

**Faculty of Engineering
Savitribai Phule Pune University, Pune
Maharashtra, India**



**Curriculum
for
Fourth Year of Computer Engineering
(2019 Course)
(With effect from 2022-23)**

Sakarya University
Third Year of Computer Engineering (2009 Course)
(With effect from Academic Year 2011-22)
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Seminat Pake Pake Curriculum Bachelor of Computer Engineering Program Outcomes (POs)

Students are expected to learn and be able to-

PO1: Engineering Knowledge	Apply the knowledge of mathematics, sciences, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2: Problem analysis	Identify, formulate, analyse complex situations and analyse complex engineering problems requiring substantial knowledge using first principles of mathematics natural sciences, and engineering sciences.
PO3: Design/ Development of Solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the environment, societal, and the environmental considerations.
PO4: Conduct Investigations of Complex Systems	Use available tools, knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5: Modern Tool Usage	Use, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering scenarios with an understanding of the limitations.
PO6: The Engineer and Society	Apply reasoning related to fundamental knowledge to create societal health, safety, legal and ethical issues and the consequent responsibilities relevant to the professional engineering practice.
PO7: Environment and Sustainability	Understand the impact of the professional Engineering activities to societal and environmental contexts, and demonstrate the knowledge of sustainable development.
PO8: Ethics	Apply ethical concepts and related to professional ethics and responsibilities and norms of the engineering practice.
PO9: Individual and Team Work	Function effectively as an individual and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10: Communication Skills	Communicate effectively in complex engineering settings with the engineering community and with society at large, such as being able to comprehend and make effective reports and design documentation, and effective presentations, and give and receive clear instructions.
PO11: Project Management and Finance	Have basic knowledge and understanding of the engineering and management principles and apply them to one's own work, as a member and/leader in a team, to manage projects and in multidisciplinary environments.
PO12: Lifelong Learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of continual technological change.

Program Specific Outcomes (PSOs)

- PSO1: Professional Skills** The ability to understand complex and provide complex programs in the areas related to algorithms, control systems, mathematics, risk design, big data and data, and understanding the efficient design of computer-aided systems of varying complexities.
- PSO2: Problem-solving Skills** The ability to apply learned practices and strategies to software project development using open-ended programming environments to achieve a given problem for business reasons.
- PSO3: Successful Career and Entrepreneurship** The ability to apply modern computer languages, mathematics, and problems in solving innovative career paths in the employment, and a need for higher education.

EE Computer Engineering 2019 Curriculum Initiative Curriculum structure:

Yorkville York University Final Year of Computer Engineering 2019 Course (Valid effective from Academic Year 2017-18)													
Semester VII													
Course Code	Course Name	Practical Skills (Maximum 3)			Prerequisites (Minimum 4)					Credit Hours			
		Lecture	Laboratory	Project	Prerequisite	Co-Prerequisite	Corequisite	Other	Total	Lecture	Laboratory	Project	Total
40000	Design and Analysis of Algorithms	3							3.0				3
40002	Discrete Systems	3			75				3.0				3
40003	Blackboard Technology	3							3.0				3
40004	Formal II	3							3.0				3
40005	Formal II	3							3.0				3
40006	Laboratory Practice I		3			75	76		3.0		3		3
40007	Laboratory Practice II		3				76		3.0		3		3
40008	Project Report I		3						3.0				3
Total Credit									24	36		60	
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40009 - 40010 - 40011									Credit				
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Saskatchewan Polytechnic University
Final Year of Computer Engineering (BSc) Courses
(Link off from Academic Year 2021.22)

Semester VIII

Course Code	Course Name	Credits (Elective Credits)	Prerequisite Courses and Marks										Final Scores					
			1	2	3	4	5	6	7	8	9	10	11	12	13	14		
400104	Eng. Fundamentals Continued	30			30	30					100	80			10			
400105	Displacement	30			30	30					100	80			10			
400106	Physics V	30			30	30					100	80			10			
400107	Physics VI	30			30	30					100	80			10			
400108	Laboratory Physics I		30				30	30			100		80		10			
400109	Laboratory Physics II		30				30		30			80		10	10			
400110	Project Final II		30				30		30	100		80			10			
Total Credits											30	80			10			
Total											100	100	100	100	100	100	100	100
400111											Credits							
Elective V											Elective VI							
400112 Artificial Language Processing											400113 AI Problem Solving							
400114 Image Processing											400115 AI & Robotics							
400116 Software Design Principles											400117 AI Research Applications							
400118 Advanced Topics in Digital Processing											400119 AI Research Computing							
400120 Robot Design											400121 AI Project							
Lab Practice VI											Lab Practice VII							
Laboratory experiments of courses: 400112, 400113											Laboratory experiments of courses: 400115, 400117							
Audio Course & ACD Systems																		
ACD - Audio Analysis and Synthesis																		
ACD - AI Communication and Synthesis																		
ACD - AI Speech, Music, and Analysis																		
ACD - AI, MUSIC - AI and New Media																		
ACD - AI, Music and Intelligence																		

General Guidelines

1. Every independent program has its own objectives and educational outcomes. These objectives and outcomes are formulated by considering various aspects and impacts of the curriculum. These **Program Outcomes (POs)** are categorically enumerated at the beginning of the curriculum (ref. NHA Manual). There should always be a rationale and a goal behind the inclusion of a course in the curriculum. Course Outcomes (COs) should highly rely on the contents of the course, namely a course are parents and founded. The **Course Objective, Course Outcomes and CO-PO mapping matrix** justify the motives, accomplishment and achieved behind having the course. **The Course Objective, Course Outcomes and CO-PO Mapping Matrix are provided for reference and there are no binding on it. The course instructor may modify them as per his or her judgment.**

2. **CO and PO Mapping Matrix:** Course Objectives and Program Outcomes (achievement mapping matrix) as well as course contents, defines the correlation levels of 5, 3, 1 and 0. The notation of 5, 3 and 1 denotes substantially (high), moderately (medium) and slightly (low). The mark '0' indicates that there is no correlation between CO and PO.

3. For each course, contents are divided into six units, I, II, III, IV, V and VI.

Elaborated example/Case Studies are included in each unit to explore how the learned topics apply to real world situations and need to be explored so as to assist students to increase their comprehension, translating the specific skills, building the knowledge to be applicable in any given situation along with an association. One or two sample questions or case studies are included for each unit. Instructor may extend the same work items. **Elaborated example/Case Studies may be assigned as self-study by students and to be included in their examination.**

4. For each unit contents, the content statement mapping is achieved with Course Outcomes. Moreover, every course the same is per their respective.

5. For laboratory courses, set of suggested assignments is provided for reference. Laboratory exercises are design suitable set of assignments for respective course at their level. **Original suitable assignments and experiments may be included in the part of laboratory work.** Inclusion of it will be the extra addition for the students and it will surely the involvement within the group of the learners and will add to the purpose of the learners.

6. For each laboratory assignment, it is essential for students to draw/write/present flowchart, algorithm, tree chart, mathematical model, tree diagram and conceptual complexity analysis (as applicable), think also for practical and formal way to get perfection of industry.

7. For each course, irrespective of the examination mode, the instructor should motivate students to read and research paper at least to recent developments and invention in the field.

8. For laboratory, instructions have been included about the construction and maintenance of laboratory work. These guidelines are to be strictly followed.

9. Term Work -Term work is continuous assessment that evaluates a student's progress throughout the semester. Term work assessment criteria specify the standards that must be met and the evidence that will be gathered to demonstrate the achievement of course outcomes. Curriculum assessment strategy for the term work should establish unequivocal standards of achievement for each course outcome. They should describe what the learner is expected to perform in the laboratory or in the field to show that the course outcomes have been achieved.

Students' work will be evaluated typically based on the extent like attractiveness, proficiency in execution of the task, regularity, punctuality, use of referencing, accuracy of language, use of supporting evidence in drawing conclusions, quality of critical thinking and similar performance measuring criteria.

10. Program codes with sample output of all performed assignments are to be submitted as software. Use of DVD or similar media containing students programs submitted by Laboratory In-charge is highly encouraged. The reference are as two journals may be submitted with program print as Laboratory. As a revision effort and little contribution towards Course II and subsequent semester, attaching printed paper as part of write-ups and program listing in journal may be avoided. Submission of journal term work in the form of software is desirable and encouraged.

Abbreviations

TW: Term Work	TE: Theory	PE: Practical
OR: Oral	DS: Document	

SEMESTER VII



Savitribi Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
AI0141: Design and Analysis of Algorithms

Teaching Scheme
 TH: 03 Hours/Week

Credits
 03

Examination Scheme
 In-Term (Paper): 30 Marks
 End-Term (Paper): 70 Marks

Prerequisite Course: Discrete Structures (180221), Fundamentals of Data Structures (180242), Data Structures and Algorithms (240252), Theory of Computation (180242)

Component Course: Laboratory Practical (1801206)

Course Objectives:

- To develop problem solving abilities using mathematical theories.
- To apply algorithmic strategies while solving problems.
- To analyse performance of different algorithms, strategies in terms of time and space.
- To develop time and space efficient algorithms.
- To study algorithmic examples in distributed and concurrent environments.
- To (reduce and trade) reduce and (trade) reduce Algorithms

Course Outcomes:

(On completion of the course, students will be able to:-)

- CO1: Formulate** the problem
- CO2: Analyse** the asymptotic performance of algorithms.
- CO3: Design and apply** algorithmic strategies to solve given problems
- CO4: Find** optimal solutions by applying various methods
- CO5: Analyse and Apply** scheduling and Sorting Algorithms.
- CO6: Solve** problems for reduction or distribution in concurrent environments

Course Content:

Unit I	Algorithms and Problem Solving	10 Marks
Algorithm: The Role of Algorithms in Computing - What are algorithms, Algorithm as technology, Analysis of Algorithms, Design of Algorithm, Need of Classification of Algorithm, Case Study on Success of Algorithms - simple examples, Parallel algorithm design issues. Problem Solving Principles: Classification of problem, problem solving strategies, classification of decomposition (Linear, logarithmic etc.) *Example/Case Studies: Tower of Hanoi		
*Mapping of Course Outcomes for Unit I (11) / (10)		
Unit II	Analysis of Algorithms and Complexity Theory	30 Marks
Analysis: Input size, best case, worst case, average case Counting Dominant operation, Insertion size, upper bound, asymptotic growth, Ω, Θ, o and ω notations, polynomial and non-polynomial problems, deterministic and non-deterministic algorithms, P, NP problems, NP class of problems, polynomial problem reduced NP complete problems, error cover and TSP and NP hard problem, Hamiltonian cycle. *Example/Case Studies: Analysis of recursive and recursive algorithms		

Mapping of Course Outcomes for Unit II

COE

Unit III Greedy And Dynamic Programming algorithms for NP-Hard

Greedy strategy: Principle, control abstraction, time analysis of control abstraction, knapsack problem, scheduling algorithms for scheduling and activity selection problem.

Dynamic Programming: Principle, control abstraction, time analysis of control abstraction, knapsack problem, 0/1 knapsack, Chain Matrix multiplication.

•Example Case Studies: Mail route covering all the cities.

Mapping of Course Outcomes for Unit III

COE, COH

Unit IV Backtracking and Branch-n-Bound

80 Hours

Backtracking: Principle, control abstraction, time analysis of control abstraction, N-queens problem, graph coloring problem, sets of subsets problem.

Branch-n-Bound: Principle, control abstraction, time analysis of control abstraction, knapsack problem.

Left and Right approaches, CSP, knapsack problem.

•Example Case Studies: Active Case Scheduling.

Mapping of Course Outcomes for Unit IV

COE, COH

Unit V Amortized Analysis

80 Hours

Amortized Analysis: Aggregate Analysis, Accounting Method, Potential Function method, Amortized analysis-heavy counter, weak Tern-Space tradeoff, Amortization in Unstable and Non-tractable Problems, Introduction to Karushman and Approximation algorithms, Amortized Algorithms: amortized queue scheduling (prior system scheduling algorithm), sorting algorithm for embedded systems.

•Example Case Studies: coding and sorting.

Mapping of Course Outcomes for Unit V

COE, COH

Unit VI Multithreaded And Distributed Algorithms

80 Hours

Multithreaded Algorithms - Introduction, Performance measures, analyzing multithreaded algorithms, Parallel loops, Race conditions.

Section Solving using Multithreaded Algorithms - Multithreaded matrix multiplication, Multithreaded merge sort.

Distributed Algorithms - Termination, Distributed breadth first search, Distributed Minimum Spanning Tree.

Long Matching: Introduction, The Hungarian matching algorithm, The Kuhn-Munkres algorithm.

•Example Case Studies: Capital asset allocation.



Learning Resources

Text Books:

1. Pradyumnachand Datta, Hrishikesh Mahalingam Datta, *"Design and Analysis of Algorithms"*, Pearson Education, ISBN 81-7731-381-6
2. Graham Rossen, Paul Bentley, *"Fundamentals of Algorithms"*, CRC, ISBN 0-7645-144-1, 1111-2

Reference Books:

1. Michael T. Goodrich, Robert Sedgwick, *"Algorithms Design Fundamentals"*, Analysis and Design Examples, Wiley, ISBN 978-0-7803-2686-7
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, *"Introduction to Algorithms"*, MIT Press, ISBN 978-0-262-03384-4
3. Horowitz and Sahni, *"Fundamentals of Computer Algorithms"*, University Press, 1976, 978-0-1707-0126-0, 777-0126
4. Rajeev Motwani and Prabhakar Raghavan, *"Randomized Algorithms"*, Cambridge University Press, ISBN 978-0-521-47455-9, 961-3
5. Don Knuth, *"Algorithms as Things: Trees and Sequences"*, Cambridge University Press, ISBN 0-521-45517-7

Links:

1. <https://www.geogebra.org/m/4kqg4jw> and <https://www.geogebra.org/m/4kqg4jw>
2. <https://www.geogebra.org/m/4kqg4jw> and <https://www.geogebra.org/m/4kqg4jw>

MOOC Course Link:

1. *Design and Analysis of Algorithms* - <https://www.coursera.org/learn/daa>

@The CO-PO Mapping Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	1	1	1	1	1	1	1	1
CO2	1	1	1	1	1	1	1	1	1	1	1	1
CO3	1	1	1	1	1	1	1	1	1	1	1	1
CO4	1	1	1	1	1	1	1	1	1	1	1	1
CO5	1	1	1	1	1	1	1	1	1	1	1	1
CO6	1	1	1	1	1	1	1	1	1	1	1	1



Savitribi Phule Pune University
Fourth Year of Computer Engineering (2018 Course)
410242: Machine Learning

Teaching Scheme**Credits**
03**Examination Scheme:****In-Sem (Paper): 30 Marks****End-Sem (Paper): 70 Marks****TH: 03 Hours/Week****Prerequisite Course:** Data Science and Big Data Analytics (40211)**Co-requisite Course:** Laboratory Practice (410242)**Course Objectives:**

- To understand the need for Machine learning
- To explore various data pre-processing methods.
- To study and understand classification methods
- To understand the need for multi-class classification.
- To learn the working of clustering algorithms
- To learn fundamental of neural network algorithm.

Course Outcome:

On completion of the course, students will be able to:-

- CO1: Identify the needs and challenges of machine learning for real time applications
- CO2: Apply various data pre-processing techniques to simplify and speed up machine learning algorithms
- CO3: Select and apply appropriately supervised machine learning algorithms for real time applications
- CO4: Implement various of multi-class classifier and measure its performance
- CO5: Compare and contrast different clustering algorithms
- CO6: Design a neural network for solving engineering problems.

Course Content**Unit 1****Introduction To Machine Learning****03 Hours**

Introduction to Machine Learning, Comparison of machine learning with traditional programming, ML vs AI vs Data Science

Types of learning: Supervised, Unsupervised, and semi-supervised, reinforcement learning techniques, Visuals of Machine learning, Concrete model, Probabilistic Models, Logic of Models, Grouping and grading models, Parameter and non-parameter models.

Important Elements of Machine Learning: Data Domain, Scalability, Statistical learning approaches

Example Case Studies

Suppose you are working for Uber where a task is to increase sales is given. Under this the requirement of the client

CO1

Mapping of Course Outcome for Unit**Unit II****Feature Engineering****03 Hours**

Example Case Studies

Market basket analysis and association Supermarkets

Diagnosis of Circuit

C38

Diagnosis of Circuit

Unit 11

Introduction To Neural Networks

ET11001

Artificial Neural Networks, Single Layer Neural Network, Multilayer Perceptron, Back Propagation Learning, Functional Link Artificial Neural Network, and Radial Basis Function Network, Activation Functions,

Introduction to Recurrent Neural Networks and Convolutional Neural Networks

Example Case Studies

Vehicle Recognition on Youtube

Diagnosis of Circuit

C39

Diagnosis of Circuit

Learning Resources

Text Books:

1. Dreyfus, L. Dreyfus, H., and Dreyfus, A. C. Hirschfeld, "Pattern recognition and machine learning", Vol. 4, No. 4, New York: Springer, 2006.
2. Arthur Samuel, "Introduction to Machine Learning", MIT Press (1999, 2011)

Reference Books:

1. Tom Mitchell, "Machine learning", MIT Press (MIT series in Computer Science, 1997)
2. Shalev Shwartz, Shai and Yoav Elan David, "Understanding modern learning: from theory to algorithms", Cambridge university press, 2014
3. James Hertz, Michael Korbay, and Dan Fox, "Data Mining: Concepts and Techniques", Elsevier Publishers Third Edition, 1999, 978125847931, 9781258144807
4. Hastie, Trevor, et al., "The elements of statistical learning: data mining, inference, and prediction", Vol. 2, New York: Springer, 2014
5. M. K. Hertz, "Pattern for Data Analysis", 2nd Edition, 1999, 9781441939793
6. John Elser, "Book-learn", Cengage, Pack Publishing, 1999, 9781441939793
7. Goodfellow, Ian, Bengio, Y., and Courville, "A Deep Learning", MIT Press, 2016

+ Blogs :

1. Python Machine Learning : http://www.it-ebooks.info/book/2511798/227_10_11_python_machine_learning-2015.pdf
1. Foundations of Machine Learning : https://www.it-ebooks.info/book/2511798/227_10_11_python_machine_learning-2015.pdf
1. Dive into Deep Learning : <http://d2l.ai>
1. A brief introduction to machine learning for engineers : https://www.it-ebooks.info/book/2511798/227_10_11_python_machine_learning-2015.pdf
1. Feature selection : https://www.it-ebooks.info/book/2511798/227_10_11_python_machine_learning-2015.pdf
1. Introductory Machine Learning Notes : <http://bit.ly/2a66666>

MOOC Courses Link:

- + Introduction to Machine Learning : https://www.it-ebooks.info/book/2511798/227_10_11_python_machine_learning-2015.pdf
- + Introduction to Machine Learning (IT Madras) : https://www.it-ebooks.info/book/2511798/227_10_11_python_machine_learning-2015.pdf
- + Deep learning : https://www.it-ebooks.info/book/2511798/227_10_11_python_machine_learning-2015.pdf

[@The CO-PO Magazine Series](#)

2019	201	202	203	204	205	206	207	208	209	210	211	212
201	1			1			1	0	0	0	0	0
202	0	1		1	1	0	1	0	0	0	0	0
203	0	0	1	1	1	0	1	0	0	0	0	0
204	0	0	0	1	1	1	0	0	0	1	1	0
205	0	0	0	1	1	0	1	0	0	1	0	0
206	0		0	1	0	1	1	0	0	1	1	0



Savitribi Phule Pune University
Fourth Year of Computer Engineering (2009 Course)
400249: Blockchain Technology

Teaching Scheme

Credits
03

Examination Scheme

Te. Test (Paper): 30 Marks
 End. Test (Paper): 70 Marks

TUE: 40 Hours/Week**Prerequisite Course:** Computer Networks and Security (190249)**Co-requisite Course:** Laboratory Practice (19400249)**Course Objectives**

- Technology behind Blockchain
- Cryptocurrency: Concepts and Smart contracts
- Different consensus algorithms used in Blockchain
- Real-world applications of Blockchain
- To analyze Blockchain Ecosystems Platform using Solidity
- To Develop Blockchain Case Studies

Course Outcomes

On completion of the course, students will be able to:-

- CO1: Interpret the fundamentals and basic concepts in Blockchain
- CO2: Compare the working of different Blockchain platforms
- CO3: Use Cryptocurrencies for cryptocurrency based transactions
- CO4: Analyze the importance of Blockchain in finding the solution to the real-world problems.
- CO5: Evaluate the different public Blockchain platforms
- CO6: Identify various applications where Blockchain technology can be effectively used and implemented.

Course Contents**Unit I****Mathematical Foundations for Blockchain****06 Hours**

Cryptography: Symmetric Key Cryptography and Asymmetric Key Cryptography, Digital Signatures, Public Key Cryptography (PKC), Cryptographic Hash Functions, SHA256, Digital Signature Algorithm (DSA), Merkle trees.

Laboratory Case Studies

Compare the Symmetric and Asymmetric Cryptography Algorithms

Mapping of Course

CO1

Outcomes for Unit I**Unit II****Finance Engineering****01 Hours**

History, Centralized Vs. Decentralized Systems, Layers of Blockchain: Application Layer, Execution Layer, Network Layer, Consensus Layer, Why is Blockchain important? Limitations of Centralized Systems, Blockchain Adoption for IoT.

[Example Case Studies](#)

Study of a research paper based on Blockchain

[Mapping of Course](#)

C10

[Overview for Unit II](#)

Unit III Blockchain Platforms and Consensus in Blockchain **M.Haris**

Types of Blockchain Platforms: Public, Private and Consortium, Blockchain Ecosystems, Hyperledger, IBS, Fabric, etc.

Consensus in Blockchain: Consensus Approach, Consensus Elements, Consensus Algorithms, Proof of Work, Hashing, General problems, Proof of Stake, Proof of Elapsed Time, Proof of Utility, Proof of Burn

[Example Case Studies](#)

Compare & contrast consensus algorithms used in blockchain technology

[Mapping of Course](#)

C11

[Overview for Unit IV](#)

Unit IV Cryptocurrency - Bitcoin and Others **M.Haris**

Introduction, Bitcoin and the Cryptocurrency, Cryptocurrency Basics, Types of Cryptocurrency, Cryptocurrency Usage, Cryptocurrency: Attributes, Guidelines, Risks

[Example Case Studies](#)

Create your own wallet for crypto currency using any of the Blockchain Platforms

[Mapping of Course](#)

C12

[Overview for Unit V](#)

Unit V Blockchain Ecosystem Platforms using Solidity **M.Haris**

What is a contract, Types of Blockchain Networks, Solidity, Ethereum's smart Contracts, introduction to smart contracts, Purpose and types of Smart Contracts, Implementing and deploying smart contracts using Solidity, Ethers (Decentralized Storage Platform), Whisper (Decentralized Messaging Platform)

[Example Case Studies](#)

Write Ethers Development Environment

[Mapping of Course](#)

C13

[Overview for Unit VI](#)

Unit VI Blockchain Case Studies **M.Haris**

Personal Blockchain Applications, Retail, Banking and Financial Services, Government Sector, Healthcare, IoT, Energy and Utilities, Blockchain Integration with other domains

[Example Case Studies](#)

Study 2 case studies of Blockchain and write a detailed report on your aspect implemented in the same.

