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. 2024-25

Electronics and Telecommunication Engineering Department

Department Vision

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

Department Mission

1. To inculcate and stimulate Electronics & allied Engineering proficiency amongst students through quality education and innovative educational practices.
2. To create engineering professionals with social consciousness.
3. To foster technical skills of students through creativity and critical thinking.
4. To enhance soft skill set of students which is crucial for career success through effectual training.

Electronics and Telecommunication Engineering
Under Graduate Program
Program Educational Objectives (PEOs)

1. Graduates will exhibit strong fundamental knowledge and technical skills in Electronics and Telecommunication Engineering and allied fields.
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.
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.

Program Outcomes (POs)

The program outcomes of B. Tech. E&TC Engineering Program are summarized as following:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
3. **Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities, relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

Engineering graduate in Electronics and Telecommunication Engineering Programme will be able to do-

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

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

Course Code Format:

2	2	E	T	U/P	2	C	C	1	T/L
Year of Syllabus revision		Program Code		U-Under Graduate, P-Post Graduate	Semester No./ Year1/2/3/…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	Core Compulsory Course
SN*	Self-Learning **N*** *indicates the serial number of electives offered in the respective category*
EN*	Core Elective **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

Sample Course Code:

22ETU5CC1T	Electromagnetic Field Theory

Walchand Institute of Technology, Solapur
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Structure of T. Y. B. Tech. Electronics and Telecommunication Engineering,
(W.E.F. 2024-2025)
Semester- V

Course Code	Name of Course	Engagement Hours			Credits	FA		SA		Total
		L	T	P		ESE		ISE	ICA	
22ETU5CC1T	Electromagnetic Field Theory	3		-	3	60		40		100
22ETU5CC1A	Electromagnetic Field Theory Tut		1	-	1				25	25
22ETU5CC2T	Analog and Digital Communication	3	-	-	3	60		40	-	100
22ETU5CC3T	Microcontrollers and Applications	3	-	-	3	60		40	-	100
22ETU5CC4T	Digital Signal Processing	3	-	-	3	60		40	-	100
22ALU5SN*9T	Self-Learning I - Humanities and Social Science	-	-	-	2	50		-		50
	Sub Total	**12**	**1**		**15**	**290**		**160**	**25**	**475**
	Laboratory					**POE**	**OE**			
22ETU5CC2L	Analog and Digital Communication Lab			2	1	25			25	50
22ETU5CC3L	Microcontrollers and Applications Lab	-	-	2	1	25			25	50
22ETU5CC4L	Digital Signal Processing Lab	-	-	2	1				25	25
22ETU5CC5P	Programming with Java	2	-	2	3	50		25	25	100
	Sub Total	**2**			**6**	**100**		**25**	**100**	**225**
	Grand Total	**14**	**1**	**8**	**21**	**390**		**185**	**125**	**700**

- **N*** *indicates the serial number of electives offered in the respective category*

Walchand Institute of Technology, Solapur
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Structure of T. Y. B. Tech. Electronics and Telecommunication Engineering,
(W.E.F. 2024-2025)

Semester –VI

Course Code	Name of Course	Engagement Hours			Credits	FA		SA		Total
		L	T	P		ESE		ISE	ICA	
22ETU6CC1T	Project Management and Operation Research	3		-	3	60		40		100
22ETU6CC1A	Project Management and Operation Research (Tutorial)		1	-	1				25	25
22ETU6CC2T	Embedded System Design	3	-	-	3	60		40	-	100
22ETU6CC3T	Database Management System	3	-	-	3	60		40	-	100
22ETU6E**N***4T	Core Elective –I	3	-	-	3	60		40	-	100
22ETU6CC5P	Open-Source Technology	2	-		2			25		75
	Sub Total	**14**	**1**	**-**	**15**	**240**		**185**	**25**	**500**
	Laboratory					**POE**	**OE**			
22ETU6CC2L	Embedded System Design	-	-	2	1	50#		-	25	75
22ETU6CC3L	Database Management System	-	-	2	1	25			25	50
22ETU6E**N***4L	Core Elective –I	-	-	2	1				25	25
22ETU6CC5P	Open-Source Technology		-	2	1	50			25	25
22ETU6MP6L	Hardware Mini Project	-	-	2	1				25	25
22ETU6IN7L	Vocational Training	_	_	_	2	_			50	50
	Sub Total	**-**	**-**	**10**	**7**	**125**		**-**	**175**	**250**
	Grand Total	**14**	**1**	**10**	**22**	**365**		**185**	**200**	**750**

- **N*** *indicates the serial number of electives offered in the respective category*
- **#** The Practical oral exam of the Hardware Mini Project will be included in the Practical oral exam of the Embedded System Design

Note:

1. Internal Continuous Assessment (ICA): ICA shall be a continuous process based on the performance of the student in assignments, class tests, quizzes, attendance and interaction during theory and lab sessions, journal writing, report presentation etc., as applicable
2. For Hardware Mini Project, Project group shall not be of more than three students.
3. Student shall select one Self Learning course on Humanities and Social Sciences (HSS) at T.Y. Part I i.e. at Semester V. Curriculum for Humanities and Social Sciences, Self-Learning (HSS) is common for all undergraduate engineering programs. Students have a choice to either select a Self-Learning (HSS) from the following Course List and appear for examination of the Institute.

