Department: Department of Electronics and Computer Engineering **Rev:** Course structure/01/NEP/2023-24
Class: S.Y. B.Tech. **Semester:** IV

Course Code	Course Type	Course	Teaching Scheme				Evaluation Scheme					Credits
			L	T	P	Total Hrs.	CA1	CA2	MSE	ESE	Total	
23EC2401	PCC	Analog and Digital Communication	3	-	-	3	10	10	30	50	100	3
23EC2402	PCC	Digital Electronics and Microprocessor	3	-	-	3	10	10	30	50	100	3
23EC2403	PCC	Operating System	3	-	-	3	10	10	30	50	100	3
23EC2404	PCC	Analog and Digital Communication Laboratory	-	-	2	2	15	15	-	20	50	1
23EC2405	PCC	Digital Electronics and Microprocessor Laboratory	-	-	2	2	15	15	-	20	50	1
23EC2406	VSEC	MATLAB Programming	-	-	2	2	25	25	-	-	50	1
23EC2407	CEP	Mini Project – III	-	-	2	2	25	25	-	-	50	1
23MILEXX	AEC	Modern Indian Language	2	-	-	2	25	25	-	-	50	2
23ECMDXX	MDM	Multidisciplinary Minor-II	3	-	-	3	10	10	30	50	100	3
23OEEC22	OE*	Open Elective-II	3	-	-	3	10	10	30	50	100	3
23HSSM03	VEC	Aptitude Skills – II	1	-	-	1	25	25	-	-	50	Audit
23HSSM04	VEC	Language Skills – II	-	-	2	2	25	25	-	-	50	1
		Total	**18**	**-**	**10**	**28**	**205**	**205**	**150**	**290**	**850**	**22**

Biomedical Engineering (Basket A)	Data Science (Basket B)	Industrial Automation (Basket C)
Linear Integrated Circuits (23ECMDA2)	Mathematics For Data Science (23ECMDB2)	Programmable Logic Controller (23ECMDC2)

Note- (OE*) Open Elective-II Course will be offered to students of other programs and will not be offered to the students of the same program.

Head of the Department
Electronics & Computer Engineering
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING
Yadrav (Ichalkaranji) Dist.Kolhapur

Analog and Digital Communication

23EC2401	PCC	Analog and Digital Communication	3-0-0	3 Credits

Teaching Scheme:	**Evaluation Scheme:**
Lecture: 3 hrs/week	CA-I: 10 Marks CA-II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Fundamental electronics & Fundamental Mathematics.

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

CO1	Summarize different modulation techniques in communication systems.
CO2	Analyze and compare different AM techniques..
CO3	Explain different FM Modulation and Demodulation techniques and its need.
CO4	Interpret various Digital modulation techniques .
CO5	Apply Sampling quantization and source coding techniques.
CO6	Solve the problem on Noise calculation in communication system.

Course Contents:

Unit 1: Introduction to Communication System Block schematic of analog communication system, Simplex and duplex systems, Modes of communication: Broadcast and point to point communication, Necessity of modulation, Classification of modulation, sampling theorem and pulse analog modulation, Introduction to multiplexing-TDM, FDM.	[6]
Unit 2: Amplitude Modulation and Demodulation Introduction, Mathematical analysis and expression for AM, Modulation index, Frequency spectrum and bandwidth of AM, Power calculations, , Low- and high-level modulation, Balance Modulator, Types of AM: DSB-FC, DSB-SC, SSB-SC, ISB and, their generation methods and comparison,	[6]
Unit 3: Angle Modulation and Demodulation Introduction, Mathematical analysis of FM and PM, Modulation index for FM and PM, Frequency spectrum and bandwidth of FM, Narrow band and wide band FM, Direct and indirect methods of FM generation, Pre emphasis and de-emphasis, Comparison of AM, FM and PM.	[6]
Unit 4: Digital modulation & Demodulation Block schematic of digital communication system, Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK)–Phase Shift Keying (PSK), BPSK, DPSK, QPSK, Quadrature Amplitude Modulation (QAM) – line codes: RZ, NRZ, Manchester, Bandwidth, efficiency and application, Comparison of various Digital modulation techniques (ASK – FSK – PSK – QAM).	[6]
Unit no 5: Source coding (06) Quantization Techniques, Study of PCM, DPCM, ADPCM, DM, ADM	[6]
Unit 6: Noise	[6]

Head of the Department
Electronics & Computer Engineering
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING
Yadrav (Ichalkaranji) Dist.Kolhapur

Introduction, Sources of noise, Types of noise, Noise calculations, Signal to Noise ratio, Noise figure, Noise Factor, Noise Temperature	

Text Books:

1. Kennedy, "Electronics Communications Systems", McGraw-Hill New Delhi-1997, 4th Edition.
2. Anokh Singh, "Principles of communication engineering" S.Chand
3. Wayne Tomasi, "Electronic Communication Systems", Pearson Education-2005, 5th Edition
4. K. Sam Shanmugam- Digital & Analog Communication (John Wiley)
5. Simon Haykin- Digital Communication (Wiley).

Reference Books:

1. Bernard Sklar, Pabitra Kumar Ray-'Digital Communications'-2nd Edition- Pearson
2. Taub- Schilling – Saha- 'Principals of communication systems' -3rd Edition-Mc Graw Hill
3. Lathi B P & Ding Z –'Modern Digital & Analog Communication Systems'- Oxford University Press, Fourth Edition
4. Ha Nguyen Ed Shwedyk-A First Course in Digital Communication – Cambridge Uni press
5. Roddy & Coolen, "Electronic communication" PHI
6. Taub & Schilling "Principles of communication systems" Tata Mc Graw Hill
7. Beasley & Miller, "Modern Electronic Communication", Prentice-Hall India-2006, 8th Edition.

