum of eight tutorials based upon above syllabus.		
Text Books		
1. Electromagnetic Engineering by William Hyte - Mc Graw Hill 2. Electromagnetics by John D. Kraus - Mc Graw Hill Third Edition 3. Electromagnetic field theory & transmission lines by G.S.N. Raju - Pearson Education 4. Antennas and Wave Propagation by G.S.N. Raju- Pearson Education 5. Antenna and Wave Propagation by K.D. Prasad-Tech India		
Reference Books		
1. Electromagnetic Schaum's outline series by J.A. Edminister -TATA Mc Graw Hill Second Edition 2. Electromagnetic waves & transmission lines by R.S. Rao – PHI 3. Antenna for all applications by John D. Kraus, Marhefka, Khan - Mc Graw Hill Third Edition 4. Applied Electromagnetics by F. Ulaby (2001 Media Edition) - PHI 5. Antenna theory analysis and design by C.A. Balanis (second edition) – Wiley		

WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR
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23ETU6CC3P: Verilog HDL Programming

Teaching Scheme		**Examination Scheme**	
Lectures	1 Hours/week	**ISE**	25 Marks
Practical/Tutorial	2 Hours/week	**ICA**	25 Marks
Credits	2	**POE**	50 Marks

Introduction:

This course introduces an overview of digital logic design using hardware description languages (HDL). It focuses on fundamental concepts of digital systems and introduces students to the use of Verilog HDL for modelling, simulating, and test digital logic circuits.

Course Prerequisite:

This course requires knowledge of digital components, and combinational and sequential logic circuit design.

Course Objectives:

1. To make students learn EDA Tools for Verilog programming and simulation.
2. To make students design Verilog HDL modules for combinational logic circuits.
3. To make students design Verilog HDL modules for sequential logic circuits.
4. To enable students to model and simulate digital circuits at the switch level using Verilog HDL.

Course Outcomes:

At the end of this course, Students will be able to,
1. Explain the different syntaxes of Verilog HDL language.
2. Implement combinational logic circuits using Verilog HDL
3. Implement sequential logic circuits using Verilog HDL
4. Analyze switch-level digital circuits using Verilog HDL.

Unit – I	**Hardware Modeling With Verilog HDL**	**4 Hours**

Hardware Encapsulation –The Verilog Module, Hardware Modeling Verilog Primitives, Descriptive Styles, Structural Connections, Behavioral Description in Verilog, Hierarchical Descriptions of Hardware, Structured (Top Down) Design Methodology, Arrays of Instances, Representation of Numbers.

Unit – II	**Logic System, Data Types, and Operators For Modeling In Verilog HDL**	**3 Hours**

Verilog Variables, Logic Value Set, Data Types, Strings. Constants, Operators, Expressions and Operands, Verilog Models for Gate Propagation Delay (Inertial Delay), Time Scales for Simulation, Verilog Models for Net Delay (Transport Delay), Examples using Verilog.

Unit – III	**Behavioral Description in Verilog HDL**	**3 Hours**
Verilog Behaviors, Behavioral Statements, Procedural Assignment, Procedural Continuous Assignments, Intra-Assignment, Blocking Assignment, Non-Blocking Assignment, Tasks, and Functions, Examples using Verilog.		
Unit – IV	**Sequential Description in Verilog HDL**	**3 Hours**
Introduction to Sequential Logic, Sequential Constructs in Verilog, Flip-Flops and Latches, Counters and Registers, State machines and Basic technology in commercial devices: State machine using Moore and Mealy model, Verilog HDL model using a state machine for sequence detector, multiplier using ADD and SHIFT method.		
Unit – V	**Switch-Level Models in Verilog**	**2 Hours**
Switch Level Models of Static CMOS Circuits, Alternative Loads and Pull Gates, and CMOS Transmission Gates. Design Examples in Verilog.		
Internal Continuous Assessment (ICA): ICA shall consist of a minimum eight experiments based on above syllabus using EDA tools based on the above concepts and a mini project		
Text Books		
1. HDL Programming VHDL And Verilog, Nazeih M.Botros, Dreamtech Press 2. HDL with Digital Design: VHDL and Verilog, Nazeih Botros. Mercury Learning And Information LLC. ISBN: 978-1-938549-81-6 3. Modeling, Synthesis and Rapid Prototyping with the Verilog HDL, M.D. CILETTI, Prentice-Hall. 4. Verilog Digital – Computer Design, M.G. ARNOLD, Prentice-Hall (PTR). 5. Fundamentals of Digital logic Design with VHDL, Brown, Vranesic – McGraw-Hill (2nd edition). 6. Digital Systems Design using Verilog, Charles H. Roth, Lizy Kurian John, Byeong Kil Lee-Cengage Learning.		
Reference Books		
1. Digital Design Principles and Practices, John F. Wakerly, Printice Hall, 3rd Edition. 2. Verilog HDL: A Guide to Digital Design and Synthesis, Samir Palnitkar, Pearson Education, 2nd Edition.		