22ALU5SN*9T Self Learning I – HSS List

Course Code	Course title
22ALU5S19T	Economics
22ALU5S29T	Intellectual Property Rights for Technology Development and Management
22ALU5S39T	Introduction to Sociology
22ALU5S49T	Stress and Coping
22ALU5S59T	Professional Ethics & Human Value

OR

The list of approved NPTEL/Online courses/Industry MOOC of minimum eight weeks duration for 'Self Learning (HSS)' shall be announced by the BOS chairman at the commencement of Semester V. Students shall register and complete one of the courses from approved lists successfully and submit the passing certificate to the department.

4. List of Core Elective - I at T.Y. B. Tech. E&TC Engineering, part II, Semester VI

22ETU6EN*4T Core Elective – I

List of Core Electives – I offered to students pursuing Honors in Artificial Intelligence and Machine Learning	
Course Code	**Course title**
22ETU6E24T	Optical Communication
22ETU6E34T	Image and Video Processing

List of Core Electives – I offered to all other students	
Course Code	**Course title**
22ETU6E14T	Data Analytics
22ETU6E24T	Optical Communication
22ETU6E34T	Image and Video Processing

5. Vocational Training - Four weeks of Vocational Training can be completed by students after the completion of Semester II up to the end of Semester VI, the report of which will be assessed in Semester VI. Students can complete two separate trainings of two weeks each or one training of four weeks. Vocational Training can be done in the form of an Industrial Internship / Vocational Training / industry-recognized MOOC course / industry-recognized Certification / Workshop or Bootcamp by industry or any other relevant activity as specified by the department

Walchand Institute of Technology, Solapur

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T.Y. B. Tech. (Electronics & Telecommunication Engineering), Semester-V

22ETU5CC1T – Electromagnetic Field Theory

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week, 3 credits	ESE: 60 Marks
Tutorial: 1hr/week, 1 credit	ISE: 40 Marks
	ICA: 25 Marks

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:

Student shall have knowledge of vector operations.

Course Objectives:

1. Define different co-ordinate systems and apply divergence, gradient, curl to vector field.
2. Derive the laws of electrostatic and magnetostatic field.
3. Determine electric and magnetic field produced at a given point due to different sources.
4. Derive Maxwell's equations and analyze wave propagation.
5. Explain antenna radiation principle and types of antennas.

Course Outcomes:

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

1. Define and 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. Explain different types of antennas and basic principle of radiation.

Unit 1 – Vector calculus **[6 Hrs.]**

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

Unit 2 – Electrostatic Field **[8 Hrs.]**

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 3 – Magnetostatic field **[8 Hrs.]**

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 4 – Maxwell's equations **[8 Hrs.]**

Maxwell's equation in point form & integral form for static field, Time varying field and harmonically varying fields.

Unit 5 – Electromagnetic wave propagation **[8 Hrs.]**

Wave propagation in lossy dielectric media and free space, Helmholtz wave equation, skin depth, Poynting theorem, power flow in uniform plane wave

Unit 6: Antennas **[7 Hrs.]**

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 reflectorantenna. Antenna Array- Pattern multiplication, Broad side array, End-fire array

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Internal Continuous Assessment:

ICA consists of minimum of eight tutorials based upon above curriculum. Tutorial shall include numerical problems, derivations etc.

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 SecondEdition
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

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T.Y. B. Tech. (Electronics & Telecommunication Engineering), Semester-V

22ETU5CC2T – Analog and Digital Communication

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week, 3 credits	ESE: 60 Marks
Practical: 2hr/week, 1 credit	ISE: 40 Marks
	ICA: 25 Marks
	POE: 25 Marks

This course introduces the basic principles of design and analysis of analog and digital communication systems. It deals with the elements of communication systems, need for modulation, the significance of information theory and coding techniques, synchronization methods, various analog and digital modulation and demodulation techniques.

Course Prerequisite:

Students shall have knowledge of analog and digital signal representation, Fourier series and Fourier transform, and basic electronic circuits.

Course Objectives:

1. To introduce basic components of communication system and concept of modulation.
2. To make student understand the significance of information theory, source coding and Error Control Codes in communication system.
3. To analyze various analog and digital communication system focusing on modulation and demodulation methods, as well as their performance features.

Course Outcomes:

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

1. Explain basic components of communication systems and a need for modulation.
2. Calculate information measures and parameters of source coding techniques for the discrete memoryless source
3. Analyze various analog modulation techniques
4. Analyze various digital modulation techniques
5. Evaluate error detection & correction capabilities of block code

Unit 1-Introduction to Analog Communication & Noise [05 Hrs.]

Introduction of Communication, Elements of communication systems, Base band & Carrier communication, Modulation, and Demodulation, Need of Modulation, Type of modulation, Type of communication Channels (Transmission line, Parallel wires, Coaxial cables, waveguides, and optical fibers), Electromagnetic spectrum, Bandwidth, Noise: source of noise - external noise- internal noise- noise calculation.

Unit 2-Analog Transmission & Reception [10 Hrs.]

Generation of AM (DSBFC), DSBSC, SSBSC, ISB & VSB, and its spectrum, Power relations applied to sinusoidal signals, Envelope detection, TRF AM Receivers, Super Heterodyne Receiver. Performance Characteristics: Sensitivity, Selectivity, Fidelity, Image Frequency Rejection, and IFRR. Mathematical analysis of FM, Frequency spectrum analysis of FM, Direct and indirect methods of FM generation, FM detection Techniques - Foster Seeley Discriminator, Ratio Detector.