[Mapping of Course](#)

C15, C16

[Overview for Unit VII](#)

Learning Resources

Error Books:

1. Martin Quast, *Blockchain Dynamics: A Quick Engineer's Guide to Understanding the Foundations of IoT, coin, and Other Cryptocurrency*, Create Space independent Publishing Platform, 15-May-2018
2. James Harkin, *Mastering Blockchain Distributed Ledger Technology, Decentralisation and Smart Contracts Explained*, Second Edition, Packt Publishing, 2018
3. Alex Larangeira, *Blockchain Programming*, Packt Publishing, 2017

Reference Books:

1. Gokuladitya Singhvi, Gokuladitya Singhvi, Prerna Sahasr Prasad, *Blockchain: A Beginner's Guide to Building Blockchain Solutions*, 2019
2. Chris Hatten, *"Introducing Ethereum and Solidity", Foundations of Cryptocurrency and Blockchain Programming for Engineers*
3. Daniel Christen, *"Blockchain Basics", A New Technical Introduction in 10 Steps*
4. Michael S. Smith, *Programming in Solidity*, Packt Publishing, 2016
5. Chaitanyani, Saksham, *India: A Group*, Abhishek K. S and Manish Kulkarni, *"Blockchain Technology"*, Curiouser Press, ISBN-10: 931213604

+Books :

1. https://www.coursera.org/learn/5757-concepts/blockchain/mastering-blockchain_2of_10/6n.pdf
2. https://www.hackerrank.com/challenges/blockchain_1of_10/6n.pdf
3. https://www.hackerrank.com/challenges/blockchain_2of_10/6n.pdf

MOOC Course Link:

1. NPTEL Course on "Introduction to Blockchain Technology & Application"
<https://nptel.ac.in/course/20194/66104C2/>
2. NPTEL Course on **Blockchain**
<https://nptel.ac.in/course/20194/66104C2/>

Y Data Mining Projects Ideas

DATE	701	702	703	704	705	706	707	708	709	710	711	712
001	1	-	-	-	-	-	-	-	-	-	-	-
002	1	-	-	-	-	-	-	-	-	-	-	-
003	1	-	1	2	-	-	-	-	-	-	-	-
004	1	-	1	-	2	-	-	-	-	-	-	-
005	1	1	1	-	-	-	-	-	-	-	-	1
006	1	1	1	1	-	-	-	-	-	-	-	-



Technological Education Institute of Athens
Fourth Year of Computer Engineering (2019 Course)
610264(A): Persuasive Computing

Teaching Scheme

Credits
33

Examination Scheme

Ta-Ten (Paper): 30 Marks
End-Ten (Paper): 70 Marks

TE: 60 Hours/Week**Prerequisite Course:** Internet of Things and Embedded Systems (110245A)**Co-requisite Course:** Laboratory Practice (110400A)**Course Objectives**

- To introduce the characteristics, basic concepts and systems issues in persuasive computing.
- To illustrate system design and architecture in persuasive computing.
- To introduce intelligent systems and interactions in Persuasive computing.
- To identify the trends and latest developments of the technologies in the area.
- To understand Interactive Design (HCI) and Persuasive Computing Environment.
- To identify Security Challenges & Ethics in Persuasive Computing.

Course Outcomes

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

- CO1. Illustrative fundamental concepts in persuasive computing.
- CO2. Explain persuasive domain and design appropriate era to get the need of real through applications.
- CO3. Identify and analyse current system issues for their efficiency in different HCI systems.
- CO4. Illustrate intelligent systems and generate intelligent interactive applications.
- CO5. Design HCI systems in persuasive computing environment.
- CO6. Explain the security challenges and know the role of ethics in the context of persuasive computing.

Course Contents**Unit 1****Introduction To Persuasive Computing****10 Hours**

Persuasive Computing: History, Principles, Characteristics, Problems Issues & Challenges.
 Advantages of Persuasive Computing.

Persuasive Computing Applications, Persuasive computing devices and interface, Device technology trends, Connecting issues and protocols.

Example Case Studies

Persuasive Computing for Personalized medicine

Mapping of Course**Outcomes for Unit 1****CO1****Unit 2****Smart Computing with Persuasive Computing Devices****10 Hours**

Smart Devices: CO1, Smart Environment: CO1 and CO2, Smart Devices: HCI and HAP, Persuasive Devices, Application and Requirements, Device Technology and Connectivity, CO1, Device characteristics, PDA, Hand Access Architecture, Voice Enabling Persuasive Computing, Voice Searchable, Special Applications in Persuasive Computing.

Example Case Studies

Assisted Aging

Mapping of Course COO*Outcomes for Unit II**

Unit III	Course Outcome	CO Marks
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Introduction, Types of Context, Context-Aware Computing and Applications, Modeling Context-Aware Systems, Mobility awareness, spatial awareness, temporal awareness, Locationing and scheduling, HCI system architecture, Middleware Support

Examples Case Studies

Mobile mapping, location systems

***Mapping of Course**

COO

Outcomes for Unit III

Unit IV	Course Outcome	CO Marks
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Introduction, Basic Concepts, UI Architecture, Semantic MED, Context Logic (B, Soft Computing), Visual, UI System Operations, Interaction Multiplicity, UI Interaction Design, Context-Aware Information Applications

Examples Case Studies

Context-awareness displays, A contextual information system using IT applications

***Mapping of Course**

CO4

Outcomes for Unit IV

Unit V	Course Outcome	CO Marks
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Introduction of Interaction Design, Basics of Interaction Design and its Concepts, Importance of Interaction Design, Difference between Interaction Design and UI, What is HCI? Importance of HCI, Advantages and Disadvantages of HCI, Elements of HCI, HCI Design and Architecture, Define Pervasive Computing, Importance of Pervasive Computing, Success factors in Pervasive Computing, Pervasive Computing Architecture and Applications, Network Computing Challenges and Opportunities for Primary Principles

Examples Case Studies

Smart Homes, Textile, Security Value, etc.) Improves interface

***Mapping of Course**

COO

Outcomes for Unit V

Unit VI	Course Outcome	CO Marks
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Security issues in Pervasive Computing, security model, authentication & authorization, access control, access control hierarchy, open source pervasive computing security challenges & requirements, Privacy & trust issues, social & user interaction issues, solution for pervasive computing challenges, Role of ethics in pervasive computing security, Awareness and Self-Determination, Responsiveness, legal, moral & social distribution, justice, digital divide and sustainable development

Examples Case Studies

Pervasive Computing Security Case Projects

***Mapping of Course**

COO

Outcomes for Unit VI**Learning Resources**



Savitribi Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
1001443, Multimedia Techniques

Teaching Scheme	Credits	Examination Scheme Is-
TH: 48 Hours/Week	03	Term Paper: 30 Marks
Prerequisite Course: Computer Graphics (214041)		End-Sem (Paper): 70 Marks
Corequisite Course: Laboratory Practice (1044004)		

Course Objective:

- To understand input and output devices, device drivers, control signals and protocols, I/Os
- To study and use standards (e.g., audio, graphics, video)
- To implement applications, multi-media, networking systems, and networking by studying stream-oriented, object-oriented methods, speech-oriented, compressed encoding
- To design and develop content-based analysis, indexing, and retrieval of audio, images, internet, etc. archives
- To demonstrate presentation, rendering, visualization, multi-media integration methods
- To Understand IoT architecture's and Multimedia Internet of things

Course Outcome:

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

- CO1: Describe the media and supporting devices commonly associated with multimedia information systems.
- CO2: Demonstrate the use of content-based information analysis in a multimedia information system.
- CO3: Critique multimedia presentations in terms of their appropriate use of audio, video, graphics, text, and other information presentation concepts.
- CO4: Implement a multimedia application using an existing system.
- CO5: Understanding of techniques for music, navigation and personal content
- CO6: Implement Multimedia Internet of Things Applications.

Course Content:

Unit 1	Introduction to multimedia	08 Hours
What is Multimedia and their Components, History of Multimedia, Hypermedia, WWW, and Internet Multimedia Tools: Static (text, graphics, and still images), Audio (sound, samples, and video, etc.) Multimedia Storage and Management, multimedia Networking Tools: Adobe Photoshop, Adobe Illustrator, Adobe Flash.		
Example/Case Studies	To study and control representation multimedia Tools	

Mapping of Course
Outcome for Unit 1

Unit 1	Graphics and Data Representation Techniques	08 Hours
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What are Graphics data types, 1-bit images, 8-bit gray-level, 16-bit gray-level images, image data types, image data type YCbCr format, 24-bit color images, Highest 16 Depth images, Color Lookup Tables, File Formats: GIF, JPEG, PNG, TIFF, PSD, APN, AI, PDF, SVG, Windows BMP, Windows WMF.

Example Case Studies To study conversion of image file formats from one to other

Mapping of Course CO3

Outcome for Unit II

Unit II	Multimedia Representation Techniques	BT Matrix
Principal concepts for the audio video (AV, HDM) Video (Personal Television System Compression, PTV, Video Phone, Streaming Live, MPEG Video (Open Physical Codec, Joint Modelers, Digital Video, Chroma Sub-sampling, Digital Video TV, Ultra High Definition TV (UHDTV), Compressed Video, High Definition Multimedia, Blu-Ray, (HDM) 3D Video and TV, content data, Basics of Digital Audio, What is Sound?, Sample Theorem, SAM, SQSB, Audio Filtering, Synthetic Speech, MIDI Overview, Playback, Storage, Compression in WAV, Coding of Audio, MPEG-1, 2, 4 (Data Multichannel)		

Example Case Studies Read and see this link is <https://books.google.com/books?id=...> software to understand the concept of waveform, frequency, wave files, format, and how to use the sample 16 bit value and also draw the illustrations from the output value CO3

Mapping of Course
Outcome for Unit II

Unit II	Compression Algorithms	BT Matrix
Introduction to multimedia - (Digital, Image and Video) compression - Fundamental concepts of video, digital audio - Basic representation of multimedia applications - Visual bit compression - Types of compression algorithms - Audio compression algorithms (MPEG, VLS, DRC, AC, Audio sample compression, Essential coding of images, Image compression algorithms Run - length codes, Quantization, Transform coding, variable length coding, statistical, Statistics of source coefficients, Image compression standard - JPEG standard, JPEG 2000 standard, J.28 standard, Wavelet image compression standard, Introduction to video compression - Video compression based on motion compensation, Search for motion vectors, MPEG Video coding I, MPEG I, 2, 4, 7 standard, Basic Audio Compression Techniques - SQSB to speech coding, Variable, MP3 audio compression		

Example Case Studies Implementation of compression algorithms

Mapping of Course CO3, CO4
Outcome for Unit II

Unit V	Augmented Reality (AR), Virtual Reality (VR) and Mixed Reality (MR)	BT Matrix
Basics of Virtual Reality, Difference between Virtual Reality and Augmented Reality, Components of Augmented Reality, Components and Performance Issues in AR, Design and Technological Challenges for Immersive Experiences, Input Devices - controllers, motion trackers and motion capture technologies for tracking, navigation and gesture control, Output devices - Head Mounted VR Displays, Augmented and Mixed reality glasses, VR interaction and peripheral graphics, Immersive virtual world, Haptic and olfactory devices, Real presence in VR, AR and MR Future applications of Immersive Technologies.		

VRML, Programming Modeling objects and virtual environments Design Algorithm applications, Medical Visualization, Entertainment, etc.

Example Case Studies Navigation, Animation, Sports

Mapping of Course CO3
Outcome for Unit I

Unit VI	Multimedia Sources of Images	BT Matrix
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Example Case Studies

Health Monitoring System

Measuring of Course Outcomes for Unit 1)

COs

Learning Outcomes**Two Books:**

1. Jay Vaughan, "Multimedia making it work", Tom McChes-0812011 ISBN: 9780470174094 ISBN13: 0470174094, third print version of the title ISBN: 9780470174045 ISBN13: 0470174045
2. Ji-Nian Li, Mark S. Green and Tang Xiao Li, "Fundamentals of Multimedia", Second Edition, Springer, 2011, ISBN: 980-9602-15-09 ISBN: 980-9602-16-00 ISBN13: 9789809602159 ISBN13: 9789809602166, Pearson Education, 2009

Reference Books:

1. Ali Youssef et al. "Multimedia Internet of Things: A Comprehensive Survey", Special Section on Mobile Multimedia: Introduction and Applications, Mobile Systems, Volume 9, 2020
2. Kalle S. Hale (Editor), Kai M. Henney (Editor), 2014, Handbook of Virtual Learning and Design: Implementation and Applications, Second Edition (Human Factors and Ergonomics 4) ISBN: 0-12-406313-6, Elsevier

e-Books:

1. https://www.doc.ic.ac.uk/~cs/teaching/2015/16multimedia/Introduction_to_Multimedia.pdf
2. <https://www.cs.cup.edu/~mrm/teaching/2011/16multimedia.pdf>
3. https://www.khanacademy/a/programming-book4_0ba3c8a9/1.pdf

MOOC Courses Link:

- <https://openai.co/courses/11/1305/>

Unit ID	CO1	CO2	CO3	CO4	CO5	CO6	CO7	CO8	CO9	CO10	CO11	CO12
CO1	1	1	1	1	1	1	1	1	1	1	1	1
CO2	1	1	1	1	1	1	1	1	1	1	1	1
CO3	1	1	1	1	1	1	1	1	1	1	1	1
CO4	1	1	1	1	1	1	1	1	1	1	1	1
CO5	1	1	1	1	1	1	1	1	1	1	1	1
CO6	1	1	1	1	1	1	1	1	1	1	1	1
CO7	1	1	1	1	1	1	1	1	1	1	1	1
CO8	1	1	1	1	1	1	1	1	1	1	1	1
CO9	1	1	1	1	1	1	1	1	1	1	1	1
CO10	1	1	1	1	1	1	1	1	1	1	1	1
CO11	1	1	1	1	1	1	1	1	1	1	1	1
CO12	1	1	1	1	1	1	1	1	1	1	1	1



Savitribi Phule Pune University
Fourth Year of Computer Engineering (2018 Course)
100214/Cyber Security and Digital Forensics

Teaching Scheme III: 40 Hours/Week	Credits 10	Examination Scheme In-Sem (Paper): 30 Marks End-Sem (Paper): 70 Marks
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Prerequisite Course: Computer Networks and Security (10049), Information Security (10024) (4)

Co-requisite Course: 100101: Laboratory Practice IV

Course Objectives:

- To introduce students cyber threats
- To understand issues in cyber crime and different attacks
- To understand underlying principles and study of the techniques associated with the digital forensic practice
- To know the process and methods of evidence collection
- To analyze and validate forensic data collection
- To apply Digital Forensic knowledge to use computer forensic tools and investigation report writing.

Course Outcomes: At the end of the course, the student should be able to:

- CO1: Analyze threats in order to protect or defend it in cyberspace from cyber-crime.
- CO2: Identify appropriate security solutions against cyber attacks.
- CO3: Illustrate the need of digital forensic and role of digital forensics.
- CO4: Explain roles and types of evidence collection.
- CO5: Analyze, validate and process crime scenes.
- CO6: Identify the methods to process legal evidence and generating investigation reports.

Course Outline		
Unit I	Introduction to Cyber Security	08 Hours
Introduction and Overview of Cyber Crime, Nature and Scope of Cyber Crime, Types of Cyber Crime: crime against an individual, Crime against property, Cyber extortion, Drug trafficking, Cyber terrorism, Need for Information security, Threats to Information Systems, Information Awareness, Cyber Security, and Security Risk Analysis		
Example/Case Studies:	Data Breach (Hijack) – Deepfakes & Spoofing https://bit.ly/3wvqg1u and https://bit.ly/3wvqg1u and https://bit.ly/3wvqg1u	
Mapping of Course Outcome for Unit I	CO1	
Unit II	Cyber Crime Issues and Cyber attacks	08 Hours
Unauthorized Access to Computers, Computer Intrusions, Virus, and Malicious Code, Internet Tracking and Cracking, Virus and Worms, Software Piracy, Intellectual Property, Data Breach, Spoofing, Hacking and Obfuscation in Internet, Cybercrime prevention methods, Application security (Client-side, I-mail, and Internet), Data Security Considerations, Backups, Backup Storage and Transport of Data, Security Technology, Firewall and VPNs, Malicious prevention mechanisms, OS Security		
Example/Case Studies:	Cyber Hacking page & their cases are given in CO1	
Mapping of Course Outcome for Unit II	CO2	
Unit III	Investigation in Digital Forensics	08 Hours
What is Computer Forensics?, Use of Computer Forensics in Law Enforcement, Computer Forensics Systems in Forensic Research, Employment Forensics, Computer Forensics Services, Benefits of Professional Forensic Methodology, Steps taken by Computer Forensics Specialist, Types of Computer		

Forensic Technology: Types of Military Computer Forensic Technology, Types of Law Enforcement – Computer Forensic Technology, Types of Business Computer Forensic Technology, Computer Forensic Evidence and Capture: Data Recovery Difficult, Data Backup and Recovery, The Role of Backup in Data Recovery, The Data Recovery Solutions.

Examples Case Studies

Mapping of Course Outcomes for Unit III

Unit 4: Evidence Collection and Data Seizure	Outcomes
Why Collect Forensic? Collection Options, Forensics, Types of Forensics – The Rules of Forensics, Vehicle Forensics, General Forensics, Collection and Archiving, Methods of Collection, Archiving, Collection Steps, Controlling Contamination, The Chain of Custody Duplication and Preservation of Digital Evidence, Preserving the Digital Crime Scene – Computer Forensic Processing Steps, Legal Aspects of Collecting and Preserving Computer Forensic Evidence Computer Image Verification and Authentication, Special Needs of Forensic Administrators, Physical Considerations, Purposes of Investigations.	
Examples Case Studies	Understand how computer forensic works by visiting http://computerforensicsforbeginners.com/computer-forensics-101/printout2/ (December 2019)

Mapping of Course Outcomes for Unit IV

Unit 5: Computer Forensic analysis and validation	Outcomes
Determining what data to collect and analyze, validating forensic data, addressing data linking techniques, and performing remote acquisition, Network Forensics, Network Forensic Overview, Performing Forensic Acquisitions, Developing standard procedures for network forensics, using network tools, examining the forensic project, Processing Crime and Incident Scenarios, Identifying digital evidence, collecting evidence in private sector incident scenes, processing for enhancement cyber scenes, preparing for a search, securing a computer incident or crime scene, saving digital evidence in the scene, saving digital evidence, thinking a digital level, reviewing a case	
Examples Case Studies	Focus cases under forensic threats, Man-in-the-middle threats, fish tank, Spoofing, and social media, Trust as a vulnerability type, preliminary responses for the forensic final case

Mapping of Course Outcomes for Unit V

Unit 6: Current Computer Forensic tools	Outcomes
Evaluating computer forensic tool tools, computer forensic software tools, computer forensic hardware tools, validating and testing forensic software, E-Mail investigation, Exploring the role of cloud in investigations, exploring the role of the cloud and server in email, investigating cloud crime and violations, understanding e-mail servers, using specialized email forensic tools.	
Examples Case Studies	Email Mail Cases & practices following examples: 1. https://www.purpleteam.com/substarring_email_mails-1616364941-1616364941.html

Mapping of Course Outcomes for Unit VI

Unit 6: Learning Exercises	Outcomes
Text Books: 1. John R. Vacca, "Computer Forensics", Computer Crime Investigations & Social Media, New Delhi. 2. Nelson, William K. Edgar, Stuart, "Computer Forensics and Incident Response", Cengage Learning.	
Reference Books: 1. Keith J. Jones, Richard Bejtlich, Curtis W. Rouse, "Real Digital Forensics", Addison-	

Wesley Pearson Education

1. Tony Deane and Brian Jaxson, "Teaching Computing", A. Frausterman Gals, Springer International altho.

Springer International altho.

2. Christopher L. T. Brown, "Computer Systems: Collection & Presentation", Humall Media.

Media.

4. Jero Mier, "The World Society, Technology & Technology", Humall Media.

e books

• <https://www.gdltire.com/computer-science-technology-network-introduction-and-cyber-crime-61551535.html>

• <https://akira.pub/knowledge-of-computer-science-technology-network-introduction-and-cyber-crime-61551535.html>

• <https://akira.pub/knowledge-of-computer-science-technology-network-introduction-and-cyber-crime-61551535.html>

• <https://akira.pub/knowledge-of-computer-science-technology-network-introduction-and-cyber-crime-61551535.html>

MOOC Course List:

- MIT Open CourseWare: <https://www.mit.edu/ocw/>

The CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1										1
CO2	1	1										2
CO3	2	2	2									2
CO4	2	2	2									2
CO5	2	2	2	2								2
CO6	2	2	2	2								2



ENTRUST Private Post University
Fourth Year of Computer Engineering (2019 Course)
400344(III) Object oriented Modeling and Design

Tracking Sheet:**Credits****03****Examination Scheme:****Internal (Open): 20 Marks****End-Sem (Paper): 70 Marks****TH: 15 Hours/Week****Prerequisite Course:** Software Engineering (110327)**Co-requisite Course:** Laboratory Practice IV (410327)**Course Objectives:**

- Describe the concepts involved in Object Oriented modelling and their benefits.
- Understand concept of use case model, sequence model and state chart model for a given problem.
- Utilize the basics of the unified process approach to design and build a software system.
- Translate the requirements into system solution for Object Oriented design.
- Choose an appropriate design pattern to facilitate development procedure before actual design process depending on nature of application.
- To describe Designing and Management of Patterns.

Course Outcomes:

On completion of the course, student will be able to:-

- CO1: Describe the concepts of object-oriented and basic class modelling.
 CO2: Draw class diagrams, sequence diagrams and interaction diagrams to solve problems.
 CO3: Choose and apply a building design pattern to the given problem.
 CO4: To analyze applications, architecture styles & software control strategies.
 CO5: To develop Class design Models & classes Legacy Systems.
 CO6: To understand Design Patterns.

Course Contents**Unit I****Introduction To Modelling****05 Marks**

What is Object Oriented? What is OO development? OO Process, Analysis for usefulness of OO Development, OO modelling history: Modelling as Design, Techniques: Modelling - abstraction, The design models: Class Modelling, Object and class concepts, Link and association concepts, Generalization and inheritance, A sample class model, Navigation of class models, Practical tips.

Strength/Case Studies

Case Study of a Web System

CO6

Mapping of Course**Outcome to Unit I****Unit II****Advanced Class Modelling and State Modelling****05 Marks**

Advanced object and class concepts, Association ends, Many associations, Syntactical, Abstract classes, Multiple inheritance, Notation: Multiplicity, Constraints, General data, Packages, Practical tips, State Modelling: Events, States, Transitions and Conditions, State diagrams, State diagram building, Practical tips.

Formulae/Case Studies Case Study of Data Flowchart for System

Mapping of Course CO1, CO2

Outcomes for Unit II

Unit III **Advanced Data Modeling and Database Modeling** **84 Hours**

Advanced Data Modeling: Nested state diagrams, Nested states, Typed generalization, Generalization, A simple state model, Relations of plain and state models, Fractional top interaction Modeling, Use case models, Sequence models, Activity models, Use case relationships, Procedural sequence models, Special constructs for activity models.

Through Case Studies Case Study of Coffee Vending Machine

Mapping of Course CO1, CO2

Outcomes for Unit III

Unit IV **Case Application Analysis: System Design** **84 Hours**

Application Analysis: Application interaction model, Application class model, Application state model, Adding operations, Overview of system design, Improving performance, Making a main plan, Breaking systems into sub-systems, Identifying concurrency, Allocation of sub-systems, Management of data storage, Handling global resources.