Head of the Department
Electronics & Computer Engineering
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING
Yadrav (Ichalkaranji) Dist.Kolhapur

Digital Electronics and Microprocessor

23EC2402	PCC	Digital Electronics and Microprocessor	3-0-0	3 Credits

Teaching Scheme:	**Evaluation Scheme:**
Lecture: 3 hrs/week	CA-I: 10 Marks CA-II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Basic Electronics, Logic Gates.

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

CO1	Make use the basic logic gates and various reduction techniques of digital logic circuit.
CO2	Design and implement combinational logic circuits.
CO3	Design and implement sequential circuits.
CO4	Explain the basic digital logic families.
CO5	Explain microprocessor architecture and its instruction set.
CO6	Analyse the interfacing of 8085 microprocessor for its various applications.

Course Contents:

Unit 1: Fundamentals of Digital Electronics Number Systems, Codes and their arithmetic (Binary, Octal, Hexadecimal), Ones and Two's complement arithmetic. Introduction to canonical forms, Standard representations for logic functions, k-map representation of logic functions (SOP and POS forms), minimization of logical functions for min-terms and max-terms (up to 4-variables), don't care conditions.	[6]
Unit 2: Combinational Circuits Introduction to combinational logic, Design of arithmetic circuits – Adder, Subtractor, Look ahead carry adder, BCD adder, Comparator, Parity Generator/Checker, Code Converter, Multiplexer, Demultiplexer, Decoder, Encoder, BCD to Seven Segment decoders.	[6]
Unit 3: Sequential Circuits 1-Bit Memory Cell, Latches and Clocked SR, JK, D & T Flip-Flops, Use of preset and clear inputs, Excitation table for Flip-Flops, Conversion of Flip-Flops Applications of Flip-Flops: Shift Registers, Counters - Asynchronous and Synchronous Counter Design.	[6]
Unit 4: Digital Logic Families and Semiconductor Memories Classification and Characteristics of digital logic families: TTL Logic, CMOS logic. Interfacing CMOS and TTL, Memory organization and operation, Classification and characteristics of memories, RAM, ROM, EPROM, EEPROM,	[6]
Unit 5: Fundamentals of Microprocessor 8085 – Architecture, Pin functions, Addressing Modes, Instruction set, Introduction to Timing Diagram – T- states, Timing diagram of instructions, Interrupt structure.	[6]
Unit 6: Programming and Interfacing Assembly Language Programming, Basic Interfacing Concepts, Introduction to Interfacing– 8255, LED, 7 – Segment Display, Stepper Motor, Relay.	[6]
Text Books: 1. Fundamentals of Digital Circuits A. Anand Kumar PHI 3rd 2008. 2. Microprocessor Architecture, Programming and Applications with 8085 Ramesh Gaonkar.	

Head of the Department
Electronics & Computer Engineering
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING
Yadrav (Ichalkaranji) Dist.Kolhapur

Reference Books:

1. Digital Design Principles Wakerly 4th 2006
2. Digital Design Leach, Malvino 4th 2011.

Operating System

23EC2403	PCC	Operating System	3-0-0	3 Credits

Teaching Scheme:	**Evaluation Scheme:**
Lecture: 3 hrs/week	CA-I: 10 Marks CA-II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Fundamental electronics & Fundamental Mathematics.

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

CO1	Explain the basic concept of operating system & their types
CO2	Illustrate the flow of process with its states and different process scheduling policies
CO3	Explain concepts of Mutual exclusion and IPC
CO4	Make use the concept of deadlocks
CO5	Illustrate concept of memory management policies
CO6	Illustrate the concepts of Unix and Linux OS

Course Contents:

Unit 1: Introduction Basics of Operating Systems: Definition – Generations of Operating systems – Types of Operating Systems, OS Service, System Calls, OS structure: Layered, Monolithic, Microkernel Operating Systems – Concept of Virtual Machine.	[6]
Unit 2: Process Management Processes: Definition, Process Relationship, Process states, Process State transitions, Process Control Block, Context switching – Threads – Concept of multithreads, Benefits of threads, Types of threads. Process Scheduling: Definition, Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time (Definition only) Scheduling algorithms: Preemptive and Non-preemptive,FCFS–SJF–RR, Multiprocessor scheduling: Types, Performance evaluation of the scheduling	[6]
Unit 3: Inter process Communication Race Conditions,Critical Section, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, and Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc., Scheduling, Scheduling Algorithms	[6]
Unit 4: Deadlocks Definition, Deadlock characteristics, Deadlock Prevention, Deadlock Avoidance: banker's algorithm, Deadlock detection and Recovery.	[6]
Unit 5: Memory Management Basic Memory Management: Definition, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition – Internal and External fragmentation and Compaction, Paging: Principle of operation – Page allocation – Hardware support for paging –, Protection and sharing – Disadvantages of paging. **Virtual Memory:**	[6]

Head of the Department
Electronics & Computer Engineering
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING
Yadrav (Ichalkaranji) Dist Kolhapur