Unit 3- Information Theory **[07 Hrs.]**

Introduction to information theory, entropy, joint entropy and conditional entropy, rate of information, mutual information, channel capacity, transmission efficiency, redundancy, Shannon's theorem, Shannon – Hartley theorem, bandwidth and S/N trade off, Shannon Fano coding, Huffman coding technique.

Unit 4- Pulse and Data Communication **[08 Hrs.]**

Digital communication system, sampling theory, Nyquist rate, aliasing, PAM, PTM, PCM generation and reconstruction, quantization, companding, PCM bandwidth, ISI, eye diagram, line coding techniques, multiplexing (TDM, FDM), differential pulse code modulation, delta modulation, adaptive delta modulation.

Unit 5- Binary Digital Modulations Techniques **[09 Hrs.]**

Binary ASK, FSK, PSK, DPSK, Coherent and non-coherent Detection. QPSK, M-ary PSK, Wideband FSK, QAM. Comparison of digital modulation schemes–Bandwidth, Power requirements & Equipment complexity, Probability of error, Matched filter receiver, Correlation receiver, Carrier recovery circuits, Synchronization, Symbol Synchronization, and Frame synchronization.

Unit 6- Error Control Codes **[06 Hrs.]**

Introduction to linear block code, linear block code examples, generator matrix, systematic linear block codes, Parity-check matrix, Syndrome testing, and Error correction.

Internal Continuous Assessment (ICA):

ICA consists of a Minimum of 8 experiments based on the above curriculum.

Text Books:

1. George Kennedy, "Electronic Communication Systems" 5th Edition, McGraw-Hill.
2. Communication Systems (Analog and Digital) – Sanjay Sharma –Katsons Publication.
3. "Analog and Digital Communication" by Singal T L McGraw Hill Education.
4. Communication System Analog & Digital – Singh & Sapre.- TMH.

Reference Books:

1. Taub & Schilling, "Principles of Communication Systems", Tata McGraw-Hill.
2. Digital & Analog Communication systems – K. Sam Shanmugan-Wiley
3. Frenzel, "Principles of Electronic Communication Systems"3rd Edition, Tata McGraw-Hill.
4. B. P. Lathi, "Modern Digital and Analog. Communication Systems", 3rd Edition, Oxford University Press

Walchand Institute of Technology, Solapur

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T.Y. B. Tech. (Electronics & Telecommunication Engineering), Semester-V

22ETU5CC3T : Microcontrollers and Applications

Teaching Scheme:
Lecture: 3hrs/week, 3 credits
Practical: 2hrs/week, 1 credit

Examination Scheme:
ESE: 60 Marks
ISE: 40 Marks
ICA: 25 Marks
POE: 25Marks

This course introduces Basics of microcontroller's theory which includes internal details of MCS51 series and PIC Microcontroller. The course also introduces Assembly level as well Embedded C Level programming aspects of both microcontrollers, Memory interfacing and Interfacing various I/O devices.

Course Prerequisite:
Student shall have knowledge of Digital Electronics.

Course Objectives:
1. To provide an introduction to microcontroller families and details of MCS51.
2. To describe core and peripheral features of PIC16f877a
3. To introduce assembly language and Embedded C programming techniques
4. To introduce hardware interfacing for I/O devices.

Course Outcomes:
At the end of the course student will be able to
1. Explain the various architecture styles of microcontrollers.
2. Describe the architecture, ON-Chip features of 8051 microcontroller.
3. Implement programming of various ON-Chip & external peripherals of 8051.
4. Describe the architecture, memory organization and features of PIC16f877a .
5. Implement programming of various PIC ON-Chip peripherals & Arduino sensor interfaces.

Unit 1: Introduction to Microcontroller: [04 Hrs.]
Introduction, Microprocessor and Microcontrollers, CISC & RISC Microcontroller, Harvard and Von Neumann architecture, Development system for Microcontroller.

Unit 2: The 8051 Architecture and Instructions: [10 Hrs.]
8051 Microcontroller Hardware, Addressing modes, Instruction set, Input / Output ports and External Memory, Counters and Timers, Serial Data Input/output, interrupts.

Unit 3: Programming Microcontroller (8051) [08 Hrs.]
The mechanics of Programming, The assembly and C Language programming concepts, Programming of Parallel & Serial Port, Timers and Interrupts. Programs for interfacing Switches, LED, Relay, LCD display, Stepper Motor, ADC 0808, 7-Segment display.

Unit 4: PIC16F877A Architectural Features & Programming: [08 Hrs.]
Introduction, Architecture, features ,Functional pin description, various registers, Program memory and data memory organization, Input/ output ports, Interrupts, various kinds of RESET.

Unit 5: Programming PIC Core Peripherals: [10 Hrs.]
Timers, Capture/ compare / PWM (CCP) Modules in PIC 16F877, Internal ADC, Universal Synchronous Asynchronous Receiver Transmitter (USART) module.

Unit 6: Programming Arduino for various Sensors Interfaces: [04 Hrs.]
Introduction to Arduino, Arduino IDE setup and installation. Interfacing of LED , Ultrasonic Sensor, PIR Sensor, IR Sensor, Temperature Sensor, LDR.

