Savitribai Phule Pune University, Pune, Maharashtra, India

Faculty of Science and Technology

National Education Policy (NEP)-2020

Compliant Curriculum

SE-Second Year Engineering (2024 Pattern)
Internet of Things

(With effect from Academic Year 2025-26)

Nomenclature

AEC   Ability Enhancement Course

CEP   Community Engagement Project

MDM   Multidisciplinary Minor

OE   Open Elective

PCC   Program Core Course

VEC   Value Education Course

VSE   Vocational and Skill Enhancement

Course WK Knowledge and Attitude

Dear Students and Teachers,

We, the members of Board of Studies Electronics and Telecommunication Engineering, are very happy to present Second Year Internet of Things (IoT) syllabus effective from the AY Year 2025-26. Subsequently this will be carried forward for TE and BE in the AY 2026-27, 2027-28, respectively.

Internet of Things (IoT) Engineering have emerged as transformative forces reshaping industries, driving innovation, and impacting our daily lives. Recognizing the growing importance and pervasive nature of these fields, we have designed this comprehensive syllabus to equip students with the foundational knowledge, practical skills. This curriculum is meticulously crafted to provide a holistic learning experience, blending theoretical concepts with hands-on applications. It aims to foster critical thinking, problem-solving abilities, enabling graduates to contribute meaningfully to the advancement and responsible deployment of technologies. The revised syllabus falls in line with the objectives of NEP-2020, Savitribai Phule Pune University, AICTE New Delhi, UGC, and various accreditation agencies by keeping an eye on the technological developments, innovations, and industry requirements.

Learners are now getting sufficient time for self-learning either through online courses or additional projects for enhancing their knowledge and skill sets. Learners can be advised to take up online courses, on successful completion they are required to submit certification for the same. We believe that this well-structured and comprehensive syllabus will serve as a robust foundation for aspiring Internet of Things professionals, enabling them to contribute significantly to the techno-logical progress and address the challenges of the 21st century.

We would like to place on record our gratitude to the faculty, students, industry experts and stakeholders for having helped us in the formulation of this syllabus.

Dr. S. D. Shirbahadurkar
Chairman,
Electronics and Telecommunication Engineering

Members of Board of Studies, Electronics & Telecommunication Engineering, Savitribai Phule Pune University, Pune	
Dr. Aaditya Abhyankar	Department of Technology, SPPU, Pune
Dr. Prachi Mukherji	MKSSS Cummins College of Engineering, Pune
Dr. S. K. Moon	Pune Institute of Computer Technology, Pune
Dr. R. P. Pawase	Amrutvahini College of Engineering, Sangamner
Dr. B. D. Jadhav	Rajarshi Shahu College of Engineering, Pune
Dr. Shailesh Kulkarni	Vishwakarma Institute of Information Technology, Pune
Dr. S. S. Musale	MKSSS Cummins College of Engineering, Pune
Dr. M. B. Mali	Sinhgad College of Engineering, Pune
Dr. B. S. Agarkar	Sanjivani College of Engineering, Kopargaon
Dr. R. N Awale	Veermata Jijabai Technological Institute (VJTI), Mumbai
Dr. Kishor Vikhe	Vice-president, Capgemini Technology Services India
Dr. Manisha Dale	Modern Education Society's College of Engineering, Pune
Dr. P. Malathi	Dr.D.Y. Patil College of Engineering, Akurdi, Pune
Dr. Urmila Patil	Dr. D. Y. Patil Institute of Technology, Pimpri, Pune

Second Year Internet Of Things

Knowledge and Attitude Profile (WK)

A Knowledge and Attitude Profile (KAP), often represented as WK (Knowledge and Attitude Profile) in some contexts, is a framework or assessment tool used to evaluate an individual's knowledge and attitudes related to a specific area, topic, or domain.

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

Reference: Self-Assessment Report (SAR) Format Undergraduate Engineering Programs Graduate Attributes and Professional Competencies Version 4.0 (GAPCV4.0)-(August2024) Page 55.

	Programme Outcomes (PO)

Programme Outcomes are statements that describe what students are expected to know and be able to do upon graduating from the program. These relate to the skills, knowledge, attitude and behaviour that students acquire through the program. On successful completion of B.E. in Electronics and Telecommunication Engineering-Eletronics and Computer Engineering, graduating students/graduates will be able to:

PO1	Engineering knowledge	Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
PO2	Problem analysis	Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development.(WK1toWK4)
PO3	Design / Development of Solutions	Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
PO4	Conduct Investigations of Complex Problems	Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modeling, analysis & interpretation of data to provide valid conclusions.(WK8).
PO5	Engineering Tool Usage	Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modeling recognizing their limitations to solve complex Engineering problems.(WK2andWK6)
PO6	The Engineer and The World	Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment.(WK1,WK5,andWK7).

PO7	Ethics	Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & International laws.(WK9)
PO8	Individual and Collaborative Team work	Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
PO9	Communication	Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences
PO10	Project Management and Finance	Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
PO11	Life-Long Learning	Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

Reference: Self-Assessment Report (SAR) Format Undergraduate Engineering Programs Graduate Attributes and Professional Competencies Version 4.0 (GAPCV4.0)-(August2024) Page56.

General Rules and Guidelines

- Course Outcomes (CO): Course Outcomes are narrower statements that describe what students are expected to know, and are able to do at the end of each course. These relate to the skills, knowledge and behaviour that students acquire in their progress through the course.

- Assessment: Assessment is one or more processes, carried out by the institution, that identify, collect, and prepare data to evaluate the achievement of Program Educational Objectives and Program Outcomes.

- Evaluation: Evaluation is one or more processes, done by the Evaluation Team, for interpreting the data and evidence accumulated through assessment practices.

Evaluation determines the extent to which Program Educational Objectives or Program Outcomes are being achieved, and results in decisions and actions to improve the program

Guidelines for Examination Scheme

Theory Examination: The theory examination shall be conducted in two different parts Comprehensive Continuous Evaluation (CCE) and End-Semester Examination (ESE).

Comprehensive Continuous Evaluation (CCE) of 30marks based on all the Units of course syllabus to be scheduled and conducted at institute level. To design a Comprehensive Continuous Evaluation (CCE) scheme for a theory subject of 30 marks with the specified parameters, the allocation of marks and the structure can be detailed as follows:

Sr.	Parameters	Marks	Coverage of Units
1	Unit Test	12Marks	Units 1 & Unit 2 (6Marks/Unit)
2	Assignments/ Case Study	12Marks	Units 3 & Unit 4 (6Marks/Unit)
3	Seminar Presentation/ Open Book Test/ Quiz	06Marks	Unit 5

Comprehensive Continuous Evaluation (CCE) of 15 marks based on all the Units of course syllabus to be scheduled and conducted at institute level. To design a Comprehensive Continuous Evaluation (CCE) scheme for a theory subject of 15 marks with the specified parameters, the allocation of marks and the structure can be detailed as follows:

Sr.	Parameters	Marks	Coverage of Units
1	Unit Test	10 Marks	Unit 1 & Unit 2 (5 Marks/Unit)
2	Seminar Presentation / Open Book Test/ Assignments / Case Study	05 Marks	Unit 3 & Unit 4

Note: Students can opt for Open Electives offered by different faculty like Arts, Science, Commerce, Management, Humanities or Inter-Disciplinary studies.
Example Open Elective I- Financial Accounting, Digital Finance, Digital Marketing can be opted from Commerce and Management faculty.
And Elective II - Project Management, Business Analytical, Financial Management can be opted from Inter-Disciplinary studies, Commerce and Management faculty respectively.

- **Unit Test**

  – **Format:** Questions designed as per Bloom's Taxonomy guidelines to assess various cognitive levels (Remember, Understand, Apply, Analyze, Evaluate, Create).

  – **Implementation**: Schedule the test after completing Units 1and 2. Ensure the question paper is balanced and covers key concepts and applications.

- **Sample Question Distribution**

  – Remembering (2Marks): Define key terms related to[Topic from Units 1 and 2].

  – Understanding (2Marks): Explain the principle of [Concept] in [Context].

  – Applying (2Marks): Demonstrate how [Concept]can be used in[Scenario].

  – Analyzing (3Marks): Compare & contrast [Two related concepts] from Units 1and 2.

  – Evaluating (3Marks): Evaluate the effectiveness of [Theory/Model] in [Situation].

- **Assignments / Case Study** : Students should submit one assignment or one Case Study Report based on Unit 3 and one assignment or one Case Study Report based on Unit4.

  – **Format:** Problem-solving tasks, theoretical questions, practical exercises, or case studies that require in-depth analysis and application of concepts.

  – **Implementation:** Distribute the assignments or case study after covering Units 3 and 4. Provide clear guidelines and a rubric for evaluation.

- **Seminar / Presentation:**

  – **Format:** Oral presentation on a topic from Unit 5, followed by a Q&A session.

  – **Deliverables:** Presentation slides, a summary report in 2 to 3 pages, and performance during the presentation.

  – **Implementation:** Schedule the seminar presentations towards the end of the course. Provide students with ample time to prepare and offer guidance on presentation skills.

- **Open Book Test:**

– **Format:** Analytical and application-based questions to assess depth of understanding.

– **Implementation:** Schedule the open book test towards the end of the course, ensuring it covers critical aspects of Unit 5.

- **Quiz:**

– **Format:** Quizzes can help your students practice existing knowledge while stimulating interest in learning about new topic in that course. You can set your quizzes to be completed individually or in small groups.

– **Implementation:** Online tools and software can be used create quiz. Each quiz is made up of a variety of question types including multiple choice, missing words, true or false etc

- **Example Timeline for conducting CCE:**

– Weeks1-4:Cover Units1 and 2

– Week5: Conduct Unit Test (12marks)

– Weeks6-8: Cover Units 3 and 4

– Week9: Distribute and collect Assignments/Case Study(12marks)

– Weeks10-12: Cover Unit 5

– Week13: Conduct Seminar Presentations or Open Book Test or Quiz (6marks)

- **Evaluation and Feedback:**

– **Unit Test:** Evaluate promptly and provide constructive feedback on strengths and areas for improvement.

– **Assignments / Case Study:** Assess the quality of submissions based on the provided rubric. Offer feedback to help students understand their performance.

– **Seminar Presentation:** Evaluate based on content, delivery, and engagement during the Q&A session. Provide feedback on presentation skills and comprehension of the topic.

– **Open Book Test**: Evaluate based on the depth of analysis and application of concepts. Provide feedback on critical thinking and problem-solving skills.

| **End-Semester Examination (ESE)** |

End-Semester Examination (ESE) of 70 marks written theory examination based on all the unit of course syllabus scheduled by university. Question papers will be sent by the University through QPD (Question Paper Delivery). University will schedule and conduct ESE at the end of the semester.

• **Format and Implementation:**

– **Question Paper Design**: Below structure is to be followed to design an End-Semester Examination (ESE) for a theory subject of 70 marks on all 5 units of the syllabus with questions set as per Bloom's Taxonomy guidelines and 14 marks allocated per unit.

– **Balanced Coverage**: Ensure balanced coverage of all units with questions that assess different cognitive levels of Bloom's Taxonomy: Remember, Understand, Apply, Analyze,

Evaluate, and Create. The questions should be structured to cover:
∗ Remembering: Basic recall of facts and concepts.
∗ Understanding: Explanation of ideas or concepts.
∗ Applying: Use of information in new situations.
∗ Analyzing: Drawing connections among ideas.
∗ Evaluating: Justifying a decision or course of action.
∗ Creating: Producing new or original work (if applicable).

– **Detailed Scheme for 70 Marks:** Unit-Wise Allocation (14 Marks per Unit): Each unit will have a combination of questions designed to assess different cognitive levels. By following this scheme, you can ensure a comprehensive and fair assessment of students' understanding and application of the course material, adhering to Bloom's Taxonomy guidelines for cognitive skills evaluation.

– **Detailed Scheme for 35 Marks :** Unit wise Allocation (08 Marks for Unit 1, 09 Marks for Unit 2, Unit 3 and Unit 4 each). Each unit will have a combination of questions designed to assess different cognitive levels. By following this scheme, you can ensure a comprehensive and fair assessment of students' understanding and application of the course material, adhering to Bloom's Taxonomy guidelines for cognitive skills evaluation.

NEP 2020 Compliant Curriculum Structure
Second Year Engineering (2024 Pattern)
Internet of Things

Level 5.0														
Course Code	Course Type	Course Name	Teaching Scheme (Hrs./week)			Examination Scheme and Marks					Credits			
			Theory	Tutorial	Practical	CCE*	End-Sem	Term work	Practical	Oral	Theory	Tutorial	Practical	Total
Semester III														
PCC-201-IOT	Program Core Course	Analog & Digital Electronics circuits	3	-	-	30	70	-	-	-	3	-	-	3
PCC-202-IOT	Program Core Course	Discrete Mathematics	3	-	-	30	70	-	-	-	3	-	-	3
PCC-203-IOT	Program core Course	Sensors, Actuators & signal processing	3	-	-	30	70	-	-	-	3	-	-	3
PCC-204-IOT	Program Core Course Lab	Electronic circuits & Sensor's lab	-	-	2	-	-	25	50	-	-	-	1	1
	Open Elective	Open Elective-I**	2	-	-	15	35	-	-	-	2	-	-	2
MDM-221-IOT	Multidisciplinary Minor	Data Structure & Algorithms	3	-	-	30	70	-	-	-	3	-	-	3
MDM-222-IOT	Multidisciplinary Minor Lab	Data Structure & Algorithms Lab	-	-	2	-	-	25	25	-	-	-	1	1
EEM-231-IOT	Entrepreneurship / Economics/ Management	Engineering Economics & Application	-	1	2	-	-	25	-	-	-	1	1	2
VEC-232-IOT	Value Education	Universal Human Values & Professional ethics	2	-	-	15	35	-	-	-	2	-	-	2
CEP-241-IOT	Community Engagement Project	Community Engagement Project	-	-	4#	-	-	25	-	25	-	-	2	2
Total			16	01	10	150	350	100	75	25	16	01	05	22
			27 Hrs.			**700 Marks**					**22 Credits**			

*Comprehensive Continuous Evaluation

**Open Elective I - Courses like Financial Accounting, Supply chain management, Digital Finance, Digital Marketing and other courses students can be opted from faculty Commerce and Management, Humanities and Inter-disciplinary bucket.