Choosing a software control strategy, Handling boundary conditions, Setting the task of priorities, Common architectural styles, Architecture of the ATM system as the example.

Through Case Studies Case Study of ATM System

Mapping of Course CO1, CO4

Outcomes for Unit IV

Unit V **Class Design, Implementation Modeling, Legacy Systems** **84 Hours**

Class Design: Overview of class design, Wrapping the gap, Reusing and reuse, Designing algorithms, Encapsulating algorithms, Refactoring, Design optimization, Evaluation of behavior, Adjustment of attributes, Representing a class design, ATM example, Implementation Modeling: Overview of implementation, Encapsulating classes, Data-tuning generalization, Encapsulating associations, Testing, Legacy Systems, Reverse engineering, Building the class models, Building the interaction model, Building the state model, Reverse engineering tips, Wrapping, Maintenance.

Through Case Studies Case study of College Library System

Mapping of Course CO4, CO5

Outcomes for Unit V

Unit VI **Design Patterns** **84 Hours**

What is a pattern and why makes a pattern? Pattern categories, Relationships between patterns, Relationships (Gang of Four) for Patterns, Formal Notation for UML, Mapping the Abstract, Particular Substrate.

Management Patterns, Command processor, View Controller, Abstract introduction, what can classes provide? Abstracted code, Where to find classic, Concrete Pattern examples

Learning Resources

Text Books:

1. Michael Wake, James Garbrough, "Object-Oriented Modeling and Design with UML", 2nd Edition, Pearson Education, 2005
2. Frank Hees, Rainer Böhmer, Hans-Joachim Pohl, Hans-Joachim Pohl, Michael Jell, "Pattern-Oriented Software Architecture, A System of Patterns", Volume 1, John Wiley and Sons, 2007

Reference Books:

1. Gaby Hooch et al, "Object-Oriented Analysis and Design with Applications", 2nd Edition, Pearson Education, 2007
2. Hisham Hefiani, Souvik Karmali, "Object-Oriented Analysis, Design, and Implementation", Universities Press, 2009
3. Hisham Hefiani, Souvik Karmali, "Object-Oriented Analysis, Design, and Implementation", Wiley, 2009
4. Robert Brach, Steve Wadsworth and Ray Farnham, "UML 2.1 Book 2, Object-Oriented Systems Analysis and Design Using UML, 2nd Edition, East Pointe Press, 2012

e-Books :

1. Object-Oriented Modeling and Design, 2010, <http://www.pdfbooks.org/object-oriented-design.pdf>
2. <http://www.pdfbooks.org/object-oriented-design.pdf>

MOOC Learning Link:

- <https://open.stanford.edu/courses/>

CO6 CO-2020 Mapping Matrix

	CO1	CO2	CO3	CO4	CO5	CO6	CO7	CO8	CO9	CO10	CO11	CO12
CO1	2	2	2	2	2	2	-	-	-	-	-	-
CO2	2	2	2	2	2	2	-	-	-	-	-	-
CO3	2	2	2	2	2	2	-	-	-	-	-	-
CO4	2	2	2	2	2	2	-	-	-	-	-	-
CO5	2	2	2	2	2	2	-	-	-	-	-	-
CO6	2	2	2	2	2	2	-	-	-	-	-	-



Seminarial/Practical Exercises
Fourth Year of Computer Engineering (2023 Cohort)
EEIC-64(E): Digital Signal Processing

Teaching Scheme	Credits	Examination Scheme
TE: 48 Hours/Week	03	In-Jew (Paper): 36 Marks Out-Jew (Paper): 74 Marks

Prerequisite Course: Engineering Mathematics I (EEIC-63)

Co-requisite Course: Laboratory Practice IV (4-EL4)

Course Objectives:

- To study and understand representations and properties of signals and systems.
- To learn methodology to analyze signals and systems.
- To study mathematical classical representation of signals and systems.
- To explore design and analysis of Discrete Time (DT) signals and systems.
- To understand Design of Filters as DT systems.
- To get acquainted with the filter theorems and other applications.

Course Outcomes:

On completion of the course, students will be able to:-

- CO1: Understand the mathematical models and representations of DT Signals and Systems
- CO2: Apply different transforms like Fourier and Z-Transform from application point of view.
- CO3: Understand the design and implementation of DT systems as DT Filters with the mathematical different transforms.
- CO4: Demonstrate the knowledge of signals and systems for design and analysis of systems
- CO5: Apply knowledge and use the signal transforms for digital processing applications
- CO6: To understand filtering and different Filter Structures

Course Contents

Unit 1	Signals and Systems	48 Hours
--------	---------------------	----------

Continues from E.E. 63, Describes how DT and Digital signals, Basic DT signals and Systems, Discrete-time Systems, Properties of DT Systems and Characteristics, Linear Time Invariant (LTI) Systems, impulse response, Linear convolution, Linear constant coefficient difference equations, FIR and IIR systems, Periodic Sampling, Relationship between Analog and DT Frequencies, Aliasing, Sampling Theorem, A/D conversion Process, Sampling, quantization and encoding

Example/Case Studies: Multirate Sampling

Mapping of Course Outcomes for Unit 1

CO1

Unit II	Frequency Domain Representation of Signals	48 Hours
---------	--	----------

Introduction to Fourier Series, Representation of DT signal by Fourier transform (FT), Properties of FT, Linearity, periodicity, time shifting, frequency shifting, time reversal, differentiation, convolution theorem, windowing theorem, Discrete Fourier Transform (DFT), IDFT and FFT, Fast-Four Transform, DFT as block transformation matrix, Properties of DFT, circular shifting, Circular Convolution, DFT as linear filtering, scaling zero and add, DFT spectra

Examples Case Studies

Number of Cases

Answers for Unit 11

Topic III: Fast Fourier Transform (FFT) and Z-Transform (ZT) [10 Marks]

Software components: MATLAB, Maple, C++ algorithms, SOSTOOLS, LMI-TOOLS, Mueser, HRT, HRT-2-matrices (GTV), AT and I-2, AT and I-3T, BKK and its properties, ZI Properties, acemichien, minc-value-theorem, Rational ZS, Poly-Zero-Pole, Behavior of signed SD signals, Inverted Z Transform (IZT), power series method, partial fraction expansion (PFE), Modelica.

References Cited (continued)

Summary of Cases

Downloaded for guest on 01/01/2016

Unit IV	Analysis of DC-DC Converters	18 March
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System function $H(s)$, $H(z)$ in terms of both order general difference equation, all pole and all zero systems, Analysis of LTI systems using $H(f)$, Inclusion of feedback: solution of difference equation, Impulse and Step response from difference equation, Pole zero plot of $H(s)$, and difference equation, Frequency response of system, Frequency response from pole-zero plot using bilinear transform, construction.

[#FlammableCageSmelter](#) [Index](#) [About](#)

*Division of Cancer 716

Pharmaceuticals, Inc. (Pfizer)

Unit 1 Digital Filter Design 11 Hours

Concepts of filtering, linear filters and approximations, splines, FIR and IIR filters, linear phase response, FIR filter design: Fourier series method, windowing method, Gibbs phenomenon, desirable features of filters, different window sequences and its analysis, design examples: IIR filter design: introduction, Mapping of s -plane to z -plane, impulse invariance method, bilinear z -transformation (BZT) method, Frequency Warping, Co-sampling, Design examples, Comparisons of FIR and IIR filters.

Research Case Studies **Workplaces of the Future**

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Shaping of Eggs

Page 10 of 10

Table 11	Three-Jarvison, and OGP Processes	10/10/10
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Other Structures for the Systems: draw form, cascade form, structure for lower plant VLS systems. Examples: Filter structure for VLS systems: draw form, cascade form, parallel form. Examples VLSI Processors: 5000, 2044, Pong, compare with conventional processor. Draw: Perceptron Block Diagram, 51148, 5107 Processor comparison to VLSI chip: Microvision Application Platform.

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**Mapping of Course
Outcomes for Unit 1.1**

C04

Learning Outcomes**Text Books:**

1. Proakis, J., Manolakis, S. D., "Digital Signal Processing", 4th Edition, Pearson Education, ISBN-978-0-13-187321-7
2. Oppenheim, A., Schuler, H., Willsky, A., "Discrete-time Signal Processing", 2nd Edition, Pearson Education, ISBN-978-0-13-187329-3

Reference Books:

1. Mitra, S., "Digital Signal Processing: A Computer Based Approach", 2nd Edition, Wiley, ISBN-978-0-471-32162-5
2. Oppenheim, J. C., Willsky, A. S., "Digital Signal Processing: A Practical Approach", Pearson Education, 1997, ISBN-0-13-021994-1/94-03-0321994-1
3. S. S. Proakis, S. V. Manolakis, A. J. Vaseghi, "Digital Signal Processing", McGraw-Hill, ISBN-0-07-409996-X
4. S. Haykin, B. S. S. S. "Digital Signal Processing", 2nd Edition, Wiley, ISBN-0-471-32162-5

e-Books:

1. An Introduction to Digital Signal Processing: A Focus on Implementation
<http://www.cse.cmu.edu/~hobbes/courses/6.035.97/6.035.97lect01.pdf>

MOOC Course Links:

- Digital signal Processing Introduction - <https://coursera.in/course/01700098>

UNIT NO	UNIT 1	UNIT 2	UNIT 3	UNIT 4	UNIT 5	UNIT 6	UNIT 7	UNIT 8	UNIT 9	UNIT 10	UNIT 11	UNIT 12
C01	2	1	1	1	1	-	-	-	-	-	-	-
C02	3	1	2	2	1	-	-	-	-	-	-	-
C03	1	2	2	2	1	-	-	-	-	-	-	-
C04	3	1	2	3	1	-	-	-	-	-	-	-
C05	3	2	3	2	3	-	-	-	-	-	-	-
C06	3	1	3	3	2	-	-	-	-	-	-	-



Savitribi Phule Pune University
Fourth Year of Computer Engineering (2018 Course)
Elective V
410245(A): Information Retrieval

Teaching Scheme**Credits**
03**Examination Scheme:****In-Sem (Paper): 18 Marks****End-Sem (Paper): 18 Marks****TUE: 04 Hours/Week****Prerequisite Courses:** Database Management Systems (410111)**Co-requisite Course:** Laboratory Practice IV (410147)**Course Objectives:**

- To study basic concepts of Information Retrieval.
- To study concepts of indexing for Information Retrieval.
- To analyze the performance of information retrieval using advanced techniques such as classification, clustering, and filtering over multimedia.
- To provide comprehensive knowledge about various evaluation methods.
- To understand the changes necessary to transfer a basic IR system into large scale search engine systems.
- To understand Parallel in Information Retrieval and Web search engines.

Course Outcome:

On completion of the course, students will be able to:-

- CO1: Implement the concept of Information Retrieval
- CO2: Construct queries in various one of retrieval techniques
- CO3: Apply techniques such as classification, clustering, and filtering over multimedia to analyze information
- CO4: Evaluate and analyze retrieval information
- CO5: Understand the data in various Applications and Extensions of information retrieval
- CO6: Understand Parallel information retrieval and web search engines

Course Contents:**Unit 1****Introduction, Basic techniques, IR Tools****03 Hours****Introduction:** The IR System, The Software Architecture of the IR System.**Book IR Models:** Boolean Model, V.E. Model (Term Frequency-Inverse Document Frequency) Weighting, Vector Model, Probabilistic Model and Latent Semantic Indexing Model.**Basic Techniques:** Simple Indexing, Stop-Word Removal and Stemming.**Example Case Studies**

A Case Study of Chicago Divisadero Library Which Aims at tracking the issues and solutions for the problems of Information Retrieval Methods by the Library.

Signature of Course**Coordinator: Dr. Dattaj**

(11)

Unit II**Basic Inverted Indexing and Query Processing****03 Hours**

Basic Inverted Indexes: Inverted Index Construction, Index Components and Index Life Cycle, The Dictionary, Non-Inverted Dictionary, Hash-based Dictionary, Interleaving Dictionary and Pointing Lists

Index Construction: Different types of Index Construction, In-Memory Index Construction, Sort-based Index Construction, Merge-based Index Construction, Disk-based Index Construction,

Other types of Indexes

Query Processing : Query Processing for Ranked Retrieval, Document-at-a-Time Query Processing, Term-at-a-Time Query Processing, Precomputing Query Contributions, Impact Ordering)

Query optimization, Lightweight Structure : Unranked Unambiguous Lists, Optimal, Implementation & Examples

Example Case Studies

Match the search patterns with the stored documents

Shipping of Course

CTE

Outcomes for Unit II

Unit III – Index Compression and Dynamic Inverted Index

80 Marks

General-Purpose Data Compression

Data Compression : Modeling and Coding, Huffman Coding, Arithmetic Coding, Symbolic List Compression

Compressing Pointing Lists:

Intersective, Gap Compression, Parametric Gap Compression, Document Array Compression Methods, Index Compression for High Query Performance, Compression Effectiveness, Decoding Performance, Document Resampling

Dynamic Inverted Indexes:

Incremental Index Updates, Compressed Inverted Lists, Noncontiguous Inverted

Document Deletion: Evaluation List, Passage Collection, Document Modifications

Example Case Studies

Compressing Short Segments with NMT: A Case Study in English to Hindi

Shipping of Course

Outcomes for Unit III

CTE

Unit IV – Probabilistic Retrieval and Language Modeling & Retrieval

80 Marks

Methods, Comparisons & Filtering

Probabilistic Retrieval: Retrieval, The Binary Independence Model, Term Frequency Document Length (BFS), Relevance Feedback, Field Weights

Language Modeling and Retrieval Methods: Generating Queries from Documents, Language Models and Smoothing, Working with Language Models, Divergence from Randomness, Perceptron-based and Ranking

Comparisons and Filtering: Dataset Examples, Classification, Linear, Semisupervised, Probabilistic Classification, Generalized Linear Models, Information-Theoretic Model

Linked on the Movie Recommendation, Filtering, and Ranking on Movie Retrieval with the of Ideal Principles

Example Case Studies

Linked on the Movie Recommendation, Filtering, and Ranking on Movie Retrieval with the of Ideal Principles

Mapping of Course Outcomes for Unit VI

F10

Unit V – Measuring Effectiveness and Learning Efficiency

80 Hours

Measuring Effectiveness – Traditional effectiveness research, The first National Evaluation (1994), Using statistics to evaluate, Measuring effectiveness effect, Experimental effectiveness research

Measuring Efficiency – Efficiency criteria, Query redesigning, Clustering, Introduction to Multiscale Hierarchical

Example Case Studies

Study of AN Handling

Mapping of Course Outcomes for Unit V

C10.4

Unit VI – Parallel Information retrieval, Web Search

80 Hours

Parallel Information retrieval – Parallel Query Processing, MapReduce

Web Search– The structure of the web, Query and Query, Static ranking, Dynamic ranking, Evaluation web search, Web Crawlers, Web search Engines, Python Script, Search Blog

Example Case Studies

Study of Google Maps' Facebook, Information retrieval

Mapping of Course Outcomes for Unit VI

CO 5, CO6

Learning Resources**Text Books:**

1. V. Bateman, C. Dellar and H. Garsch, Information Retrieval: Implementing and Evaluating Search EnginesTM MIT Press, 2010, ISBN: 0-406-75976-4
2. F. Markey, P. Raghavan, and H. Sahasra, Introduction to Information RetrievalTM, Cambridge University Press, 2009, i.i. 9780521860717
3. Francis Bacon, Vane and Herbert Wilson: New, Modern Information Retrieval: The Concepts and Technology behind SearchTM, 2nd Edition, ACM Press Books 2011.
4. Brian Croft, Donald Vinter and Victor Steadman, "Search engines: Information Retrieval in Practice", In: Editors Actions Venter, 2009, ISBN: 9781157561204

Reference Books:

1. C. J. Rasmussen, "Information Retrieval", <https://www.doc.ic.ac.uk/~Kath/ProbSem.html>
2. W. H. Hays, Information Retrieval: A (Health and Biomedical Perspective)TM, Springer, 2002.
3. G. Kuhlke, M. F. Murphy, "Information storage and Retrieval System", Springer, 2009
4. W. H. Hays, A. Lafferty, "Language Modeling for Information RetrievalTM", Springer, 2006.

e-Books :

1. Information Retrieval, www.informationsretrieval.org

4. <https://github.com/117132366>

2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
100	1	1	2	3	4	5	6	7	8	9	10	11
101	1	1	2	3	4	5	6	7	8	9	10	11
102	1	1	2	3	4	5	6	7	8	9	10	11
103	1	1	2	3	4	5	6	7	8	9	10	11
104	1	1	2	3	4	5	6	7	8	9	10	11
105	1	1	2	3	4	5	6	7	8	9	10	11
106	1	1	2	3	4	5	6	7	8	9	10	11



Savitribai Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
Elective V

406245(B) GPU Programming and Architecture

Page No. _____

Teaching Scheme

Credit

Examination Scheme

TTH: 30

05

Mid-Semester (TTH): 30 Marks

Exam Week:

End-Sem (TTH): 70 Marks

Prerequisite Course: Computer Graphics(CGE44)

Co-requisite Course: Laboratory Practice IV(CGE45)

Course Objectives:

- To Understand Graphics Processing Unit (GPU) Concepts
- To understand the basics of GPU architecture.
- To write programs for massively parallel processors
- To understand the issues in mapping algorithms for GPUs
- To introduce of various GPU programming models
- To examine the architecture and capabilities of modern GPUs

Course Outcomes:

After completion of the course, students should be able to:-

CO1: describe GPU architecture

CO2: Write programs using CUDA, identify issues and doing them

CO3: Implement efficient algorithms in GPUs for various applications. Identify, such as matrix multiplication

CO4: Write simple programs using OpenCL

CO5: identify efficient parallel programming patterns in various programs

CO6: Analyze the modern GPU architecture and it's applications

Course Contents**Unit I: Introduction to Graphics Processing Unit (GPU)****07 Hours**

Evolution of GPU architecture → Understanding Parallelism with GPU → Typical GPU Architecture
 → CUDA Execution Overview → Threads, Blocks, Grids, Warps, Scheduling → Memory Hierarchy
 with CPU/GPU Shared Memory, Global Memory, Constant Memory and Texture Memory

***Example/Case**

Review of traditional Computer Architectures

Studies***Mapping of Course** CO1**Outcomes for Unit I****Unit II: Code Programming****27 Hours**

Using CUDA → Multi GPU → Multi-GPU Solutions → Optimizing CUDA Applications: Profile &
 Incompatibilities, Memory Considerations, Transfers, Thread Usage, Resource Constraints

***Example/Case**

Writing CUDA programs

Studies***Mapping of Course** CO2**Outcomes for Unit II****Unit III: Programming Issues****07 Hours**

Common Patterns: CUDA's Error Handling, Parallel Programming Models, Synchronization, Algorithmic Issues, Finding and Avoiding Errors

Example Date Study of various CUDA errors

Student

Mapping of Course CO-7

Outcome for Unit

III

Unit IV	OpenCL Basics	87 Hours
OpenCL Standard, Keywords, Host Device Interaction, Execution Environment, Memory Model, Host OpenCL Examples		

Example Date Write OpenCL basic program

Student

Mapping of Course CO-4

Outcome for Unit

IV

Unit V	Algorithm on GPU	87 Hours
Parallel Patterns: Calculation, Prefix Sum, Matrix Matrix + Matrix Multiplication + Programming Heterogeneous Cluster		

Example Date Develop matrix multiplication mapping of algorithm

Student

Mapping of Course CO-3

Outcome for Unit V

Unit VI	OpenCL and Application Design	87 Hours
OpenCL for Heterogeneous Computing Application Design: Efficient Parallel Network Routing Algorithm		

Example Date Develop OpenCL for heterogeneous computing

Student

Mapping of Course CO-6

Outcome for Unit

VI

Learning Resources

Text Books:

1. Shane Cook, "CUDA Programming: A Developer's Guide to Parallel Computing with GPUs (Applications of GPU Computing)", First Edition, Morgan Kaufmann, 2012
2. David B. Kirk, Paulius Iliadis, Hitesh Sahas, Dong Hyeon Chung, "Heterogeneous computing with OpenCL", 1st Edition, Morgan Kaufmann, 2012
3. Alexander Oster-Lachmann, David B. Kirk, "Heterogeneous Computing with OpenCL"

Reference Book:

1. Nicholas W. H. "CUDA Handbook: A Comprehensive Guide to GPU Programming", Addison – Wesley, 2015.
2. Jason Sanders, Edward Sutter, "CUDA by Example: An Introduction to General Purpose GPU Programming", Addison – Wesley, 2008.
3. David H. Kirk, Wen-mei W. Hwu, "Programming Massively Parallel Processors", A Hands-on Approach, Third Edition, Morgan Kaufmann, 2016.
4. <http://www.mcs.anl.gov/pdubs/comp/comp.html>
5. <http://www.opnl.org>

oLinks:

1. <https://www.pdfdrive.com/cuda-handbook-a-comprehensive-guide-to-gpu-programming-p4-q3>

NPTEL/YouTube video lecture link

- https://www.youtube.com/watch?v=6wDj_6v4t8w

The CO-PO Mapping Matrix

CO PO	PO									PO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	9	PO10	PO11	PO12
CO1	1	1	1	1	1		1					
CO2	1	1	1	1	1							
CO3	1	1	1	1	1							
CO4	1	1	1	1	1							
CO5	1	1	1	1	1							
CO6	1	1	1	1	1							



Savitribai Phule Pune University
Fourth Year of Computer Engineering (1110 Course)
Elective V
4112450C-1: Mobile Computing

Tracking Scheme	Grade	Evolutionary Scheme (T)
T0: 2 Near-Well	2	100% Near-Well (T0) : 38 2nd-5th (T0) : 3

Pharmacokinetic Comments: Compazine, Nabilone and Sandoz 63, 244

Campylobacter *Campylobacter* *Campylobacter* *Campylobacter*

Every Day:

- To structure the novel concepts and principles in mobile computing. This includes design techniques involved, and research in system issues for the design and implementation of mobile computing systems, and applications.
- To demonstrate the protocols of mobile communication.
- To know GPRS and its data and support services.
- To study allocation, bandwidth management and wireless fundamentals.
- To summarize VLSI and HLL identification algorithms.
- To have current on design issues being used in field and design and development of various network, network using simulation tools.

Course Overview

- CO1: Develop a strong grounding in the fundamentals of mobile Networks
- CO2: Apply knowledge in MAC, Network, and Transport Layer protocols of Wireless Network
- CO3: Illustrate Global Systems for Mobile Communications
- CO4: Use the 4G-LTE technology based network with bandwidth capacity planning, QoS and RRM identified an algorithm.
- CO5: Classify network and transport layer of mobile communication
- CO6: Discuss the development of various wireless network standards using an introduction

Case 1

Task	Introduction to Mobile Computing	IT Issues
	Introduction to mobile computing. Comparison of mobile computing to public computing. Applications of mobile computing. Generation of mobile devices M1 to M4. Features of mobile computing. The Internet Technology. Public Wireless Telephone network (PSTN), Radio Communications system (PCS, PWS Network), etc., etc., etc., etc.	
*Template Case Studies	M1 Network - Systems showing the 10th generation in M1 mobile networks.	
*Mapping of Course Outcomes to Task I	(CO)	

Dur II	Syllable Writing practice	ET Home
an analysis of WAF, VAF applications, WAF Architecture, WAF Forward Proxy, Challenges in WAF Implementation, Benefits, Drawbacks, Routing protocols for all the various networks DDOS and ACSF, Network Application Gateway, WAF SaaS, IGAAN, WebSCL, Cloud, Various Networks, Various Implementations, Case Study projects, Firewall Management and Config, Assessment Tools, etc.		