Internal Continuous Assessment (ICA):
ICA consists of 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.
5. Arduino: The Complete Guide to Arduino for beginners- James Arthur Daniel Jones

Reference Books:

1. Data sheets of MCS51 family microcontrollers, PIC 16F877A Flash microcontrollers,
2. 8051 Microcontroller by I Stott, Mackenzie, Rathel & Phan – Fourth Edition – Pearson Publication.
3. Programming and Interfacing with Arduino -Dr. Yogesh Misra ,CRC press.

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T.Y. B. Tech. (Electronics & Telecommunication Engineering), Semester-V

22ETU5CC4T: Digital Signal Processing

Teaching Scheme:
Lecture: 3hrs/week, 3 credits
Practical: 2hrs/week, 1 credit

Examination Scheme:
ESE: 60 Marks
ISE: 40 Marks
ICA: 25 Marks

This course covers basic analysis tools and techniques for digital signal processing of signals. The course presents design and implementation of Finite and Infinite Impulse response filters and applications of DSP.

Course Prerequisite:

Student shall have knowledge of signals and system. Student shall also have basic knowledge of mathematics and transforming tools like Laplace and Z-transform.

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1. **Course Objectives:**
   To implement the techniques like frequency domain sampling, DFT manipulation, and circular convolution in DSP enables signal analysis and processing.
2. To proficiently employ DFT-based linear filtering methods and Radix-2 FFT algorithms for efficient signal processing of long data sequences.
3. To design, analyze and compare DSP systems like FIR and IIR Filter.
4. To draw the structure for the realization of a given system.

Course Outcomes:

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

1. Implement the techniques like frequency domain sampling, DFT manipulation, and circular
2. convolution in DSP enables signal analysis and processing.
   Employ DFT-based linear filtering methods and Radix-2 FFT algorithms for efficient signal processing of long data sequences.
3. Design FIR and IIR Filters.
4. Draw the structure for the realization of a given system

Unit 1–Discrete Fourier Transform **[11 Hrs]**

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 2– Linear filtering methods based on the DFT: **[11 Hrs]**

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 3- FIR Filter Design **[08 Hrs]**

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 4- IIR Filter Design **[07 Hrs]**

IIR Filter Design by Impulse Invariance, IIR Filter Design by Bilinear Transformation, Characteristic of commonly used Analog Filters (Butterworth Filter), Some examples of Digital Filter Design Based on above Transformation, IIR implementation technique.

Unit 5- Realization of Digital Linear Systems **[07 Hrs]**

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.

Textbooks:

1. Digital Signal Processing – Principles, Algorithms and Applications by John G Proakis-4th edition, Pearson Education.
2. Digital Signal Processing 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

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T.Y. B. Tech. (Electronics & Telecommunication Engineering), Semester-V

22ETU5CC5P – Programming with Java

Teaching Scheme:	**Examination Scheme:**
Lecture: 2 hrs/week, 2 credits	ISE: 25 Marks
Tutorial: 2hr/week, 1 credit	ICA: 25 Marks
	POE: 50 Marks

The course introduces Java language's syntax and object-oriented programming paradigms from the perspective of Java language. Further, the course thoroughly touches upon the vital aspects ofthe usage of Java runtime library packages' classes and methods.

Course Prerequisite:

Students must be familiar with basic programming language like C.

Course Objectives:

1. To introduce the basics of Object-Oriented Programming paradigm
2. To introduce the core components of Java programming language
3. To make students facilitate error handling exceptions.
4. To equip students with essential skills in I/O programming, and multithreading to develop efficient and scalable applications

Course Outcomes:

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

1. Implement Object Oriented Programming paradigm using Java language.
2. Design and implement Inheritance and interface concepts in Java.
3. Apply appropriate Exception handling mechanisms in java programs.
4. Proficiently utilize Java's core features to develop efficient and scalable applications

Unit 1 - Basics of Java and Strings in Java [04 Hrs]

Building blocks of Java Language: Variables, Operators, Expressions, Statements, Blocks, Control flow Statements, Input and Output, Data Types, Arrays, Type Casting.

String, String Buffer and String Builder Classes in Java

Unit 2 – Classes, Objects and Packag [06 Hrs]

Class, Object, Object reference, Constructor, Constructor Overloading, Method Overloading, Recursion, Passing and Returning object form Method, new operator, this and static keyword, finalize() method, Access control, modifiers, Abstract class, Wrapper classes.

Package: Use of Package and Access control.

Unit 3 – Inheritance and Interface [06 Hrs]

Use of Inheritance, Inheriting Data members and Methods, constructor in inheritance, MultilevelInheritance – method overriding, handling multilevel constructors –super keyword, final keywords. Creation and Implementation of an interface.

Unit 4- Exceptions and Error Handling **[04 Hrs]**

Exceptions and Errors, Catching and Handling Exceptions, Chained Exceptions, Custom Exceptions.

Unit 5- I/O Programming **[04 Hrs]**

Basic I/O: I/O Streams, Byte Streams, Character Streams, Buffered Streams, Data Streams, ObjectStreams, File Operations.