#Note: For Community Engagement, the actual teaching load shall consider 2 Hrs/Week and rest 2 Hrs. society engagement for students

NEP 2020 Compliant Curriculum Structure
Second Year Engineering (2024Pattern)
Internet of Things

Level 5.0															
			Teaching Scheme (Hrs./week)			Examination Scheme and Marks					Credits				
Course Code	Course Type	Course Name	Theory	Tutorial	Practical	CCE*	End-Sem	Termwork	Practical	Oral	Theory	Tutorial	Practical	Total
Semester IV															
PCC-251-IOT	Program Core Course	Communication & Networking Technologies	3	-	-	30	70	-	-	-	2	-	-	2
PCC-252-IOT	Program Core Course	Introduction to IoT	3	-	-	30	70	-	-	-	3	-		3
PCC-253-IOT	Program Core Course	Computer Architecture & Microcontroller	3	-	-	30	70	-	-	-	3	-	-	3
PCC-254-IOT	Program Core Course Lab	Communication & Networking Technologies Lab	-	-	2	-	-	25	25	-	-	-	1	1
	Open Elective	Open Elective-II**	2	-	-	15	35	-	-	-	2	-	-	2
MDM-271-IOT	Multidisciplinary Minor	Object Oriented Programming	3	-	-	30	70	-	-	-	2	-	-	2
MDM-272-IOT	Multidisciplinary Minor	Microcontroller and Object-oriented Programming Lab	-	-	2	-	-	25	-	25	-	-	1	1
VSE-281-IOT	Vocational and Skill Enhancement Course	IoT Skill enhancement Lab	-	1	2	-	-	25	25	-	-	1	1	2
AEC-282-IOT	Ability Enhancement Course	Modern Indian Languages (Marathi/Hindi)	-	1	2	-	-	25	-	-	-	1	1	2
EEM-283-IOT	Entrepreneurship/Economics/Management	Entrepreneurship skill Development	-	1	2	-	-	25	-	-	-	1	1	2
VEC-284-IOT	Value Education Course	Environment Awareness	2	-	-	15	35	-	-	-	2	-	-	2
Total			16	03	10	150	350	125	50	25	14	03	05	22
			29 Hrs.			700 Marks					22 Credit			

*Comprehensive Continuous Evaluation

**Open Elective II - Courses like Project Management, Business Analytical, Product management Financial Management and other courses students can be opted from faculty Commerce and Management, Humanities and Inter-disciplinary bucket.

Savitribai Phule Pune University, Pune

Maharashtra, India

SE -Department of Internet of Things

2024 Pattern

Semester III

With effect from Academic Year 2025–26

Savitribai Phule Pune University
Second Year of Internet of Things (2024Course)

PCC-201-IOT: Analog and Digital Electronic Circuits		
Teaching/scheme	**Credits**	**Examination Scheme**
Theory: 03Hours/Week	03	**CCE:** 30 Marks
		End-Semester: 70 Marks

Prerequisite Courses, if any: Basic Electronics Engineering and Basic Electrical Engineering

Companion Course, if any: Laboratory Practical

Course Objectives:

The objective of this course is to provide students with

- An understanding of EMOSFET amplifier and ability to design the amplifier circuit
- An understanding of applications of op-amp and ability to design of opamp based circuits
- An understanding of Combinational and Sequential digital ckt and ability to design Combinational and Sequential digital circuit
- An understanding of use of analog and digital circuits in real life applications

Course Outcomes:

After successful completion of the course, students will be able to:

CO1: Design EMOSFET amplifier circuits

CO2: Design operational amplifier-based circuits for given applications

CO3:Design Combinational and Sequential digital circuits

CO4: Design digital circuits using state machines

CO5: Solve real life problems using digital and analog circuits

Course Contents		
Unit I	**Design and Analysis of EMOSFET Amplifier**	**(09 Hours)**
Non ideal characteristics of EMOSFET such as Finite output resistance, body effect, sub-threshold conduction, breakdown effects, temperature effect. Comparison of Common Source (CS), Common Drain (CD) and Common gate (CG) amplifier configurations. Concept of DC load line, two port model of EMOSFET, design and analysis of dc circuit for common source amplifier configuration, numerical. Concept of AC load line, AC equivalent circuit of a common source amplifier configuration, design & analysis of common source amplifier configuration with respect to input and output impedance, gain and frequency response, numerical.		
#Exemplar	Public address system, transmitter and receiver of wired (telephone) and wireless systems (satellite, mobile), computers etc.	

Mapping of Course Outcomes for Unit No.1 : CO1

Unit II	**EMOSFET and OPAMP Applications**	**(09 Hours)**

EMOSFET Applications - CMOS inverter, resistor & diode, feedback amplifiers and its effects, design and analysis of voltage series feedback amplifier and numerical. Concept of Barkhausen criterion for oscillator, comparison of various oscillator such as Colpitts, Heartily, Wein bridge and RC phase shift, design and analysis of RC phase shift oscillator and numerical. OPAMP applications circuit design and analysis such as voltage follower, summing and differential amplifier, practical integrator, comparator, Schmitt trigger	
#Exemplar	Waveform and frequency generator for application such as receiver and transmitter in TV, mobile, telephone etc
Mapping of Course Outcomes for Unit No.1 : CO1	

Unit III	Combinational and Sequential Logic Digital Circuits	(09Hours)
Combinational logic Circuit – Decimal to binary and binary to decimal code convertor, 2-bit adder and subtractor, 2- bit digital comparator, 4:1 and 8:1 multiplexers and relevant de-multiplexers. Sequential logic Circuit - 1 Bit memory cell, shift registers, synchronous and asynchronous counters, ring and twisted ring counters, up and down counters.		
#Exemplar	Digital computer, counting mechanism in industry etc	
Mapping of Course Outcomes for Unit III	CO3	

Unit IV	State Machines and its Application	(09 Hours)
State diagram, state table, state reduction, state assignment, comparison of Mealy and Moore machines, Mealy and Moore machine implementation, programmable logic devices and their architecture - PROM, PAL, PLA, FPGA and CPLD, semiconductor memories types and their characteristic parameters, performance parameters for a digital logic circuit such as speed, power dissipation, figure of merit, fan in, fan out, current, voltage, noise immunity		
#Exemplar	Traffic light control, computer memory etc.	
Mapping of Course Outcomes for Unit IV	CO4	

Unit V	Data Conversion & Applications	(09 Hours)
Various types of ADCs and DACs and their performance parameters, study of successive approximation ADC and R-2R ladder type of DAC, Square & triangular wave generator, electronic analog computer, traffic light controller using finite state machine, bottling plant counting mechanism using counter		
#Exemplar	audio recording, data acquisition systems, and sensor interfaces, communication systems such as TV receivers, analog computers, computer/pen drive memories, public traffic light system, industrial counting applications	
Mapping of Course Outcomes for Unit V	CO5	

Learning Resources

Textbooks:
1. Donald Neaman, "Electronic Circuits – Analysis and Design" Third edition, Mc Graw Hill.
2. Ramakant Gaikwad, "Op amps & Linear Integrated Circuits", Pearson Education.
3. R.P. Jain, "Modern digital electronics", 3rd edition, 12th reprint Tata McGraw Hill Publication,2007.
4. M. Morris Mano, "Digital Logic and Computer Design" 4the Edition, Prentice Hall of India

Reference Books:
1. Millman Halkias, "Integrated Electronics"
2. David A. Bell, "Electronic Devices and Circuits", 5th Edition, Oxford press
3. Anand Kumar, "Fundamentals of Digital Circuits" 1st edition, Prentice Hall of India, 2001
4. Digital Principles and Applications (SIE) | 8th Edition: Leach, Malvino, Saha

e-Books:

1.https://ebooks.lpude.in/computer_application/ad/DCAP108_DIGITAL_CIRCUITS_AND_LOGIC_DESIGNS.pdf

2.https://mrce.in/ebooks/Analog%20Integrated%20Circuit%20Design%202nd%20Ed.pdf

MOOC / NPTEL/YouTube Links:
1. NPTEL Course "Analog Electronic Circuits" https://nptel.ac.in/courses/108105158
2.NPTEL Course on "Analog Circuits": https://nptel.ac.in/courses/108101094
3.NPTEL Course "Digital Circuits" by Prof. Santanu Chattopadhyay (IIT Kharagpur)
4.NPTEL Course "Digital Circuits" by Prof. Goutam Saha (IIT Kharagpur)
Virtual Labs Links
http://vlabs.iitb.ac.in/vlabs/vlab_bootcamp/bootcamp/electronerds/index.html
http://vlabs.iitkgp.ernet.in/be/
https://nptel.ac.in/courses/108/105/ 108105113/
https://nptel.ac.in/courses/117/106/117106086/
https://nptel.ac.in/courses/108/105/108105132/
https://da-iitb.vlabs.ac.in/exp/generalized-simulator/
https://dld-iitb.vlabs.ac.in/

[#Exemplar: These are the practical applications based on the contents of the particular unit and for information only. *Comprehensive Continuous Evaluation]

<table>
<tr><td colspan="3">Savitribai Phule Pune University
Second Year of Internet of Things (2024 Course)</td></tr>
<tr><td colspan="3">PCC-202-IOT : Discrete Mathematics</td></tr>
<tr><td>Teaching/scheme</td><td>Credits</td><td>Examination Scheme</td></tr>
<tr><td>Theory: 03Hours/Week</td><td>03</td><td>CCE: 30 Marks
End-Semester: 70 Marks</td></tr>
<tr><td colspan="3">Course Prerequisites: Fundamental of Sets, Permutations & Combinations and Matrix algebra.</td></tr>
<tr><td colspan="3">Course Objectives:
To familiarize the students with concepts and techniques of discrete mathematics: sets, logic, relations, functions, combinatorics, graphs, trees, and algebraic structures enabling them to understand and apply these theories and principles relevant to computer science.</td></tr>
<tr><td colspan="3">Course Outcomes:
After successful completion of the course, students will be able to:
CO1: Formulate, interpret, and solve real-world problems by applying key concepts from sets, logic, combinatorial techniques and formal proof methods relevant to computer science.
CO2: Analyze different types of relations and its closures, construct & use functions and solve recurrence relations to enable algorithmic solution to problems.
CO3: Model and devise algorithmic solution using graphs & trees and solve problems in network theory and data structures.
CO4: Apply the concepts of algebraic structures such as Group, Ring and Field, applied to coding theory</td></tr>
</table>

<table>
<tr><td colspan="3">Course Contents</td></tr>
<tr><td>Unit I</td><td>Sets and Logic</td><td>(09 Hours)</td></tr>
<tr><td colspan="3">Sets: Introduction, Types of Sets, Operation and Laws, Principle of Inclusion and Exclusion, Multisets
Logic: Propositions, Operations and Connectives, Truth table, Logical Equivalence, Normal Forms, Logical implication, Rules of Inference, Validity, Compactness and Resolution, Predicative and quantifiers, Methods of Proofs and Principle of Mathematical Induction.
Combinatorics: Counting Principle, Permutation and Combination, Pigonhole Principle, Binomial coefficients and Identities.</td></tr>
<tr><td>Unit II</td><td>Relations and Functions</td><td>(09 Hours)</td></tr>
</table>

Relations: Definitions, Types of relations, Properties, n-ary relations, Closure of relations, Equivalence relation, Equivalence classes, Partitions, Partial ordering relations, Hasse Diagram, Lattices, Chain and Antichains, Transitive closure and Warshall's algorithm.

Functions: Definitions, Types of functions, Composition of functions, Invertible functions, Generating functions, Recurrence relations, Solution of linear recurrence relation with Constant Coefficients

Unit III	Graph and Applications	(09 Hours)

Terminology and types of graphs, Hand shaking lemma, Matrix representation of graphs, Adjacency and Incidence matrix, Isomorphism, Connectivity, Eulerian and Hamiltonian graphs, Shortest path, Travelling salesman problem, Dijkstra's algorithm, Planar graph and Euler formula, Graph colouring, Chromatic number, Dual of Graph, Clique number.

Unit IV	Trees	(09 Hours)

Introduction, Properties, Rootedtree, Binary Search tree, Tree traversal, Path length, Weighted tree, Prefixcode, Huffmancoding, Spanning tree, Minimal spanning tree, Kruskal algorithm, prims algorithm, Cut set, The Max flow- Min cut theorem (Transport Network).

Unit V	Algebraic Structure and Coding Theory	(09 Hours)

Introduction to Algebraic structures, Semi group, Monoid, Group, Abelian group, Cyclic group, Congruence relation, Homomorphism, Normal subgroup, Ring, Field, Galois Theory, Coding Theory.

Learning Resources

Textbooks:

1. Kenneth H. Rosen,"Discrete Mathematics and its applications", Tata McGraw Hill.

2. C. L. Liu. "Elements of Discrete Mathematics", Tata McGraw Hill.

Reference Books:
1.   Bernard Kolman, Robert C. Busby, Sharon Ross. "Discrete Mathematical structures", Prentice Hall.
2.   Ralph P. Grimaldi. "Discrete and Combinatorial Mathematics" Pearson Addison Wesley.
3.   Sriram P and Steven S," Computational Discrete Mathematics" Cambridge University Press.
4.   Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science", Prentice Hall.
5.   Edgar G. Goodaire, Michael M Parmenter," Discrete Mathematics with Graph Theory", 3 rd Edition, Pearson Education
6.   A R Vasishtha, "Abstract Algebra", Krishna Prakashan.

Savitribai Phule Pune University
Second Year of Internet of Things (2024Course)

PCC-203-IOT: Sensors, Actuators & signal processing		
Teaching/scheme	**Credits**	**Examination Scheme**
Theory: 03 Hours/Week	03	**CCE:** 30 Marks **End Sem:** 70 Marks

Prerequisite Courses, if any: Electrical & Electronics Engineering, Engg Mathematics

Course Objectives:
The objective of this course is to provide students with
- Knowledge of means of measuring various physical variables.
- Understanding of various types of sensors, smart sensors & actuators and their applications
- Understanding of different types of signals and its processing
- Understanding the Fourier transform, fast Fourier transform, DFT and their applications

Course Outcomes:
After successful completion of the course, students will be able to:

CO1: Understand the fundamental principles, types, and characteristics of sensors and actuators, and generalized measurement system

CO2: Understand the displacement, level & flow sensor and its types.

CO3: Understand the pressure sensor & smart sensors and its types.

CO4: To understand the fundamentals and properties of signal

CO5: To learn discrete Fourier transform, fast Fourier transform, properties of DFT

Course Contents		
Unit I	**Introduction to Sensors and actuators**	**(09 Hours)**

Sensors and actuators: Significance of Sensor and actuator Measurements (comparison, detailed structure), Classification of Sensors. Types of Actuators, bandwidth and frequency response, actuator range, power and energy considerations, tradeoffs between force/displacement or torque/speed, control systems and electronics, industrial considerations
Smart Material Actuators: Piezoelectric transducers, Electroactive polymers, Shape Memory alloys, Artificial Muscle materials
Generalized measurement system: Introduction to DAQ, Types, and Components and architecture (detailed block diagram) of a Data Acquisition System.

Selection criteria of sensors for IoT

#Exemplar	Multiple applications like smart city
Mapping of Course Outcomes for Unit I	CO1

Unit II	Displacement, Level & Flow Sensors	(06 Hours)

Displacement Measurement: Transducers for displacement, displacement measurement, potentiometer, Capacitance Types, Digital Transducers (optical encoder).

Strain Measurement: Theory of Strain Gauges, gauge factor

Measurement of Angular Velocity: Tachometers, Digital tachometers and Stroboscopic Methods.

Acceleration Measurement, introduction to Accelerometer and vibrometers, strain gauge based and piezo electric accelerometers

Level measurement: Introduction, Differential pressure level detectors, Capacitance level sensor,

Ultrasonic level detectors and Radar level transmitters and gauges.