Sardarbal Phak Pong University
Fourth Year of Computer Engineering (2019 Course)
Elective V
400345 (D): Software Testing and Quality Assurance

Tracking Number:
TR- 05 Hours/Week

Credits:
03

Examination Scheme:
In-Sem (Paper): 30 Marks
End-Sem (Paper): 70 Marks

Prerequisite Course: Software Engineering (118273), Software Project Management (118275/119)
Co-requisite Course: Lab: Python IV

Course Objectives:

- Introduce basic concepts of Software testing
- Understand the test plan to increase the effectiveness, test coverage, and reasonable speed for software testing.
- Understand objectives, types test, stress-oriented, risk based and other testing.
- Understand the importance of software quality and software reliability to system development.
- Know in detail systematic testing and traditional for systematic testing.
- To learn and understand the contribution of people and tools that are doing well to help QA professionals increase efficiency.

Course Outcome:

On completion of the course, student will be able to:-

- CO1: Describe** fundamental concepts of software testing, such as manual testing, systematic testing and software quality assurance.
- CO2: Design and Develop** project test plan, design test cases, test data, and conduct test operations.
- CO3: Apply** recent technologies and the software software testing for testing software.
- CO4: Apply** different approaches of quality management, company, test quality, standards for software system.
- CO5: Apply** test results to efficiency. Add more Quality Tools.
- CO6: Apply** test results to the efficient testing framework.

Course Contents:

Unit-1

Introduction to Software Testing

03 Hours

Introduction: General properties, Definition, Core Concepts, Classroom supplies and process, Definition of Testing, Testing and Debugging, Need of Testing, Quality Assurance and Testing, Why Software has Errors, Defects and Failures and its Causes and Effects, Total Quality Management(TQM), Quality practices of TQM, Quality Management through: Standard process, Product, Cultural Change, Customer Requirements, Relationship and metrics, Problem Solving Techniques and Software Tools, Software Quality, Classification of Software product Quality assurance, Quality and Productivity Relationship, Populations of Product, Software Development Process, Types of Product, Software Development Lifecycle Models, Software Quality Management, Processes related to Software Quality, Quality Management System's Structure, Pillars of Quality Management System, Important aspects of quality management.

Example Case Studies

1. Officers salary model for an Airline Company
2. SMP for airlines Cost for financial Service Provider

Mapping of Course Outcomes for Unit I

Unit II	Test Planning and Quality Management	BT Hours
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Test Planning – Software Design Strategy, Test Organization – Test Manager, Design, Tester Roles, Test plan purpose, Design, Coverage, Test Strategy and Approach, Test cases, Design, Test Data, Test Data-Dev criteria, Test Execution Schedule, Use cases, Testing, Scenario, Testing, Test Monitoring, Design, Coverage, Test Matrix – Test Case Productivity, Test case Coverage, Defect, Acceptance, Design, Rejection, Test Efficiency, Efforts and Schedule Variance, Test Plans, Writing Factors, Test Report, Design configuration Management, Quality Assurance Process, Documentation and Design Issues, Software Quality, Quality Management Importance, Quality Best practices.

Example Case Studies

1. Online Reservation System
2. Quality Engineering services for Virtual Domain company (Case Study) (page 11-16)

Mapping of Course Outcomes for Unit II

Unit III	Test Case Design Techniques	BT Hours
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Software Testing Methodologies: White Box Testing, Black Box Testing, Grey Box Testing, Test Case Design Techniques: Static Techniques: Informal Reviews, Walkthroughs, Technical Reviews, Inspections, Dynamic Techniques: Structural Techniques: Statement Coverage Testing, Branch Coverage Testing, Path Coverage Testing, Conditional Coverage Testing, Loop Coverage Testing, Black Box Techniques: Boundary Value Analysis, Equivalence Class Partition, Error Translation Techniques, Cause-Effective Graph, Decision Table, Use Case Testing, Experimental Based Techniques, Error guessing, Heuristic testing

Levels of Testing: Functional Testing, Unit Testing, Integration Testing, System Testing, User Acceptance Testing, Smoke/Breaker Testing, Regression Test, Stress, Non-Functional Testing, Performance Testing, Security Test, Usability Testing, Compatibility Testing, Security Testing, Fuzzing Testing, Smack Testing, Recovery Testing, Installation Testing, Rollback Testing, Web Based Testing, HTTP Testing, HTTP Testing, Cross-browser Testing.

Link: <http://www.knowledgegate.com/testing/courses/software-testing/testing.html>

testing (testing, software-research)

Example Case Studies

1. Case Study: Manual Testing (Detecting/Tracking Software Defects)
Link: <http://www.testingforall.org/bug-tracker-cases/study/testing-online-manual-testing-software-defects/>
2. Case Study: Defect Life Cycle (writing down/finding issues, writing their account which is already added and approved.)

Mapping of Course Outcomes for Unit III

Unit IV	Software Quality Assurance and Quality Control	BT Hours
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Software Quality Assurance: Introduction, Comparison of Software Product Quality Assurance, Quality and Productivity Relationship, Requirements of a Product, Characteristics of Software

Software Development Process, Types of Products, Schemes of Complexity Definitions, Software Quality Management, Why Software has Defects? Processes Related to Software Quality, Quality Management System Schemes, Pillars of Quality Management System, Important Aspects of Quality Management.

Software Quality Control: Software quality models, Quality management and metrics, Quality plans, Implementation and documentation, Quality tools including CASE tools, Quality control and reliability of quality process, Quality management system models, Complexity metrics and Cause and Effecting, International quality standards – ISO 9000

Example Case Studies

1. Case Study 01 – Android Application Acceptance Test Suite
2. Case Study 02 – API Acceptance Test Suite

Link to above case studies – [Software Quality Assurance Case Studies - YouTube](https://www.youtube.com/watch?v=3833333333)

Mapping of Course

Outcomes for Unit II

Unit II	Automated Testing Tools/Performance Testing Tools	IT Matrix
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Automated Testing: What is automation testing, Automated Testing Process, Automation Frameworks, Benefits of automation testing, how to choose automation testing tool, Software Automation Tools: Selenium's Tool Suite, Selenium IDE, Selenium RC, Selenium WebDriver, Selenium Grid, Automation Tools: SoapUI, Rational Process Automation (RPA), JUnit, Appium.

Performance testing: What is Performance testing what is use of J2 Tools used for performance testing – Apache JMeter.

Example Case Studies

1. Case Study: Userbase operational automation testing framework
2. Case Study: (J2EE) Automated Software Testing – A Case Study (www.ibm.com)

Mapping of Course

Outcomes for Unit I

Unit II	Testing Framework	IT Matrix
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Testing Framework: Software Quality, Software Quality Elements, Achieving Software Quality, Software Quality Assurance Elements of SQA, SQA Tools, Goals and Metrics, Formal Approaches to SQA, Rational Software Quality Assurance, Six Sigma for Software Engineering, ISO 9000 Quality Standard, SQA Plan, Total Quality Management, Product Quality Metrics, In-process Quality Metrics, Software maintenance, Software 1 tools tools, Flow Chart, Checklists, Pareto Diagram, Histogram, Run Chart, Scatter diagram, Control chart, Cause Effect diagram, Defect Removal Efficiency and Process.

Example Case Studies

1. Case study: Software Quality in Academic Institutions
2. Case study: Evolution of an Automated Testing Framework, A Case Study (www.ibm.com)

Mapping of Course

Outcomes for Unit II

Unit II	Learning Resources
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Savitribi Phule Pune University
Fourth Year of Computer Engineering (2018 Course)
Elective V
40551(E): Compiler

Teaching Scheme

Credits
03

Examination Scheme

In-Sem (Theory): 30 Marks
End-Sem (Theory): 30 Marks

TH: 60 Hours/Week

Prerequisite Courses: Theory of Computation(TOMAT), Systems Programming and Operating System(I/O&I)

Co-requisite Course: Compiler Theory (40551(E)).

Course Objectives:

- To understand language translation theories and compiler design stages
- To illustrate the various parser configurations
- To comprehend the use of system directed translation in assembly code
- To understand Storage Management and Control Structure Implementation
- Learn to develop a Code generator
- To demonstrate the various optimization methods used in the generation of efficient optimizing compilers

Course Outcome:

On completion of the course, students will be able to:-

- CO1: **Design and implement** a lexical analyzer using LEX tools
- CO2: **Design and implement** a syntax analyzer using YACC tools
- CO3: **Understand** system directed translation and machine representation
- CO4: **Generate** intermediate codes for high-level statements
- CO5: **Construct** algorithms to produce compiler code
- CO6: **Analyze and transform** programs to improve their time and memory efficiency

Course Contents:**Unit I****Notion and Concepts****30 Marks**

Introduction to Compiler Design issues, phases, phases, symbol table, Preliminaries Memory management, Operating system support for compiler, Lexical Analysis Issues, Regular Expressions, Phases of Lexical analysis, Block Schemata, Automatic construction of lexical analyzer using LEX, LEX Notation and specification.

Example/Case Studies

Study of LEX Compiler

Mapping of Course Outcomes for Unit

CO1

Unit II**Parsing****30 Marks**

Syntax, Analysis CFI, top-down and bottom-up parsers, LR(0), Predictive parser, SLR, LR(1), LL(1) parsers, using ambiguous grammar, Error detection and recovery, semantic construction of parsers using YACC, Introduction to Semantic analysis, Need of semantic analysis, type checking and type conversion

[Example Case Studies](#) Study of YACC

Mapping of Course Outcomes for Unit II

CO1

Unit III: System Translation Schemes 30 Hours

System Directed Translation – Abstract grammar, S and L abstracted grammar, bottom up and top down evaluation of S and L abstracted grammar, System Directed translation scheme, Intermediate code – read, type, Symbol Table, DAG, Three Address codes, Quadruples, Triples and Indirect Triples, Intermediate code generation of declaration statement and assignment statement.

[Example Case Studies](#) Applications of System Directed Translation

Mapping of Course Outcomes for Unit III

CO1

Unit IV: Runtime Storage Management 30 Hours

Storage Management – Stack, heap and temp. activation record, static and automatic data, parameter passing, return values, passing array and variable address of arguments, Static and Dynamic scope, Calling Sequence, functions of automatic activation record, if-else statement, loop-invariant while-do-while statements, for, nested blocks, display mechanism, array assignment, pointers, function call and return, Translation of DO statement, Class, members and Methods.

[Example Case Studies](#) COBOL – Compiler and runtime based address translation model

Mapping of Course Outcomes for Unit IV

CO1

Unit V: Code Generation 30 Hours

Code Generation – Issues in code generation, basic blocks, flow graphs, DAG representation of basic blocks, Target machine description, peephole optimisation, Register allocation and Assignment, Single code generation, Code generation from labelled tree, Concepts of code generation.

[Example Case Studies](#) Code Generation in a Virtual Machine Code based KeyTarget Compiler
(<http://www.muhimbi.com/Articles/DLL11.pdf>)

Mapping of Course Outcomes for Unit V

CO1

Unit VI: Code Optimisation 30 Hours

Local Optimisation, local, global and loop optimisation, Optimising transformations, control flow evaluation, common sub-expression elimination, variable propagation, code movement, strength reduction, dead code elimination, DAG based local optimisation, Introduction to global data flow analysis, Data flow equations and iterative data flow analysis.

**Outline of Course
 Overview for Unit 11**

Overview of computer systems (overview)
 (10%)

Learning Resources

Text Books:

1. R. Allen, R. Sedgwick, J. D. L. Brown, "Compilers: Principles, Techniques, and Tools", Pearson Education, ISBN 0-13-212945-9
2. Dick Dron, Hal Jacobs, Longsight, "Modern Compiler Design", Wiley, ISBN 05-205-04155

Reference Books:

1. Anthony J. Chis Ross, "Compiler Construction Using Java", JavaT and Java Wiley, ISBN 0-814-734899-1
2. R. M. Hameed, "Compiler Design", Oxford University press, ISBN 0-19-006604-1
3. J. R. Larios, J. M. Garcia, D. Garcia, "Lex and Yacc", J. Wiley, 2008, ISBN 978-0-470-1861-5

eBooks:

1. Basics of Compiler Design
<http://www.studyskills.com/for-technical-skills-basics-1012.pdf>
2. Modern Compiler Design
<http://www.studyskills.com/for-technical-skills-basics-1012.pdf>

MOOC Courses Link:

- <https://openstax.in/courses/196397196>

2024-25 PG Diploma Marks

2024-25	2023-24	2022-23	2021-22	2020-21	2019-20	2018-19	2017-18	2016-17	2015-16	2014-15	2013-14	2012-13
90%	100	100	100	100	100	100	100	100	100	100	100	100
80%	100	100	100	100	100	100	100	100	100	100	100	100
70%	100	100	100	100	100	100	100	100	100	100	100	100
60%	100	100	100	100	100	100	100	100	100	100	100	100
50%	100	100	100	100	100	100	100	100	100	100	100	100
40%	100	100	100	100	100	100	100	100	100	100	100	100
30%	100	100	100	100	100	100	100	100	100	100	100	100
20%	100	100	100	100	100	100	100	100	100	100	100	100
10%	100	100	100	100	100	100	100	100	100	100	100	100



Savitribi Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
403246: Laboratory Practice III

Teaching Scheme: Practical: 80 Theory: 20	Credits: 03	Examination Scheme: Term work: 50 Marks Practical: 70 Marks
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Corequisite Course: Design and Analysis of Algorithms (403243), Machine Learning (403245), Blockchain Technology (403242)

Course Objectives:

- Learn effect of data preprocessing on the performance of machine learning algorithms
- Develop in-depth understanding for implementation of the regression models
- Implement and evaluate supervised and unsupervised machine learning algorithms
- Analyse performance of an algorithm
- Learn how to implement algorithms that follow algorithm design strategies namely divide and conquer, greedy, dynamic programming, backtracking, branch and bound
- Understand and explore the working of III related technology and its applications

Course Outcomes:

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

- CO1: Apply preprocessing techniques on datasets.
 CO2: Implement and evaluate linear regression and random forest regression models.
 CO3: Apply and evaluate classification and clustering techniques.
 CO4: Analyse performance of an algorithm.
 CO5: Implement an algorithm that follows one of the following algorithm design strategies: divide and conquer, greedy, dynamic programming, backtracking, branch and bound.
 CO6: Understand the basic concepts in Blockchain technology and its applications

Guidelines for Instructor's Manual

The instructor's manual is to be developed as a reference and **must** be relevant. It should include: syllabus (include outcomes/program outcome alignment), standard problem, summaries of the course, conclusion and assessment guidelines, topics under consideration, concept, objectives, outcomes, set of typical applications/assignment questions, and references.

Guidelines for Student's Laboratory Journal

The laboratory assignments are to be submitted by students in the form of a journal. Journal consists of Certificate, table of contents, and handwritten write-up of each assignment (Title, Date of Completion, Objectives, Problem Statement, Software and Hardware requirements, Questions/grade levels and answer's key, Theory, Concept involved, algorithm, flowchart, test cases, Test Data, result/approach), mathematical model (if applicable), conclusion/analysis. Program codes with sample output of all performed assignments are to be submitted as a softcopy. As a conscious effort and time invested for learning Course IT and assessment outcome, attaching printed paper as part of write-ups and program listing in a journal must be avoided. Use of HOD containing student program submitted by Laboratory in-charge is highly encouraged for reference on or two periods may be considered with program prints in the Laboratory.

Guidelines for Laboratory / Term Work Assessment

Continuous assessment of laboratory work should be based on overall performance of Laboratory assignments by a student. Assessment of such Laboratory assignments will assign grade/ marks based on parameters, such as timely completion, performance, innovation, efficient codes, presentation, documentation and so on.

Guidelines for Practical Transactions

Practical assignments must be decided jointly by the internal examiner and external examiner. During practical assessment, maximum weightage should be given to satisfactory implementation of the problem statement. Relevant questions may be asked at the time of evaluation to test the student's understanding of the fundamentals, effective and efficient implementation. This will encourage thoughtful evaluation and the approach and hence will encourage any questioning or doubt in the minds of the students. An adhering to these principles will demonstrate our true efforts in the growing state of student's education.

Guidelines for Laboratory Conduct

The instructor is supposed to frame the assignments by understanding the prerequisites, technological aspects, safety and recent trends related to the topic. The assignment framing policy needs to address the average students and inclusive of enrichment to attract and promote the intelligent students. Use of open source software is encouraged. Based on the concepts learned, learners may also set the assignment on some project that is suitable to each branch's beyond the scope of the syllabus (Operating Systems recommended), C++, Java, Python, Solidity, etc.

Virtual Laboratory

- <http://ceel.iiitk.ac.in/>
- <http://cds.iiitk.ac.in/cds/cds.html#cds/cds/index.php>
- <http://cds.iiitk.ac.in/cds/cds.html#cds/cds/index.php>

Suggested List of Laboratory Experiments/Assignments. Assignments from all the Groups (A, B, C) are compulsory.

Course Content

Group A: Design and Analysis of Algorithms

Any 4 assignments and 1 mini project are mandatory:

1. Write a program to compute Fibonacci numbers and find its step count.
2. Implement gcd using recursive with division using a greedy method.
3. Write a program to solve a fractional knapsack problem using a greedy method.
4. Write a program to solve a 0/1 knapsack problem using dynamic programming or branch and bound strategy.
5. Write a program to generate binomial coefficients using dynamic programming.
6. Design N-Queen matrix having first Queen placed. Use backtracking to place remaining Queens to generate the final N-queen's matrix.

Mini Project

- Write a program to implement matrix multiplication. Also implement multithreaded matrix multiplication with either one thread per row or one thread per cell. Analyze and compare their performance.

OR

Implement merge sort and multithreaded merge sort. Compare time required by both the algorithms. Also analyze the performance of each algorithm for the best case and the worst case.

OR

Implement the naive string matching algorithm and KMP algorithm for string matching. Observe difference in working of both the algorithms for the same input.

Group II: Machine Learning

Any 4 assignments and 1 Mini project are compulsory.

- Predict the price of the Uber ride from a given pickup point to the agreed drop off location. Further following tasks:
 1. Preprocess the dataset.
 2. Identify variables.
 3. Check the correlation.
 4. Implement linear regression and random forest regression models.
 5. Evaluate the models and compare their respective scores. Model: RMSE, MAE, etc.
 Dataset link: <https://www.kaggle.com/datasets/purethanone/uber-dataset>

- Classify the email using the binary classification method. Input: Spam detection has two states: as Normal Mail = Not Spam, or Unusual/Spam = Spam. Use K-Nearest Neighbors and Support Vector Machine for classification. Analyze their performance.
 Dataset link: The email spam dataset on the Kaggle
<https://www.kaggle.com/datasets/benhamer/email-spam-classification-dataset>

- Given a bank customer, build a neural network-based classifier that can determine whether they will leave or not in the next 6 months.
 Dataset Description: The case study is from an open source dataset from Kaggle. The dataset contains 12,000 sample points with 14 distinct features such as: Creditworthiness, CreditHistory, Geography, Gender, Age, Income, Education, etc.
 Link to the Kaggle project: <https://www.kaggle.com/ashishbhatnagar/bank-customer-churn-modelling>
 Further following steps:
 1. Read the dataset.
 2. Data input: the features and target set and divide the data set into training and test sets.
 3. Normalise the data and test data.
 4. Initialize and build the model. Identify the pattern of experimentation and implement the same.
 5. Print the accuracy score and confusion matrix (5 points).

- Implement Gradient Descent Algorithm to find the local minima of a function.
 For example, find the local minima of the function $y(x) = 3x^2$ starting from the point $x = 2$.

- Implement K-Nearest Neighbors algorithm on diabetes.csv dataset. Compare the model results, accuracy, error rate, precision and recall on the given dataset.

Dataset link: <https://www.kaggle.com/datasets/ashishbhatnagar/diabetes>

6)	Implement K-Means clustering hierarchical clustering on sales_data_sample.csv dataset. Determine the number of clusters using the elbow method. Dataset link : https://www.kaggle.com/datasets/rajmangrkar/sales-data-sample
7)	Mini Project Use the following dataset to analyze age and income in the market and predict future stock price scenario based on India's historical data from 2010 to 2020. Dataset Link: https://www.kaggle.com/datasets/rajmangrkar/stock-data Build a machine learning model that predicts the type of people who survived the Titanic disaster using passenger data (i.e. name, age, gender, socio-economic class, etc.) Dataset Link: https://www.kaggle.com/datasets/rajmangrkar/titanic

Group C: Blockchain Technology

Any 4 assignments and a MA or project are mandatory.	
1.	Installation of Metasploit and study working of its port forwarding.
2.	Create your own exploit using Metasploit for application security.
3.	Write a smart contract on a test network, for bank account of a customer for following operations: - Deposit money - Withdraw money - Share balance
4.	Write a program in solidity to create student data, use the following constraints: - Student id - Address - Rollback Display the an smart contract on blockchain and observe the transaction fee and gas value.
5.	Write a survey report on types of Blockchain and its real time scenarios.
6)	Mini Project: Create a 2D application called app for a meeting system.

ETThe CO-PO Mapping Matrix

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1	2	2		2	2	-	2	2
CO2	2	2	2	2	2	2	-	2	2	-	2	2
CO3	2	2	2	2	2	2	-	2	2	-	2	2
CO4	2	2	2	-	2	-	-	2	2	-	2	2
CO5	2	2	2	-	2	-	-	2	2	-	-	2
CO6	2	2	2	2	2	-	-	2	2	-	-	2



Seminar: Final Paper University
Fourth Year of Computer Engineering (2018 Course)
4002nd Laboratory Practice IV

Teaching Scheme:
Practical: 34 Hours/Week

Credits:
6E

Examination Scheme and Marks:
Term: Weeks 28-30

Computer Course: EECS1114/EECS114 + EECS115/EECS115A

Course Objectives:

- Learn and/or apply an development related to particular computing
- Understand various methods for design
- Understand various functionalities and use of various tools for assessment of performance
- Understand information retrieval process using standard tools available
- Learn C/C++ programming and implementation of same using open source libraries
- Learn installation and use of open source software testing tools

Course Outcomes:

After completion of this course, students will be able to:

- CO1: Apply and/or application development for selected real life problems
- CO2: Design and develop systems using various multi-media components
- CO3: Identify various functionalities and demonstrate using various tools
- CO4: Apply information retrieval tools for natural language processing
- CO5: Develop an application using open source C/C++ programming language
- CO6: Apply software testing tools to perform assessment testing

Guidelines for Instructor's Manual

The instructor's manual is to be developed as a reference and hands-on resource. It should include principles about university projects (course department/university projects), description of the course, conduct and Assessment guidelines, topics under consideration, control objectives, resources, set of typical applications/experiments/ guidelines, and references.

Guidelines for Student's Laboratory Journal

The laboratory assignments are to be submitted by students in the form of journal. Journal consists of Curriculum table of contents, and handwritten write-up of each assignment (Title, Date of Completion, Objectives, Problem Statement, Software and Hardware requirements, Assessment grade/sheet and assessment sign, theory, Concepts tested, algorithm, flowchart, test cases, Test Data Set/ applicability, mathematical model (if applicable), conclusion/analysis. Program codes with sample output of all programmed assignments are to be submitted as appendix. As a continuous effort and fair contribution towards Goals IV and development assessment, attaching printed papers as part of write-ups and program listing is pointed must be avoided. Use of PDF containing student progress, submitted by Laboratory In-charge is highly encouraged. For reference use of two journals may be maintained with progress given in the Laboratory.