Basics of Virtual Memory – Hardware and control structures– Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging (Concepts only) – Page Replacement policies: Optimal (OPT), First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).	
Unit 6: Unix/Linux Operating System Development of Unix/Linux, Role & Function Of Kernel, System Calls, Elementary Linux command& Shell Programming, Directory Structure, System Administration, Case study: Linux, Windows Operating System.	[6]

Text Books:

1. Russell, Norvig, Artificial Intelligence: A Modern Approach, Third edition, Prentice Hall, 2010
2. Hastie, Tibshirani, Friedman.The elements of statistical learning, Second edition, Springer, 2009
3. Tsang. Foundations of constraint satisfaction, Academic press, 1993
4. Daphne Koller and Friedman. Probabilistic Graphical Models-Principles and Techniques, The MIT Press, 2009

Reference Books:

1. Tom Adelstein and Bill Lubanovic, Linux System Administration, O'Reilly Media, ISBN-10:0596009526, ISBN-13: 978-0596009526
2. Harvey M. Deitel, Operating Systems, Prentice Hall, ISBN-10:0131828274, ISBN-13:978- 0131828278
3. Thomas W. Doeppner, Operating System in depth: Design and Programming, WILEY, ISBN:978-0-471-68723-8
4. Mendel Cooper, Advanced Shell Scripting, Linux Documentation Project
5. Operating Systems by D. M. Dhamdhere, Tata Mc Graw Hill 2nd edition Unix Shell Programming– by Yashwant Kanetkar, BPB publications

Head of the Department
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SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING
Yadrav (Ichalkaranji) Dist.Kolhapur

Analog and Digital Communication Laboratory

23EC2404	PCC	Analog and Digital Communication Laboratory	0-0-2	1 Credit

Teaching Scheme:	**Evaluation Scheme:**
Practical: 2 hrs./week	CA-I: 15 Marks CA-II:15 Marks End Semester Exam-20 Marks

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

CO1	Demonstrate generation and detection of analog and digital modulation techniques.
CO2	Examine the concept of sampling and reconstruction
CO3	Apply time division multiplexing concept with different pulse modulation techniques

Minimum 08 Experiments should be Conducted.

List of Experiments:

Sr. No.	**Name of the Experiments**
1.	Demonstration of Amplitude modulation and demodulation
2.	Calculation of modulation index of AM using AM Wave using and Trapezoidal Pattern
3.	Observe Waveform of DSB modulation and Demodulation
4.	To Study SSB modulation and Demodulation
5.	To Perform experiment on Frequency Modulation and Demodulation
6.	To Study Natural Flat top sampling and reconstruction
7.	Demonstration of PWM modulation and Demodulation
8.	To Perform experiment on PPM modulation and Demodulation
9.	To Perform experiment on four- channel PAM- TDM
10.	To Study Amplitude Shift Keying
11.	To Study Frequency shift keying
12.	To Study Phase shift keying

Head of the Department
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SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING
Yadrav (Ichalkaranji) Dist.Kolhapur

Digital Electronics and Microprocessor Laboratory

23EC2405	PCC	Digital Electronics and Microprocessor Laboratory	0-0-2	1 Credit

Teaching Scheme:	**Evaluation Scheme:**
Practical: 2 hrs /week	CA-I: 15 Marks CA-II:15 Marks End Semester Exam-20 Marks

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

CO1	Demonstrate the basic logic gates and various reduction techniques of digital logic circuits.
CO2	Design, and verify combinational and sequential logic circuits.
CO3	Make use of 8085 instructions to build simple assembly language program.

List of Experiments: Minimum 10 Experiments should be conducted.

Sr.No.	Name of the Experiments
1.	Realization of Basic Gates using Universal Gates
2.	Design of Half Adder and Full Adder using Basic Gates
3.	Design of Half Subtractor and Full Subtractor using Basic Gates
4.	Design and Implement 4-bit Binary to Gray and Gray to Binary
5.	Design of 8:1 MUX using IC 74151
6.	Design 1:8 DEMUX using IC 74138
7.	Study of basic gates using TTL and CMOS IC
8.	Study and verify D FF and JK FF
9.	Design and test counters using Flip-flop
10.	Design and test MOD - 5 counter using Flip-flop
11.	Experiment Based on Arithmetic and Logical Operation: - (Minimum one) Addition / Subtraction, Multiplication / Division
12.	Experiment Based on Arrays: - (Minimum one) Block Transfer / Block Exchange, Finding Minimum / Maximum, Arranging in Ascending /Descending, etc
13.	8255 Based Experiments: - (Minimum one) Display interface, Stepper motor interface, ADC, DAC
14.	Write, Simulate & Verify VHDL Code to Verify the Basic Logic Gates truth table.
15.	Write, Simulate & Verify VHDL Code for Head Adder and Full Adder

Head of the Department
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SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING
Yadrav (Ichalkaranji) Dist.Kolhapur

MATLAB Programming

23EC2406	VSEC	MATLAB Programming	0-0-2	1 Credits

Teaching Scheme:	Evaluation Scheme:
Practical: 2 hrs/week	CA-I: 25 Marks CA-II: 25 Marks

Pre-Requisites: Fundamental electronics & Fundamental Mathematics.