Flow measurement: Introduction, definition and units, classification of flow meters, differential pressure and variable area flow meters, Positive displacement flow meters, Electro Magnetic flow meters.

#Exemplar	Industrial and home applications
Mapping of Course Outcomes for Unit II	CO2

Unit III	Pressure sensors & Smart sensors	(06 Hours)

Pressure Measurement: Microphones, Elastic pressure transducers, bellows and piezoelectric pressure sensors, High Pressure Measurements, Bridge man gauge.
Smart sensors: Evolution from traditional to smart sensors, Definition and architecture of smart sensors, Differences between conventional and smart sensors.
Key points: Sensing elements and transduction principles, Signal conditioning circuits (amplifiers, filters), DAQ in smart sensors, Communication protocols used in smart sensors. Wireless sensors and WSN: Introduction to wireless sensors. Detailed architecture of WSN

#Exemplar	Aerospace, automotive & smart agriculture
Mapping of Course Outcomes for Unit III	CO3

Unit IV	Classification of signals	(09 Hours)

Standard signals– Step, Ramp, Pulse, Impulse–Real and complex exponentials
and Sinusoids–Representation of Continuous and discrete time signals–
Classification of signals – Continuous time (CT) and Discrete Time (DT), signals– Periodic & Aperiodic signals– Deterministic & Random signals–Energy & Power signals

#Exemplar	Nature of Real-life audio (voice), video, radio Signals and electrical Currents, modern applications of the convolution, Speech recognition and natural language processing (NLP):
Mapping of Course Outcomes for Unit IV	CO4

Unit V	Introduction - Discrete Time signal processing	(09 Hours)

Frequency domain sampling–Discrete Fourier Transform (DFT) – deriving DFT from DTFT– properties of DFT – periodicity– symmetry– circular convolution- overlap save and overlap add method– Fast computation of DFT - Radix-2 Decimation-in-time (DIT) Fourier transform (FFT)– Decimation-infrequency (DIF)– Fast Fourier transform (FFT	
#Exemplar	Applications of Fourier Transform in spectral analysis, communication, filtering, and biomedical signal processing

Mapping of Course Outcomes for Unit V	CO5

Learning Resources

Textbooks:

1. Mechanical Engineering Measurements - A. K. Sawhney – Dhanpat Rai& Sons, NewDelhi.

2. Instrumentation Devices & Systems - C.S. Rangan & G.R.Sarrna - Tata McGrawHill

3. Patranabis. D, "Sensors and Transducers", Wheeler publisher, 1994

4. Allan V. Oppenheim, S.Wilsky and S.H.Nawab, "Signals and Systems",Pearson, 2015.

5. John G Proakis and Manolakis, "Digital Signal Processing Principles, Algorithms and Applications", Pearson, Fifth Edition, 2021.

6. B.G. Liptak, Process Measurement and Analysis, CRC Press, 4th Edition, 2003.

Reference Books:
1. Sensors and Actuators: Control System Instrumentation -Clarence W Silva, CRC Press USA
2. Sensors and Actuators in Mechatronics: Design and Applications: Andrzej M Pawlak, CRC Press USA
3. Measurement Systems (Applications and Design) - E.O. Doebelin - McGrawHill.
4. Robert H Bishop, "The Mechatronics Hand Book", CRC Press, 2002.
5. Thomas. G. Bekwith and Lewis Buck.N, Mechanical Measurements, Oxford
6. and IBH publishing Co. Pvt. Ltd
7. Sanjit K. Mitra, "Digital Signal Processing – A Computer Based Approach", Tata McGraw Hill, 2007.

MOOC/NPTEL Courses:

1. https://onlinecourses.nptel.ac.in/noc25_ee123/preview

2. https://onlinecourses.nptel.ac.in/noc25_ee177/preview

[#Exemplar: These are the practical applications based on the contents of the particular unit and for information only. *Comprehensive Continuous Evaluation]

Savitribai Phule Pune University
Second Year of Internet of Things (2024 Course)

PCC-204-IOT: Electronic Circuits & Sensor's Lab		
Teaching Scheme	**Credits**	**Examination Scheme**
Practical : 02 Hours/Week	01	**Term Work** : 25 Marks
		Practical : 50 Marks

Companion Course, if any: Electronics Circuits, Electrical Electronics

List of Experiments (Electronics Circuits)

Group A: Any Three to be Performed

1. Design, build single stage CS configuration & verify DC operating point and comment on results.

2. Implement current series feedback amplifier & measure R_{if}, R_{of}, G_{mf} and comment on result.

3. Design, build & test integrator/differentiator using Op-Amp and comment on result.

4. Design, build & test Schmitt trigger using Op-Amp and comment on result.

5. Design & implement adjustable voltage regulator using IC LM317/LM337 and comment on result.

Group B: Any four to be Performed

6. Design, build & test half-wave and full-wave rectifier.

7. Design, build & test square and triangular waveform generator using Op-Amp.

8. Design and implement code converter, full adder and full subtractor function using IC-74138

9. Design and Implement 8:1 MUX using IC-74153 & Verify its Truth Table.

10. Design and Implement MOD-N, Up/down Counter with mode control using IC-74191 / IC-74193. Draw Timing Diagram.

11. Design, build & test 2 or 3-bit R-2R ladder DAC.

Group C: Course Project (Any one ,Group of 3 Students)

12. Case Study 1: Design and implement a linear regulator variable power supply.

13. Case Study 2: Design and implement signal conditioning circuit for temperature measurement and control system.

Virtual LAB Links:
1. **Integrated Circuits:** http://vlabs.iitb.ac.in/vlabs-dev/vlab_bootcamp/bootcamp/ electronerds/index.html

2. **Basic Electronics Virtual Lab:** http://vlabs.iitkgp.ernet.in/be/

Note:

1.   One practical from Group A and B should be performed as simulation practical (using any avail- able tool).

2.   Additional (min. 2) practicals are to be performed using Virtual Lab.

List of Experiments (Sensor's)	
Guidelines for Students Lab Journal	
1	Title of the experiment
2	Problem Statement

3	Logic Design of given problem statement
4	Logic diagram with IC number pin connections
5	Observation table / Truth table
6	Timing diagram
7	Result table
8	Conclusions
9	Mention real life examples concerned with the respective experiments

	Guidelines for Laboratory / Term Work Assessment
1	Continuous assessment of laboratory work based on overall performance and laboratory performance of students.
2	Each laboratory assignment assessment should assign grade/marks based on parameters with appropriate weightage.
3	Suggested parameters include timely completion, performance, efficiency, punctuality, and neatness.

	Suggested List of Laboratory Experiments (Using Hardware) **(1ˢᵗ is compulsory &Any two from 2 to 5)**
1	Types of sensors: temperature, soil moisture, ultrasonic, PIR
2	Design and implement a data acquisition system using sensors (e.g., temperature, pressure, or light sensor
3	Design and implement a data acquisition system using sensors with actuators (e.g., temperature, pressure, or light sensor
4	Design and implement a control system using position sensors to track and control actuators for precise positioning and motion control applications
5	Design and implement a control system using velocity sensor.

	Suggested List of Laboratory Experiments (Using LabVIEW Software) **(6ᵗʰ is compulsory &Any two from 7 to 10)**
6	Introduction to LabVIEW Programming Introduction, Advantages of LabVIEW Software,
7	Design and implement a data acquisition system using LabVIEW to collect and process data from sensors (e.g., temperature, pressure, or vibration sensors in real-time, utilizing LabVIEW's graphical programming environment and data acquisition tools
8	Design and implement a data acquisition system using LabVIEW to collect and process data from sensors to control actuators (e.g., LEDs, motors, or valves) in real-time, utilizing LabVIEW's graphical programming environment
9	Design and implement a control system using LabVIEW to read position data from sensors (e.g., potentiometers, encoders, or LVDTs)
10	Design and implement a control system using LabVIEW to read velocity data from velocity sensor.

One practical from the Group should be performed as simulation practical (using any available tool).

Savitribai Phule Pune University
Second Year of Internet of Things (2024Course)

MDM-221-IOT: Data Structures and Algorithms		
Teaching/scheme	**Credits**	**Examination Scheme**
Theory: 03Hours/Week	03	**CCE**: 30 Marks **End-Semester:** 70 Marks

Prerequisite Courses, if any: Basic mathematics, foundational knowledge of problem-solving and logic building, programming concepts using C language.

Companion Course, if any: Laboratory Practical

Course Objectives:
- To introduce students to the fundamentals of C++ programming with object-oriented concepts.
- To develop understanding of various searching and sorting algorithms and their performance.
- To understand the concepts and applications of linear and non-linear data structures.
- To implement and analyze data structures such as linked lists, stacks, queues, trees, and graphs using C++.
- To enable students to apply data structures and algorithms to solve real-world problems efficiently.

Course Outcomes:
After successful completion of the course, students will be able to:

CO1: Apply object-oriented programming concepts using C++ for problem solving.

CO2: Analyze searching and sorting algorithms for efficiency.

CO3: Implement various types of linked lists and understand their applications.

CO4: Implement stack and queue data structures and apply them in relevant problems.

CO5: Apply trees and graphs to represent and solve complex problems.

Course Contents		
Unit I	**Introduction to C++**	**(09Hours)**

Basics of Object-Oriented Programming (OOP), C++ syntax and program structure, data types, variables, operators, Functions and parameter passing, Classes and objects, Constructors and destructors, Function overloading and operator overloading.

Case Study – Complex number arithmetic for scientific and engineering calculations, use of basic C++ concepts — classes, objects, constructors, and operator overloading for complex number arithmetic (Addition, Subtraction, Multiplication)

#Exemplar	System programming, operating systems, Game development, Embedded System, device drivers, scientific simulations, Artificial Intelligence/ Machine Learning Libraries.

Mapping of Course Outcomes for Unit I	CO1	

Unit II	**Searching and Sorting Algorithms**	**(09 Hours)**

Algorithms: Analysis of Iterative and Recursive algorithms, Time and space complexity, Asymptotic notation- Big-O, Theta and Omega notations.

Searching methods: Linear, Binary and Fibonacci Search.

Sorting methods: Bubble, Insertion, Selection, Merge, and Quick Sort.

Implementation of searching and sorting algorithms using C++.

Case Study - e-commerce platform, searching products and sorting based on price for a user query.

Introduction to dynamic programming, Top-Down Approach (Memoization), Bottom-Up Approach (Tabulation).

#Exemplar	Voter search, roll number lookup, product search on e-commerce platform, price sorting, merit list generation, sort employee records by salary.

Mapping of Course Outcomes for Unit II	CO2	

Unit III	**Linked Lists**	**(09 Hours)**

Definition and importance of data structures, Classification of data structures,

Singly Linked List: Creation, insertion, deletion, traversal, searching, sorting.

Doubly Linked List: Creation, insertion, deletion, traversal,

Circular Linked List: Creation, insertion, deletion, traversal,

Case Study – Polynomial representation, Use of singly linked lists where each node stores coefficient and exponent of polynomial, polynomial addition.

Case Study - Use of doubly linked list to represent playlist with next and previous track options. Songs can be added/removed dynamically and navigated forward/backward

#Exemplar	Managing a music playlist, Browser History Navigation, undo/redo operations, Round-Robin Scheduling

Mapping of Course Outcomes for Unit III	CO3	

Unit IV	**Stacks and Queues**	**(09 Hours)**

Stack: Concept, implementation using arrays and linked lists, Stack operations: push, pop, peek, Stack Applications,

Case Study - parsing logic in compilers and calculators - conversion of infix to postfix expressions using stack, followed by evaluation.

Queue: Implementation using arrays and linked lists, Queue operations- enqueue, dequeue, peek.

Types of queues: Circular queue, Priority Queue, Queue Applications,

Case Study - Hospital Emergency Queue System, Use of priority queue or combination of normal queue + sorting mechanism.		
#Exemplar	Expression parsing, compiler design, calculators, Ticket counters, call center queues, print job management, CPU Job Scheduling	
Mapping of Course Outcomes for Unit IV	CO4	
Unit V	**Trees and Graphs**	**(09 Hours)**
Trees: Terminology, binary trees, binary search trees (BST). Threaded binary tree, Tree traversals: Inorder, Preorder, Postorder, AVL trees: Rotations and balancing, Graphs: Representations (adjacency matrix/list), Graph traversals: BFS, DFS, Minimum Spanning tree- Kruskal's Algorithm, Prim's Algorithm. Case Study – GPS/Map navigation, Use of weighted graphs and Dijkstra's Shortest Path Algorithm.		
#Exemplar	Mapping systems (like Google Maps), social media connections, File system navigation, friend recommendation on social media, organizational charts, search engines, database indexing	
Mapping of Course Outcomes for Unit V	CO5	

Learning Resources

Textbooks:
1. E. Balagurusamy, "Object-Oriented Programming with C++", McGraw Hill
2. Ellis Horowitz, Sartaj Sahni, "Fundamentals of Data Structures in C++", Orient Blackswan
3. Yashavant Kanetkar, "Data Structures Through C++", BPB Publications

Reference Books:
1. Robert Lafore, "Object-Oriented Programming in C++", Sams Publishing
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", Pearson
3. BjarneStroustrup, "The C++ Programming Language", Addison-Wesley
4. YedidyahLangsam, Moshe J. Augenstein and Aaron M. Tenenbaum, "Data structures using C and C++",Pearson

e-Books:
1. Fundamentals of Programming C++ (Richard L. Halterman)

2. Data Structures and Algorithm Analysis in C++, 3rd Edition (Clifford A. Shaffer)

MOOC / NPTEL/YouTube Links:
1. Data Structures And Algorithms, IIT Delhi, https://nptel.ac.in/courses/106102064

2. Introduction to Data Structures, https://onlinecourses.swayam2.ac.in/cec24_cs17/preview

[#Exemplar: These are the practical applications based on the contents of the particular unit and for information only. *Comprehensive Continuous Evaluation]

Savitribai Phule Pune University			
Second Year of Internet of Things (2024 Course)			
MDM-222-IOT: Data Structure & Algorithms Lab			
Teaching/scheme	**Credits**	**Examination Scheme**	
Practical: 02Hours/Week	01	**Term work**: 25 Marks	
		Practical: 25 Marks	

Companion Course, if any: Data Structure & Algorithms

Course Objectives:
- To introduce basic C++ programming concepts such as classes, objects, constructors, and operator overloading for developing object-oriented solutions.
- To develop problem-solving skills by implementing standard searching and sorting algorithms using C++.
- To provide hands-on experience with dynamic data structures like linked lists, stacks, queues, and trees to reinforce their theoretical understanding.
- To enable students to implement and traverse graphs using adjacency lists and apply depth-first and breadth-first search algorithms

Course Outcomes:
After successful completion of the course, students will be able to:

CO1: Implement object-oriented programming features in C++ to solve problems such as complex number arithmetic.

CO2: Implement searching and sorting algorithms and evaluate their performance for given data.

CO3: Apply appropriate data structures like linked lists, stacks, queues, and binary search trees to solve basic computational problems.