WALCHAND INSTITUTE OF TECHNOLOGY, SOLAPUR
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23ETU6VS7P: Open-Source Technology

Teaching Scheme		**Examination Scheme**	
Lectures	1 Hours/week	**ESE**	-
Practical	2 Hours/week	**ISE**	-
Credits	2	**ICA**	50 Marks

Introduction:

The Open-Source Technologies course is designed to provide students with a comprehensive understanding of two essential components of modern software development: Linux Shell Scripting and Git. In this course, students will explore the fundamental concepts, tools, and techniques used in Linux shell scripting and version control using Git. By gaining practical hands-on experience, students will develop the skills necessary to work efficiently and effectively in open-source environments.

Course Prerequisite:

This course requires basic knowledge of Linux operating system, familiarity with command-line interfaces, understanding of programming concepts.

Course Objectives:

1. To provide a historical overview of Linux, its importance, and its distributions.
2. To understand the structure of the Linux filesystem and master basic file management commands.
3. To develop proficiency in essential system administration tasks.
4. To master the fundamentals and advanced techniques of shell scripting and automation.

Course Outcomes:

At the end of the course, students will be able to

1. Describe Linux's history, its significance, and key distributions.
2. Navigate the Linux file system, using basic commands for streamlined file handling.
3. Manage users and groups, disk partitions, software packages, system processes, and backup/restore procedures.
4. Create shell scripts for automating tasks and version controlling with Git.

Unit – I	**Introduction to Linux**	**3 Hours**

History and Evolution of Linux: Unix and the birth of Linux, Key milestones in Linux development. Linux Distributions: Overview of popular distributions (Ubuntu, Fedora, CentOS, etc.), Choosing the right distribution. Linux vs. Other Operating Systems: Comparison with Windows and macOS. Installation of Linux: Installation process (dual boot, virtual machine, live USB), Basic post-installation setup.

Unit – II	Linux Filesystem and File Management	4 Hours
Linux Filesystem Hierarchy: Understanding root (/) and directory structure, Important directories (/home, /etc, /var, /usr, /bin, /lib). File Types and Permissions: Regular files, directories, symbolic links, Understanding file permissions (read, write, execute): Basic File Management Commands: Navigation: ls, cd, pwd, File operations: cp, mv, rm, mkdir, rmdir, touch, Viewing files: cat, less, more, head, tail. File Editing: Introduction to text editors (nano, vim)		
Unit – III	**System Administration and Management**	**4 Hours**
User and Group Management: Adding, modifying, and deleting users and groups, understanding permissions and ownership. Disk Management: Partitioning, mounting file systems, LVM (Logical Volume Management). Package Management: Installing, updating, and removing software (apt, yum, zypper, etc.). Process Management: Monitoring and managing processes, understanding system resources. Backup and Restore: Strategies and tools for data backup and recovery.		
Unit – IV	**Shell Scripting and Automation**	**4 Hours**
Introduction to Shell Scripting: Basic syntax, variables, and control structures. Advanced Scripting Techniques: Functions, arrays, and debugging scripts. Automating Tasks with Cron and At: Scheduling scripts and jobs. Text Processing Tools: grep, sed, awk, and regular expressions. Version Control with Git: Basics of Git, version control concepts, and repository management.		
Internal Continuous Assessment (ICA): ICA shall consist of a minimum eight experiments based on above syllabus		
Text Books		
1. Open-Source Technology by Kailash Vadera and Bhavyesh Gandhi 2. Linux Command Line and Shell Scripting Bible by Richard Blum (Author), Christine Bresnahan 3. Learn Version Control with Git: A step-by-step course for the complete beginner, by Tobias Günther 4. Online Content: https://docs.github.com/en/get-started/using-git/about-git		
Reference Books		
1. Managing Open-Source Projects: A Wiley Tech Brief (Technology Briefs Series Book 24) by Jan Sandred 2. Open Source: Technology and Policy By Fadi P. Deek and James A.M.McHugh, Cambridge University Press. 3. Ubuntu 20.04 Essentials: A Guide to Ubuntu 20.04 Desktop and Server Editions Ubuntu 4. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer, by Tsitoara.		