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

CO1	Experiment with various arithmetic operators and functions in MATLAB.
CO2	Develop efficient programming skills using Branching and Control statements.
CO3	Make use of different build and user-defined functions in MATLAB
CO4	Construct different Processing Model Using Simulink Toolbox in MATLAB

Unit 1: Introduction to MATLAB Introduction to Matlab Software, The Command Prompt, Workspace, Simple Mathematical Expressions **Basic Mathematics Using MATLAB**:-MATLAB basics variables, arrays, Multidimensionalsub-arrays, Special values, displaying output data, data files, scalar and array operations, Hierarchy of operations built-in Matlab functions **Graph**:-Introduction to plotting, Debugging Matlab programs.	[6]
Unit 2: Branching and Control Statements Branching, Statements and logical data type, Branches, write if & for loop logical arrays and vectorization, programming User-defined &i/o functions	[6]
Unit 3: Private functions, Nested functions. complex data, string functions, text read function, load and save commands, an introduction to Matlab file processing, file opening and closing, binary i/o functions, formatted i/o functions, comparing formatted and binary i/o function, file positioning and status functions	[6]
Unit 4: Simulink basics Simulink modeling, solvers, simulating models using variables from MATLAB, data import/export, state-space modeling & simulation, creation of subsystems	[6]
Text Books: 1. Getting Started with MATLAB by Rrudra Pratap 2. MATLAB and its Applications in Engineering by Raj Kumar Bansal	
Reference Books: 1. MATLAB for Beginners by Peter Issa Kattan 2. A Guide to MATLAB for Beginners and Experienced user by Brian R	

Head of the Department
Electronics & Computer Engineering
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING
Yadrav (Ichalkaranji) Dist.Kolhapur

List of Experiment (Minimum 8 Experiment)

1. To study Basic of MATLAB.
2. Write a program for Operation on matrix.
3. Write a program for Complex function handling.
4. Write a Program for branching & looping statements.
5. To study 2D and 3D plotting.
6. Write a program for User defined function.
7. Write a Program for file handling.
8. To study String Manipulation.
9. Write a program for Simulink.
10. Write a program for the Generation of Discrete & Continuous signals.
11. Write a program for the Operation of signal & sequence.

Head of the Department
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SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING
Yadrav (Ichalkaranji) Dist.Kolhapur

Mini Project-III

23EC2407	CEP	Mini Project-III	0-0-2	1Credits

Teaching Scheme:	Evaluation Scheme:
Practical:2hr/week	CA-I: 25 Marks CA-II: 25 Marks

Pre-Requisites: Mini Project

About Ideathon:

The project is a part of addressing societal and industrial needs. An Ideathon is a brief, intense event where students can work on some of the most important problems that the world is facing today. Ideathon's are brainstorming events where people with diverse knowledge backgrounds, skill sets and interests get together to predetermined problems, and come up with substantive, innovative and comprehensive solutions. An Ideathon's output might be ideas, a roadmap or an actionable plan. Teams leverage design thinking and cutting-edge techniques to brainstorm and collaborate on potential solutions within a given time frame.

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

CO1	Identify problems based on societal /research needs
CO2	Apply Knowledge and interpersonal skills to solve societal problems in a group.
CO3	Outline the proper inferences from available results through theoretical/ experimental/simulations.
CO4	Analyze the impact of solutions in societal and environmental context for sustainable development.
CO5	Demonstrate capabilities of self-learning in a group, which leads to lifelong learning.
CO6	Demonstrate project management principles during project work.

Course Contents:

Week 1: Higher Education and Case Study Pedagogy • Students shall form a group of 3 to 4 students, while forming a group shall not be allowed less than three or more than four students, as it is a group activity. • Allocation of mentor	[2]
Week 2: Topic Selection • Briefly interact with students to provide hand-holding for topic selection. • Students should do survey and identify needs, which shall be converted into problem statement for mini project in consultation with faculty supervisor • **Illustrative Examples : Any Industry or Societal Problem** • Finalization of Title.	[2]
Week 3: Case Study Design/Ideathon: Part 1 • If needed, provide hand-holding to students for finalizing objectives. • Review the objectives of the case study groups. • Identify what can be quantified related to your topic and how. • Decide objectives for your case study. • Continue reading especially recent work specific to your topic.	[2]

Head of the Department
Electronics & Computer Engineering
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING
Yadrav (Ichalkaranji) Dist.Kolhapur

Week 4: Case Study Design/Ideathon: Part 2 • Prepare a roadmap of your case study, identify what is to be measured on the field. • Ensure student groups have finalized the objectives.	[2]
Week 5: Survey Design • Prepare a questionnaire and try it out with your group members as mock. • Decide sampling strategy.	[2]
Week 6: Analysis Phase-1 • Students in a group shall understand problem effectively, propose multiple solution. • The students have to work on different approaches and search for the different methodology to solve the problem in consultation with the project guide.	[2]
Week 7 Analysis Phase-2 • The students have to finalize the best methodology to solve the problem in consultation with the project guide. • 25% Presentation has to be conducted by mentor/guide based on above activity.	[2]
Week 8: Analysis-3 • Identify appropriate data visualization tools for your case study. • Analyze the data	[2]
Week 9: Analysis-4 • Identify appropriate data visualization tools for your case study. • Analyze the data	[2]
Week 10: Report writing Part:1 • Prepare an outline of the report and start organizing the write-up for the first draft. • Prepare and submit the first draft of the report to the course coordinator.	[2]
Week 11: Report writing Part:2 • Make necessary corrections if any as per the suggestions of course coordinator. • Submit the final draft of the case study	[2]
Week 12: Final Presentation • 50% Presentation has to be conducted by mentor/guide based on above activity.	[2]

Head of the Department
Electronics & Computer Engineering
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING
Yadrav (Ichalkaranji) Dist.Kolhapur

Modern Indian Language

23MILE01	AEC	Marathi	2-0-0	2 Credits

Teaching Scheme	Evaluation Scheme
Lecture: 2 hrs/week	CA-I :25 Marks CA-II :25 Marks

Pre-Requisites: Nil

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

CO1	Develop the knowledge of local language/mother tongue and relate the same to daily life and social media.
CO2	Make use of rhetoric and verb to form sentences in Marathi Language
CO3	Identity Infinitive compounds in the given Marathi sentence.
CO4	Make use of Phrases and proverbs and form a sentence and Solve Prose Assessment/Summary Writing
CO5	Model a letter to appropriate end user in Marathi Language
CO6	Identity writing type of Marathi stanza and write appropriate writing.