CO4: Develop graph-based solutions and perform BFS and DFS traversals using adjacency list representation.

Guidelines for Student's Lab Journal

The students Lab Journal should contain following related to every experiment –

1. Title of the experiment
2. Mapped Objective and mapped outcome
3. Software and Tools used.
4. Brief theory, algorithm/flowchart.
5. Sample input/output - test cases with example inputs and corresponding outputs.
6. Conclusions.

Guidelines for Laboratory/ TW Assessment

1. Continuous assessment of laboratory work is to be done based on overall performance.

2. Each lab assignment/experiment assessment will assign grade/marks based on parameters with appropriate weightage.

3. Suggested parameters for overall assessment as well as each laboratory assignment include:

   ✓ Timely completion.

   ✓ Performance.

   ✓ Punctuality and neatness.

Suggested List of Laboratory Experiments

Group A (Any 8)

1. Program to demonstrate basic C++ concepts — classes, objects, constructors, and operator overloading for complex number arithmetic (Addition, Subtraction, Multiplication)

2. Implement a) Linear Search and b) Binary Search algorithms using C++

3. Implement a) Bubble Sort, b) Insertion or Selection Sort algorithms using C++

4. Implement Singly Linked List with insertion, deletion, and display operations.

5. Implement Doubly Linked List with insertion, deletion, and display operations.

6. Implement Stack using a) arrays and b) linked list.

7. Evaluate postfix expression (input will be postfix expression)

8. Implement Queue using a) arrays and b) linked list.

9. Implement Binary Search Tree with insertion, deletion, and traversal (inorder, preorder, postorder).

10. Implement Graph using adjacency list. Perform BFS and DFS traversals.

Group B (Course Project)

Develop an application that solves a real-world problem or simulates a practical system

using appropriate data structures, implemented in C++.

General Guidelines-

- **Team Size:**

  Individual or group of up to 3 students.

- **Selection of Topic:**

  Students must choose a problem where the use of one or more data structures is essential.
  Project must be **interactive** (menu-based or GUI-based).
  Some suggested domains- Railway reservation system, Hospital Queue System, College Result Processing, Phone Book.

- **Mandatory Technical Requirements:**

  Use of **at least one data structure** (e.g., Linked List, Stack, Queue, Tree, Graph). Implement **searching and/or sorting algorithms**.
  Include **basic object-oriented concepts** like classes, constructors, and operator overloading.
- **Documentation Must Include:**
  Project Title and Abstract
  Problem Statement
  Data Structures Used and Justification System
  Design / Flowchart / Class Diagram Sample
  Input /Output
  Code (with comments)

  Conclusion and Future Scope

Savitribai Phule Pune University
Second Year of Internet of Things (2024Course)

EEM-231-IOT: Engineering Economics & Applications		

Teaching/scheme	Credits	Examination Scheme
Tutorial:01Hour/Week	01	**Term Work**:25 Marks
Practical:02Hours/Week	01	

Course Objectives:
- To understand key economic principles and the time value of money for engineering decisions.
- To learn demand forecasting, cost analysis, and decision-making under uncertainty
- To explore market structures, pricing strategies, and value engineering in electronics.
- To develop investment evaluation skills and grasp macroeconomic impacts on tech-businesses.

Course Outcomes:

After successful completion of the course, students will be able to:

CO1: Apply economic principles and time value of money concepts using practical tools.

CO2: Perform break-even and CVP analyses to support engineering decisions.

CO3: Analyze market competition and pricing strategies with case studies.

CO4: Evaluate projects with capital budgeting and interpret macroeconomic effects on electronics.

Course Contents		
Unit I	Theories and Laws of Economics for Engineers	(04 Hours)
Introduction to Engineering Economics, Basic economic concepts: Utility, scarcity, opportunity cost, Economic systems and firm objectives, Laws of demand and supply, elasticity, Value, wealth,andequilibriumprice,Timevalueofmoney(PresentValue,FutureValue,annuity (basics)		
Unit II	Principles of Engineering Economics and Costing	(04 Hours)
Demand forecasting techniques and applications in tech markets, Cost behavior: Fixed, variable, marginal, total, Cost-volume-profit and break-even analysis, Decision-making under un-certainty (intro to decision theory), Economies of scale in electronics manufacturing		
Unit III	Applications of Economics in Electronics Industry	(04 Hours)
Market structures: Perfect competition, monopoly, monopolistic competition, Pricing strategies and product life cycle costing, Game theory basics and strategic behavior, Make-or-buy decisions and Value Engineering in electronics, Kaizen and productivity in technical operations		
Unit IV	Investment Analysis and Applied Macroeconomics	(04 Hours)
Capital budgeting: Payback period, Net Present Value (NPV), Internal Rate of Return (IRR), Profitability Index, Equipment replacement decisions, Overview of macroeconomic indicators: Gross Domestic Product (GDP), Consumer Price Index (CPI), Business cycles, inflation, interest rates, and impact, CSR, sustainability, and policy impacts on tech firms, Exposure to areas like IPR, R&D, and innovation economics		

Extra two practical's shall be based on the syllabus of all units apart from the following list:

Any Six practical's can be carried out, below list:

1. Case examples from electronics industries (e.g.,Telecom spectrum pricing, consumer electronics)
2. Excel-based Time Value of Money (TVM)computations
3. Forecast demand for a telecom device (Routing and Switching Networking communication devices /AI enabled Smart IOT devices and sensor)
4. Performbreak-evenand Cost-Volume-Profit(CVP)analysis using spreadsheet
5. Case study: Comparison of Pricing strategy between two service providers such as of Jio, Airtel, BSNL etc.
6. To carryout mini project based on market and pricing strategy analysis of a smart device or IoT product
7. Evaluate a small-scale engineering project(e.g.,set up of lab or unit based)
8. Group discussion: Impact of government policies and budget on electronics and telecom sector

Learning Resources

Textbooks:

1. A Textbook of Engineering Economics: The Principles and Applications, D. R. Kiran, BS Publications, 2021.

2. Engineering Economics Test & Cases, DND wivedi, Dr H L Bhatia & Dr S N Maheshwari, Vikas Publishing House Pvt. Ltd.

Reference Books:

1. Principles of Engineering Economics with Applications, Zahid A. Khan, Arshad N. Siddiquee, Brajesh Kumar, Mustufa H. Abidi 2nd edition, Cambridge University.
2. Practical Applications of Engineering Economics, Kal R. Sharma, Momentum Press. Engineering Economics, R. Panneerselvam, PHI Learning Private Ltd.

<table>
<tr><td colspan="3" align="center">Savitribai Phule Pune University
Second Year of Internet of Things (2024Course)</td></tr>
<tr><td colspan="3" align="center">VEC-232-IOT: Universal Human Values and Professional Ethics</td></tr>
<tr><td align="center">Teaching/scheme</td><td align="center">Credits</td><td align="center">Examination Scheme</td></tr>
<tr><td>Theory: 02Hours/Week</td><td align="center">02</td><td>CCE:15Marks

End-SemesterExam:35Marks</td></tr>
</table>

Course Objectives:

- To help the students develop a holistic, humane world-vision, and appreciate the essential complementarities between values and skills to ensure mutual happiness and prosperity

- To elaborate on 'Self-exploration' as the process for Value Education

- To facilitate the understanding of harmony at various levels starting from self and going towards family and society.

- To elaborate on the salient aspects of harmony in nature and the entire existence

- To explain how the Right understanding forms the basis of Universal human values and definitiveness of Ethical human conduct.

- To provide the vision for a holistic way of living and facilitate transition from chaotic life to an orderly life.

Course Outcomes:

After successful completion of the course, students will be able to:

CO1: Recognize the concept of self-exploration as the process of value education and see they have the potential to explore on their own right.

CO2: Explore the human being as the coexistence of self and body to see their real needs/basic aspirations clearly.

CO3: Explain relationship between oneself and the other self as the essential part of relationship and harmony in the family.

CO4: Interpret the interconnectedness, harmony and mutual fulfillment in-herent in the nature and the entire existence.

CO5: Draw ethical conclusions in the light of Right understanding facilitating the development of holistic technologies production systems and management models.

<table>
<tr><td colspan="3" align="center">Course Contents</td></tr>
<tr><td align="center">Unit I</td><td align="center">Introduction to Value Education</td><td align="center">(07 Hours)</td></tr>
<tr><td colspan="3">(i) Understanding Value Education
(ii) Self-exploration as the Process for Value Education
(iii) Continuous Happiness and Prosperity-the Basic Human Aspirations and their Fulfillment
(iv) Right Understanding, Relationship and Physical Facility</td></tr>
</table>

| (v) Happiness and Prosperity-Current Scenario |
| (vi) Method to Fulfil the Basic Human Aspirations |

Unit II	Harmony in the Human Being	(07 Hours)

(i) Understanding Human being as the Co-existence of the Self and the Body

(ii) Distinguishing between the Needs of the Self and the Body

(iii) The Body as an Instrument of the Self

(iv) Understanding Harmony in the Self

(v) Harmony of the Self with the Body

(vi) Programme to Ensure self-regulation and Health

Unit III	Harmony in the Family and Society	(08 Hours)

(i) Harmony in the Family - the Basic Unit of Human Interaction "Trust' - the Foundational Value in Relationship

(ii) 'Respect'- as the Right Evaluation

(iii) Values in Human-to-Human Relationship

(iv) Understanding Harmony in the Society

(v) Vision for the Universal Human Order

Unit IV	Harmony in the Nature (Existence)	(08 Hours)

(i)   Understanding Harmony in the Nature

(ii)   Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature

(iii)   Realizing Existence as Co-existence at All Levels

(iv)   The Holistic Perception of Harmony in Existence

(v)   Professional Ethics in the light of Right Understanding

(vi)   Strategies for Transition towards Value-based Life and Profession

Learning Resources

Textbooks:

1. A Foundation Course in Human Values and Professional Ethics, RR Gaur, R Asthana, GP Bagaria, 3rd revised edition, UHV Publications, 2023, ISBN: 978-81-957703-7-3 (Printed Copy), 978-81- 957703-6-6 (e-book)

2. Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 3rd revised edition, UHV Publications, 2023, ISBN: 978-81-957703-5-9 (Printed Copy), 978-81-957703-0-4 (e-Book)

Reference Books:

1. P.L.Dhar, R. R. Gaur, 1990, Science and Humanism, Common wealth Publishers.

2. A. Nagaraj, 1999, Jeevan Vidya: Ek Parichaya, Jeevan Vidya Prakashan, Amarkantak

3. B.P.Banerjee, 2005, Foundations of Ethics and Management, Excel Books.

4. A.N.Tripathy, 2003, Human Values, New Age International Publishers.

5. E.G.Seebauer & Robert L.Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press

6. B.L.Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

7. M. Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics and Human Values, Eastern Economy Edition, Prentice Hall of India Ltd.

8. M.K.Gandhi,"TheStoryofmyExperimentswithTruth",DiscoveryPublisher

MOOC/NPTEL Courses:

1. Swayam Course on"Understanding Human Being Nature and Existence Comprehensively " by Dr. Kumar Sambhav, Director, UP Institute of Design (UPID), Noida.https://onlinecourses.swayam2.ac

2. NPTEL Course on "Exploring Human Values: Visions of Happiness and Perfect Society" by Prof. A. K.Sharma, Department of Humanities and Social Sciences, IIT Kanpur.

    https://nptel.ac.in/courses/

E-Resources:-

1. https://fdp-si.aicte-india.org/download.php#1/
2. https://madhyasth-darshan.info/postulations/knowledge/knowledge-of-humane-conduct/
3. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw

Savitribai Phule Pune University		
Second Year of Internet of Things (2024Course)		
CEP-241-IOT: Community Engagement Project		
Teaching/scheme	**Credits**	**Examination Scheme**
Practical:04Hours/Week	02	**TermWork:**25Marks **Oral/Presentation:**25Marks

 Prerequisite: Students should have prior knowledge of

1. Basic understanding of social and ethical responsibilities

2. Teamwork and communication skills acquired in prior course work or group activities

3. Familiarity with problem-solving methodologies and project planning

4. Conversation in local language

Companion Course:
- CEP is an experiential learning approach that combines education, learning, community development, and meaningful community service.
- Project involves students in community development and service activities and applies the experience to personal and academic development.
- The targeted contribution of college students to the village/local development will benefit the community.
- The college has an opportunity to help students become more socially conscious and responsible while simultaneously becoming a socially conscious organization.

Course Objectives:
- Establish a mutually beneficial relationship between the college and the community
- Opportunities to engage with their local community, fostering empathy, teamwork, and problem- solving skills while contributing positively to their surroundings.
- An understanding of the challenges faced by the local community and the role of engineering in addressing those challenges.
- The ability to apply technical knowledge and skills to design solutions or interventions that create a positive impact on the community.
- The skills to evaluate and critically analyze the outcomes of their engagement activities, deriving actionable insights for sustainable impact

Course Outcomes:

After successful completion of the course, students will be able to:

CO1: Identify and Analyze local community needs and challenges by engaging with stakeholders and evaluating real-world problems.

CO2: Design and Implement practical, creative, and context-specific solutions using engineering principles to address community issues.

CO3 : Reflect and Evaluate the effectiveness of their interventions and articulate lessons learned through reports and presentations.

Course Contents
Implementation

- A group of 3 to 4 students could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay/college premise.

- Each group/practical batch is allotted to a faculty member of the department as a mentor.

- A division of 60 students can have 3 batches of minimum 20 students. Practical load of 4 hours to be allocated to each batch.

- The group of students will be associated with a government official / village authorities / NGOs etc. concerned, allotted by the district administration, during the duration of the project.

- The Community Engagement Project should be different from the regular programs of NSS/NCC/Gr Club/Hobby Clubs, Special Interests Groups etc

- An activity book has to be maintained by each of the students to record the activities undertaken/involved and will be countersigned by the concerned mentor / HoD.

- Project report shall be submitted by each student / group of students.

- An internal evaluation shall also be conducted by a committee constituted by the HoD. Evaluation to be done based on the active participation of the student and marks could be awarded by the mentor / HoD.

- Students groups can conduct an awareness program on Health and Hygiene or in Organic Farming or in Fisheries or in advocating prohibition of liquor or about renewable energy, e-waste management or any other activity in an area of their studies and as per his / her aptitude.

- Oral Examination shall consist of presentation and demonstration of the project work carried out by the project groups.
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Suggestive list of topics under Community Engagement Project

The below lists are not exhaustive and open for HoD's or mentors to add, delete or modify. It is expected that the focus should be on specific local issues in their nearby areas.