Unit 6 - Java Collections Framework and Multithreading **[6 Hrs]**

Introduction to collections, The Comparable and Comparator Interfaces, Sorting using Comparable & Comparator. **Collections**: Lists, Sets, Maps, Trees, Iterator and Collections Class. **Multithreading**: Creating Threads, Thread scheduling and priority, Thread interruptions and synchronization.

Internal Continuous Assessment (ICA):

ICA consists of a minimum of eight experiments and a mini-project based on the above syllabus.

Text Books:

1. Head First Java, Kathy Sierra, Bert Bates, O'Reilly Publication
2. The Java™ Programming Language, 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.
2. Java: The Complete Reference 8 Edition - Herbert Schildt, Tata McGraw - HillEducation
3. The Java™ Tutorials. Oracle Inc.

e-resources:

1. http://docs.oracle.com/javase/specs/
2. http://docs.oracle.com/javase/tutorial/

Walchand Institute of Technology, Solapur

(An Autonomous Institute)

T.Y. B. Tech. (Electronics & Telecommunication Engineering), Semester-VI

22ETU6CC1T – Project Management and Operation Research

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week, 3 credits	ESE: 60 Marks
Tutorial: 1hr/week, 1 credit	ISE: 40 Marks
	ICA: 25 Marks

This course introduces with various stages involved in development of any project and components associated with it. It also deals with the various research methods that need to followed for the efficient execution of projects.

Course Prerequisite:

Basic understanding of management fundamentals and project development.

Course Objectives:

1. To introduce students to the project development life cycle
2. To make students aware of different methods used for project planning, scheduling, and risk management.
3. To impart knowledge in concepts of Operations Research
4. To analyze models associated with Operations Research.

Course Outcomes:

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

1. Apply Project Management Life Cycle to real-time projects
2. Apply project planning and scheduling concepts for project development and compare various techniques.
3. Use risk management planning techniques for project development.
4. Explain the significance of Operation Research and various models for solving a problem under consideration.
5. Find the optimal solution for the Linear Programming Problem and explain replacement models.
6. Apply Assignment models for effective utilization of facilities and explicate the factors associated with the Location and Layout of facilities.

Unit 1: Project Management [07 Hrs.]

Concepts of project management, function of project management, categories of project, project evaluation, project failure, project life cycle concept and cost components.

Unit 2: Project Planning and Scheduling [08 Hrs.]

Work Breakdown structure (WBS) and linear responsibility chart, Interface Co-ordination and concurrent engineering, Project cost estimation and budgeting, Top down and bottoms up budgeting, Networking and Scheduling techniques (PERT, GANTT chart (no numerical)).

Unit 3: Risk Management [06 Hrs.]

Risk & its categories, risk management planning, risk identification and risk register, Qualitative and quantitative risk assessment, Risk response strategies for positive and negative risks.

Unit 4: Introduction of Operation Research [07 Hrs.]
Definition of operations research, Characteristics of operations research and its other aspects, Models of operations research, Limitations of operations research.

Unit 5: Linear Programming Problem & Replacement Model [08 Hrs.]
Introduction to LPP, Applications of LPP, Advantages of LPP, Formulation of problem, Graphical Method, Simplex method. Replacement Model–Introduction**,** Need for replacement, failure mechanism, Categories of replacement problems.

Unit 6: Assignment Model, Location and Layouts of facilities [06 Hrs.]
Introduction, applications of assignment models, types of assignment problems, Methods to solve balanced and unbalanced assignment problems, facility location, General Procedure for making location decisions, factors affecting location decision.

Internal Continuous Assessment (ICA):
ICA consists of a minimum of eight tutorials based on the above curriculum. The tutorial shall include case studies related to the above syllabus.

Text Books:
1. Hamdy Taha, "Operations Research – An Introduction", 7th edition PHI (2003)
2. S. D. Sharma, "Operation Research", Kedarnath and Rannalt Pub.
3. Hira and Gupta, "Operation Research", S. Chand and Co.
4. K Nagarajan, "Project Management", New Age International Publication
5. Bob Hughes, Mike Cotterell, Rajib Mall, "Software project management" McGraw Hill

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Reference Books:
1. Richard Newton, "Project Management- Step by Step", PEARSON
2. P Rama Murthy, "Operations Research", 2 nd edition New Age International Publication

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T.Y. B. Tech. (Electronics & Telecommunication Engineering), Semester-VI

22ETU6CC2T: Embedded System Design

Teaching Scheme:	**Examination Scheme:**
Lecture: 3hrs/week, 3 credits	ESE: 60 Marks
Practical: 2hrs/week, 1 credit	ISE: 40 Marks
	ICA: 25 Marks
	POE: 50 Marks

This course introduces Embedded System Design with software and hardware perspective. The course also introduces practical design aspects of embedded system.

Course Prerequisite:

Student shall have knowledge of digital circuits, basic C programming, and Microcontroller fundamentals.