Course Contents:

अध्याय 01: भाषा परीचय भाषा आणि व्यक्तिमत्व सहसंबंध, भाषा, जीवनव्यवहार आणि नवमाध्यमे व समाजमाध्यमे, णिन्ह व्यवस्था-णवरामणिन्हे, संवाद कौशल्य (त ंडी परीक्षा), सववनाम-पुरुषात्मक, दशंवक, संबंधी, प्रश्नाथवक, सामान्य व आत्मवाि क सववनाम, णवशेषि-गुि णवशेषि, संख्या णवशेषि, साववनामीक णवशेषि	[4]
अध्याय 02: मराठी व्याकरण नाम, सववनाम, णवशेषि, णियापद, णियाणवशेषि अव्यय, शब्दय गी अव्यय, उभयान्वयी अव्यय, केवलप्रय गी अव्यय, णवभी व त्याि े प्रकार, काळ व प्रकार	[4]
अध्याय 03: अलंकार व क्रियापदे **अलंकार**-शब्दलांकर- अनुप्रास, यमक, श्लेष उदाहरि, अथावलंकार-उपमा, उत्प्रेक्षा, व्यक्तिरे क, अपदुनती, रूपक, व्यक्तिरे क, अननव्य, अणतशय उदाहरि **प्रयोग**-कतवरी, कमवी, भावे **वाक्यप्रकार**-केवल वाक्य, णमश्रवाक्य, संयुिवाक्य **समास**-अव्ययीभाव, तत्पुरुष, द्वंद्व, बहूवृही **क्रियापदे**- कताव व कमव, णियापदाि े प्रकार- अकमवक, सकमवक, उभयणवध, संयुि, णियाणवशेषि- कालवाि क, स्थळवाि क, ररतीवाि क, संख्यावाि क, प्रश्नाथवक, णनषेधाथवक	[4]
अध्याय 04: वाक्प्रचार व म्हणी व गद्य आकलन/सारांश लेखन अथव सांगून वाक्यात उपय ग करि (कमीत कमी ३० वाक्य प्रिार व म्ही), गद्य आकलन - अपणित गद्य उतारा व त्यावरील प्रश्न उत्तरे (कमीत कमी ०५ उतारे व त्यावरील प्रश्न उत्तरे), सारांश आकलन	[5]
अध्याय 05: लेखन प्रकार पत्रलेखन व त्याि े प्रकार-णनमंत्रि, आभार, अणभनंदन, मागिी, क टुंणबक, णवनंती, तिार संधी -स्वरसंधी, व्यंजनसंधी, णवसगवसंधी, वृत्त लेखन, जाणहरात लेखन, कथा लेखन, अहवाल लेखन, आवेदन पत्र, अणभप्रायलेखन	[5]

Head of the Department
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SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING
Yadrav (Ichalkaranji) Dist.Kolhapur

अध्याय 06: कल्पनाणवस्तार व मुलखात कल्पना णवस्तार, मुलाखत कौशल्ये, मुलाखतीिे वैणशष्ट्ये, मुलाखतीिे स्वरूप, मुलाखत घेताना घ्यावयाि ी काळजी, मुलाखत देताना आवश्यक बाबी उदा.आत्मणवश्वास, व्यक्तिमत्व णवकास, भाषा कौशल्ये इ.	[4]

Text Books:

1. व्यावहाररक मराि ी, डॉ.ल.रा.नणसराबादकर, फडके प्रकाशन, क ल्हापूर.
2. व्यावहाररक मराि ी, डॉ.लीला ग णवलकर, डॉ.जयश्री पाटिकर, स्नेहवधवन प्रकाशन, पुि े
3. सुगम मराि ी व्याकरि लेखन, म .रा. वाळंबे, णनतीन प्रकाशन पुि े

Reference Books:

1. अणनवायव मराि ी व्याकरि, लेखन व आकलन, डॉ. प्रल्हाद लुलेकर, केदार काळवि, Pearson पक्तिकेशन्स
2. मराि ी व इंग्रजी अत्यावश्यक णनबंध, प्रा.णवजयकुमार वेधपाि क, K'Sagar पक्तिकेशन
3. उपय णजत लेखन, मराि ी, प्राि ी शेंडे, सावली म्हात्रे, टागेट पक्तिकेशन्स

Head of the Department
Electronics & Computer Engineering
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING
Yadrav (Ichalkaranji) Dist.Kolhapur

Modern Indian Language Hindi

23MILE02	AEC	Hindi	2-0-0	2- Credits

Teaching Scheme	Evaluation Scheme
Lecture: 2 hrs/week	CA-I :25 Marks CA-II :25 Marks