Guidelines for Laboratory/Term Work Assessment

Continuous assessment of laboratory work should be based on overall performance of Laboratory assignments by a student. Each Laboratory assignment assessment will assign grade/marks based on parameters such as timely completion, performance, innovation/efficiency and creativity.

Guidelines for Practical Examination

Practical examinations must be divided equally by the internal examiner and external examiner. During practical assessment, students' strengths should be given to satisfactory representation of the

positive statement. Answer question may be asked at the time of evaluation to test the student's understanding of the fundamental, effective and efficient implementation. This will encourage frequent evaluation and this approach and hence will not create any uncertainty or doubt in the mind of the students. So, adhering to these principles will commitment and team effort to the promising end of a student's academic.

Guidelines for Laboratory Conduction

The instructor is supposed to frame the assignments by understanding the personalities, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and provide the intelligent students. Use of open source software is encouraged. Based on the concepts learned, instructor may also set one assignment as mini-project that is suitable to respective student beyond the scope of syllabus.

Virtual Laboratory : <http://vlab-sts.slabs.ac.in/>

1. <http://labs.jtkap.ernet.in/>

2. <http://lab.asarita.edu/?url=3&lock=279&time=1205&run=1>

AI02044(A) Firmware Computing

Any 3 assignments from group 1 and 1 Mini project. From group 2 is mandatory.

Group 1

1. Develop an android location system in Library public system where it can direct a user to the bookshelf from a mobile device.
2. Design a personal application in which remote computer monitors one health device. It will determine when one is in trouble & will take appropriate action for rescue.
3. Develop an android application in which one will use the Internet to find nearby open parking space.
4. Android from factory flagstones = Self, Walking, Running, Throwing etc.
5. Design and build a sensing system using sensors controllers like - Arduino, Raspberry Pi, etc. Callouts to sense the environment around them and act accordingly.
6. Smart Mobile Application with notification sending for users to get the phone in charging / silent mode, Call, message, find music based on the operation of the device.

Group 2

1. **Mini project:** Develop from following features which uses the GPs of an Android-based Smartphone is record and analyze various features that could give user in the work, then setting the user to select particular from there given total list and place an order.
2. **Mini Project :** Design a mobile sensing platform mounted on a phone that integrates several sensors, such as touch pressure, imaging, inertial measurements, localization and a Radio Frequency Identification (RFID) reader for fruit classification and grading system.

3. Mini Project : Sketch (draw) a window Objects for Visually Impaired People. It should cover following points:

- a) Identifying obstacles around the user body from the ground to the head.
- b) Attaching some instructions to the user about the movement within a circle of path or radius.
- c) Finding some way around the obstacles.
- d) Providing information about the distance between the user and the obstacle with essential direction instructions.

10. Mini Project: Develop a Real-time application like a smart home with following requirements: If anyone enters at door the camera module automatically captures his image and it is the email account of user or send notification to the user. User will open mail after user's approval.

410443: Multimedia Techniques

Group 1

Any 5 assignments from group 1 and 1 Mini project from group 2 is mandatory

1. To study and investigate some multimedia tools and create an application using appropriate tool to design the college webpage.
2. To create AVI, image that demonstrate various features of an image editing tool.
3. Create or play a sample MIDI format sound file using LMMS / MuseScore / Forge the software tool. Edit the sample file by applying effects like bend, slide, vibrato, and harmonizer/pull-off. Export / Convert final MIDI to MP3 file format.
4. Implement run-length coding, quantization, and hierarchical coding for the encoder and decoder of three-level hierarchical H.263.
5. Create an universal video to music (living room, hot bed) scene (cost) with only main game objects. All game objects can be created using 3D model or use available 3D models.
6. Create a web page for a clothing company which contains all the details of that company and about five links to other web pages.

Group2

7. Mini Project: Design and develop a Navigation Assistance System.
8. Mini Project: Design and develop a traffic Monitoring System.

410444: Cyber Security and Digital Forensics

Any 3 assignments from group 1 and 1 Mini project from group 2 is mandatory

Group 1

1. Write a program for Tracking / sniffing/dump / monitoring Email Contents i.e. Write a program to analyze e-mail header.
2. Implement a program to generate damage: corrupt CAPTCHA image.
3. A person on a nearby local is trying to connect into a Wi-Fi network by trying to crack the Password as user the IP Address received, write a program detect such attempts and prohibit the

- access. Develop the necessary accounts by using an IEEE 802.11, Landport & Wi-Fi adapter and Access Point.
4. Write a computer network applications program for monitoring permanent Internet files and related statistics.
5. Write a program for loop capturing and instant correlation.
6. Configure and demonstrate use of vulnerability assessment tool (like Wireshark or SPOT).
7. Study of Network.

Group 2

1. Mini-project: Perform the following steps:
 - Go to the National Child Labour Bureau Coordination Centre (NCLB) Website at <http://www.nclb.co.uk>
 - Click on the following child employment link.
 - c. Read "How to Report Labour Exploitation or Labour Abuse Related to Children."
2. Mini-Project: Perform the following steps:
 - Go to <http://www.madgip.gov.in/madgip/industry/industry.htm>
 - b. Read the 1991 report on cyber malwares.

40024(D) Object Oriented Modeling and Design

Not a suggestion for group 1 and 2 Mini-project from group 2 is mandatory

Group 1

1. Draw state model for telephone line, with various activities.
2. Write basic class diagrams to identify and describe key concepts like classes, types to test systems and their interrelations.
3. Draw use or reuse Use Case diagrams for capturing and representing requirements of the system. Use case diagrams must include simple, showing decomposition and steps of the Use Case for various scenarios.
4. Draw use or reuse Use Case diagrams for capturing and representing requirements of the system. Use case diagrams must include simple, showing decomposition and steps of the Use Case for various scenarios.
5. Draw activity diagrams to display object-oriented flows or like flow charts.
6. Draw component diagrams showing that you will build your system including existing components along with a few new ones.
7. Draw deployment diagrams to model the runtime configuration of your system.

Group 2

1. Mini Project: Draw all UML diagrams for your project work.
2. Mini Project: Draw following UML diagrams for Book Management application:
 - a. Class Diagram's
 - b. Object Diagram
 - c. Use Diagram
 - d. Component Diagram's

40024(E) Digital Signal Processing

Not a suggestion for group 1 and 2 Mini-project from group 2 is mandatory

Group 1

1. Develop a program to generate maps to of $\cos$, $\sin$, $\csc$ and $\sec$ and a graph of specified sampling frequency and input parameters. (Test the results for different and by frequency (FF) and sampling frequency (FS) i.e. 25, 4, 3, 4, 5)
2. Find the output of a system described by given difference equation and initial conditions for given input sequence. Plot the output of difference equation (Obtain the response for different systems by changing the type of difference equation (N) and coefficients and also for different input sequence data. Observe the response for continuous, sampled, discrete, FIR and IIR systems).
3. Write a program to plot the magnitude and phase responses of a Fourier Transform (FT). (Obtain the responses for different inputs. Observe the Periodicity)
4. Find the N point DFT (IDFT) of the given sequence $x(n)$. Plot the magnitude spectrum (256) VS k . Analyze the output for different N and the same input sequence data. Also observe the periodicity and symmetry property).
5. Find the N point discrete convolution of given two sequences. Find a 3rd order linear system. Compute the discrete convolution of given two continuous time DFT and IDFT.
6. Develop a program to plot the magnitude and phase responses of a given system for given input sequence of impulse $\delta(n)$. Obtain the frequency response for different systems. Compare the frequency response of a system with the discrete Fourier transform (DFT) coefficients.

Group 2:

1. **Mini-Project:** Design and develop the N-point radix-2 DFT or 160-FFT algorithm to find DFT or IDFT of given sequence $x(n)$. Analyze the output for different N. Program should work for any value of N and output should be generated for all corresponding steps i.e. 8
2. **Mini-Project:** Obtain the Fourier transform of different window functions to plot the magnitude and phase spectrum. (Window Functions: Rectangular, Triangular, Bartlett, Flanning, Hamming, Kaiser, Hanning) and compare the desirable features of window sequences for different lengths. Observe the main lobe side lobe.
3. **Mini-Project:** Design an FFT filter bank given specifications using windowing method. Application should work for different types of filter specifications i.e. LPF, HPF, BPF and all window sequences. Plot the frequency response for different frequency tones i.e. analog and DT frequency i.e. 10
4. **Mini-Project:** Design an FFT filter for given specifications using Filterbank Tuning method. (Generalized code to search any filter length for a transfer function FFT). Application should work for different types of filter specifications that is LPF, HPF, BPF etc. and for different transfer functions of an analog filter.

ASSIGN(4) Information Retrieval

Group 1: one person from a group 1 and 1 Mini project from group 2 is mandatory

Group 1:

1. Write a program to compute Similarity between two text documents.
2. Implement Inverted Index Algorithm
3. Write a program for Pre-processing of a text document, stop word removal.
4. Write a programme program to create the matrix of occurrence of each alphabetic character in the given document. The output for each letter should be same irrespective i.e., include both upper case and lower case versions of the letter, ignore non-alpha numeric characters.
5. Write a program to represent sample web crawler.
6. Write a program to parse XML text, generate Web graph and compute its pagerank's page.

Group 2:

1. Mini project: Develop Document recommendation system

5. **Mini Project:** Develop a smart alarm and analysis system.

6. **Mini Project:** Develop a data mine discovery system.

402245(B) GPU Programming and Architecture

Note: Two projects for Group 1 and 1 Mini project. From group 2 is mandatory.

Group 1:

1. Write a program using OpenCL for heterogeneous computing.
2. Write CUDA programming with some simple things such as dot product, calculation of pi using integration method etc.
3. Write CUDA programming for matrix multiplication and matrix multiplication.
4. Write OpenCL "Hello World" basic program.
5. Develop a program using the various abilities of OpenCL and CUDA to analyze the performance of various graphics.
6. Case study on "Evolution of traditional Computer Architecture".

Group 2:

Mini Project: Image data compression.

Mini Project: Visualization to develop project for image processing and data video processing.

Mini Project: Parallel programming.

402245(C) Mobile Computing

Note: Two projects for Group 1 and 1 Mini project. From group 2 is mandatory.

Group 1:

1. To implement a Java function of Link between Multiple Accounts (LMA) to test the efficiency and robustness of a code is to be used for LMA operation. Write an application based on the above concept.
2. Implementation of CAN security algorithm (CAN-SEC).
3. Write an application that shows basic graphical presentation on the screen.
4. Develop a native application that uses GPS location information.
5. Design an android Application for Event Notification.

Group 2:

5. **Mini Project:** Develop an application for the following system, issues:
 - a) Form 1: Create a new account for each user.
 - b) Form 2: Deposit money in customer account.
 - c) Link both forms, after completing of first form the user should be directed to the second form.

8) Provide different menu options

7. **Mini Project:** Create the module for collecting cellular service network performance parameters using adaptive NIS Manager
- i) Network Time Monitor
 - ii) Signal Strength
 - iii) 5G Network Status
 - iv) Mobility Management Information

8. **Mini Project:** Create the module for payment of fees for College by demonstrating the following methods:
- i) Fee Module, for calculation of fee
 - ii) Use automated Taint for successful payment of fee
 - iii) Implement an alert in case someone missed out on the fee submission deadline
 - iv) Create an alert when payment gateway

9. **Mini Project:** Create an app to add of a product to list, the database and make sure to add following features
- i) SMS messaging and email provision
 - ii) Search options
 - iii) Tracking, with services
 - iv) Anywhere access enabled call
 - v) Use Alerts for user notifications

AI22A50 Software Testing and Quality Assurance

Note: Assignments from group 1 and 3. Mini project from group 2 is mandatory

Group 1:

1. Write TEST Scenario for Email Login Page
2. TEST Scenario for Email Login Page
3. Write Test cases for email alert for Social Media application on website
4. Create Defect Report for Any application or web application
5. Comparison of Business grid and software Workflows Diagram, give college (document on this)
6. Prepare Software requirement specifications for any project or problem statement

Group 2:

7. **Mini Project:** Software Testing and Quality Assurance Mini Project Develop website of college information using HTML, CSS, JAVASCRIPT and PHP, MySQL. Database used to store user account, username, and registration form details. Regular Expression routines for testing purposes
8. **Mini Project:** Create a web application by selecting software system environment, platform, and programming language. Write some on Test Plan covering features to be tested and bug discovery. Prepare Test Cases inclusive of Test Procedures for identified Test Scenarios. Perform selective BlackBox and WhiteBox testing covering Unit and Integration test by using

iterative testing task. Prepare test reports based on Test Plan and Criteria and judge the acceptance of application developed.

3. **Mini Project** : Create a small web-based application by selecting relevant system measurement platform and programming languages. Monitor describe Test Plan including features to be tested and bug scenarios. Monitor scripts in order to perform regression tests. Identify the bugs using browser WebDriver and JUnit and generate test reports about passing and failing testing.

AIMS/EO/Quantum Computing

1. Analyze simple states of superposition and the effect of doing the measurement at different base states.
2. Build simple quantum circuits with single and two-qubit gates.
3. Build logic for running quantum programs on IBM qubits.
4. Analyze the effectiveness of simple error correction scheme.
5. Implement quantum programs in NISQ model of computing.

QTL/CO-POs/eqs/ed/eqs

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	2	-	3	-	-	2	3	2	3	2
CO2	3	-	2	2	3	2	-	2	2	2	3	2
CO3	3	-	2	2	3	2	-	2	2	2	2	2
CO4	3	-	2	-	3	-	-	2	2	2	2	2
CO5	3	-	2	-	3	-	-	2	2	2	2	2
CO6	3	-	2	-	3	-	-	2	2	2	2	2



Savitriba Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
412108 – Project Work Stage I

Teaching Scheme:	Credit:	Examination Scheme:
Assessment Scheme/Week:	4	Presentation & Exhibit:

Course Objectives:

- To apply the knowledge for solving real-time problems
- To develop problem-solving ability
- To organize, analyze and report on a substantial piece of team work over a period of several months
- To evaluate a function/approaches, and justify the use of selected tools and techniques
- To follow appropriate corporate ground and industry format
- To develop relevant social, ethical and legal issues
- To find information for yourself from appropriate sources such as journals, books, research journals and from other sources, use to learn necessary and good skills
- To Work in Teams and have professional attitude

Course Outcome:

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

- Select and take decisions by applying knowledge
- Analyze alternative approaches, apply and use work appropriate and for health situation
- Write project reports and technical documents in a standard
- Participate effectively in multi-disciplinary and interdisciplinary teams contributing their work
- Inter personal relationships, conflict management and leadership qualities

Guidelines

Project work Stage I is an integral part of the Project work. In this, the student shall complete the initial work of the Project which will consist of problem statement, literature review, SRS, Model and Design. This student is expected to complete the project at least up to the design phase. As a part of the program report of project work Stage I, the student shall deliver a presentation on the achievement in Technology pertaining to the selected project topic. The student shall submit the duly certified project report of Project work Stage I to standard format for satisfactory completion of the work by the concerned guide and head of the Department/Institute. The assessment will be according to a panel of students of which one is internally an external examiner. The assessment will be largely based on work including oral and written delivery, presentation skills, documentation, synthesis, analysis and report.

Below guidelines and format as mentioned in Project Workbook recommended by Board of Studies



Savitribi Phule Pune University
Fourth Year of Engineering (1004 Course)
40048: Audit Course*

In addition to credits, it is recommended that there should be audit courses, as preference to such students starting from second year in order to supplement student's knowledge and skills. Student will be awarded the bachelor's degree if **he/she** **meets** specified total credit [1] and clear all the audit courses specified in the particulars. The student will be awarded grade as **NP** on successful completion of audit course. The student may opt for any of the audit courses per semester, starting in second year first semester. Though not mandatory, such a selection of the audit courses helps the learner to explore the subject of interest, to gain a clear insight, in achieving the very objectives of audit course's inclusion. List of options offered is provided. Each student has to choose one audit course from the list per semester. Evaluation of audit course will be done at Institute level. Audit Method of instruction and method of assessment for audit courses are suggested.

Criteria

The student registered for audit course shall be awarded the grade **NP** (Audit Course Pass) and shall be included with **NP** grade in the Semester grade report for that course, provided student has the minimum attendance as prescribed by the Savitribi Phule Pune University and satisfactory performance and internal appearing grade in that audit course. No grade points are associated with this **NP** grade and performance in these courses is not accounted in the calculation of the performance index (GPA) and (GPA). Evaluation of audit course will be done at Institute level only [1].

Guidelines for Completion and Assessment: This can be done in following list and format only.

- | | |
|-----------------------------------|--|
| • Lecture/ Demo Lecture | • Assigns |
| • Video (Visual) Film and reports | • Mini-Project |
| • Demonstration /y projects/works | • Study as experience on recent topic. |

Course Guidelines for Assessment: May use or more of following list and format only.

- Written Test
- Demonstration/Practical Test
- Presentation or Report

Audit Course's Options

Audit Course Code	Audit Course Title
AE-1.1	MOOC- Learn from Netflix
AE-1.1	Entrepreneurship Development
AE-1.11	Basics of Things
AE-1.1V	3D Printing
AE-1.1M	Industrial Safety and Environment Consideration



Savitribai Phule Pune University
Fourth Year of Engineering (2018 Course)
EE6256- Audit Course 7
AC7 – I: MOOC-based New EEL

This course aims to provide students with the digital competency, various resources available under SWAYAM and help them with their own courses.

Course Objectives

- To provide interactive and flexible support to students transitioning among students, postgraduates, and experts.
- To provide learn additional skills anytime and anywhere.
- To enhance learning and learning on campus and online.

Course Outcomes

On completion of the course, students will be able to

- CO1: To acquire additional knowledge and skills.

About Course

MOOC's Initiative Open Online Courses provide affordable and flexible way to learn new skills, pursue lifelong learning and deliver quality educational experiences at scale. Whether you transitioned to learning for yourself, advancing your career or leveraging online courses to advance your workplace, SWAYAM, NPTEL, etc. or can help **you** take help. World's largest SWAYAM MOOCs, a new paradigm of education for anyone anywhere anytime, as per your convenience. Aimed to provide digital education free of cost and to facilitate learning of all the education courses prepared by the best more than 1000 specially chosen faculty and teachers in the country. SWAYAM MOOCs enhance active learning for improving lifelong learning skills by providing easy access to global resources.

SWAYAM is a programme initiated by Government of India and designed to achieve the three central principles of Education Policy viz., access, equity and quality. The objective of this effort is to take the best teaching-learning resources to all, including the most disadvantaged. SWAYAM seeks to bridge the digital divide for students who have hitherto remained untouched by the digital revolution and have not been able to join the mainstream of the knowledge economy. This is done through an indigenous developed IT platform that facilitates learning of all the courses taught to students from 7th class till post-graduation in a seamless way, anywhere at any time. All the courses are structured, prepared by the best teachers in the country and are available, free of cost to the students in India. More than 1,000 specially chosen faculty and teachers from across the Country have participated in preparing these courses.

The courses listed at SWAYAM is generally in 4 phases – (1) video lecture, (2) specially prepared reading material that can be downloaded/print out off-coursework learn through code and queries and (3) an online discussion forum for clearing the doubts. Steps have been taken to enrich the learning experience by using real-time video and audio media and state-of-the-art pedagogy technology, in order to ensure best quality content are produced and delivered. Given National Coordinator's have been appointed. They are NPTEL, for engineering and IITs for post-graduation education.

Guidelines

Instructors are requested to provide students to get the course (and open content) with proper naming. The department will take care of providing necessary infrastructural and facilities for the courses.

References

1. <https://mooc.gov.in>
2. <https://nptel.ac.in/nptel.ac.in>
3. <https://www.400.org>

Savitriba Phule Pune University, Pune
Fourth Year of Computer Engineering (2018 Course)
410246: Audit Course 7
ACT – II: Entrepreneurship Development

This Course aims at instilling Entrepreneurial skills in the students by giving an exposure of the various opportunities and challenges entrepreneurs are subjected to having as entrepreneurs.

Course Objectives:

- To introduce the aspects of Entrepreneurship
- To impart a 360 degrees to product development
- To understand IP, Trademarks, Copyright and patents
- To know the facets of Financial plan, Entrepreneurial Teams and Financial Management

Course Outcomes:

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

- CO1 Understand the legalities in product development
- CO2 Understand the process of IP, Trademarks, Copyright and patents
- CO3 Understand and apply financial plan
- CO4 Manage Entrepreneurial Finance
- CO5 Acquire managerial skill as an entrepreneur

Course Content

1. Introduction: Concept and Definition, Entrepreneur vs. Intrapreneur, Role of entrepreneurship in economic development, Entrepreneurship process Factors impacting innovation of entrepreneurship, Managerial versus entrepreneurial thinking, Making Entrepreneur vs. Invention, Entrepreneurial activities and characteristics, Entrepreneur versus Invention, Entrepreneurial Talent, Women Entrepreneur, Social Entrepreneurship, Characteristics and Types of Entrepreneurs, ERM Proposition, Factors of Entrepreneurial Tendency, Traits/Qualities of an Entrepreneur.

2. Creating Entrepreneurial Ventures : Generating Business idea, Sources of Innovation, methods of generating ideas, Creativity and Entrepreneurship, Business planning process, Drawing business plan, Business plan failure, Entrepreneurial leadership → components of entrepreneurial leadership, Entrepreneurial Challenges, Legal issues → Starting business entity, Incorporation and Other, registration for formation of a Private/Public Limited Company, Intellectual Property Protection – Patent, Trademarks and Copyrights.

3. Functional plan: Marketing plan for the new venture, cost/benefit analysis, steps in preparing marketing plan, marketing mix, contingency planning, Organizational plan → designing organization structure and Systems, Financial plan → plan from income statements, Ratio analysis.

4. Entrepreneurial Finance: Debt vs. equity financing, Sources of Finance – External funds, private placements, venture capital, financial institutions, supporting contemporary issue financing, Funding opportunities for startups in India, 1. Entrepreneur Management: Managing growth and maintenance – growth versus survival for growth, Team management, Negotiations, Joint ventures, Mergers and acquisition, India.

5. Kumar, Anita, "Entrepreneurship: Creating and Launching an Entrepreneurial Organization", Pearson (2005), ISBN: 978-07304-9339-7, 978-013-076773-6

6. Gilad, Joram, "Entrepreneurship: Starting, Developing and Managing a New Enterprise", IIR/IIR (2014), ISBN: 978-013-076773-6

7. Davis, Tanya, "Entrepreneurship", Oxford Publishers, ISBN: 978-013-049443-4

8. Chaudhary, Parvinder, "Entrepreneurship Development and Small Business Enterprise", Pearson Education, ISBN: 978-81302087, ISBN: 978-177182064

Savitribi Phule Pune University, Pune
Fourth Year of Computer Engineering (CSE) Course
403/19- Audit Course *
AC7 – III: Set of Things

This course aims to provide an understanding of the various security attacks and how to design secure systems and secure networked systems that lead to robustness. It gives an outline of the techniques for developing a secure application.