Course Objectives:

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

Course Outcomes:

On the completion of this course, Students will be able to

1. Describe ARM core architecture.
2. Implement programs for on chip peripherals of LPC2148.
3. Implement programs for interfacing different devices with LPC2148.
4. Describe NVIDIA Jetson Orin Nano board and implement object detection program.
5. Implement semaphore and inter task communication in RTOS

Unit 1: ARM Fundamentals **[6 Hrs]**

Introduction to Embedded System, ARM7TDMI core architecture, ARM extension family, Pipeline, Memory management, Bus architecture

Unit 2: On Chip Peripherals **[10 Hrs]**

Study of on-chip peripherals like I/O ports, Timers, Interrupts, ADC, DAC, WDT, UART, I2C, CAN

Unit 3: ARM 7 Interfacing **[8 Hrs]**

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

Unit 4: Introduction to NVIDIA Development Board **[8 Hrs]**

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

Unit 5: RTOS Fundamentals **[12 Hrs]**

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 minimum eight experiments and a mini project based on above syllabus.

Note: # The Practical oral exam of the Mini Project will be included in the Practical oral exam of the Embedded System Design

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Textbooks:

1. Datasheet of LPC2148.
2. Frank Vahid-Embedded Systems-Wiley India
3. Datasheet of NVIDIA Jetson Orin Nano
4. Introduction to Embedded Systems: Shibu K V McGraw-Hill Education

Reference Books:

1. DR. K. V. K. K. Prasad -Embedded/real time system–Dreamtech
2. Embedded real systems Programming–Iyer, Gupta, TMH

E-Resources for NVIDIA Jetson Orin Nano

1. NVIDIA Jetson Orin Nano development board information - https://developer.nvidia.com/embedded/learn/get-started-jetson-nano-devkit#intro
2. NVIDIA Jetson Orin Nano Development board OS installation and setup - https://docs.nvidia.com/jetson/archives/r35.3.1/DeveloperGuide/text/IN/QuickStart.html
3. 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

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T.Y. B. Tech. (Electronics & Telecommunication Engineering), Semester-VI

22ETU6CC3T – Database Management System

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week, 3 credits	ESE: 60 Marks
Practical: 2hr/week, 1 credit	ISE: 40 Marks
	ICA: 25 Marks
	POE: 25 Marks

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:

Students shall have knowledge of analog and digital signal representation, Fourier series and Fourier transform, and basic electronic circuits.

Course Objectives:

1. To understand the basics of database design, structure, implementation and applications.
2. To develop the logical design of the database using data modelling concepts such as entity relationship diagrams.
3. To understand and use Structured Query Language to query, update, and manage a database.
4. To apply normalization techniques to normalize the database.
5. To familiarize the students with the fundamentals of database transaction processing, learn techniques for concurrency control and recovery methods.

Course Outcomes:

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

1. Utilize fundamental database system ideas to create relational models and schemas, as well as develop schemas with the E-R model and normalization.
2. Utilizing SQL and relational algebra, extract and modify data as well as access and maximize data retrieval using indexing and hashing strategies.
3. Apply ACID properties for transaction processing.
4. Explain concurrency control and recovery methods.

Unit 1: Introduction to DBMS **[03 Hrs]**

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

Unit 2: E-R model **[05 Hrs]**

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.

Unit 3: Relational Model **[06 Hrs]**

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 4: Introduction to SQL **[08 Hrs]**

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.].

Unit 5: Intermediate SQL **[07 Hrs]**

Additional basic operations, Set operations, NULL values, Aggregate functions, Nested sub queries, Modification of the databases. Join operations, Views, Integrity constraints, Authorization.

Unit 6: Normalization **[05 Hrs]**

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 7: Indexing and Hashing **[05 Hrs]**

Basic Concepts, Ordered Indices, B+ Tree Index Files, B Tree Index Files, Multiple Key Access, Static and Dynamic Hashing, Comparison of Indexing and Hashing, Index definition in SQL.

Unit 8: Transactions and Concurrency Control **[06 Hrs]**

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 8 experiments based on the above curriculum.

Suggestive list of Experiments

1. Implementation of Basic SQL DDL commands
2. Implementation of SQL DML commands
3. Draw E-R diagram for any specific database application
4. Write simple queries in SQL on the schema created for a specific application
5. Write SQL queries using aggregate function and nested subqueries,
6. Write SQL queries using Views and Join operation
7. Write SQL queries for different integrity constraints and authorization commands.
8. Convert the created database into 1NF, 2NF, 3NF and BCNF.
9. Write a program to implement dynamic hashing on the database previously created.
10. Write a program to simulate log-based protocol using immediate database modification.
11. Write a program to simulate concurrency control protocol

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) 5thedition.
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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T.Y. B. Tech. (Electronics & Telecommunication Engineering), Semester-VI

CORE ELECTIVE –I

22ETU6E14T– Data Analytics

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week, 3 credits	ESE: 60 Marks
Practical: 2hr/week, 1 credit	ISE: 40 Marks
	ICA: 25 Marks

This course provides foundation-level training that enables immediate and effective participation in data and other data analytics projects. It includes an introduction to data and data analytics. The course provides a grounding in basic analytic methods and an introduction to data analytics technology and tools.

Course Prerequisite:

Student shall have knowledge of Statistics, Probability theory.

Course Objectives:

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

1. To understand Data Analytics Life Cycle and Business Challenges.
2. To understand Analytical Techniques and Statically Models.
3. To understand methods for data analytics practitioners.

Course Outcomes:

On completion of the course, student will be able to–

1. Deploying the Data Analytics Lifecycle to address data analytics projects.
2. Use the right method to solve real problem.
3. Selecting appropriate data visualizations to clearly communicate analytic insights.
4. Use the tools and techniques to apply different algorithms and methodologies.