The students are expected to carry out these projects with involvement, commitment, responsibility and accountability. The mentors of a student/group of students shall

1. Use/miss-use of cell phones
2. Career orientation of youth
3. Water facilities and drinking water availability
4. Health and hygiene of the school going students, homemakers and old personals
5. Health intervention and awareness programs
6. Horticulture
7. Herbal and Nutrition
8. Traditional and Modern healthcare methods
9. Food habits
10. Air/Sound/Water pollution
11. Plantation and Soil protection
12. Renewable energy and Solar Systems
13. Yoga awareness and practice
14. Healthcare awareness programs and their impact
15. Organic farming, IoT implementations
16. Food adulteration
17. Incidence of Diabetes and other chronic diseases
18. Blood groups and blood levels
19. Chemicals in daily life
20. Music and dance
21. Women education and empowerment

Project Scope

- Conduct workshops or awareness drives on topics like digital literacy, environmental sustainability, mental health, or career planning for local stakeholders.
- Develop a simple prototype or solution that addresses a real-world problem (e.g., a water-saving device, simple mobile apps, or tools for community use).
- Organize clean-up drives, tree plantations, recycling campaigns, or energy conservation initiatives.

- Promote health through awareness programs on hygiene, nutrition, and exercise.
- Teach basic computer or technical skills to students, staff, or the community

Proposal Submission
CEP Group should Submit a two-page project proposal, preferably prior to the term commencement outlining the following:-   • Title of the project   • Aim, Objective and expected outcome   • Plan of execution (timeline and activities).   • Place of the CEP and involvement of any local authority, NGP   • Required resources (if any).   • Get approval from the designated faculty mentor.

Learning Resources

Textbooks:

1. Waterman, A. Service-Learning : A Guide to Planning, Implementing, and Assessing Student Projects. Routledge, 1997.
2. Beckman, M., and Long, J.F. Community-Based Research : Teaching for Community Impact. Stylus Publishing, 2016.
3. Design Thinking for Social Innovation. IDEO Press, 2015.
4. Dostilio, L.D., et al. The Community Engagement Professional's Guide book : A Companion to The Community Engagement Professional in Higher Education. Stylus Publishing, 2017

MOOC/NPTEL/YouTube Links:

1. NPTELcourse:EcologyandSociety,https://onlinecourses.nptel.ac.in/noc20_hs77/preview

Web Links:-

1. UNESCO : Education for Sustainable Development https://www.unesco.org
2. EPICS (Engineering Projects in Community Service) https://engineering.purdue.edu/EPICS
3. Ashoka : Innovators for the Public https://www.ashoka.org Design for Change - https://www.dfcworld.com

Savitribai Phule Pune University, Pune

Maharashtra, India

SE - Department of Internet of Things

2024 Pattern

Semester IV

With effect from Academic Year 2025–26

<table>
<tr><td colspan="3" align="center">Savitribai Phule Pune University
Second Year of Internet of Things (2024 Course)</td></tr>
<tr><td colspan="3" align="center">**PCC-251-IOT: Communication & Networking Technologies**</td></tr>
<tr><td align="center">**Teaching/scheme**</td><td align="center">**Credits**</td><td align="center">**Examination Scheme**</td></tr>
<tr><td>**Theory:** 03Hours/Week</td><td align="center">02</td><td>**CCE**: 30 Marks
End-Semester: 70 Marks</td></tr>
</table>

Prerequisite Courses if any: Basic knowledge of communication engineering

Companion Course, if any: Laboratory Practical

Course Objectives:

The objective of this course is to provide students with
1. To understand the functioning of data communication and computer network.
2. To provide an in-depth understanding of the OSI reference model.
3. To provide an in-depth understanding of the TCP/IP reference model.
4. To develop practical skills in designing and implementing different types of networks using IP Addressing.
5. To emphasize the importance of computer network security aspects.

Course Outcomes:

After successful completion of the course, students will be able to:

CO1. To understand the fundamentals of data communication and networking.

CO2. To understand & analyze OSI Reference Model.

CO3. To understand & analyze TCP/IP network communication model.

CO4. To design & implement of small computer network by configuring IP addresses.

CO5. To understand the concepts of Cryptography

<table>
<tr><td colspan="3" align="center">**Course Contents**</td></tr>
<tr><td align="center">**Unit I**</td><td align="center">**Information Theory & Analog communication**</td><td align="center">**(09 Hours)**</td></tr>
<tr><td colspan="3">Concept of amount of information, information units Entropy: marginal, conditional, joint and relative entropies, relation among entropies Mutual information, information rate, channel capacity. Analog communication –Types of Modulation –A M – F M – Phase Modulation–Pulse Modulation–PAM– PWM–PPM–PCM. Basic concept of radio wave propagation</td></tr>
<tr><td>**Examplar**</td><td colspan="2">5G Communication, Satellite Communication, Cell Phone Base Station</td></tr>
<tr><td colspan="3">**Mapping of Course Outcomes for Unit I: CO1**</td></tr>
<tr><td align="center">**Unit II**</td><td align="center">**Digital & Data communication**</td><td align="center">**(09 Hours)**</td></tr>
<tr><td colspan="3">**Concepts of Sampling theorem** – Nyquist rate–Digital Modulation Schemes–ASK–FSK– PSK–Radio signal transmission – Multiple access techniques –Cellular Wireless Networks.</td></tr>
</table>

Process of data communication and its components: Transmitter, Receiver, Medium, Message. **Protocols, Standards**, Standard organizations. Bandwidth, Data Transmission Rate, Baud Rate and Bits per second. **Modes of Communication** (Simplex, Half duplex, Full Duplex). Signal & its properties		
Examplar	**Instant Messaging and social media, File Sharing,**	

Mapping of Course Outcomes for Unit II: CO2

Unit III	Networking & Models	(09 Hours)
Networks–OSI Reference Model: Layered Architecture, (Functions and features of each Layer) Peer-to-Peer Processes- Interfaces between Layer, Protocols. TCP/IP Model. **Types of Networks**: Local area networks (LAN), Metropolitan area networks (MAN), Wide area networks (WAN), Network Topologies, Types of Transmission Media: Guided Media, Unguided Media, Network Devices: Bridge, Switch, Router, Gateway, Access Point		
Examplar	**Internet & Web services, Telecommunication networks, health care**	

Mapping of Course Outcomes for Unit III: CO3

Unit IV	IP addressing & Common Network standard	(09 Hours)
Introduction: Functions of Network layer. Switching Techniques: Circuit switching, Message Switching, Packet Switching. IP Protocol: IPv4 , IPv6 **Addressing mechanism in the Internet IP Addressing** - IP Address classes, IP addressing, Subnetting, super netting, Masking. IPv4 addressing. IPv6 addressing – representation, address space allocation, Auto configuration **Network layer Protocols**: ARP, RARP, ICMP, and IGMP. Network Routing and Algorithms: Static Routing, Dynamic Routing, Distance Vector Routing, Link State Routing, Path Vector. Routing Protocols: RIP, OSPF, BGP, and MPLS. 802.11 & variants-Bluetooth & variants-802.15.4 & variants-Other Standards -NFC -LORA -DSRC,		
Exemplar	**Internet, Cybersecurity, web development, Telecommunications**	

Mapping of Course Outcomes for Unit IV: CO4

Unit V	Network Security	(09 Hours)
Foundations Computer Security: Definition and need of computer security, Security Basics: Confidentiality, Integrity, Availability, Accountability, Non- Repudiation and Reliability. Threat to **Security:** Viruses, Phases of Viruses, Types of Viruses, Dealing with Viruses, Worms, Trojan Horse, Intruders, Insiders. **Type of Attacks**: Active and Passive attacks, Denial of Service, DDOS, Backdoors and Trapdoors, Sniffing, Spoofing, Man in the Middle, Replay, and Encryption attacks. TCP/IP Hacking. Information, Need and Importance of Information, Security, need of security, Basics principles of information security. Introduction of Cryptography: Plain Text, Cipher Text, Cryptography, Cryptanalysis, Cryptology, Encryption, Decryption.		
Exemplar	**protect computer networks from unauthorized access, misuse, theft, or damage to hardware, software, and electronic data.**	

Mapping of Course Outcomes for Unit V: CO5

Learning Resources

Textbooks:
1. Data communications and networking. -- Forouzan Behrouz A.-- Tata McGraw Hill, New Delhi,

2. Computer Networks-Tanenbaum Andrew S.—Publication--PHI Learning Pvt Ltd, Delhi

3. Data Communication and Networks -- Godbole Achyut -- Tata McGraw Hill, New Delhi

4. Cryptography & Network Security – Atul Khate, McGrawHill Education, New Delhi

Reference Books:

1. Internetworking with TCP/IP Principles, Protocols and Architectures- Comer Douglas E.- PHI Learning pvt Ltd, Delhi.

2. Cyber security –Dieter Gollman - Wiley Publications, New Delhi.

e-Books:

1.https://www.tutorialspoint.com//computer_security/computer_security_quick_guide.html

MOOC / NPTEL/YouTube Links:

1. www.nptelvideos.in/2012/11/data-communication.html.

2. http://www.myreadingroom.co.in/notes-and-studymaterial/68-dcn/750- analog-to- analog-conversion-techniques.html.

3. http://nptel.ac.in/courses/106105162/

[#Exemplar: These are the practical applications based on the contents of the particular unit and for information only. *Comprehensive Continuous Evaluation]

Savitribai Phule Pune University
Savitribai Phule Pune University **Second Year of Internet of Things (2024 Course)**
PCC-252-IOT: Introduction to IoT

Teaching/scheme	Credits	Examination Scheme
Theory: 03Hours/Week	03	**CCE**: 30 Marks **End-Semester:** 70 Marks

Prerequisite Courses, if any:

Microcontrollers, Embedded System, Embedded C programming

Companion Course, if any: Laboratory Practical

Course Objectives:

1. To introduce the fundamentals in M2M along with the basic concepts of an IoT..
2. To give Insights into the Architecture and Sensors and Actuators for an IoT.
3. To Exposing students to the usage of Protocol Standardization for IoT with IoT Edge and
   Gateway Network with Communication protocols.
4. To develop design skills for Security and Privacy in IoT.
5. To provide IoT Solutions with sensor-based application through embedded system
   platform.

Course Outcomes:

After successful completion of the course, students will be able to:

CO1. Explain the various concepts, terminologies, and architecture of IoT systems.

CO2. Understand the working of microprocessor & Microcontroller.

CO3. Explore and apply various protocols for the design of IoT systems.

CO4. Gain knowledge of IoT Security and Privacy methods.

CO5. Develop Application based case study in IOT.

Course Contents		
Unit I	**Introduction to IoT**	**(09 Hours)**
Introduction, Definitions, Characteristics of IoT, History of IoT, Trends in Adaptation of IoT, Difference between IoT Devices and Computers. Physical Design of IoT, Logical Design of IoT, IoT frameworks, IOT Enabling Technologies, (Wireless Sensor Network, Cloud Computing, Big Data Analysis), IoT and M2M		
#Exemplar	Introduce IOT in live applications like home appliances ,internet	
Mapping of Course Outcomes for Unit I: CO1		
Unit II	**IOT Design Methodology and Platform**	**(09 Hours)**
IoT Design Methodology Steps and IoT System Design Cycle. , Basics of IoT Networking, Networking components of IoT, IoT communication Models, IoT Communication APIs Hardware Platforms – Introduction to Arduino & Basic Programming, Introduction to Raspberry Pi & Basic Programming Interfacing basics (SPI,I2C,UART,USRT,CAN).		

#Exemplar	Applications of IOT in automation and measurement industry

Mapping of Course Outcomes for Unit II: CO2

Unit III	IOT Protocols	(09 Hours)

Non IP Based Protocols: IEEE 802.11, Bluetooth, ZigBee IP Based Protocols: IPV4, IPv6, 6LowPAN, Application Based Protocols: AMPQ, MQTT. Authorization and Access Control in IOT

#Exemplar	Software product development, Web app development.

Mapping of Course Outcomes for Unit III: CO3

Unit IV	IoT Security and Privacy	(09 Hours)

Introduction, Vulnerabilities of IOT, Security requirements, Challenges and threats to IoT security, Encryption and authentication techniques, Privacy concerns and regulations, best practices for securing IoT devices, Security Model for IOT

#Exemplar	Cyber security

Mapping of Course Outcomes for Unit IV: CO4

Unit V	Domain-Specific Smart Systems: Case Studies	(09 Hours)

Designing IoT Applications: Requirement Analysis and Architecture, Development of a sample IoT application, Integration with Cloud Services and APIs. System integration and real-world challenges.

Case studies: Smart agriculture, Smart health, Smart cities, Smart transportation, Industrial IoT.

#Exemplar	Industrial, home, health and agricultural applications.

Mapping of Course Outcomes for Unit V: CO5

Learning Resources

Textbooks:
1. Ovidiu Vermesan, Peter Fresiss, "Internet of Things" From research and innovation to Market Deployment", River Publishers series in Communication, USA.
2. Olivier Hersent, David Boswarthick, and Omar Elloumi, "The Internet of Things: Key Applications and Protocols", 2nd Edition, Wiley Publications.

Reference Books:
1. Olivier Hersent, David Boswarthick, and Omar Elloumi, "The Internet of Things: Key Applications and Protocols", WileyPublications
2. Internet of Things, Arsheep Bahga and Vijay Madisetti.

e-Books:
1. Hakima Chaouchi, "The Internet of Things Connecting Objects to the Web" ISBN: 978-1-84821-140-7, Wiley Publications
2. Daniel Minoli, "Building the Internet of Things with Ipv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications

MOOC / NPTEL/YouTube Links:
1.   Arduino Project Hub; TinyML Projects with Arduino; Arduino.cc;
https://create.arduino.cc/projecthub; Accessed: May 12, 2025
2. Coursera
3. Udemy

[#Exemplar: These are the practical applications based on the contents of the particular unit and for information only. *Comprehensive Continuous Evaluation]

Savitribai Phule Pune University
Second Year of Internet of Things (2024 Course)

PCC-253-IOT: Computer architecture and Microcontroller

Teaching/scheme	Credits	Examination Scheme
Theory: 03Hours/Week	03	**CCE**: 30 Marks **End-Semester:** 70 Marks

Prerequisite Courses, if any:

Analog and Digital electronic circuits

Companion Course, if any: Laboratory Practical

Course Objectives:

1. Understand the fundamental components and organization of computer systems.
2. Analyze the design and performance of computer architectures.
3. Understand architecture and features of 8051.
4. Interfacing of real-world peripheral devices with microcontroller
5. Design microcontroller-based systems.