Course Objectives:

- To understand the various IoT Protocols
- To Understand the IoT Reference Architecture and Real World Design/Connectors
- To learn the concept of Attacks

Course Outcomes:

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

- CO1: Implement security on a network and how to design the secure application robust to attacks
- CO2: Understand various attacks like DoS, Traffic overflow, web specific attacks specific web specific attacks
- CO3: Understand ACIs needed to deal with common programming issues that lead to common security problems and to know how to develop secure applications

Course Content

1. Introduction

2. IEC/Event-Driven Networks

3. Anatomy of a Network: The Control Plane

4. IoT Networks and Security: - Networks and services in IoT, Communication and networking in IoT, Evolution from cellular to IoT, Data analysis in IoT, IoT applications and applications, Security threats and techniques in IoT, Data confidentiality and privacy in IoT, Reliability, safety and other design goals in IoT, Types of Attacks in the Internet of Things: Examples of Typical IoT Attacks, Mitigation, use of Denial and Denial

5. Service Layer Protocols and Security: - Basics, HTTP, Transport, Connection, Security and Other Service-Layer Protocols, Data and Network Service Layer: MQTT, DTN, CoAP, OMA, HTTP - Security in IoT Networks: MAC, IEEE 802.15.4, 4G/LTE/LTE-A, Application Layer: Transport and Service Layer protocols: Transport Layer (TCP, UDP), Data Link Layer (IEEE 802.11, 802.15.4, 802.16, 802.17)

Network Layer: HTTP, CoAP, DTN, OMA, DTN

Books:

1. Ross J. Korth, - **Principles of Computer Systems**, "Understanding the Internet of Things", Springer ISBN 978-1-441-11116-1, 1-441-11116-1, ISBN 978-1-441-11117-2
2. David Mind, - **Building the Internet of Things with Python and Raspberry Pi**, No Starch Press, 1st Edition 2014
3. George J. Vigna, - **The Internet of Things: A Practical Guide to Understanding and Protecting Your Data**, IBM Security Systems
4. David Mind, - **Building the Internet of Things with Python and Raspberry Pi**, No Starch Press, 1st Edition 2014
5. David Mind, - **Building the Internet of Things with Python and Raspberry Pi**, No Starch Press, 1st Edition 2014
6. David Mind, - **Building the Internet of Things with Python and Raspberry Pi**, No Starch Press, 1st Edition 2014
7. David Mind, - **Building the Internet of Things with Python and Raspberry Pi**, No Starch Press, 1st Edition 2014
8. David Mind, - **Building the Internet of Things with Python and Raspberry Pi**, No Starch Press, 1st Edition 2014
9. David Mind, - **Building the Internet of Things with Python and Raspberry Pi**, No Starch Press, 1st Edition 2014
10. David Mind, - **Building the Internet of Things with Python and Raspberry Pi**, No Starch Press, 1st Edition 2014

Savitribi Phule Pune University
Fourth Year of Engineering (2019 Course)
400149: Addtl Course 7
ACT - IV- 3D Printing

This course aims to provide introduction of 3D printing machine and explain the business side of 3D printing.

Course Objectives:

- To **acquire** basic knowledge of drafting terminology and construction of geometrical figures using drawing instruments, procedure to prepare a drawing sheet as per SP:40:2001
- To **improve** skill of technical sketching, multi-view drawings, Isometric, oblique and metric construction.
- To **impart** practical aspects to generate detailed and assembly views with dimensions, annotations, in 3D Modeling software.
- To **develop** prototype and use product for 3D Printing.

Course Outcome:

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

CO1: To demand the basic knowledge of Shop Floor safety rules and regulations issues of Machines and 3D printing machines.

CO2: Understand the concept of concept of technical sketching, multi-view drawings, Isometric, oblique, and metric construction.

CO3: Sketching and Distinguish drafting terminology and construction of geometrical figures using drawing instruments, procedure to prepare a drawing sheet as per SP:40:2001

CO4: Describe and Explain practical aspects to generate detailed and assembly views with three view annotations, in 3D Modeling software.

CO5: Apply concepts and **Explain** the simple mechanical parts, prototype and use product for 3D Printing.

Course Contents

1. **Getting Started with 3D Printing:** How 3D Printing is a new Modern Manufacturing, Exploring Benefits of 3D Printing, Exploring Applications of 3D Printing.
2. **Outlining 3D Printing Resources:** Identifying Available Materials for 3D Printing, Identifying Available Services for 3D Printable Objects.
3. **Exploring the Business Side of 3D Printing:** Customizing 3D Printing, Understanding 3D Printing's Impact on Traditional mass of business, Exploring 3D Printing Business.
4. **Exploring Personal 3D printing Device:** Exploring 3D printed Aircraft, Considering Customer level 3D Printing, Deciding on Buying or Your Own.

Books:

1. Richard Heine, Kallid K.M. Hansen, " 3D Printing for Dummies", No Starch Press, ISBN 129086112
2. Greg Norton, "3D Printing: Machines + 3D Printing for Beginners + How to 3D Print", ISBN 9781714000469
3. Lisa Wallace-Knox and Nick Klox, "Getting Started with 3D Printing: A Hands-on Guide to the Hardware, Software, and Services Behind the New Manufacturing Revolution", Wiley Media, ISBN 1480430034
4. Jeff Hirsch, "3D Printing: Tips on Getting Started with 3D Printing to Help you make Invaluable Income for your Business"

Tamil Nadu State Open University, Tiruvarur
Fourth Year of Computer Engineering (MEIS Course)
400249: Audit Course V
ACT – V: Industrial Safety and Environment Coursework

This course aims to provide knowledge of industrial safety performance planning and accident prevention.

Course Objectives:

- To understand industrial hazards and safety requirements with course
- To know the basis of safety performance planning
- To know the causes of accident prevention
- To understand the impact of industrialisation on environment
- To know the diversified industrial requirements of safety and security

Course Outcomes:

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

- CO1: Develop the plan for safety performance
- CO2: Demonstrate the action plan for accidents and hazards
- CO3: Apply the safety and security system in the industry
- CO4: Evaluate the environmental issues of industrialisation

Course Contents

1. Introduction: Elements of safety programming, safety management, upgrading environmental programmes, safety procedures and performance strategies, education, training and development in safety.

2. Safety Performance Planning

Safety Performance: An occurrence of an accident, it is an accident, injury or incident. The safety performance, occupational health and industrial hygiene. Understanding the risk, emergency preparedness and response, prevention of accidents involving hazardous substances.

3. Accident Prevention

What is accident prevention?, Maintenance and Inspection, Managing Techniques, Control Accident Prevention, Safety Education and Training.

4. Organization Safety

Basic Elements of Organized Safety, Roles of Safety Officer, Safety Audit Functions, Safety Sampling and Inspection, Risk Safety Analysis/HRA, Safety Survey, On-site and Off-site Emergency Plan, Reporting of Accidents and Dangerous Occurrences.

5. Industrial Pollution

Introduction, Work Environment, Sources, pollution of Air/Water/Environment and Prevention, Risk Environmental Protection Procedures, Protection of Environment in Global Scenario, Environmental Issues, Climate Change Impacts, GHG Mitigation Options, Sinks and Barriers.

6. Industrial Security (Industry visit)

General security Systems in Industry, Accession Security, Computer Security, Building Security, M/C Security, Wireless Security, E-mail Security, Security in Open environment.

Books:

1. Kinister: "Practical Industrial Safety, Health, Environment and Security", Lexcel Publications, 1999.
DR. NIN/128403, CI, 978-8191175424

R. L. M. Dwivedi, "Industrial Safety Management", TMH, ISBN: 9780070617801

SEMESTER VIII



Savitribi Phule Pune University
Fourth Year of Computer Engineering (2018 Course)
400160: High Performance Computing

Page No. _____

Teaching Scheme
 Tilt: 4 Hours/Week

Credits
 3

Examination Scheme:100
 Mid-Semester (TH) : 30
 End-Term (TE) : 70

Prerequisite Courses: Algorithms (CSE201), Principles of Programming Language (CSE202), Computer Networks and Security (CSE244)

Companion Course: Laboratory Practice (M400254)

Course Objectives:

- To understand different parallel programming models
- To analyze the performance and avoiding of parallel programs
- To illustrate the various techniques to parallelize the algorithm
- To implement parallel communication operations.
- To discriminate CLUST, No distribution and its components.
- To Understand Scope of Parallel Computing and its search algorithms

Course Outcomes:

- CO1: **Understand** various Parallel Paradigms
 CO2: **Design and Develop** an efficient parallel algorithm to solve given problem
 CO3: **Illustrate** data communication operations on various parallel architecture
 CO4: **Analyze** and measure performance of modern parallel computing systems
 CO5: **Apply** CUDA architecture for parallel programming
 CO6: **Analyze** the performance of HPC applications

Course Content

Unit I	Introduction to Parallel Computing	09 Hours
Introduction to Parallel Computing: Motivating Parallelism, Modern Processors: Array-process computer architecture, General-purpose Cache-based Multiprocessor architecture, Parallel Programming Paradigm: Implicit Parallelism, Hierarchy of Parallel Computing Paradigm, Physical Organization of Parallel Platforms, Communication Types in Parallel Machines, Levels of parallelism, Models: SIMD, MIMD, SPMD, SPWET, Data Flow Model, Branchless Computation, Architectures: N-way symmetric architectures, multi-proc, node-based. *Example/Case Studies: Case study: Web-crawling system		
*Mapping of Course Outcomes for Unit I		
Unit II	Parallel Algorithm Design	09 Hours
Global Issues for Matrix Computation (10x10): architecture - Matrix Sparsity, Row-Station Remains, Scheduling algorithms, Sparsity: Data Sparsity, HMM3D, GPFS - GPFS system and parallel architecture 2.3.1/IRAN, UNITS core network, Improvements in Core Network, R2.11 Architecture R2.11a, R2.11b standard *Example/Case Studies: IPoC: A new Core Networking Protocol for 5G Networks.		

*Mapping of Course Outcomes for Unit II

CO2

Unit III Parallel Communication 09 Hours

Basic Communication: Dev-to-Dev Broadcast, All-to-All Broadcast, All-to-All Broadcast and Reduction, All-Reduce and Prefix Sum Operations. **Collective Communication using MPI:** Gather, Scatter, Broadcast, Blocking and non-blocking MPI, All-to-All Operational Communication, One-to-All, Improving the speed of some collective communication operations.

*Example/Case Studies Case study: Matrix-Vector Multiplication using MPI

*Mapping of Course Outcomes for Unit III

CO3

Unit IV Architectural Modeling of Parallel Programs 09 Hours

Issues of Overhead in Parallel Programs. **Performance Measures and Analysis:** Amdahl's and Gustafson's Laws, Speedup Factor and Efficiency, Cost and Utilization, Overhead Ratio and Relationship, The Effect of Overhead on Performance, Scalability of Parallel Systems, Minimum Execution Time and Minimum Cost, Optimal Execution Time, Asymptotic Analysis of Parallel Programs. **Matrix Computation:** Matrix-Vector Multiplication, Matrix-Matrix Multiplication.

*Example/Case Studies Case study: The HLL Model of parallel computation

*Mapping of Course Outcomes for Unit IV

CO4

Unit V CUDA Architecture 09 Hours

Introduction to GPU: Introduction to GPU Architecture overview, Introduction to CUDA C, CUDA programming model, write and launch a CUDA kernel, Handling kernel, CUDA memory model, Manage communication and synchronization, Parallel programming in CUDA C.

*Example/Case Studies Case study: GPU applications using Fortran and CUDA on NVIDIA

*Mapping of Course Outcomes for Unit V

CO5

Unit VI High Performance Computing Applications 09 Hours

Scope of Parallel Computing. **Parallel Search Algorithms:** Depth First Search (DFS), Breadth First Search (BFS). **Parallel Sorting:** Bubble sort, Merge. **Distributed Computing:** Master-slave Architecture, MapReduce - Hadoop, GPU Applications, Parallel Computing, FFA, AI, ML.

*Example/Case Studies Case study: Distributed dataflow and management: Smart Modeling/Smart planning

*Mapping of Course Outcomes for Unit VI

CO6

Learning Resources

Yeni Ekle:

1. Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, "Introduction to Parallel Computing", 2nd edition, Addison-Wesley 2003, ISBN 0-201-83663-2
2. Gerald J. Scotts, "Parallel Processing and Parallel Algorithms: Theory and Computation", Springer-Verlag 2000, ISBN 0-791-8-6012-7, ISBN 0-791-8-6012-1
3. John Chang, Marc Tremblay, and Ty McKeethen, "Professional C++ Programming", John Wiley & Sons, Inc., 1999, ISBN 0-764-17912-7

Referans Ekle:

1. Kai Hwang, "Systolic Parallel Computing", McGraw-Hill 1988
2. George S. Arbutnot and Alan Gendish, "VLSI Parallel Computing", The Benjamin and Cummings Pub. Co., Inc.
3. James Siskin, Robert Rader, "VLSI by Example", Addison-Wesley, 1989-1990, ISBN 0-13-111766-1
4. Richard Hsieh L, "An Introduction to Parallel Programming", Morgan Kaufmann Publishers ISBN 0-791-8-3102-5
5. Karim Sallou, Fekke, "Quantum Computing: A gentle introduction", MIT Press, 2011 ISBN 9780262086666
6. Ajay D. Kulkarni, Mahesh Prasad, "Theoretical Computing: Principles, Algorithms, and Systems", Cambridge Mass 2011, ISBN 07901210942

e-Book :

1. http://cdlibasaswerty.com/Books/1113311242/introduction_to_high_performance Computing_for_scientists_and_engineers.pdf
2. <https://www.researchgate.net/publication/34747864>

NPTEL/YouTube video lecture Ekl:

- <https://nptel.ac.in/courses/2018fall/66100007/>
- <https://www.youtube.com/watch?v=9H12t3t11d4>

The CO-PO Mapping Matrix

CO PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1		-	-	-	-	-	-	-	-	-
CO2	1	1		-	-	-	-	-	-	-	-	-
CO3	1	1		-	-	-	-	-	-	-	-	-
CO4	1	1	-	1	-	-	-	-	-	-	-	-
CO5	1	1	-	1	-	-	-	-	-	-	-	-
CO6	1	1	-	1	-	-	-	-	-	-	-	-



Savithribai Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
410251: Deep Learning

Teaching Scheme	Credits	Examination Scheme
TTH: 60 Hours/Week	03	Ta. Sem (Paper): 30 Marks End Sem (Paper): 70 Marks

Prerequisite Course: Machine Learning (410241)

Co-requisite Course: Laboratory Practice (410254)

Course Objectives:

- To understand the basics of neural networks.
- Comparing different deep learning models.
- To understand the Structure and Architecture of Deep Learning.
- To understand the basics of deep reinforcement learning models.
- To analyze Types of Networks.
- To Analyze Reinforcement Learning.

Course Description:

On completion of this course, students will be able to:-

- CO1: Understand the basics of Deep Learning and apply the tools to implement deep learning applications.
- CO2: Perform deep reinforcement of deep learning models (e.g., will expect with this-reinforced multi-armed bandits and scheduling, reinforcement of the agent).
- CO3: To apply the techniques of Convolutional (CNN) and Recurrent Neural Network (RNN) for implementing Deep Learning models.
- CO4: To implement and apply deep generative models.
- CO5: To construct and apply complex reinforcement learning algorithms.
- CO6: To Understand Reinforcement Learning Problems.

Course Contents

Unit I	Foundation of Deep Learning	07 Hours
What is machine learning and deep learning? Supervised and Unsupervised Learning, loss function, model hyper parameters, nonlinear fitting, regularization, Evaluation of machine learning, History of deep learning, Advantages and challenges of deep learning, Learning representations from data, Understanding how deep learning works in three layers, Common Architectural Principles of Deep Networks, Architecture Design, Application of Deep learning, Introduction and use of popular software tools such as TensorFlow.		
Lecture, PPT, Video, Cells, Assignments		
Recommended Study Material:	Deep Mind, AlphaGo, GoMaster Dynamics	
Mapping of Course Outcomes for Unit I	CO1	
Unit II	Deep Neural Networks (DNNs)	07 Hours

Introduction to Neural Networks: The Backpropagation, The Perceptron, Multilayer Feed-Forward Networks, Training Neural Networks: Backpropagation and Forward propagation, Activation Functions: Linear, Sigmoid, Tanh, Hard Tanh, ReLU, Rectified Linear, **Loss Functions:** Loss Function Selection, Loss Functions for Regression, Loss Functions for Classification, Loss Functions for Recommendation, **Hyperparameters:** Learning Rate, Initialization, Momentum, Stochastic Gradient Descent, Example of an NN, Hidden Units and Functions, other backpropagation, Convolutional Learning, Implementing ConvNet, Pooling and Expanding product, Attention, Softmax Analysis, Deep Learning with Physics, Support vector

[Example Case Studies](#) A Case Study for Multilayer Classification

[Mapping of Course](#) (13)

Outcomes for Unit II

Unit III **Convolutional Neural Network (CNN)** **10 Hours**

Introduction, CNN architecture overview, The Basic Structure of a Convolutional Network, Striding, Pooling, Typical Pooling, The Full ConvNet, Pooling Fully Connected Layers, The Inference, Inference Layers, Local Binary Normalization, Training a Convolutional Network

[Example Case Studies](#) monkey, MNIST

[Mapping of Course](#) (13)

Outcomes for Unit III

Unit IV **Recurrent Neural Network (RNN)** **10 Hours**

Recurrent and Recursive Net: Unfolding Computational Graphs, Recurrent Neural Networks, Unrolled RNNs, Encoder-Decoder Sequences to Sequence Architectures, Deep Recurrent Networks, Memory Neural Networks, The Challenge of Long-Term Dependencies, Hidden State Networks, Linky Units and Other Strategies for Multiple Time Scales, The Long Short-Term Memory and Other Good RNNs, Optimization for Long-Term Dependencies, Explicit Memory, **Practical methodology:** Performance Metrics, Default Baseline Models, Understanding What is Hidden Many Data, Selecting Hyperparameters

[Example Case Studies](#) Multitask Neural Recognition

[Mapping of Course](#) (13)

Outcomes for Unit IV

Unit V **Deep Generative Models** **10 Hours**

Introduction to deep generative models, Generative Models, Deep Autoencoders, Generative adversarial network (GAN), Restricted Boltzmann network, generative models, types of GANs, Applications of GAN networks

[Example Case Studies](#) GAN for generation of cat or face images

[Mapping of Course](#) (13)

Outcomes for Unit V

Unit VI **Reinforcement Learning** **10 Hours**

Introduction of deep reinforcement learning, States, Actions, Rewards, Basic Reinforcement Learning, challenges of reinforcement learning, Dynamic programming algorithms for reinforcement learning, Learning and Deep Q Networks, Deep Q reinforced networks, Deep reinforcement learning for the Game Tetris

**Mapping of Course
 Outcomes for Unit 1.1**

CO6

Learning Resources

Text Books:

1. Goodfellow, I., Bengio, Y., Courville, A. "Deep Learning", MIT Press, 2016.
2. Ian Goodfellow & Aaron Courville, "Deep Learning"
3. Chao-Asgerwal, "How of Networks and deep learning", A booklink
4. Mikellilathana, "Fundamentals of Deep Learning", OPI
5. HuanliuShu, "Deep Learning with Python"

Reference Books:

1. Richard S. Sutton and Andrew G. Barto, "Reinforcement Learning: An Introduction"
2. by YoshuaBengio, "Deep Learning from scratch: Building with Python from first Principles" O'Reilly
3. Francois Fleuret, "Deep Learning for Engineers: Practical Guide with Python and TensorFlow"

e-Books :

1. <http://www.deeplearningbook.org/> (Hillfort: www/fundamentals/learning.pdf)
2. <http://www.fundamentals-deeplearning.com/learningbook.pdf>

MOOC Courses Link:

- <https://www.coursera.org/deeplearning>

UNIT	101	102	103	104	105	106	107	108	109	1010	1011	1012
CO1	4	6	-	-	1	-	-	-	-	-	-	2
CO2	4	2	2	2	1	-	-	-	-	-	-	1
CO3	3	2	2	2	2	-	1	-	-	-	-	1
CO4	-	2	1	1	2	-	1	-	-	-	-	1
CO5	2	2	4	2	2	-	-	-	-	-	-	1
CO6	-	2	2	2	2	-	-	-	-	-	2	-



Savitribi Phule Pune University
Fourth Year of Computer Engineering (2018 Course)

Elective V

4061504/ Natural Language Processing

Teaching Scheme

Credits

Examination Scheme

TH: 03 Hours/Week

03

In-Sem (Paper): 30 Marks

End-Sem (Paper): 30 Marks

Prerequisite Course: Discrete Mathematics (110111), Theory of Computation (110112),

Data Science and Big Data Analytics (110113)

Co-requisite Course: Laboratory Practice V0401204

Course Objectives:

- To be familiar with fundamental concepts and techniques of natural language processing (NLP)
- To acquire the knowledge of various morphological, syntactic, and semantic NLP tasks
- To identify the various languages including techniques for NLP
- To use appropriate tools and techniques for processing natural languages
- To comprehend the relevance and world applications in NLP domains
- To describe Applications of NLP and Machine Translations

Course Outcome:

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

- CO1: Describe the fundamentals of concepts of NLP, challenges and issues in NLP
- CO2: Analyze Natural languages morphologically, syntactically and semantically-118
- Describe the concepts of morphology, syntax, semantics of natural language
- CO3: Illustrate various language modeling techniques
- CO4: Compare the NLP techniques for the information retrieval task
- CO5: Demonstrate the use of NLP for keyword techniques for text-based processing of natural language
- CO6: Develop real world NLP applications

Course Contents

Unit I	Introduction to Natural Language Processing	03 Hours
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Introduction: Natural Language Processing, Why NLP is hard? Programming languages Vs Natural Languages, Are natural languages regular? Formal notations for NLP, Issues of NLP, Challenges and Unresolved Problems in NLP

Basics of text processing: Tokenization, Stemming, Lemmatization, Part of Speech Tagging

Example Case Studies Why English is not a regular language.
<http://cs.beth.ac.uk/~harry/teaching/06.nlp/complexity.pdf> page 20
 118

Outline of Course

Course Out Unit I

Unit II	Language Syntax and Semantics	03 Hours
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Morphological Analysis: What is Morphology? Types of Morphemes, Inflectional morphology & Derivational morphology, Morphological parsing and Finite State Transducers (FST)

Symbolic Analysis: Syntax, Representations of Natural Language, Parsing Algorithms, Part-of-speech, semantic class, prepositional and Statistical parsing

Semantic Analysis: Lexical Semantics, Relations among lexemes in their context –

Homonymy, Polysemy, Synonymy, Antonymy, WordNet, WordSense, Disambiguation (WSD), Negation

Hybrid approach, Latent Semantic Spaces

Example Case Studies

Study of Stanford Parser and Part Tagger

<https://nlp.stanford.edu/software/lex-parser.html>

<https://nlp.stanford.edu/software/lex-parser.html>

Measure of Course (10)

Outcome for Unit II

Unit III	Language Modeling	OT Hours
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Prerequisites: languages existing, Markov models, Generative models of language, Log Linear Models, Embedded Models

N-gram models: Simple n-gram models, Estimation parameters and smoothing, Evaluating language models, **Word Embedding/ Vector Semantics:** High-dimension, L2/L3, word2vec, GloVe, Canonicalized representations (BLLI)

Topic Modeling: Latent Dirichlet Allocation (LDA), Latent Semantic Analysis, Non-negative

Matrix Factorization

Example Case Studies

Study of language modelling for Indian languages

Measure of Course (10)

Outcome for Unit III

Unit IV	Information Retrieval using NLP	OT Hours
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Information Retrieval: Introduction, Vector Space Model

Named Entity Recognition: NER System Building Process, Evaluating NER System

Entity Extraction, Entity Extraction, Entity Identification, Coreference resolution, Coreference Resolution

Example Case Studies

Natural Language Processing based Information Extraction & retrieval

<https://www.infodivides.com/2018/05/25/2018-05-25-Infodivides.html>

Measure of Course (10)

Outcome for Unit IV

Unit V	NLP Tools and Techniques	OT Hours
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Frameworks: NLP Libraries: Natural Language Tool Kit (NLTK), and Co. Stanford, Gensim etc.