Unit 1– Data Analytics Lifecycle and Big Data [05 Hrs]

Background and Overview of Data Analytics Lifecycle, Discovery, Data Preparation, Model Planning, Model Building, Communicate Results, Operationalize, Case Study: Global Innovation Network and Analysis (GINA) What Can We Do With Data? Big Data and Data Science, Big Data Architectures, Small Data, What is Data? A Short Taxonomy of Data Analytics, Examples of Data Use.

Unit 2: Descriptive statistics and analysis: [09 Hrs]

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 3: Data Quality and Pre-processing: **[08 Hrs]** Data Quality, Converting to a Different Scale Type, Converting to a Different Scale, Data Transformation, Dimensionality Reduction.

Unit 4: Clustering and FPM: **[08 Hrs]**

Clustering: Distance Measures, Clustering Validation, Clustering Techniques, **Frequent Pattern Mining**: Frequent Item sets, Association Rules, Behind Support and Confidence, Other Types of Pattern

Unit 5: Regression and Classification: **[08 Hrs]**

Regression: Predictive Performance Estimation, Finding the Parameters of the Model, Technique and Model Selection, **Classification**: Binary Classification , Predictive Performance Measures for Classification, Distance-based Learning Algorithms, Probabilistic Classification Algorithms.

Unit 6- Big Data Analytics **[06 Hrs]** 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.

Internal Continuous Assessment (ICA):

ICA shall consist of minimum 8 assignments based on the syllabus contents.

Text books:

1. David Dietrich, Barry Hiller, "Data Science and Big Data Analytics", 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. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer
4. Ashutosh Nandeshwar , "Tableau Data Visualization Codebook", Packt Publishing, ISBN 978-1-84968-978-6

Reference Books:

1. Maheshwari Anil, Rakshit, Acharya, "Data Analytics", McGraw Hill, ISBN: 789353160258.
2. Mark Gardner, "Beginning R: The Statistical Programming Language", Wrox Publication,ISBN: 978-1-118-16430-3
3. Luís Torgo, "Data Mining with R, Learning with Case Studies", CRC Press, Talay and Francis Group, ISBN9781482234893
4. Carlo Vercellis, "Business Intelligence - Data Mining and Optimization for Decision Making", Wiley Publications, ISBN: 9780470753866.

Walchand Institute of Technology, Solapur

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T.Y. B. Tech. (Electronics & Telecommunication Engineering), Semester-VI

CORE ELECTIVE –I

22ETU6E24T – Optical Communication

Teaching Scheme:
Lecture: 3 hrs/week, 3 credits
Practical: 2hr/week, 1 credit

Examination Scheme:
ESE: 60 Marks
ISE: 40 Marks
ICA: 25 Marks

Course Prerequisite:
Student should have knowledge of basic communication system, light reflection, refraction process.

Course Objectives:
1. To make students to understand basic working principle of optical fiber.
2. To introduce to student basic losses in optical fiber & reasons behind the losses.
3. To make students to understand the basics of optical sources (LASER & LED).
4. To make students to understand the basics of optical detectors & netwoks.

Course Outcomes:
At the end of the course, students will be able to
1. Demonstrate working of optical fiber.
2. Explain transmission losses & characteristics of optical fiber.
3. Illustrate different optical sources.
4. Explain the different types of optical detectors & networks.

Unit 1– Introduction **[06 Hrs.]**
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 2– Optical Fiber losses and Joints **[07 Hrs.]**
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 3– Optical Sources **[08 Hrs.]**
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 4-Optical Detectors **[08 Hrs.]**
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 5-Optical Networks **[06 Hrs.]**

Optical Networks: Introduction, networking terminology, optical network modes, SONET / SDH, Optical Ethernet, Fiber Distributed Data Interface (FDDI), data buses.

Unit 6-Fiber Optical Communication Systems **[07 Hrs.]**

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 8 experiments 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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T.Y. B. Tech. (Electronics & Telecommunication Engineering), Semester-VI

CORE ELECTIVE –I

22ETU6E34T: Image and Video Processing

Teaching Scheme:	**Examination Scheme:**
Lecture: 3hrs/week, 3 credits	ESE: 60 Marks
Practical: 2hrs/week, 1 credit	ISE: 40 Marks
	ICA: 25 Marks

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:

Student shall have knowledge of Digital Signal Processing

Course Objectives:

1. To describe and performs basic operations on image and video.
2. To design and apply filter on images in spatial and frequency domain.
3. To analyze and implement algorithm for image and video processing application using modern tools.
4. To select and apply 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. Implement algorithm for image and video processing application using modern tools.
4. Apply appropriate technique for preprocessing, segmentation and feature extraction of images and videos in real time applications.

Unit 1: Image fundamentals [06 Hrs]

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

Unit2: Image Enhancement [08 Hrs]

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.

Unit3: Image segmentation and Morphology: [07 Hrs]

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

Unit4: Image Restoration [06 Hrs]
Degradation model, noise models, estimation of degradation function by modeling, restoration using spatial filters.

Unit5: Video Formation, Perception and Representation: [07 Hrs]
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.