Course Outcomes:

After successful completion of the course, students will be able to:

CO1. Understand the fundamental components, organization, and design principles of computer architecture

CO2. Understanding the trade-offs between instruction-level parallelism, pipelining, and other architectural features that impact performance and efficiency

CO3. Understand the fundamentals of microcontroller and programming

CO4. Describe the programming details with peripheral support

CO5. Develop interfacing I/O models according to applications

Course Contents		
Unit I	**Introduction to computer architecture**	**(09 Hours)**

Basic Functional units of Computers: Functional units, basic Operational concepts, Bus structures. Software, Performance, Multiprocessors, Multicomputer.
Data Representation: Signed number representation, fixed and floating-point Representations.
Computer Arithmetic: Addition and subtraction, multiplication Algorithms, Division Algorithms. Error detection and correction codes

#Exemplar	Digital electronics, Micro computer

Mapping of Course Outcomes for Unit I: CO1

Unit II	**Instruction set architecture**	**(09 Hours)**

Functional Concepts: Register transfers, Perform Arithmetic and logical operations, Fetching Word from memory, soring word in memory, Arithmetic logic shift unit. Multiple Bus organizations, Hard wired Controls, micro program controls etc **The Memory System**: Memory Hierarchy, Internal organization of memory chips, Cache memory, Performance Considerations, Virtual Memories

#Exemplar	Processor design

Mapping of Course Outcomes for Unit II: CO2

Unit III	**Introduction to 8051 Microcontroller Architecture**	**(08 Hours)**
Introduction and Evolution of 8-bit Microcontroller, Comparison between Microprocessors and Microcontrollers, CISC and RISC Architecture, Van Neumann and Harvard Architectures, Limitations of 8 -bit microcontrollers **8051 Architecture**: Feature, Block diagram of 8051 and explanation, Registers, Program Status Word (PSW), SFRS, Internal Memory organization, Timers and its modes, Interrupt Structure, Serial Communication, Sample programs of data transfer, Delay using Timer (0 &1) and interrupt. All Programs in embedded C.		
#Exemplar	Embedded Applications	

Mapping of Course Outcomes for Unit III: CO3

Unit IV	**Parallel Port Interfacing and Programming -I**	**(09 Hours)**
Pin diagram, Port Structure. Addressing modes, Overview of Instruction set, IO Interfacing Requirements, Bit operation programs, programs of Data transmission and reception using Serial port. Interfacing of LED, Keys, 7 segment display and LCD, all programs in embedded C		
#Exemplar	Embedded Systems, Automotive Systems, IoT Devices, Home Automation	

Mapping of Course Outcomes for Unit IV: CO4

Unit V	**Parallel Port Interfacing and Programming -II**	**(08 Hours)**
Interfacing of DAC 0808, Sensor interfacing using ADC 0809, Stepper motor, Relay, Buzze Design of Data acquisition System (DAS): All programs in C language Communication protocol: Study of RS232, RS 485, I2C, SPI protocols.		
#Exemplar	Industrial Control Systems, Embedded Systems, Automotive Systems, Home Automation	

Mapping of Course Outcomes for Unit V: CO5

Learning Resources

Textbooks: 1: C. Hamacher, V. Zvonko, S. Zaky, "Computer Organization", McGraw Hill, 2002, 5th edition. 2: Mahumad Ali Mazadi, Janice Gillispie Mazadi, Rolin D McKinlay ―The 8051 Microcontroller & Embedded Systems (Using Assembly and C) ‖ 2nd Edition, PHI

Reference Books: 1. J. Hays, "Computer Architecture and Organization", 2nd Edition, McGraw-Hill, 1988 ISBN 0 – 07 – 100479 – 3 2. 2. Stallings William, "Computer Organization and Architecture: Principles of structure and function", 2nd Ed, Maxwell Macmillan Editions, 1990 ISBN 0 – 02 –946297 – 5

3. Kenneth J. Ayala, 'The 8051 Microcontroller Architecture, Programming and Applicationns', Cengage Learning. Second edition
4. Ajay Deshmukh, 'Microcontrollers Theory and Applications', TATA McGraw Hill.

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e-Books:
2. David A. Patterson and John L. Hennessy – A comprehensive guide to computer organization and
    design, covering the fundamentals of computer architecture
3. Muhammad Ali Mazidi. Janice Gillispie Mazidi. Rolin D "The 8051 Microcontroller and Embedded.
    Systems. Using Assembly and C. Second Edition.

MOOC / NPTEL/YouTube Links:
1. https://onlinecourses.nptel.ac.in/
2. Coursera: https://www.coursera.org/courses?query=microcontroller
3. Udemy: https://www.udemy.com/course/complete-8051-microcontroller-programming-course-
     at89s52/
4. https://www.udemy.com/course/8051-microcontroller-embedded-c-and-assembly-language/

[#Exemplar: These are the practical applications based on the contents of the particular unit and for information only. *Comprehensive Continuous Evaluation]

Savitribai Phule Pune University
Second Year of Internet of Things (2024 Course)

PCC-254-IOT: Communication & Networking Technologies Lab

Teaching/scheme	**Credits**	**Examination Scheme**
Practical: 02Hours/Week	01	**Term Work**: 25 Marks **Practical:** 25 Marks

Guidelines for Student's Lab Journal
The students Lab Journal should contain the following contains related to every experiment as applicable.
Title of the experiment
Objective
Apparatus with their detailed specifications. (Hardware / Software)
Brief theory related to the experiment.
Connection diagram /Circuit diagram / Block diagram / Flowchart.
Observation table
Sample calculations / Software Program
Results and Waveforms
Conclusions.

	Guidelines for Laboratory/ TW Assessment
1.	Continuous assessment of laboratory work is to be done based on overall performance and Laboratory performance of the student.
2.	Each Laboratory assignment assessment should assign grade/marks based on parameters with appropriate weightage.
3.	Suggested parameters for overall assessment as well as each Laboratory assignment include timely completion, performance, efficiency, punctuality, and neatness.

Suggested List of Laboratory Experiments (Any 10)
Group A: Hardware Practical's (Any 6)

1.	Setup a wired LAN using Layer 2 Switch. It includes preparation of cable, testing of cable using line tester, configuration machine using IP addresses, testing using PING utility.
2.	Implementation of LAN using suitable multiuser Windows operating System and demonstrating client-server and peer to peer mode of configuration
3.	2. Simulating various Networks (LAN, WAN) using relevant network devices on Simulator a) Ping b) ipconfig / ifconfig c) Host name d) Whois e) Netstat f) Route g) Tracert/Traceroute/ Tracepath h) NSlookup i) ARP j) Finger k) Port Scan / nmap
4.	Observe and note the details of the live type of traffic (ARP, Frame analysis, Ethernet) from interface using packet capture and analysis tool
5.	Using a Network Simulator (e.g., packet tracer) Configure router using RIP

6.	Write a program to demonstrate Sub-netting and find subnet masks.
7.	Write a program to implement link state /Distance vector routing protocol to find suitable path for transmission.
8.	Use packet Tracer tool for configuration of 3 router network using one of the following protocol RIP/OSPF/BGP
Group B: Software Practical's (Any 3)	
9.	Observe and note the working of protocols using PING / TRACEROUTE / PATHPING and capture packets in LAN using packet capture and analysis tool.
10.	Configure servers like HTTP / FTP and understand packet sequence and data flowing between client-server using packet analysis tools.
11.	Executing Proxy, web Server using simulator.
12.	Executing Telnet, DHCP Server using simulator.
Group C: Experiential Learning (Any 1)	
13.	Design and implement for the insecurity of default passwords, printed passwords and password transmitted in plain text.
14.	Write a program for Encryption and Decryption.

Savitribai Phule Pune University
Second Year of Electronics and Telecommunication/EC Engineering (2024 Course)

MDM-271-IOT: Object Oriented Programming		
Teaching Scheme	**Credits**	**Examination Scheme**
Theory : 03 Hours/Week	02	**CCE :** 30 Marks **End-Semester:** 70 Marks

Prerequisite Courses: Basic Object-Oriented Programming concept using C++

Course Objectives:

1. To understand the fundamentals of object-oriented programming using C++.
2. To develop Java programs using classes, objects, inheritance, polymorphism, and exception handling.
3. To work with built-in Java libraries, packages and multithreading.
4. To foster problem-solving and logical thinking through real-world examples and programming practices

Course Outcomes:

On completion of the course, learner will be able to:

CO1**:**   Explain concepts of Object-Oriented Programming using C++.

CO2:   Implement classes, objects, constructors, and destructor concepts in JAVA to build modular programs.

CO3:   Analyze and design JAVA codes using abstract classes, inheritance and polymorphism.

CO4:   Evaluate the concept of interfaces & packages

CO5:   Design and implement JAVA based mini project

Course Contents		
Unit I	**Introduction to OOP Concepts**	**(09 Hours)**
Introduction to procedural programming, Limitations of procedural programming, Need of object- oriented programming, Fundamentals of object-oriented programming :Class, Object, Encapsulation, Abstraction, Inheritance, Polymorphism, **Basics of C++ programming**, Functions, Inline functions, Default arguments, Reference variables, Dynamic initialization of variables, memory management operators, Member dereferencing operators, operator precedence, typecast operators, Scope resolution operators. Creating Classes and Objects, Access Specifiers		
Mapping of Course Outcomes for Unit I : CO1		
Unit II	**Introduction to Core Java**	**(09 Hours)**
Evolution of Java, Features of Java, Java Virtual Machine (JVM), Java Runtime Environment (JRE), Java Development Kit (JDK), Structure of a Java Program, Compilation and Execution Process. Java Syntax: Data Types, Variables, Operators, Control Statements and Loops. Creating Classes and Objects using		

JAVA. Constructors, method overloading, Static members and Methods, this pointer, Garbage collection, finalize methods, final variables and methods, final class

Mapping of Course Outcomes for Unit II :CO2

Unit III	Inheritance and Polymorphism	(09 Hours)

Types of Inheritance in Java (Single, Multilevel, Hierarchical), Method Overriding, Dynamic Method Dispatch, Use of super and final keywords, Abstract Methods and classes, One dimensional and two-dimensional arrays, wrapper classes.

Mapping of Course Outcomes for Unit III :CO3

Unit IV	Interfaces and Packages	(09 Hours)

Interfaces: Introduction to Interfaces, Multiple Inheritance using Interfaces, Using static method in interface , Functional Interfaces and Lambda Expressions.

Packages: Java API Packages, Using System Packages, Creating accessing and using a package, Importing packages, Adding a class to a Package, Hiding classes.

Mapping of Course Outcomes for Unit IV : CO4

Unit V	Multithreading and Exception Handling	(09 Hours)

Introduction to multithreading: Introduction, Creating thread and extending thread class.

Concept of Exception handling: Introduction, Types of errors, Exception handling syntax, Multiple catch statements, Creating Custom Exceptions.

Mini Project: Real world application using JAVA

Mapping of Course Outcomes for Unit V :CO5

Learning Resources

Textbooks:
1. E Balagurusamy, "Programming with C++", Tata McGraw Hill, 3rd Edition.
2. E Balagurusamy, Programming with JAVA , Tata McGraw Hill, 6th Edition
3. Herbert Schildt, Java: The complete reference, Tata McGraw Hill, 7th Edition

Reference Books:

1. T. Budd, Understanding OOP with Java, Pearson Education

2. Y. Daniel Liang (2010), Introduction to Java programming, 7th edition, Pearson education, In

3. Cay Horstmann, Core Java Volume 1, Kindle, 11 edition

4. M.T. Savaliya, Advanced Java Technology, Dreamtec

MOOC / NPTEL Courses:

1. NPTEL Course "Programming in C++"https://nptel.ac.in/courses/106/105/106105151/

2. NPTEL Course " Programming in Java"https://nptel.ac.in/courses/106/105/106105191/

<table>
<tr><td colspan="3" align="center">Savitribai Phule Pune University
Second Year of Internet of Things (2024 Course)</td></tr>
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Savitribai Phule Pune University Second Year of Internet of Things (2024 Course)		
MDM-272-IOT: Microcontroller and Object-Oriented Lab		
Teaching/scheme	**Credits**	**Examination Scheme**
Practical: 02 Hours/Week	01	**Term Work**: 25Marks **Oral:** 25Marks

Course Objectives:
1. To offer practical experience with the, basic operations of microcontroller.
2. To offer practical experience with the different addressing modes and instructions of microcontroller
3. Introduce the principles of Object-Oriented Programming (OOP) such as classes, objects, inheritance, encapsulation and abstraction.
4. Explore exception handling, multithreading, file I/O, and GUI development

Course Outcomes:

After successful completion of the course, students will be able to:

CO1: Generate and perform operations of microcontroller

CO2: Learn assembly and embedded C programming language

CO3: Learn how to interface microcontroller with external devices.

CO4: Create Java programs using classes, objects, and methods to model real-world scenarios

CO5: Apply inheritance, polymorphism, encapsulation, and abstraction in CPP and Java programs

Guidelines for Student's Lab Journal
The students Lab Journal should contain following related to every experiment –
● Title of the experiment ● Objective ● Computer detailed specifications. ● Brief theory related to the experiment. ● Program with its output print and Conclusions.
Guidelines for Laboratory/ TW Assessment
• Continuous assessment of laboratory work is to be done based on overall performance and Laboratory performance of student. • Each Laboratory assignment assessment should assign grade/marks based on parameters with appropriate weightage. • Suggested parameters for overall assessment as well as each Laboratory assignment include • Timely completion, performance, efficiency, punctuality, and neatness.
Suggested List of Laboratory Experiments

	Group A: Microcontroller (any 6)	
	Note: All programs in embedded C for 8051	
1.	Bit Operation Programs on 8051	
2.	Simple programs on Memory transfer.	
3.	Parallel port interacting of LEDS—Different programs (flashing, Counter, BCD, HEX, etc)	
4.	Key Controlled Programs (Flashing of LED)	
5.	Interfacing of Multiplexed 7-segment display (counting application)	
6.	LCD Interfacing for Display of String	
7.	DAC Interfacing for generation of Waveforms	
8	Stepper Motor Interfacing	
9	Interfacing of Relay / Buzzer	

********(Any programming platform can be used) **********

	Group B Object oriented programming (Any 6 & mini project compulsory)	
1.	Class and Objects: i) Write a program in C++ to perform following operations on complex numbers Add, Subtract, Multiply, Divide, Complex conjugate. Design the class for complex number representation and the operations to be performed	
2.	Java Basics: Write a program in Java to find all the roots of a quadratic equation.	
3.	Methods: Write a program in Java using methods i) To find factorial of a given number. ii) To display first 50 prime numbers. iii) To find sum and average of N numbers.	
4.	Constructor: Create a Bank Account class with deposit, withdraw, and balance check functionalities...	
5.	Arrays & Strings: Write a program in Java to sort i) List of Integers ii) List of Names	
6.	2 dimensional Arrays: Write a Program in Java to add two matrices...	
7.	Inheritance: Create a base class Employee and derived classes Manager, Developer with	

	overridden salary computation
8.	Abstract Class:
	Demonstrate an example where both abstract class and interface are used in a payment gateway context..
9.	Threads:
	Write a program to create multiple threads and demonstrate how two threads communicate with each other
10.	Compulsory: Mini Project (Group of 3)

e-Books:

https://www.nrigroupindia.com/ebook/Introduction%20to%20Machine%20Learning%20with%20P

ython%20(%20PDFDrive.com%20)-min.pdf

MOOC / NPTEL/YouTube Links:
   https://nptel.ac.in/courses/106102220

Savitribai Phule Pune University
Second Year of Internet of Things (2024 Course)

VSE-281-IOT: IoT Skill enhancement Lab		
Teaching/scheme	**Credits**	**Examination Scheme**
Practical: 02Hours/Week	01	**Term Work**: 25 Marks **Practical:** 25 Marks

Guidelines for Student's Lab Journal
The students Lab Journal should contain the following contains related to every experiment as applicable.
Title of the experiment
Objective
Apparatus with their detailed specifications. (Hardware / Software)
Brief theory related to the experiment.
Timing diagram
Observation table
Results and Waveforms
Conclusions.
Guidelines for Laboratory/ TW Assessment

1. Continuous assessment of laboratory work is to be done based on overall performance and Laboratory performance of the student.