Pre-Requisites: Nil

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

CO1	Develop the awareness of Hindi language and relate the same to daily life and social media.
CO2	Identity Infinitive compounds in the given Marathi sentence.
CO3	Make use of Phrases and proverbs and form a sentence in Hindi language.
CO4	Identity the mistakes in grammar of Hindi language and corrections in it
CO5	Make use of rhetoric to form sentences in Hindi Language
CO6	Illustrate the prose and verse in the given literature

Course Contents:

अध्याय 01: ह ंदी भाषा परीचय णहन्दी भाषा और उसका णवकास, णहन्दी साणहत्य का इणतहास, भाषा केणवणभन्न मौक्तखक भाषा, णलक्तखत भाषा, रूप-विमाला, णवराम णिन्ह, शब्द रिना, अथव, वाक्य रिना, वी का उच्चारि और वगीकरि	[5]
अध्याय 02: समास समास, णियाएँ, अनेकाथी शब्द, णवल म शब्द, पयावयवाि ी शब्द,	[5]
अध्याय 03: मु ावरे एवं लोकोक्ति मुहावरे एवं ल क क्ति, तत्सम एवं तद्भव, देशज, णवदेशी, वतवनी, अथवब ध	[4]
अध्याय 04: ह न्दी भाषा में प्रयोग ोने वाली अशुक्तियाँ णहन्दी भाषा में प्रय ग ह ने वाली अशुक्तियाँ, अनेक शब्द के णलए एक शब्द, रस	[5]
अध्याय 05: अलंकार अलंकार, छन्द, णवशेषि और णवशे ष्य, भाषा-णवज्ञान	[4]
अध्याय06: भाषा-ह वज्ञान भाषा-णवज्ञान, णहन्दी पद्य/गद्य रिना व रिनाकार, संज्ञा से अवयव तक, ररि स्थान की पूणतव, िमबिता.	[4]
Text Books: 1. णहंदी व्याकरि- पं कमताप्रसद गुरु, प्रकाशन संस्था, नई णदल्ली 2. णहंदी साणहक्तत्यक का णवदय ानाणनक इणतहास-डॉ गिपणतिंद्र गुप्त, ल कभारती प्रकाशन, नई णदल्ली.	
Reference Books: 1. णहंदी भाषा णशक्षि - संपा णहंदी अध्ययन मंडल, साणवत्रीबाई फुले पुि े णवणश्वद्यालय पुि े, राजकमल प्रकाशन	

Head of the Department
Electronics & Computer Engineering
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING
Yadrav (Ichalkaranji) Dist. Kolhapur

Multidisciplinary Minor
A. Linear Integrated Circuits

23ECMDA2	MDM	Linear Integrated Circuits	3-0-0	3 Credits

Teaching Scheme:	**Evaluation Scheme:**
Lecture: 3 hrs/week	CA -I :10 Marks CA -II :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Basic Electronics & Analog Circuit.

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

CO1	Explain the characteristics of IC & op-amp parameters.
CO2	Design linear and Nonlinear applications using op-amp.
CO3	Compare different active filters using op-amp.
CO4	Make use of op-amp to test various oscillators using op-amp.
CO5	Make use of IC 555 and design multivibrators.
CO6	Relate and implement different converters using op-amp.

Course Contents:

Unit 1: Introduction to op-amp Block diagram of OP-AMP, Explanations of each block, Differential Amplifier configurations, Differential amplifier analysis (DC) for dual-input balanced-output configuration using, level shifter, current mirror circuits, and Op-Amp parameters. OP-AMP configurations: Voltage Series Amplifier, voltage shunt amplifier.	[6]
Unit 2: Applications of op-amp Summing, Scaling & Averaging Amplifiers using Op-amps, Differential amplifier using op-amp, Subtractor Circuit, Instrumentation amplifier, Precision Rectifiers, Comparators, Schmitt Trigger, Clippers & Clampers.	[6]
Unit 3: Active Filters Introduction, Analysis & Design of Butterworth filters: High Pass filter, Low Pass filter (First & Second order), Band Pass filter, Band Reject filter, All Pass Filter, Introduction to Chebyshev Filter.	[6]
Unit 4: Waveform Generators Analysis & Design of Square wave generator, Triangular wave generator, Sawtooth wave generator. Analysis & Design of RC phase shift oscillator, RC wein-bridge oscillator, Colpitts oscillator, Hartley oscillator.	[6]
Unit 5: Special Purpose ICs IC 555 Timer: Block Diagram, Operating Principle, Multi-vibrator using IC 555. IC 565 PLL: Operating Principles, applications, Introduction of (block diagram, features, and application areas): IC OP177 op-amp,	[6]
Unit 6: System Design Using Op-amp Analog to digital Converter, Digital to analog Converter, V to I & I to V Converter, voltage	[6]

Head of the Department
Electronics & Computer Engineering
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING
Yadrav (Ichalkaranji) Dist. Kolhapur

to frequency converter, On off controller, proportional controller, PID Controller
Text Books: 1. Ramakant A. Gaikwad, "Op Amps and Linear Integrated Circuits", Pearson Education second and latest edition
Reference Books: 1. Robert Coughlin, Fredric Driscoll, "Operational Amplifiers and Linear Integrated Circuits", Sixth edition, PE, 2006. 2. David Bell, "Operational Amplifiers and Linear ICs", Third edition, Oxford University Press\ 3. B. Somanathan Nair, "Linear Integrated Circuits- Analysis, Design& Applications", Wiley India. 4. T.R Ganesh Babu, "Linear Integrated Circuits" 3rd Edition, Sci tech Publication 5. David. A. John & Ken Martin "Analog Integrated Circuit Design", Student Edition, Wiley 6. Sergio Franco "Design with op-amp & Analog Integrated Circuits", 3rd Edition, Tata McGraw Hill. 7. Sergio Franco "Design with op-amp & Analog Integrated Circuits", 3rd Edition, Tata McGraw Hill. 8. S. Salivahanan & Bhaaskaran "Linear Integrated Circuits", 1st Edition, Tata McGraw Hill.