Unit6: Two-Dimensional Motion Estimation [08 Hrs]
Optical Flow: 2-D motion Vs Apparent Motion, optical flow equations, motion representation, motion estimation criteria, optimization method.
Block Based Methods: Block motion models, Phase correlation method, Block matching method

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

Text Books:

1. Gonzales and Woods--Digital Image Processing, Pearson Education, India, Third Edition
2. Murat Tekalp—Digital Video Processing, Pearson, 2010.
3. A. I. Bovik—Handbook on Image and Video Processing", Academic Press.

Reference Books:

1. Anil K. Jain,―Fundamentals of Image Processing, Prentice Hall of India, First Edition, 1989.
2. John W. Woods,―Multidimensional Signal, Image and Video Processing, Academic Press 2012
3. J. R. Ohm,―Multimedia Communication Technology", Springer Publication.

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T.Y. B. Tech. (Electronics & Telecommunication Engineering), Semester-VI

22ETU6CC5P – Open-Source Technologies

Teaching Scheme:	**Examination Scheme:**
Lecture: 2 hrs/week, 2 credits	ISE: 25 Marks
Tutorial: 2hr/week, 1 credit	ICA: 25 Marks
	POE: 50 Marks

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:

1. Basic knowledge of Linux operating system
2. Familiarity with command-line interfaces
3. Understanding of programming concepts (e.g., variables, loops, conditionals)

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. To summarize Linux's history, its significance, and key distributions.
2. To effectively navigate and manage the Linux file system, using basic commands for streamlined file handling.
3. To manage users and groups, disk partitions, software packages, system processes, and backup/restore procedures.
4. To create, optimize, and manage shell scripts for automating tasks and version controlling with Git.

Unit 1: Introduction to Linux **[07 Hrs.]**

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 2: Linux Filesystem and File Management **[08 Hrs.]**

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 3: System Administration and Management **[15 Hrs.]**

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 4: Shell Scripting and Automation **[15 Hrs.]**

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 be based upon minimum Eight Experiments based on the 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.

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T.Y.B.Tech. (Electronics & Telecommunication Engineering), Semester-VI

22ETU6MP6L: Hardware Mini Project

Teaching Scheme:

Practical: 2hrs/week, 1 credit

Examination Scheme:

ICA: 25 Marks

This course is introduced to enable students to apply the knowledge and skills learnt in various courses to solve/implement predefined practical problem. The Project work imparts learning additional skills to develop the ability to define, design, analyze and implement solutions for the given problem and lead to its accomplishment with proper planning.

Course Prerequisite:

Students shall have knowledge of basic circuit designing, knowledge of different components, testing, soldering and programming skills.

Course Objectives:

1. Apply theoretical concepts learned in the course to real-world projects, reinforcing understanding and retention.
2. Develop students' ability to analyze problems, identify requirements, and devise solutions in the context of hardware design and implementation.
3. Foster collaboration and teamwork skills by assigning group projects that require students to work together to achieve common objectives.
4. Provide opportunities for students to present their projects to their peers and instructors and also teach students how to document their projects effectively.

Course Outcomes:

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

1. Apply theoretical knowledge acquired in the course to real-world hardware projects.
2. Demonstrate strong problem-solving skills, effectively identifying, analyzing, and addressing challenges encountered during the hardware design and implementation process.
3. Collaborate effectively in groups to complete hardware mini projects.
4. Students will develop the ability to create clear, concise, and comprehensive project documentation, including schematics, code, design reports, and presentations.

Guidelines for project implementation:

1. Project group should not be more than 3 students.
2. Domains for projects may be based on a particular application from the following, but not limited to:
   i. Instrumentation and Control Systems
   ii. Electronic Communication Systems
   iii. Biomedical Electronics
   iv. Power Electronics
   v. Audio, Video Systems
   vi. Embedded Systems
   vii. Mechatronics Systems
   viii. Internet of Things
   ix. Agriculture Automation
   x. Robotics
3. Week 1 & 2: Formation of groups, searching for an application-based hardware project
4. Week 3 & 4: Finalization of Mini project & Distribution of work.
5. Week 5 & 6: PCB artwork design using an appropriate EDA tool & Simulation.
6. Week 7 & 8: Procurement of electronic components for the project & PCB manufacturing.
7. Week 9, 10 & 11: Hardware assembly, testing, fabrication
8. Week 12: Demo, Group presentation & report submission

Internal Continuous Assessment:

1. The seminar shall consist of the Literature Survey, Market survey, Basic project work and applications of Mini project.
2. Seminar Assessment shall be based on Innovative Idea, Presentation skill, depth of understanding, applications, Future Scope and Individual Contribution.
3. A certified copy of seminar/project report shall be required to be presented at the time of final submission.

Note: # The Practical oral exam of the Mini Project will be included in the Practical oral exam of the Embedded System Design

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Text Books:

1. Robert Boylested, ― Essentials of Circuit Analysis‖, PHI Publications
2. Meenakshi Raman, Sangeeta Sharma ― Technical Communication, Principles and Practice, Oxford University Press
3. A.E. Ward, Angus ― Electronic Product Design, Stanley Thornes Publishers, UK.
4. C Muralikrishna, Sunita Mishra, ― Communication Skills for Engineers, Pearson
5. Matt Richardson and Shawn Wallace – Getting Started with Raspberry Pi, O'Reilly
6. Cefn Hoile, Clare Bowman, Sjoerd Dirk Meijer, Brian Corteil and Lauren Orsini – Raspberry Pi and AVR Projects, SPD