2. Each Laboratory assignment assessment should assign grade/marks based on parameters with

appropriate weightage.

3. Suggested parameters for overall assessment as well as each Laboratory assignment include timely completion, performance, efficiency, punctuality, and neatness.

Suggested List of Laboratory Experiments (Any 12)	
Group A: Embedded Programming & Interfacing (Any 5)	
1.	Toggling of LEDs & Timer based LED Toggle.
2.	Controlling LEDs blinking pattern through UART & Transmitting a string through UART
3.	On-chip Temperature measurement through ADC
4.	Study of all types of sensor interfacing with microcontroller
5.	Reading Temperature and Relative Humidity value from the sensor
6.	Generation of alarm through Buzzer.
7.	Reading of atmospheric pressure value from pressure sensor

Group B: IoT (Any 7)	
8.	Study & Survey of various development boards for IoT.
9.	Study & Survey of various IoT platforms.
10.	Interfacing sensors and actuators with Arduino Uno
11.	Build a cloud-ready temperature sensor with the Arduino Uno and any IoT Platform.
12	Interfacing Sensors and actuators with Arduino Uno
13	IoT based Stepper Motor Control with Raspberry Pi.
14	IoT based Web Controlled Home Automation using Arduino Uno
15	A Simple IoT Project with the ESP8266 Wi-Fi module
16	Implement a RFID Based IoT Project

Savitribai Phule Pune University Second Year of Internet of Things (2024 Course)		
AEC-282-IOT: Modern Indian Languages (Marathi)		
Teaching/scheme	**Credits**	**Examination Scheme**
Tutorial: 01Hours/Week **Practical:** 02 Hours/Week	02	**Term Work**: 25 Marks

Course Objectives:

अभ्यासक्रमाची उद्दिष्टे :

१. प्रगत भाषिक कौशल्यांची क्षमता विकसित करणे.
२. प्रसारमाध्यमांतील संज्ञापनातील स्वरूप आणि स्थान स्पष्ट करणे.
३. व्यक्तिमत्त्व विकास आणि भाषा यांच्यातील सहसंबंध स्पष्ट करणे.
४. लोकशाहीतील जीवनव्यवहार आणि प्रसारमाध्यमे यांचे परस्पर संबंध स्पष्ट करणे.
५. प्रसारमाध्यमांसाठी लेखनक्षमता विकसित करणे.

UNIT I & UNIT II	
घटक	**तपशील**
१	१. भाषा आणि व्यक्तिमत्त्व विकास : सहसंबंध २. लोकशाहीतील जीवनव्यवहार आणि प्रसारमाध्यमे
२	प्रसारमाध्यमांसाठी लेखन १ वृत्तपत्रासाठी बातमीलेखन आणि मुद्रितशोधन २ नभोवाणीसाठी भाषणाची संहितालेखन ३ दूरचित्रवाणीसाठी माहितीपटासाठी संहितालेखन

UNIT III & UNIT IV	
१	१. भाषा, जीवन व्यवहार आणि नवमाध्यमे, समाजमाध्यमे २. नवमाध्यमे आणि समाजमाध्यमांचे प्रकार : ब्लॉग, फेसबुक, ट्विटर. ३. नवमाध्यमे आणि समाजमाध्यमांविषयक साक्षरता, दक्षता, वापर आणि परिणाम
२	१. वेबसाईट आणि ब्लॉग, ट्विटरसाठी लेखन २. व्यावसायिक पत्रव्यवहार

संदर्भ ग्रंथ :

१   सायबर संस्कृती, डॉ. रमेश वरखेडे
२   उपयोजित मराठी, संपादक डॉ. केतकी मोडक, संतोष शेणई, सुजाता शेणई
३   ओळख माहिती तंत्रज्ञानाची, टिमोथी जे. ओ लिअरी
४   संगणक, अच्युत गोडबोले, मौज प्रकाशन, मुंबई.
५   इंटरनेट, डॉ. प्रबोध चोबे, मनोरमा प्रकाशन, मुंबई.
६   व्यावहारिक मराठी, डॉ. ल. रा. नसिराबादकर, फडके प्रकाशन, कोल्हापूर.
७   आधुनिक माहिती तंत्रज्ञानाच्या विश्वात, शिक्रापूरकर दीपक, मराठे उज्ज्वल, उत्कर्ष प्रकाशन, पुणे.

Guidelines for Ability Enhancement Courses - Modern Indian Language (Marathi)
Term Work Evaluation

1. Subject teacher should frame minimum 08 assignments-based covering on all four units.

    शिक्षकाने चारही युनिट्सवर किमान ०८ असाइनमेंट-अभ्यासक्रमावर आधारित तयार करावेत.

2. They can identify students depending upon the degree of difficulty in understanding the language and frame the assignments accordingly.

    शिक्षक ,विद्यार्थ्यांना भाषा समजण्यात किती अडचण येते यावर अवलंबून आणि त्यानुसार असाइनमेंट तयार करू शकतात.

Suggested List of Assignments (Marathi):

1. Read a specific column (Sports, political, finance, editorial, education, international news etc) in the daily Marathi newspapers, summarize and present in the practical. A summary should be added as part of the journal.

   दैनिक मराठी वर्तमानपत्रांमध्ये विशिष्ट कॉलम (क्रीडा, राजकीय, वित्त, संपादकीय, शिक्षण, आंतरराष्ट्रीय बातम्या इ.) वाचा, सारांश द्या आणि व सादरीकरण करा. त्या संदर्भातला सगळा सारांश जर्नल मध्ये जमा करावा .

2. Write blogs and posts on social media up to 200 words on recent development in their field of study,

   सोशल मीडियावर त्यांच्या अभ्यासाच्या क्षेत्रातील अलीकडील विकासावर 200 शब्दांपर्यंत ब्लॉग लिहा,आणि पोस्ट करावा

3. Professional letter / report writing.
    a. Write letter to the principal for organizing NSS camp in nearby village. Preparation of the budget, permission letters and report submission in the University

जवळच्या गावात एनएसएस शिबिर आयोजित करण्यासाठी मुख्याध्यापकांना पत्र लिहा.

विद्यापीठात बजेट, परवानगी पत्रे आणि अहवाल सादर करणे.

    b. Write a letter for internship sponsorship to any organization.

कोणत्याही संस्थेला इंटर्नशिप प्रायोजकत्वासाठी पत्र लिहा.

4. Book Review – Students are expected to read any novel, fiction or literature book of their choice and write a review on post it on social media of their choice.

पुस्तक पुनरावलोकन - विद्यार्थ्यांनी त्यांच्या आवडीचे कोणतेही कादंबरी, काल्पनिक कथा किंवा साहित्य पुस्तक वाचावे आणि त्यावर पुनरावलोकन लिहून ते त्यांच्या आवडीच्या सोशल मीडियावर पोस्ट करावे अशी अपेक्षा आहे.

5. Participation in Competitions (in college/outside the college) debate, declamation, elocution – A Report should be submitted

स्पर्धांमध्ये (महाविद्यालयात/महाविद्यालयाबाहेर) सहभाग वादविवाद, भाषणे, वक्तृत्व - अहवाल सादर करावा.

6.   Group Activity: Road show, skit play, one-act play
        गट क्रियाकलाप: रोड शो, स्किट प्ले, एकांकिका

7.   Participation in Purushottam karandam, Firodia karandak, Dajikaka Gadgil Karandak and Shreetej Karandak.
        पुरुषोत्तम करंडम, फिरोदिया करंडक, दाजीकाका गाडगीळ करंडक आणि श्रीतेज करंडक या स्पर्धेमध्ये सहभाग नोंदवावा.

8.   Marathi film Review – Social Marathi movie available and write a review on post it on social media of their choice.

मराठी चित्रपट पुनरावलोकन - सामाजिक आशाय वर आधारित मराठी चित्रपट उपलब्ध आहे आणि त्या चित्रपटाची समीक्षा करून त्यावर सारांश लिहावा व तो वर्तमानपत्रे किंवा सोशल मीडियावर पोस्ट करावा पसंतीच्या सोशल मीडियावर पोस्ट करा.

<table>
<tr><td colspan="4" align="center">Savitribai Phule Pune University
Second Year of Electronics & Computer Engineering (2024 Course)</td></tr>
<tr><td colspan="4" align="center">**EEM-283-IOT : Entrepreneurship Skill Development**</td></tr>
<tr><td align="center">**Teaching Scheme**</td><td align="center">**Credits**</td><td colspan="2" align="center">**Examination Scheme**</td></tr>
<tr><td>**Tutorial :** 01 Hour/Week</td><td align="center">01</td><td colspan="2">**Term Work** : 25 Marks</td></tr>
<tr><td>**Practical :** 02 Hours/Week</td><td align="center">01</td><td colspan="2"></td></tr>
</table>

Course Objectives: The course aims to:

1. Introduce the fundamental principles of entrepreneurship, forms of business organizations, and the startup ecosystem.

2. Enable students to identify, evaluate, and select viable business opportunities using structured techniques.

3. Familiarize students with business models, financial planning, and market validation strategies.

4. Expose students to key marketing strategies, customer acquisition techniques, and branding essentials for startups

5. Develop students' entrepreneurial mindset and their ability to communicate and pitch business ideas effectively using structured storytelling techniques

Course Outcomes: Upon successful completion of this course, students will be able to:

-   CO1: Describe the role of entrepreneurship in economic growth and the startup ecosystem.

-   CO2: Apply creative techniques to viable business ideas based on customer needs.

-   CO3: Develop a basic business model using tools like the Business Model Canvas through market research.

-   CO4: Implement basic marketing strategies for startups.

-   CO5: Deliver a concise business pitch using storytelling and effective communication techniques.

<div align="center">Course Contents</div>

Complete the syllabus within 20 hrs. Discuss the issues and content in more details during practical hours batchwise.

Unit I - Introduction to Entrepreneurship

Entrepreneurship: Definition and evolution, Role of entrepreneurship in economic development
Role of entrepreneurship in economic development – Role in job creation, GDP, and innovation.
Characteristics of an Entrepreneur: Key traits: Risk-taking, innovation, pro-activeness, Leadership, perseverance, and resilience
Types of Entrepreneurships: Startup entrepreneurship, Social entrepreneurship, Intrapreneurship (corporate entrepreneurship), Lifestyle and small business entrepreneurship,

Forms of Business Organization – Sole proprietorship, partnership, private limited, public limited.
Entrepreneurial Mindset: Growth mindset and adaptability, Creativity and problem-solving, Opportunity recognition and initiative-taking

Overview of the Startup Ecosystem: Key stakeholders: Incubators, accelerators, angel investors, VCs, Government support schemes (Startup India, Atal Innovation Mission, etc.), Global vs. Indian startup ecosystems

Case Study:

1. Ritesh Agarwal – Founder of OYO Rooms (India)

2. Falguni Nayar – Founder of Nykaa (India)

3. Nandan Nilekani – Co-founder of Infosys & Architect of Aadhaar (India) etc.

Unit II -Idea Generation & Opportunity Recognition

Creativity Techniques for Idea Generation: Definition and importance of creativity in entrepreneurship. Brainstorming: Rules of effective brainstorming. Individual vs. group brainstorming. Mind Mapping: Visual idea structuring using central themes and branches. Tools (manual and digital) for mind mapping.

Understanding Customer Needs and Pain Points: Customer pain points and their identification, Problem-solution fit: Linking pain points to possible solutions. Observational techniques, user interviews, and empathy mapping.

Evaluating Opportunities: Difference between an "idea" and an "opportunity." Basic filters: Desirability, feasibility, and viability. Tools: SWOT Analysis, Opportunity Matrix, Industry trends, market gaps.

Feasibility Analysis Basics: Market Need Assessment: about the users, the problem complexity. Scalability Check: Geographically or vertically growth of the idea, Barriers to scaling. Introduction to the "Lean Canvas".

Case Study : Analyzing how "Dunzo" or "BigBasket" identified urban pain points and How "Zerodha" scaled in India with a digital-first approach

Unit III - Business Model Development

Introduction to Business Model Canvas: Definition and purpose of a business model, Overview of the Business Model Canvas by Osterwalder, Benefits of using BMC for startups.

Key Components of BMC: Value Proposition: Defining what unique value the product/service offers. Addressing customer pain points. Customer Segments: Identifying target customers. Creating customer personas Revenue Models: Direct sales, subscriptions, freemium, licensing, etc.

Basic Market Research for Validation: Importance of market research in early-stage business development. Designing effective surveys and customer feedback forms. Conducting basic interviews and analyzing responses. Introduction to MVP (Minimum Viable Product) and feedback loops.

Case study: Map the BMC for a well-known startup (e.g., Uber or Zomato).

Unit IV - Marketing Strategies & Customer Acquisition

Basics of Branding and Positioning: Introduction to Brand – Elements of brand identity: name, logo, voice, tone, and values. Positioning – How to create a unique space in the customer's mind. Position- ing maps, Value-based positioning vs. competitor-based positioning Startup Branding Challenges – Limited budget, building trust, clarity in messaging.

Costing & Pricing Strategies – Fixed vs. variable costs, break-even analysis.

Introduction to Digital Marketing: Distribution Channels: Traditional vs. digital distribution. Social Media Marketing: Platforms overview (Instagram, LinkedIn, Facebook, X/Twitter) Creating a content strategy and calendar Organic vs. paid reach

Search Engine Optimization (SEO): Basics of how search engines work, Keyword research and con- tent optimization, On-page vs. off-page SEO Importance of Digital Presence – Website essentials, blogs, and analytics tools.

Customer Acquisition Strategies: Understanding the Customer Journey – Awareness, interest, deci- sion, action. Early-Stage Customer Acquisition Tactics: Word-of-mouth & referrals, Influencer mar- keting (micro-influencers), Email marketing basics, building a landing page and collecting leads Retention vs. Acquisition – Importance of building long-term customer relationships.

Case Studies :
1. Zomato – Branding & Positioning in a Competitive Market
2. Mamaearth – Digital-First Customer Acquisition
3. Nykaa – Customer Segmentation and Channel Strategy

Unit V - Pitching & Business Communication

Crafting an Elevator Pitch: Definition and purpose, Key elements: Problem, solution, value proposi- tion, target audience, Delivery tips: Clarity, brevity, confidence

Storytelling & Communication: Importance of Storytelling in Business, Structure of a Business Story: Setup, Conflict, Resolution. Communication Skills: Verbal and Non-verbal

Overview of Funding Sources: Public & private capital sources, venture capital, debt financing. Boot- strapping: Meaning, benefits, and risks, Angel investors: Role, expectations, approach, Brief on incubators, government schemes, crowdfunding.