Head of the Department
Electronics & Computer Engineering
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING
Yadrav (Ichalkaranji) Dist Kolhapur

B. Mathematics for Data Science

23ECMDB2	MDM	Mathematics for Data Science	3-0-0	3 Credits

Teaching Scheme:	**Evaluation Scheme:**
Lecture: 3 hrs/week	CA-I :10 Marks CA-II :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: HSC Mathematics.

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

CO1	Determine whether a given structure is vector space, subspace structure, determine basis and dimension of vector space.
CO2	Solve algebra of linear transformations, convert a given linear transformation into matrix form.
CO3	Find the Orthogonalization in inner product space, apply diagonalization to find powers of matrices.
CO4	Illustrate and formulate fundamental probability distribution and density functions, as well as functions of random variable.
CO5	Apply different methods to find the correlation between the variables. Develop basic mathematical tools for regression analysis.
CO6	Apply various statistical tests to test the hypothesis.

Course Contents:

Unit 1: Vector spaces The n-dimensional vectors, Vector space, Subspace, Linear dependance & independence of vectors, basis and dimension.	[6]
Unit 2: Linear transformations Definition, algebra of linear transformations, Inverse of a Linear transformation, Composition of a linear Transformation, Range and Kernal, Rank and nullity, Rank-Nullity theorem, Matrix representation of a linear transformation.	[6]
Unit 3: Eigen values, Eigen vectors and Inner product spaces Introduction to Eigen values and Eigen vectors of a matrix, Eigen Bases, Diagonalization, Inner product space, Norm of a vector, Normed vector space, Orthogonal and orthonormal sets, Gram Schmidt Orthogonalization process.	[6]
Unit 4: Basic Probability & Theoretical Probability Distributions Basic concepts of probability, Random variables, Probability distributions, Probability mass function, Probability density function,Binomial distribution, Poisson distribution, Normal distribution, Fitting of binomial & Poisson's distributions, Properties of binomial, Poisson and normal distributions.	[6]
Unit 5: Correlation & Linear Regression Analysis Introduction, Types of correlation, Karl Pearson's correlation coefficient, Spearman's rank correlation Coefficient, Probable errors. Linear and non-linear regression, Lines of regression, Derivation of regression lines of y on x and x on y, Coefficients of regression, Properties of regression coefficient.	[6]

Head of the Department
Electronics & Computer Engineering
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING
Yadrav (Ichalkaranji) Dist.Kolhapur

Unit 6: Applied Statistics Test of significance for Large sample size (z tests) for single mean, difference of means, single proportion, difference of proportions, Test of significance for small sample size (t test).	[6]

Text Books:

1. G. V. Kumbhojkar, Probability and Random Processes, C. Jamnadas and Co., 14th Edition, 2010
2. Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.
3. Stephen H. Friedberg, Linear algebra, 5th Edition, by Pearson.
4. David C lay, steven R lay,Linear algebra and its applications,5th edition, pearson.

Reference Books:

1. Kishor S. Trivedi, Probability, Statistics with Reliability, Queuing and Computer Science Applications, Wiley India Pvt. Ltd, 2nd Edition, 2001.
2. Vijay K. Rohatgi, A. K. Md. Ehsanes Saleh, An Introduction To Probability and Statistics, Wiley Publication, 2nd Edition, 2001.
3. Seymour Lipschutz, Mark Lipson, Linear Algebra, 3rd edition, Schaum's Outline
4. Infostudy's Linear algebra by Dr.A.P.singh , 3rd edition

Head of the Department
Electronics & Computer Engineering
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING
Yadrav (Ichalkaranji) Dist.Kolhapur

C. Programming Logic Controller

23ECMDC2	MDM	Programming Logic Controller	3-0-0	3 Credits

Teaching Scheme:	**Evaluation Scheme:**
Lecture: 3 hrs/week	CA-I: 10 Marks CA-II: 10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Fundamental electronics & Fundamental Mathematics.

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

CO1	Explain the major components of a Programmable Logic Controller (PLC)
CO2	Illustrate the different parts of PLC.
CO3	Experiment with the PLC programming with different condition.
CO4	Make use of Ladder Logic for writing programs directly from narrative description
CO5	Experiment with Programming timers and counters

Course Contents:

Unit 1: Introduction to PLC PLC: Characteristics, Operation, function, Types of PLC, Architecture Of PLC, Applications of PLC and PC v/s PLC.	[6]
Unit 2: PLC Hardware The I/O Section, Discrete I/O Modules, Analog I/O Modules, Special I/O Modules, I/O Specifications, The Central Processing Unit (CPU), Memory Design, Memory Types, Programming Terminal Devices, Recording and Retrieving Data, Human Machine Interfaces (HMIs), Power Supply.	[6]
Unit 3: PLC programming Processor Memory Organization, Program Scan, PLC Programming Languages, Relay-Type Instructions, Instruction Addressing, Branch Instructions, Internal Relay Instructions, Programming Examine If Closed and Examine If Open Instructions, Entering the Ladder Diagram, Modes of Operation.	[6]
Unit 4: Fundamental PLC Wiring Diagrams and Ladder Logic Programs: Electromagnetic Control Relays, Contactors, Motor Starters, Manually Operated Switches, Mechanically Operated Switches, Sensors, Output Control Devices, Seal-In Circuits, Latching Relays, Converting Relay Schematics into PLC Ladder Programs, Writing a Ladder Logic Program Directly from a Narrative Description.	[6]
Unit 5: Programming timers and Counters Mechanical Timing Relays, Timer Instructions, On-Delay Timer Instruction, Off-Delay Timer Instruction, Retentive Timer, Cascading Timers. Counter Instructions, Up-Counter, Down-Counter, Cascading Counters, Incremental Encoder-Counter Applications, Combining Counter and Timer Functions.	[6]
Unit 6: Process Control, Network Systems, and SCADA: Types of Processes, Structure of Control Systems, On/Off Control, PID Control, Motion Control, Data Communications, Supervisory Control and Data Acquisition (SCADA).	

Text Books:

1. Programming Logic Controllers: Frank Petruzella, McGraw Hills, 5th Edition
2. Programmable Logic Controllers Principles and applications Webb John W. and Reis A. Ronald PHI,New Delhi Latest edition

Head of the Department
Electronics & Computer Engineering
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING

3. Programmable Logic Controllers Bolton W. Elsevier India Pvt. Ltd. New Delhi
4. Programmable Logic Controllers John R Hack worth Pearson education New Delhi, Latest edition

Reference Books:

1. Process Control InstrumentationC. D. JOHNSONJohn Wiley and Son
2. Programmable Logic Controllers and Industrial Automation an Introduction Mitra, Madhuchanda; Gupta, Samarjit Sen Param International Publising (India) Pvt. Ltd., New Delhi, Latest edition.

Head of the Department
Electronics & Computer Engineering
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING
Yadrav (Ichalkaranji) Dist.Kolhapur

Aptitude Skills-II (Verbal Ability)

23HSSM03	VEC	Aptitude Skills- II	1-0-0	Audit

Teaching Scheme:	Evaluation Scheme:
Lecture: 1hrs/week	CA1: 25 Marks CA2: 25 Marks

Pre-Requisites: Basic Mathematics

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

CO1	Apply sentence formation rules to spot the error
CO2	Solve the questions based on the types of tenses
CO3	Solve the questions based on Direct/Indirect Speech and Passive/active voice and Substitution and Elimination
CO4	Make use of Proverbs, Idioms and phrases in sentence construction and the vocabulary

Course Contents:

Unit 1 Structure and Types of Sentences, Conditional Sentences.	[3]
Unit 2 Present tense, Past tense, Future tense, Use of Tenses in Sentence forming.	[3]
Unit 3 Direct and Indirect Speech, Active and Passive Voice Use of Modal verbs in Sentence Forming, Substitution and Elimination.	[3]
Unit 4 Use of Proverbs, Idioms and Phrases in Sentence Construction, Judgment and Inference Sentence Vocabulary Building in Various Situations.	[3]

Text Books:

1.Raymond Murphy, Essential English Grammar with Answers, Murphy.
2.Objective General English by R.S. Aggarwal, S Chand Publishing;Revised edition (15 March 2017).

Reference Books:

1. Rao and D.V. Prasada, Wren & Martin High School English Grammar and Composition Book, S. Chand Publishing, 2017.
2.Murphy, Intermediate English Grammar with Answers,Cambridge University Press; Second edition.

Head of the Department
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SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING
Yadrav (Ichalkaranji) Dist.Kolhapur

Language Skill- II

23HSSM04	VEC	Language Skill- II	0-0-2	1 Credit

Teaching Scheme:	**Evaluation Scheme:**
Practical: 2 hrs/week	CA-I: 25Marks CA-II: 25Marks

Pre-Requisites: Language Skill I

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

CO1	Develop programs using Functions.
CO2	Make use of Structures & Union to develop programs in C language.
CO3	Make use of Pointers to develop programs in C language.
CO4	Develop programs to perform various operations on files using File Handling.

Course Contents:

Sr.No.	**Name of the Experiments**
1.	Develop programs on using different built-in functions.
2.	Develop programs on using function without argument and without return category.
3.	Develop programs on using function with argument and without return category.
4.	Develop programs on using function without argument and with return category.
5.	Develop programs on using function with argument and with return category.
6.	Develop programs using more than one used defined functions.
7.	Develop programs on recursion.
8.	Develop programs on Structure using various entities and size of structure.
9.	Develop programs on array of structure.
10.	Develop programs on structures and functions and compare structure and union.
11.	Develop programs to display different data type of data and their addresses using pointer
12.	Develop programs on pointer to array, pointer to structure, pointer to functions and pointer expressions.
13.	Develop program to read, write and append data from a file.

Text Books:

1. C Programming Absolute Beginner's Guide, Que Publishing; 3rd edition (22 August 2013)
2. C Programming Language 2nd Edition, Pearson Publication

Reference Books:

1. Programming in C Practical Approach by Ajay Mittal, Pearson Let Us C, By Yashwat Kanetkar
2. LetUS C , Yashawant Kanetkar

Head of the Department
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SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING
Yadrav (Ichalkaranji) Dist.Kolhapur