Languages Known: Causal Knowledge Networks, WordNets, Indian Language WordNet (IndoWordNet), WordNet, Prolog, Haskell, Universal Dependency Tools

Word Sense Disambiguation: LSA Algorithm **Wikipedia's algorithm**, WordNet for Word Sense Disambiguation

Example Case Studies

Word Vectors, <https://www.cit.lic.ac.uk/wordpress/wordpress/>

Stanford WordNet https://www.nltk.org/_static/wordnet/wordnet.html

Wiki Library, <https://www.plantation.com/2018/05/25/2018-05-25-Infodivides.html>

**Mapping of Course
Outcomes for Unit 1**

(136)

Unit 11	Applicability of COs	POs/PSOs
Machine Translators: Rule-based translators, Statistical Machine Translators (SMT), Deep Logical Translation		
Structural Analysis, Question Answering, Text Entailment, Document Processing, Clustering and Computational Agents, Natural Language Generation		
Example Case Studies: Rule-encoding of English Translates Rule-encoding of IBM Watson Natural Language Processing		
Mapping of Course Outcomes for Unit 11	(136)	

Learning Resources**Text Books:**

1. Jurafsky, Daniel, and James H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing", Computational Linguistics and Speech Recognition, PL/NIPS/DP Publications
2. Manning, Christopher D., and John Schütze, "Foundations of Statistical Natural Language Processing", Cambridge, MIT Press

Reference Books:

1. Jurafsky Daniel, James Martin, "Speech and Language Processing with Python – Analyzing Text with the Natural Language Toolkit", O'Reilly Publications
2. Djavanmardian, "Text Analysis with Python: A Practical Rule-Based Approach to Mining Available English Language Data", Aptara Publications (2004, 4104421200)
3. Alexander Clark, Chris Fox, and Sharon Lapins, "The Handbook of Computational Linguistics and Natural Language Processing", Wiley-Blackwell Publications
4. Jurafsky Daniel, "Natural Language Processing", MIT Press
5. Jurafsky Daniel, "An Introduction to Information Retrieval", Cambridge University Press

Web:

1. <https://web.stanford.edu/~jurafsky/slp3/book.html>
2. <https://www.coursera.org/course/nlp11.1.10110.pdf>

NOTES Course Info:

- <https://open.stealth.com/1044444/>
- <https://open.stealth.com/1044444/>

5 The CO-PO Mapping Matrix

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	-	-	-	-	-	-	-	-	-
CO2	3	3	2	2	2	-	-	-	-	-	-	1
CO3	2	3	3	2	2	-	1	-	-	-	-	2
CO4	1	2	3	3	1	-	2	2	-	-	-	1
CO5	2	2	3	3	3	-	-	1	-	-	-	1
CO6	3	3	3	3	3	2	3	3	-	-	-	3



Distributed Phase Probe Circuitry
Fourth Year of Computer Engineering (2019 Course)
Elective V
410351 (B)- Image Processing

Teaching Scheme

TH: 60 Hours/Week

Credits

03

Examination Scheme

In-Sem (Paper): 30 Marks

End-Sem (Paper): 70 Marks

Prerequisite Course: Discrete Mathematics (20041)**Component Course:** Laboratory Practice VI (410359)**Course Objectives:**

- To Understand High Level Image Processing Concepts.
- To Study Various Methods for Image Enhancement using Spatial and Frequency Domain.
- To Learn Classification Techniques for Image Segmentation.
- To Understand Image Compression and Object Recognition.
- To Study Various Image Restoration Techniques.
- To Understand various Medical and Satellite Image Processing Applications.

Course Outcome:

On completion of the course, students will be able to:-

CO1: Apply Relevant Mathematics Required for Digital Image Processing.**CO2:** Apply Spatial and Frequency Domain Method for Image Enhancement.**CO3:** Apply algorithmic approaches for image segmentation.**CO4:** Summarize the Concept of Image Compression and Object Recognition.**CO5:** Explain the Image Restoration Techniques.**CO6:** Explain the Medical and Satellite Image Processing Applications.**Course Content****Unit I****Introduction to Digital Image Processing****60 Hours**

Introduction, Fundamental steps in Digital Image Processing, Components, Elements of visual perception, Image Sensing and Acquisition, Image Sampling and Quantization, Relationships between pixels, different Color Models, Image Types, Image File Formats, Connected Labeling algorithm.

Introduction to OpenCV and to Open and Display Images using Python or C++ or Java.

***Example/Case Studies:**

Write a program to create a image file, save the same as jpg, gif, jpeg format and display it.
 (11)

Mapping of Course*Outcomes to Unit I****Unit II****Image Enhancement****60 Hours**

Introduction to Image Enhancement and its importance, Types of image enhancement- **Spatial Domain Image Enhancement:** Intensity Transformations, Contrast Stretching, Histogram Equalization, Correlation and Convolution, Smoothing Filters, Sharpening Filters, Gradient and Laplacian.

Frequency Domain Image Enhancement: Low Pass Filtering in Frequency Domain (Gibbs,

Topics of Experiments		Assessment/Short Exam Questions
Introduction, Cameras, High Pass Filter in Frequency Domain (Lab, Discussion, Question)		
*Example Case Studies	Write a program for image enhancement using suitable algorithm for a given specification. Local enhancement, Averaging and Sharpening	
*Mapping of Course Outcomes for Unit II	CO3	
Unit III	Image Segmentation and Analysis	10 Marks
Introduction to Image Segmentation and its need. Classification of Image Segmentation Techniques: Threshold based Image Segmentation, Edge based Segmentation, Edge Detection, Edge Linking, Hough Transform, Watershed Transform, Clustering Techniques, region approach		
*Example Case Studies	Study the different image segmentation techniques for image segmentation	
*Mapping of Course Outcomes for Unit III	CO3	
Unit IV	Image Compression and Object Recognition	10 Marks
Image Compression: Introduction to Image Compression and its need, Classification of Image Compression Techniques- run-length coding, Huffman Encoding, Huffman coding, Scalar and vector quantization, Compression standards-JPEG, MPEG, Video compression		
Object Recognition: Introduction, Computer Vision, Lower Methods in Computer Vision, Classification Methods and Algorithms, Object Detection and Tracking, Object Recognition		
*Example Case Studies	Explain image compression and object recognition techniques	
*Mapping of Course Outcomes for Unit IV	CO4	
Unit V	Image Restoration and Reconstruction	10 Marks
Introduction, Model of Image degradation, Noise Models, Classification of image restoration techniques, Blind deconvolution techniques, Lucy Richardson filtering, Wiener Filtering		
*Example Case Studies	Explain classification of image restoration techniques	
*Mapping of Course Outcomes for Unit V	CO5	
Unit VI	Medical and Satellite Image Processing	10 Marks
Medical Image Processing: Introduction, Medical Image Enhancement, Segmentation, Medical Image Analysis (Diagnosis of Brain MRI or Cancer, MRI vs. Medical Center)		
Satellite Image Processing: Concepts and Foundations of Remote Sensing, GPS, GIS, Systems of Photographic Systems, Basic Principles of Photogrammetry, Multispectral, Thermal, and Hyperspectral Imaging, Earth Resource Satellite Imaging in the Optical Spectrum		
*Example Case Studies	Important application for medical image processing or satellite image processing using OpenCV or Python	

Learning Resources

Text Books:

1. Robert C. Gonzalez, Richard E. Woods, Steven E. Eddins, "Digital image processing", Pearson Education, Fourth Impression, 2008, ISBN 978-01-3171696-9.
2. A. K. Jain, "Fundamentals of Digital Image Processing", Pre, ISBN-0-03-01-231-8, 1984-8.
3. Gonzalez, R. E. and Woods, R. E., "Fundamentals of Digital Image Processing", Pearson Education, First Edition, 2007, ISBN-0171002709.
4. Margaret Cyganek, "Object Detection and Recognition in Digital Images: Theory and Practice", Wiley, First Edition, 2011, ISBN 978-0-470-93671-1.
5. Ignatius Cox, Matthew Oliver, Jeffrey Blom, Abena Fredrick, Tim Walker, "Digital Watermarking and Steganography", Morgan Kaufmann (MK), ISBN 978-0-12-372585-1.
6. Thomas S. Huang, Ralph W. Kneib, Jonathan Chaitin, "Barcode Reading and Image Interpretation", Wiley, Seventh Edition, 2011, ISBN 978-1-118-09601-7.

Reference Books:

1. Raimo Hästö, "Handbook of Medical Imaging", Academic Press, Second Edition, 2005, ISBN 978-0080379448.
2. Ignatius, Eddins and Woods, "Digital image processing" .. Vol. One: FBI, Second Impression- 2010, ISBN(1) 978-0-07-014473-6, ISBN(10) 07-014473-6.

e-Books:

- <http://booksonline.in/26-digital-processing-and-transmission-the-demoslab-book>

MOOC Courses: Info:

- <http://open.coursera.org/1710678>

@The CO-PO Mapping Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	1	1	-	-	-	+	1	+	-	+
CO2	1	2	2	2	2	1	-	-	1	-	-	1
CO3	1	2	2	2	2	1	-	-	1	-	-	1
CO4	1	1	2	2	2	1	-	+	1	+	-	1
CO5	1	1	1	2	2	1	-	-	1	-	-	1
CO6	1	2	2	2	2	1	1	-	1	-	2	1



Savitribi Phule Pune University
Fourth Year of Computer Engineering (2019 Course)

Elective V

4180521C: Software Defined Networks

Tracking Scheme	Credits	Examination Scheme
TE: 0	3	Semester (TE): 5B
Hours/Week		End-Sem (TE): 70

Prerequisite Course: Computer Networks and Security(201944)

Compulsory Course: Laboratory Practice VI(418055)

Course Objectives:

- To learn the fundamentals of software defined networking and understand the difference between traditional networks and software defined networks
- To gain conceptual understanding of Software Defined Networking (SDN) and its role in Data Center
- To study about the SDN Programming.
- To study industrial deployment use-cases of SDN
- To study about the various applications of SDN
- To discuss SDN components

Course Outcomes:

On completion of the course, student will be able to:-

- CO1: Interpret the need of Software Defined networking solutions
- CO2: Analyze different methodologies for scalable Software Defined Networking solutions
- CO3: Select best practices for design, deploy and installation of next generation networks
- CO4: Develop programmability of network elements
- CO5: Demonstrate virtualization and SDN Architecture using Open Flow protocol
- CO6: Design and develop various applications of SDN

Course Content

Unit I	Introduction	IT Notes
	Challenges of traditional networks, History of Software Defined Networking (SDN), Modern Data Center – Traditional, French Architecture – Why SDN – Evolution of SDN – How SDN Works – Centralized and Distributed Control and Data Planes	
*Example Case	Video Streaming	
Index	https://campus.meritx.com/what-is-sdn-sdn-use-cases/video-streaming/	
*Mapping of Course	CO1, CO2, CO3	
Outcomes for Unit I		

Unit II	OPEN FLOW & SDN CONTROLLERS	IT Notes
	Open Flow Overview, The Open Flow Switch, The Open Flow Controller, Open Flow Ports, Message Types, Pipeline Processing, Flow Tables, Matching, Instructions, Action Set and Set, Open Flow Protocol, Protocol and Reactive Flow, Tables, Open Flow Architecture, Open Flow Advantages and Disadvantages, Open v Switch Features, Operation of Open SDN, Introduction to SDN controller	

Example Case

Similar

Behavior Anomaly Detection in SDN Control Plane: A Case Study of Topology Discovery Attacks

<https://www.researchgate.net/publication/327349540>

Mapping of Course

Outcomes for Unit II

CO1,CO4

Unit II	DATA CENTERS	IT Hours
Data Center Definition, Data Center Elements (Adding, Moving, Deleting Resources, Failure Recovery, Multitenancy, Traffic Engineering and Path Efficiency), Emerging Technologies for the Data Center, SDN Use Cases in the Data Center, SDN Solutions for the Data Center Network – VLAN – VVPN – VxLAN – NVGRE		

Example Case

Similar

The World's Smallest Laptop Unit II: Data Center

A York's Infrastructure Case Study

<https://www.emuleware.com/updates/news/2017/06/06/york-universities-smallest-laptop-data-center/>

Mapping of Course

Outcomes for Unit III

CO3

Unit III	SDN PROGRAMMING	IT Hours
Programming SDNs: Northbound Application Programming Interface, Control Languages and Tools, Composition of SDNs – Introduction of Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications		

Example Case

Similar

Case Study: Italian Universities Uses SDN to Optimize

<https://www.researchgate.net/publication/316874000/abstract>
Italian Universities Uses SDN to Optimize

Mapping of Course

Outcomes for Unit IV

CO4

Unit IV	Network Functions Virtualization (NFV)	IT Hours
Definition of NFV, SDN vs NFV, In-band network Element, Benefits of Network Functions Virtualization, Challenges for Network Functions Virtualization, Leading NFV Vendors, Comparison of NFV and SDN		

Example Case

Similar

NFV deployment case study: future insights

<https://www.dell.com/whitepapers/nfv-deployment-case-study-future-insights>

Mapping of Course

Outcomes for Unit V

CO5

Unit V	SDN Use Cases	IT Hours
Single SDN Framework – Multi SDN Framework – Open Orchestration Controller – Cloudlet Controller – Embedded Cloudletting – Data Center Orchestration		

Example Case

Similar

Cloud-based network built using SDN and a high-performance network

from Japan.

Mapping of Course

Outcomes for Unit VI

CO6



Savitribi Phule Pune University
Fourth Year of Computer Engineering (2019 Course) Elective
VI
418262(D): Advanced Digital Signal Processing

Teaching Scheme TUE: 60 Hours/Week	Credits 03	Examination Scheme: In-Sem (Paper: 30 Marks End-Sem: Paper: 70 Marks)
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Prerequisite Courses: (418261) (A) Digital Signal Processing

Co-requisite Courses: Laboratory Practices (418257)

Course Objectives:

- To study the parametric methods for power spectrum estimation.
- To study adaptive filtering techniques and applications of adaptive filtering.
- To learn and understand Multi-rate DSP and applications.
- To explore speech and its applications.
- Understand basic concepts of speech production, speech analysis, speech coding and parameter representations of speech.
- Apply knowledge about different methods used for speech coding and understand various applications of speech processing.
- Learn and understand basics of Image Processing and various Image Filter with its applications.

Course Outcomes:

On completion of the course, students will be able to:-

- CO1: Understand and apply different transforms for the design of DIT Digital systems
- CO2: Explore the knowledge of adaptive filtering and Multi-rate DSP
- CO3: Design DT systems in the field area of adaptive filtering, spectral analysis and multi-rate DSP
- CO4: Apply use of DCT and WT in speech and image processing
- CO5: Develop algorithms in the field of speech, image processing and other DSP applications
- CO6: Identify Image Processing Techniques

Course Content

Unit I	DFT and Applications	30 Marks
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DFT and Applications – Linear filtering, spectral leakage, Spectral resolution and resolution of Window Length, Frequency analysis, 2-D DFT, applications in Image and Speech Processing

***Example/Case Studies** Case Study of Image / Speech Processing Applications

***Mapping of Course Outcomes for Unit I** CO1

Unit II	Adaptive FIR and IIR Filter Design	30 Marks
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Adaptive FIR and IIR Filter Design – DT Filters, FIR and IIR filters, Adaptive FIR Filter design, Recursive algorithm and Newton method, LMS method, Applications, Adaptive IIR Filter design, Applications, Least square design, Applications

***Example/Case Studies** Implementation of DT Filter and FIR filter with suitable application

Studies

*Mapping of Course: (11)

Outcomes for Unit II

Unit III	Mathematical DSP and applications	10 Hours
Introduction, Discrete Fourier Transform by a Factor 2, Interpolation by a Factor 1/2, Sampling Rate Conversion by a Rational Factor M/N , Filter Design and Implementation for sampling rate Conversion, Multirate Digital Signal Processing, Multirate Implementation of Sampling Rate Conversion, Applications of Multirate Signal Processing, Sampling Rate Conversion of Discrete Fourier Transform and Discrete Cosine Transform, Iterative Representation of a Stochastic Random Process, Forward and Backward Inverse Prediction, Solution of the Normal Equations, Properties of Linear Prediction Error Filter, NO Lecture and MATLAB Lecture-Lab Exercise.		

*Example Case Implementation for sampling rate Conversion Multirate Digital Signal Processing

Studies

*Mapping of Course: (11)

Outcomes for Unit II

Unit IV	Spectral Estimation	10 Hours
Spectral Estimation - Determination of density spectrum, Nonparametric method, Parametric method, Prediction, DCT and ST = DCT and K2, transform, STFT, WT, Hart-Wavelet and Daubechies-Wavelet, Applications of DCT and STFT		

*Example Case A spectral estimation case study of ECG using discrete-time adaptive methods

Studies

*Mapping of Course: (11)

Outcomes for Unit II

Unit V	Speech processing	10 Hours
Speech processing - Speech coding: Linear Vocoder, LTP, formant coding, Adaptive Transform Coding, Harmonic Coding, Vector Quantization based Codes, Prediction of Speech excitation, Speech segmentation, Vector speech synthesis, speech enhancement, Speech Verification, Applications.		

*Example Case
Studies
Implementation of form segmentation techniques for enhanced speech recognition (11)

*Mapping of Course

Outcomes for Unit II

Unit VI	Image Processing	10 Hours
Image Processing - Image or 2D signal and image enhancement techniques, Bit plane, Line pair, Highpass and bandpass for image enhancement and edge detection, Optimum linear filter and order statistic filter, Image noise - Wiener and Median Filter, applications		

*Example Case Matlab image processing for compression

Studies

(L1) & (L2) & (L3) parameter: A survey

*Mapping of Course

Outcomes for Unit II

	(11)	
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Text:

1. J. G. Proakis, D. E. Manolakis, "Digital Signal Processing: Principles, Algorithms, and Applications," Prentice Hall, 2005, 4th edition, ISBN: 0-13-067252-2.
2. D. Strela D. Sique, "Advanced Digital Signal Processing," Wiley Publ., 2011, ISBN: 9781118124114.
3. S. K. Mitra, "Digital Signal Processing: A Computer Based Approach", McGraw Hill Higher Education, 2006, 1st edition, ISBN: 0-07-302597-7
4. Rabiner and Bering, "Fundamentals of Speech Recognition", Prentice Hall, 1994, ISBN: 0-13-101151-2.
5. Rafael L. Gonsales, Richard S. Woods, "Digital Image Processing and Analysis", Pearson Education, 3rd ed., 2007, ISBN: 978-0-205-35656-5

References:

1. Chaitin, Maruyama, "Digital Image Processing and Analysis," Extra University Edition PHL, 2nd Ed., ISBN: 978-0-120-8086-2
2. LathiRazavi, "Digital Signal Processing", Oxford University Press, 2015, ISBN: 978-0190906210
3. Richard E. Croft, "Modern Digital Signal Processing," Thomson Brooks/Cole, 2004, ISBN: 076-019-903-6 ISBN: 978-013-06261-8
4. Nathan Morgan and Jim Field, "Speech and Audio Signal Processing: Processing and Perception Speech and Music", 1999, John Wiley and Sons, ISBN: 087911347
5. Raghuram, M. Raj, Ajithkumar, "Wavelet Transforms: Introduction to Theory and applications," Pearson Education, New, 2004 Dale Geyer and John R. Jacki Oeller, "Digital Signal Processing and the Microcontroller", Prentice Hall, ISBN: 0-13-040301-2

eL Books:

1. Fundamentals of Signal Processing, <http://www.eandereview.org/>
2. <http://www.stat.wisc.edu/rich/Bk-Articles/Book/Speech%20Processing%20and%20Digital%20Signal%20Processing%20and%20Audio%20Reduction%20BY%20Razavi%201997.pdf>
3. <http://www.researchgate.net/publication/2577879161912.pdf>
4. <http://imgp.uwaterloo.ca/~wp-courses/ephotos/2014/03/Andrew-Lathi-Digital-signal-processing%2007%202nd%20ed%201.pdf>
5. http://www.system-analysis.de/~sdl/teaching/bp-aipe-act/Contra-Memo_Advanced-DSP.pdf
6. <http://elibrary.org/pdf/Elib/2151610b3687/abstract/3841654363a.pdf>

MDOC Course Link:

- http://wulfsonetnet.apd.ac.ir/doc/2_2e88.pdf

@The CO-PO Mapping Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PO1	1	0	0	1	0	-	-	-	-	-	-	-
PO2	1	1	0	1	1	-	-	-	-	-	-	-
PO3	2	2	0	2	2	-	-	-	-	1	-	-
PO4	1	0	0	1	1	-	-	-	-	-	-	1
PO5	1	2	2	1	2	-	-	-	-	-	-	1
PO6	1	2	1	0	1	-	-	-	-	-	-	-



Sarmatshik State Free University
Fourth Year of Computer Engineering (2019 Course)
Elective V
(1035)(E) Open Elective

Teaching Scheme

TE: M.HasanWakil

Credits

03

Distribution Scheme for Sem

(Paper): 10 Marks

End-Sem (Paper): 10 Marks

The open elective included, we are to give the student a wide choice of subjects from other Engineering Programs. To minimize the cost of the building and to find the top is less choice of the students the time of open elective at end of the term. Flexibility is extended with the choice of open elective allows the learner to choose interdisciplinary courses that are technology related courses to expand the knowledge horizon. With this idea instructor gets the freedom without any restrictions to choose the approved by academic council and board of teacher.



Technological Education Institute of Athens
Fourth Year of Computer Engineering (2018 Course)
Elective VI
AI035(A): Pattern Recognition

Teaching Scheme**Credits****Responsible Scheme****TE: 65 Hours/Week****03****Dr. Gerasimos Papadimitriou****Dr. Gerasimos Papadimitriou****Prerequisite Courses:** Fundamentals of Data Structures(CS1042), Data Structures and Algorithms(CS1052)**Co-requisite Course:** Laboratory Practice V(CS1025)**Course Objectives:**

- To learn the basic concept of Pattern recognition
- To study different approaches of pattern recognition
- To learn various pattern classification techniques
- To survey current advances and applications in pattern recognition
- To implement Optimal Path Searching techniques
- To illustrate Pattern Recognition techniques

Course Outcomes:

On completion of the course, students will be able to:-

- CO1: Analyze various type of pattern recognition techniques
- CO2: Identify and apply various pattern recognition and classification approaches to solve the problems.
- CO3: Evaluate various cost and distance of pattern recognition
- CO4: Synthesize recent advances in pattern recognition and their various applications
- CO5: Implement **Dynamic's optimality principle and dynamic programming**
- CO6: Analyze Patterns using Genetic Algorithms & Pattern recognition Applications.