Case study:
1. Shark Tank India – Pitch Analysis (Any Season)
2. Airbnb – The Original Pitch Deck
3. Dropbox – Storytelling Through Demonstration
4. Dunzo – Investor Pitch Evolution

Learning Resources

Text Books:

1. Bygrave, W.D., Zacharakis, A., & Corbett, A.C. Entrepreneurship, 6th Edition, Wiley, 2025. ISBN: 9781394262809.

2. Drucker, Peter F. Innovation and Entrepreneurship: Practice and Principles, Reprint Edition, Harper Business, 2006. ISBN: 9780060851132.

3. Osterwalder, Alexander & Pigneur, Yves. Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers, 1st Edition, Wiley, 2010. ISBN: 9780470876411.

Reference Books:

1. Ries, Eric. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, 1st Edition, Crown Business, 2011. ISBN: 9780307887894.

2. Kawasaki, Guy. The Art of the Start 2.0: The Time-Tested, Battle-Hardened Guide for Anyone Starting Anything, Portfolio (Penguin Random House), 2015. ISBN: 9781591847847.

MOOC / NPTEL/YouTube Links: -

1. Entrepreneurship Essentials By Prof. Manoj Kumar Mondal IIT Kharagpur
https://onlinecourses.nptel.ac.in/noc20_ge08/preview

2. Entrepreneurship By Prof. C Bhaktavatsala Rao
IIT Madras https://onlinecourses.nptel.ac.in/noc21_mg70/preview

3. https://onlinecourses.nptel.ac.in/noc20_mg35

4. https://www.coursera.org/learn/entrepreneur-guide-beginners

5. https://wadhwanifoundation.org/

YouTube/Video Links

1. https://www.youtube.com/@wadhwani-foundation/videos

List of Assignments to be carried out during practical session

No	Title	Objective	Description
1	Entrepreneurial Mindset Reflection	To encourage students to explore their personal views on entrepreneurship and recognize the key characteristics of an entrepreneurial mindset by studying the journey of a real-world entrepreneur.	**Write a reflective essay** (500–600 words) based on the following: • Explain what entrepreneurship means to you personally. • Identify an entrepreneur (Indian or global) whom you admire and explain the reasons for your admiration. • Highlight specific mindset traits (e.g., risk-taking, resilience, innovation, adaptability) that contributed to this entrepreneur's success. • Reflect on how these traits align with your own strengths or indicate areas you wish to develop.

2	Idea Generation Challenge	To foster creativity, structured brainstorming, and the ability to identify potential business opportunities based on real-world problems.	**Generate 10 Business Ideas** Use any structured brainstorming technique Ideas can be tech-based, social impact, service-based, or product-based 2. Select One Idea- Choose the most promising idea from your list 3. Write a 1-page Concept Summary, include the following: • Problem Identified: Describe the specific problem or pain point your idea addresses. • Solution Overview: Briefly describe your business idea. • Target Audience: Identify the group of people or organizations that would benefit. • Market Potential: Discuss the viability and scalability of the idea.
3	Business Model & Customer Validation	To help students develop a clear, structured business model and test its assumptions through customer conversations. The goal is to learn how to validate ideas through real-world feedback and refine the business concept accordingly.	**Part A: Business Model Canvas** 1. Choose a business idea (from Assignment 2 or a new one). 2. Create a Business Model Canvas with all 9 key blocks: o Customer Segments o Value Propositions o Channels o Customer Relationships o Revenue Streams o Key Resources o Key Activities o Key Partnerships o Cost Structure 3. Present the BMC in visual or tabular format.

			Part B: Customer Interviews & Insights 1. Identify 2–3 potential customers from your target segment. 2. Conduct brief interviews (5–10 minutes each) to gather insights on: o Their pain points o Their reaction to your proposed solution o Willingness to pay or use your product/service 3. Summarize findings in a 1–1.5 page report that includes: o Key customer quotes or paraphrased insights o A revised Value Proposition or Customer Segment block (if needed) o A short reflection: key learnings and potential changes to your idea
4	Business Launch Plan – Marketing & Financial Snapshot	To develop a practical understanding of how marketing stratey and financial planning go hand-in-hand in launching a startup. Students will define a basic marketing campaign and align it with estimated costs, pricing, and projected revenue.	You are preparing to launch your business idea. Prepare a combined Marketing and Financial Snapshot including the following **Part A: Marketing Campaign Plan** • Define your target market by identifying primary customers. • Design a mini-campaign using one or more of the following channels: Social media (e.g., Instagram, LinkedIn) Print/digital flyers Email marketing • Describe the campaign content, including the message or offer to be promoted. • Optionally, create 1–2 sample marketing materials. • Write a 300-word explanation outlining your marketing strategy and expected impact.
			Part B: Financial Snapshot 1. Startup Costs – Estimate your initial costs (fixed + variable) 2. Pricing Strategy – State your pricing model and justification 3. Break-even Analysis – Basic cost vs. sales estimate 4. 6-Month Revenue Projection – Expected sales and income 5. Format: Use a simple table or spreadsheet (optional)

5	Elevator Pitch Video	To help students develop confidence and clarity in presenting their business idea in a short, compelling format. The exercise simulates real-world investor or networking scenarios where entrepreneurs must grab attention quickly.	**Prepare a 90-second elevator pitch for your business idea** (the same or refined idea used in earlier assignments). Your pitch should cover the following elements: o The Problem – Problem Identification o The Solution – Description of your product/service. o Value Proposition – The unique value proposition. o Target Audience – Audience for your idea. o Call to Action – E.g. request for support, funding, feedback, etc. **Deliver Your Pitch:** o Record a video and submit it with written version of your pitch. o Ensure clear speech, confident body language (for video), and persuasive tone. **Reflection (Short Write-up):** o Share what you learned about communicating your idea o Describe challenges or rewards you experienced in the process

Savitribai Phule Pune University		
Second Year of Internet of Things (2024 Course)		
VEC-284-IOT: Environment Awareness		
Teaching/scheme	**Credits**	**Examination Scheme**
Theory: 02Hours/Week	02	**CCE**: 15 Marks **End-Semester:** 35 Marks

Course Objectives:

The objective of this course is to provide students with

1. To introduce the multidisciplinary nature and scope of environmental studies.

2. To understand ecosystem structures, biodiversity, and ecological balance through hands-

   on observation and documentation.

3. To examine the use and impact of natural resources on environmental sustainability.

4. To explore biodiversity conservation practices and develop eco-sensitive thinking through field-based inquiry.

Course Outcomes:

After successful completion of the course, students will be able to:

CO1: Illustrate the interdependence of ecosystems through activity-based exploration

CO2: Analyze the role of natural resources in sustainable development using real-world data.

CO3: Investigate biodiversity threats and conservation strategies through surveys and projects

CO4: Create awareness tools or reports promoting sustainability based on their findings.

Course Contents
Environment and Ecosystem

1. Environment Meaning of Environment, Types of Environments, Components of Environment,
2. Man- Environment relationship, importance of environment,
3. Need for Public Awareness
4. Ecosystem-Meaning, Major Components of Ecosystem
5. Case studies of Forest Ecosystem, Grassland Ecosystem, Desert Ecosystem, Aquatic Ecosystem
6. Stability of Ecosystem in Sustainable Environment

Environment Pollution

1.	Definition of Pollution, Types of Pollution
2.	Air Pollution-Meaning, Sources, effects of air pollution, Air Pollution Act
3.	Water Pollution Meaning, Sources, Effects of Water pollution, Water Pollution Act
4.	Noise Pollution Meaning, Sources, Effect of Noise Pollution
5.	Solid Waste Pollution Meaning, sources, Effect of Waste Pollution
6.	Environment Protection Act Air (Prevention and control of Pollution) Act,
7.	Water Act (Prevention and control of Pollution) Act,
8.	Solid waste Pollution Act in India

9.	E-waste management

Practical Assignments	
Week	Topic to be covered
1	Introduction: Group discussion and poster making on "Why Environmental Studies Matter for Technologists"
2	Eco Mapping: Identify and document elements of an ecosystem within the college campus
3	Model the Food Web: Create food chains and food webs using flowcharts (digital tools like Canva / Lucid chart)
4	Case Study Review: Present real-world examples of forest, grassland, and aquatic ecosystems
5	Soil and Water Testing Activity: Test soil pH, water quality (use school-level kits), and interpret results
6	Field Visit / Virtual Tour: Document deforestation or mining impact in a chosen region; students prepare a comparative report
7	Water Audit Exercise: Estimate water usage at home/hostel and identify areas of overuse; propose conservation measures
8	Renewable Energy Models: Create a simple model or PPT on any renewable energy source (e.g., solar cooker, wind energy demo)
9	Biodiversity Documentation: Survey nearby areas for plant/animal species; identify any endemic/endangered species
10	Conservation Proposal Pitch: In groups, students prepare a mini proposal for biodiversity conservation at local level
11	Group Project Work: Work on mini project report/documentation on any ecosystem/natural resource/e-waste management topics
12	Presentation & Viva: Final presentation and oral examination based on project work and learning portfolio
Learning Resources	
Textbooks:	

1. Odum, Eugene P. "Fundamentals of Ecology"
2. R. Rajagopalan, "Environmental Studies – From Crisis to Cure", Oxford

Reference Books:
1.   Erach Bharucha, "Textbook of Environmental Studies", UGC
2.   Anubha Kaushik and C.P. Kaushik, "Environmental Studies", New Age International
e-Books:
1.   https://www.environment.gov.in
2.   https://www.unep.org

Savitribai Phule Pune University, Pune

Maharashtra, India

Task Force for Curriculum Design and Development

Programme Co-ordinator: Dr. Prabhat Pallav, Dr. Ashwini Bade, Prof. M.U.Inamdar of Siddhant COE, Pune.

Core Committee -BoS members

Dr r. B. D. Jadhav, Dr. Sandeep Musale & Dr. Shailesh Kulkarni
Member, Board of Studies-Electronics & Telecomm Engineering

Core Committee Members

Dr. Prachi Mukherji	MKSSS Cummins College of Engg for Women, Pune
Dr. S.K. Moon	Pune Institute of Computer Technology, Pune
Dr. D.S. Mantri	Sinhgad Institute of Technology, Lonavala
Dr. Yogesh Gurav	Dr.D.Y. Patil Technical campus, Varale-Talegaon, Pune
Dr.D.G. Bhalke	D.Y. Patil Institute of Technology, Pimpri, Pune
Dr. Sagar Shinde	NMIT, Talegaon, Pune
Dr. R. G. Mapari	PCCOER, Pune
Prof. Nagesh Patil	Sinhgad Institute of Technology, Lonavala

Team Members for Course Design

Analog and Digital Electronic Circuits	
Dr.B.D. Jadhav (M-BoS)	Rajarshi Shahu College of Engineering, Pune
Dr .S.K.Moon (M-BoS)	Pune Institute of Computer Technology, Pune
Dr. Yogesh Thakre	PVGs College of Engineering, Pune
Dr. P. P. Chitte	Pravara Rural Engineering College, Loni
Dr. S. V. Mahajan	Sir Visvesvaraya Institute of Technology, Nashik

Discrete Mathematics

Dr. N.S. Mujumdar	JSPM's Rajarshi Shahu College of Engineering, Pune
Dr. Pravin Thakare	Zeal College of Engg & Research, Narhe, Pune
Dr. Radhika Menon	BoS Engg Science Co-ordinator, SPPU
Dr. Dipak Mahurkar	Sanjivani College of Engineering, Kopargaon
Ms. T. B. Katte	Pravara Rural Engineering College, Loni
Ms. N. S. Sapike	Pravara Rural Engineering College, Loni

Sensors Actuators and Signal Processing	
Dr. Ashwini. Bade	Siddhant College of Engineering, Pune.
Dr D.G. Bhalke	D Y Patil Institute of Technology, Pimpri, Pune
Dr. R. G. Mapari	PCCOER, Pune

MDM -1 (Data Structures & Algorithms)	
Dr. Dale M. P. **(BoS Member)**	Wadia College of Engineering, Pune
Dr. G. R. Patil	AIT, Pune
Prof. Dhekale Santosh B.	AISSMS CoE, Pune
Dr. Varsha Degaonkar	I2IT,Pune
Prof. Armaan Shaikh	Dr. D. Y. Patil Institute of Technology, Pune

Engineering Economics & Applications	
Dr. B. S. Agarkar(M-BoS)	Sanjivani College of Engineering, Kopargaon
Dr. Pratap Shinde	BSCOER, Narhe, Pune
Dr. S. P. Ghodake	Sanjivani College of Engineering, Kopargaon
Dr. Makrand Jadhav	RMD Sinhgad SoE, Pune
Dr. J. P. Shinde	RMD Sinhgad SoE, Pune

Community Engagement Project	
Dr. Shailesh Kulkarni (M-BoS)	VIIT, Pune
Mr. R. R. Bhambare	Pravara Rural Engineering College, Loni
Dr. P.M. Ghate	Rajarshi Shahu College of Engineering, Pune

Communication & Networking technology	
Dr. Pr. Kr. Pallav	Siddhant College of Engineering, Pune.
Prof. Nagesh Patil	Sinhgad Institute of Technology, Lonavala
Dr. Ashwini Bade	Siddhant College of Engineering, Pune.
Mr. M. U. Inamdar	Siddhant College of Engineering, Pune.

Introduction to IOT	
Mr. M. U. Inamdar	Siddhant College of Engineering, Pune.
Dr. Madhavi Repe	Dr. D. Y. Patil Institute of Technology, Pune
Prof. Mohan Singade	Dr. D.Y. Patil Technical Campus, Varale-Talegaon, Pune
Dr. Ashwini Bade	Siddhant College of Engineering, Pune.
Dr. Pr. Kr. Pallav	Siddhant College of Engineering, Pune.

Computer architecture & Microcontroller	
Dr. Dnyaneshwar Mantri	Sinhgad Institute of Technology, Lonavala
Dr. Ajay Paithane	Rajarshi Shahu College of Engg, Tathwade, Pune
Dr. Ashwini Bade	Siddhant College of Engineering, Pune.
Dr. Sarika N. Patil	NMIET Talegaon, Pune
Dr. Pr. Kr. Pallav	Siddhant College of Engineering, Pune.

Object Oriented Programming	
Dr. S. K. Moon(M-BoS)	Pune Institute of Computer Technology, Pune
Dr. V. S. Ubale	Amrutvahini College of Engineering, Sangamner
Dr. S. B. Rahane	Amrutvahini College of Engineering, Sangamner
Shashikala Koti	Sinhgad College of Engineering, Pune

Entrepreneurship skill Development	
Dr. Sandeep Musale (M-BoS)	MKSSS Cummins College of Engineering for Women, Pune
Dr Pratap Shinde	BSCOER, Narhe, Pune
Mr. R. R. Bhambre	Pravara Rural Engineering College, Loni
Dr. M. M. Jadhav	NBN, Pune

Chairman

Dr. S. D. Shirbahadurkar - Board of Studies Electronics & Telecomm. Engineering

Savitribai Phule Pune University, Pune

Dean

Dr. Pramod Patil -Dean–Science and Technology

Savitribai Phule Pune University, Pune

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