Selection of Modules:

Students select the modules 1,2,3 and module 5 are compulsory and select any two (02) modules from remaining modules

Course Content**Unit I****Pattern Recognition****03 Hours**

Introduction of Pattern Recognition with its application, Pattern Recognition systems, Design cycle of pattern recognition, Learning and adaptation, Representation of Patterns and classes, Feature Extraction, pattern recognition study approaches

***Example/Case Studies**

Evaluation on spatial and temporal variations in water quality by pattern recognition techniques.

***Mapping of Course Outcomes for Unit I**

CO1

Unit II**Error Estimation & Decision Theory****03 Hours**

introduction, linear covariance models, sparse matrix solutions (Jacobi, Marquadt, LSQR, Moler) and sparse band cluster, robust solutions based on statistical hypothesis testing, RHC data

introduction, Bayesian decision theory, continuous- and discrete features, two-category classification, maximum entropy classification, discriminant functions

Parameter Estimation- Maximum Likelihood Estimation, Bayesian Parameter Estimation, Efficient Statistics, Problems of degeneracy

Non-Parametric techniques: density estimation, Fisher's Wilcoxon, Mann and Wilcoxon, Weighted Classification, Freely class features

Example Case Studies Special and temporal an quality pattern recognition using another vector techniques

Mapping of Course Outcomes for Unit II CO1

Unit III **Structural pattern recognition** **10 Hours**

Tree Classifier, Decision Tree, Random Forests, **Structural Pattern recognition**: Elements of formal grammar, string grammar as pattern description, Recognition of syntactic description, Parsing, Stochastic grammar and applications, Graph based structural representations, Stochastic method: Hidden Markov learning

Example Case Studies Case study in optical word recognition.

Mapping of Course Outcomes for Unit III CO1

Unit IV **Clustering** **10 Hours**

introduction, Hierarchical Clustering, applications of clustering algorithm, the single linkage, complete, linkage and average, linkage algorithm, Ward's method, Partition clustering, K-means algorithm, clustering algorithms based on graph theory (kruskal spanning tree algorithm) Optimization methods used in clustering: clustering using similarity, Normalizing

Example Case Studies Case Study on Image recognition From a list of symptoms

Mapping of Course Outcomes for Unit IV CO1

Unit V **Template Matching and Unsupervised Learning** **10 Hours**

Maximization based on Optimal Path searching technique: Bellman's optimality principle and dynamic programming, The edit distance, Dynamic time Warping, Minimax used for evaluation, Inference using bayes models

Example Case Studies Pattern recognition in time series database: A case study on financial database

Mapping of Course Outcomes for Unit V CO4

Unit VI **Query Logs and Pattern Recognition** **10 Hours**

Pattern recognition classification, Pattern classification using Genetic Algorithms
 Pattern recognition applications: Applications of pattern recognition techniques in object recognition, Biometric, Facial recognition, IRIS scanner, Finger prints, 3D object recognition

Example Case Studies Study of fingerprint recognition

Measuring of Course Outcomes for Unit 11 CO6

Learning Resources

Text Books:

1. R. O. Duda, P. E. Hart, D. G. Stork, "Pattern Classfication", 2nd Edition, Wiley-Interscience, John Wiley & Sons, 2001
2. S. Theodoridis and K. Koutroumbas, "Pattern Recognition", 4th Edition, Academic, Academic Press, ISBN: 978-1-01789-233-0
3. D.J. Koptcy, "Pattern Recognition and Neural Networks", Cambridge University Press, ISBN-0-521-48046-7

Reference Books:

1. David V.S. Murty, M.N. Sural (Eds) Pattern Recognition, 3rd Edition, Elsevier Press, Hyderabad.
2. David G. Stork and Elad Yoon-Ten, "Computer Manual in MATLAB in accompany Pattern Classification", Wiley-Interscience, 2004, ISBN-0-11-0471270-7
3. Maki S. Pateira, "Digital Image Processing and Pattern Recognition", 1st Edition, 1978, ISBN-0-09-04
4. citation in MATLAB: <http://gnps.wisc.edu/CS/990573/>

e-Books:

1. <http://www.cse.psu.edu/~dcs10/teach/597/lectures-and-slides.pdf>
2. http://www.dcs.warwick.ac.uk/CS9071/lect11_2006.pdf
3. <http://www.dcs.warwick.ac.uk/teaching/99/Pattern511/Pattern.pdf>
4. <http://www.dcs.warwick.ac.uk/teaching/99/Pattern511/Pattern.pdf>

MOOC Course Links

- <http://gnps.wisc.edu/CS/990573/>

The CO-PO Mapping Matrix

	CO1	CO2	CO3	CO4	CO5	CO6	CO7	CO8	CO9	CO10	CO11	CO12
PO1	1			1			1	1	1	1	1	1
PO2	1	1		1	1	1	1	1	1	1	1	1
PO3	1	1	1	1	1	1	1	1	1	1	1	1
PO4		1	1	1	1	1	1	1	1	1	1	1
PO5	1	1	1	1	1	1	1	1	1	1	1	1
PO6		1	1	1	1	1	1	1	1	1	1	1
PO7		1	1	1	1	1	1	1	1	1	1	1



Sentential Peak Point University
Fourth Year of Computer Engineering (2018 Course)
Elective VI
AI050(B): Soft Computing

Teaching Scheme

Credits
03

Examination Scheme

In-Sem (Paper): 30 Marks
 End-Sem (Paper): 30 Marks

Prerequisite Courses: Computer Organization (AI014)**Companion Course:** Laboratory Practice V (AI01201)**Course Objectives:**

- To study the various soft computing approaches.
- To understand the soft computing techniques and algorithms for problem solving.
- To be familiar with the various application areas of soft computing.
- To apply the soft computing techniques for developing intelligent systems.
- To analyse and solve problems using genetic algorithms.
- To understand hybrid systems paradigm and Applications Areas of Soft Computing.

Course Outcomes:

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

- CO1:** Understand implementation of soft computing and its usage of various soft computing techniques.
- CO2:** Understand Artificial Neural Network and its characteristics and implement ANN algorithm.
- CO3:** Understand and implement Fuzzy-based Computing Techniques.
- CO4:** Understand the Fuzzy logic and implement fuzzy algorithms for solving real life problems.
- CO5:** Apply characteristics of Genetic algorithms for problem solving.
- CO6:** Develop hybrid systems for problem solving.

Course Content

Topic	Introduction To Soft Computing	IT Topics
Introduction to Soft Computing and Computational Intelligence. Characteristics of Soft computing, Comparison Soft Computing Vs Hard Computing, Requirements of Soft Computing, Soft Computing Techniques - Artificial Neural Network, Fuzzy Logic, Evolutionary computing and Hybrid systems, Applications of Soft Computing		
Example Case Studies 1. Study of Soft Computing techniques for Waste Management 2. Study of IBM Research Water-pipeline AI- a case look for non-linear computing		
Summary of Course Outcomes for This		

Example Case Studies

1. Study of Soft Computing techniques for Waste Management
2. Study of IBM Research Water-pipeline AI- a case look for non-linear computing

Summary of Course Outcomes for This

(11)

Unit II**Artificial Neural Network****07 Hours**

Neuron, Neuron structure and types, Artificial Neurons and its model, activation functions, neural network architecture: single layer and multi-layer feed forward networks, recurrent networks. Various learning techniques: perceptron and convergence rule, backpropagation and least-squares error training, propagation models: single layer artificial neural network, multi-layer perceptron model, back propagation learning methods, effect of learning rate coefficient, back propagation algorithm, function approximating backpropagation training, applications.

Example Case Studies Study of handwritten recognition using ANN.

Mapping of Course CO1

Outcomes for Unit II

Unit III**Evolutionary Computing****07 Hours**

Problem Solving as A Search Task, Hill Climbing And Stochastic Ascending, Evolutionary Computing, Evolution Strategies, Evolutionary Programming, Genetic Programming, Selected Applications From The Literature: A Brief Description, Scope Of Evolutionary Computing, Introduction to Evolutionary Single-Objective Optimisation, Particle Swarm Optimisation, Introduction: inspiration, mathematical model, standard and binary PSO, Artificial Immune System algorithm.

Example Case Studies Study of Engineering application of Artificial neural network algorithms
CO2

Mapping of Course

Outcomes for Unit III

Unit IV**Fuzzy Logic****08 Hours**

Introduction to Fuzzy Logic, Classical Set, Fuzzy Set: membership, Operations on classical sets, properties of classical sets, fuzzy set operations, properties of fuzzy sets, Classical Notation, Fuzzy Notion, **Fuzzy Inference process** – Membership functions, fuzzification, Membership value Assessment, inference, truth extension, defuzzification – weighted Average Method, Maximum Membership, Fuzzy Expertise Method, Mating, **Developing a Fuzzy Control** – System Architecture and Operation of FLC System, FLC System Models, Application of FLC System.

Example Case Studies Study of Object Detection Model Using Fuzzy Logic Controller

Mapping of Course

CO3

Outcomes for Unit IV

Unit V**Genetic Algorithms****07 Hours**

Introduction To Basic Technologies in Genetic Algorithm: Individuals, Genes, Chromosomes, Population, Single GA: General Genetic Algorithm; Operators in Genetic Algorithm: Encoding, Selection, Crossover (Recombination), Mutation; Stopping Condition for GA Flow; Constraints in Genetic Algorithm; Problem Solving Using Genetic Algorithm; Holland Classifier System: the Production System, the Bucket Brigade Algorithm and rule transmission; Advantages and Disadvantages of Genetic Algorithms; Applications of Genetic Algorithm.

Example Case Studies Use of Genetic Algorithm to design a solution to the Traveling Salesman Problem. **Session 1:** 1. An Introduction to Coding 2. Better Objective Function 3. Apply Solution Method 4. Crossover 5. Mutation 6. Repeat until stopping criteria is met. 7. Stop

Mapping of Course CO4

Outcomes for Unit V

MOOC Course Links

- NPTEL Course – Introduction of Built Computing, IT Management by Prof. Acharya
Semester: <https://nptel.ac.in/course/20182017/>
- NPTEL Course – Mobile Network and Applications, IT Management by Prof. Sarma
Semester: <https://nptel.ac.in/course/20182018/>
- NPTEL Course – Core Logic and Neural Networks, IT Management by Dr. Rajar
Semester: <https://nptel.ac.in/course/20182019/>

3 The 1500 Shipping Items

CODE	150	151	152	153	154	155	156	157	158	159	15A	15B	15C
CGE	1	2	-	2	-	3	-	-	-	-	-	-	1
CGC	3	1	1	3	1	2	-	-	-	-	-	-	1
CGD	3	1	2	5	1	2	-	-	-	-	-	-	1
CGE	3	2	1	3	1	2	-	-	-	-	-	-	1
CGF	1	3	2	5	1	2	-	-	-	-	-	-	1
CGH	3	1	1	3	1	2	-	-	-	-	-	-	1



Savitribai Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
[11255]A: Elective-17 Business Intelligence

Tracking Scheme	Credits	Formulation Scheme
TR 13	40	Mid-Semester (TR): 30 marks; End-Sem (TR): 10 marks.
Exam Week		

Prerequisite Course: 31024: Database Management Systems, 31025: Data Science & Big data Analytics, 41042: Machine Learning
Coquisite Course: 41025: Laboratory Practice VI

- **Course Objectives:**

1. To introduce the concepts and components of Business Intelligence (BI)
2. To introduce the technologies that enable BI (data warehousing, OLAP)
3. To identify the business impact and benefits of BI systems
4. To explain different data programming techniques
5. To identify machine learning model as per business need
6. To understand the BI applications in marketing, logistics, finance and other organizations etc.

• **Course Overview:** The curriculum of this course, the students will benefit in

- **ETL:** Differentiate the concepts of Extract, Transform, Load & Warehouse Intelligence
- **ETL:** Use Load Warehouse & Business Intelligence to design a BI system
- **ETL:** Build graphical reports
- **ETL:** Apply different data processing algorithms on data
- **ETL:** implement each of loading algorithm as per business reqs
- **ETL:** ETL with OLAP in real-time, Analytics, and Storage and other common methods and the

Case Study

Unit I	Introduction to Decision support systems and Business intelligence	10 Hours
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Decision support systems: Definition of a system supporting one of the decision-making processes, activities of information systems. *Decision Support Systems*, development of a decision support system, the four stages of Simon's decision-making process, and common mistakes and weaknesses of decision makers.

Business Intelligence: It is components & architecture, providing the focus of BI, making a better experience for all business users, but user exceptions, setting up data for BI, data, information and knowledge, the role of mathematical models, business intelligence architecture, data and business intelligence.

Example Case If you cannot connect to the Internet, the Internet Explorer icon in the taskbar will have a red X over it.

Smell: <https://www.youtube.com/watch?v=2Bx-hd-cuag> (pink flower bud fragrance)

*discipline of course

Overview for Unit I

Unit II	The Architecture of IPv4 and IPv6	17 hours
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AI and Data and humans and its types - Relation between AI and Data - CLAP (Cognitive Language Processing) definitions - Different CLAP Architectures-Data Machine Tools in Human Intelligence-Field of DSS, DSI, MIS and Data Data Science - Need for Human Intelligence

(Difference between OLAP and OLTP - Dimensional analysis - What are cubes? Drill-down and roll-up - slice and dice operation - OLAP models - ROLAP versus MOLAP - defining schemas: star, snowflake and fact constellation)

*Example Case	A case study on Retail Industry	
Reader	https://www.datacentralengineering.com/2018/07/11/3111.pdf	
*Mapping of Course	CO2	
Outcomes for Unit II		
Unit III	Reporting Architecture	17 Hours
Building reports with relational vs. non-relational data models; Types of Reports – List, summary, hierarchy, Chart, map, Bar chart etc; Data Grouping & Sorting, Filtering Reports, Adding Calculations to Reports, Conditional Formatting, Adding Summary Lines to Reports, Drill up, drill down, drill through capabilities, Print or schedule report, different output forms – HTML, excel, pdf, and etc.		
*Example Case	Project III Case Study – Data for the retail industry based on Healthcare & Policy	
Reader	https://datacentralengineering.com/2018/07/11/3111.pdf	
*Mapping of Course	CO3	
Outcomes for Unit III		
Unit IV	Data preparation	17 Hours
Data validation – incomplete data, data affected by noise, Data transformation – standardization, Format conversion, Data reduction – Sampling, Feature selection, Principal component analysis, Data discretization, Data exploration – 1. Univariate analysis : Graphical analysis of unimodal attributes, Graphical analysis of numerical attributes, Measures of central tendency for numerical attributes, Measures of dispersion for numerical attributes, Identification of outliers for numerical attributes 2. Bivariate analysis : Graphical analysis, Measures of correlation for numerical attributes, Contingency tables for categorical attributes, 3. Multivariate analysis : Graphical analysis, Measures of correlation for numerical attributes		
*Example Case	Case study on Data preparation phase of AI system	
Reader	https://datacentralengineering.com/2018/07/11/3111.pdf	
*Mapping of Course	CO4	
Outcomes for Unit IV		
Unit V	Super of Machine Learning in Business Intelligence Process	17 Hours
Classification : Classification problems, Evaluation of classification models, Bayesian methods, Logistic regression, Clustering : Clustering methods, Partition methods, Hierarchical methods, Evaluation of clustering results, Association Rule : Sources of Association Rule, Apriori Algorithm		
*Example Case	Business applications for comparing the performance of a stock over a period of time – https://datacentralengineering.com/2018/07/11/3111.pdf	
*Mapping of Course	CO5	
Outcomes for Unit V		
Unit VI	AI Applications	17 Hours

Tools for Business Intelligence, Role of analytical tools in BI, Case study of Analytical Suite, MSTR, KMMSE, Rapid Miner, R.

Data analysis, Business analytics, ERP and Business Intelligence, BI and operations management, BI in inventory management system, BI and human resource management, BI Applications in CRM, BI Applications in Marketing, BI Applications in Logistics and Production, Role of BI in Finance, BI Applications in Banking, BI Applications in Telecommunications, BI in e-business management.

Example Case Studies: Logistics planning in the food industry

Source: <https://techsolutions.csis.com/casestudy>

<https://www.bentley.com/en-us/products/industry/casestudy>

Mapping of Course COB

Outcomes for Unit

U1

Learning Resources

Text Books:

1. Fundamentals of Business Intelligence, Christopher W. Weverka Eds, Springer 2011
2. R. Sharda, R. Tannen, & S. Tashan, Business Intelligence and Analytics Systems for Decision Support, 10th Edition, Pearson Education India, 2015

Reference Books:

1. Piny, Pinyan, "Data Warehousing Fundamentals", John Wiley
2. Introduction to Business Intelligence and Data Warehousing, DPH, PPH
3. Business Intelligence: Data Mining and Analytics for Decision Making, Data Science, Wiley, 2019
4. Data Mining for Business Intelligence, Wiley
5. HBI, Educational Services, Data Science and Big Data Analytics, Discovering, Analyzing, Visualizing and Predicting Data, Wiley ISBN: 1118091136
6. San R. Follis, Data Science: A Holistic Approach to Business Intelligence and Data Warehousing, Pearson Education, 2017, ISBN: 1111711000

e-Books:

1. <http://www.bentley.com/en-us/products/industry/casestudy>
2. <https://www.csis.com/casestudy>
3. <https://www.bentley.com/en-us/products/industry/casestudy>
4. <https://www.bentley.com/en-us/products/industry/casestudy>

NPTEL/TeaTube video lecture links:

- Business Analytics for strategic decision: <https://openstax.org/r/11030004>
- Business analytics and data mining modeling using R: <https://openstax.org/r/11030002>
- Business Analytics for Engineers: <https://openstax.org/r/11030005>

2 The CO-PO Mapping Matrix

CO-PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	1	2	-	-	-	-	-	-	-
CO2	1	1	1	1	1	-	-	-	-	-	-	-
CO3	1	1	1	1	1	-	-	-	-	-	-	-
CO4	2	2	2	1	1	-	-	-	-	-	-	-
CO5	2	2	2	2	1	-	-	-	-	-	-	-
CO6	-	1	-	1	1	-	-	-	-	-	-	-



Savitribi Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
(38253)D : Quantum Computing

Teaching Scheme

Credits
03

Examination Scheme:
 Theory (Paper): 30 Marks
 End-Sem (Paper): 30 Marks

III: 30 Hours/Week**Prerequisite Course:** Data Structures and Algorithms (21601), Data Science and Big Data Analytics (21621)**Co-requisite Course:** Laboratory: Practice (1616247)**Course Objectives:**

- To provide introduction and necessary exposure to the topics in the upcoming discipline of Quantum Computing and Quantum Learning.
- To enable the students to learn Quantum Computing and Quantum Machine Learning to provide them the learning outcome as that helps them understanding and working on quantum Quantum Computing, Algorithms and Software Frameworks.
- To enable the students to develop hybrid systems by applying Quantum Machine Learning to general business applicable areas.
- To study Quantum Information Theory and Quantum Computing Programming Model of Computation.
- To study Quantum Algorithms and apply them to develop hybrid solutions.
- To study Quantum Learning concepts for more handling the Quantum Computing, Algorithms and complete the analysis, hardware and software implementations and presents the results available open source to help growth in the industry and academia.

Course Outcomes:

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

- CO1: To understand the concepts of Quantum Computing.
- CO2: To understand and apply models to mathematical foundation and quantum mechanics.
- CO3: To understand and implement leading blocks of Quantum circuits.
- CO4: To understand quantum information to processing and Simulation tools.
- CO5: To understand basic signal processing algorithms FFT, DFT and FFT.
- CO6: To study and solve examples of Quantum Fourier Transform and its applications.

Course Contents**Unit I****Introduction to Quantum Computing****30 Hours**

Fundamental Concepts of Quantum computing:

Introduction and Overview, Global Perspectives, Quantum like Quantum Computing, Quantum Algorithms, Quantum algorithms and Quantum information processing.

Delivery of Course Documents for CO1**Unit I****Mathematical foundation of Quantum Computing****30 Hours**

Quantum Mechanics

Linear Algebra and Quantum mechanics, Principles of Quantum mechanics, wave function, evolution, Quantum measurement, distinguishing quantum states, projector measurements, POVM measurements, Bloch Spheres systems, Global view and applications, Hadamard operator.

Mapping of Course Outcomes

C112

for Unit II

Unit III	Building Blocks for Quantum Programs	Dr. Haren
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Quantum Computation: Quantum circuits, Quantum operations and multi-qubit operations, Controlled operations, Principal subroutines and Principal high-level Monte-carlo, Values of Quantum Gates, Two-level unitary: gates, single qubit and TNOT, Use of ccz of multi-level operations, Quantum computational complexity.

Mapping of Course Outcomes for

C113

Unit III

Unit IV	Quantum Search Algorithms and Fourier Transforms	Dr. Haren
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Simulation of quantum systems, Simulation of algorithmic complexity growth of quantum systems, Quantum random algorithms, Examples of quantum simulations, perspectives of quantum simulation.

Understanding: Basics of Fourier transforms, Discrete Fourier Transforms, Fast Fourier Transforms, Applications, mathematical representations of FFT, DFT and FFT

Mapping of Course Outcomes

C113/C114

for Unit II

Unit V	Quantum Fourier Transforms and Applications	Dr. Haren
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Quantum Fourier Transforms: Phase estimation, performance and complexity analysis, Coding applications, Inverse applications, General applications of Quantum Fourier transforms: period finding, discrete algorithms, Other Quantum Algorithms.

Mapping of Course Outcomes

C115

for Unit I

Unit VI	Quantum Machine Learning	Dr. Haren
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Quantum Machine Learning and Quantum AI, Quantum State of Nervous, Quantum Natural Language Understanding, Quantum Cryptography, Applications: Overview for Quantum Machine Learning, Quantum Neural Network, Sparse Data, Parameter related Optimization Problems, Success Probability, Feature selection.

Mapping of Course Outcomes

C116

for Unit II

Learning Outcomes		
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Text Books:

1. Michael A. Nielsen, "Quantum Computation and Quantum Information", Cambridge University.
2. Frank, "Quantum Machine Learning (What Quantum Computing Means to Data Mining)", John Wiley & Sons, London - Elsevier Publications.
3. Andrew W. Senior, "Principles of Quantum Artificial Intelligence", Institute of Physics Publishing - (Institute of Physics, Perseus) - World Scientific Publishing, Berkeley - Elsevier Engineering Publications.

Reference Books:

1. Peter Drosten, Kai - "Mathematische Grundlagen der Quantenphysik", Pearson, ISBN: 978-3-598-29014-2, ISBN: 0-7167-11100-0
2. Michael A. Nielsen, "Quantum Computation and Quantum Information", Cambridge University Press, Peter Drosten, Kai - "Mathematische Grundlagen der Quantenphysik", Pearson, ISBN: 978-3-598-29014-2, ISBN: 0-7167-11100-0
3. David J. Winfree, "Quantum Computing Explained", Wiley
4. Michael A. Nielsen, David J. Winfree, "Quantum Computation and Quantum Information: A First Course in Quantum Information Science", Cambridge University Press, ISBN: 978-0-521-87622-3
5. Nielsen, Michael A., Chuang, Isaac L., "Quantum Computation and Quantum Information: A First Course in Quantum Information Science", Cambridge University Press, ISBN: 978-0-521-87622-3

Links

1. <http://www.quantum-computing.de/>

2. <http://www.quantum-computing.de/>

MOOC Course Links:

1. <https://www.coursera.org/course/quantum-computing>

2. <https://www.coursera.org/course/quantum-computing>

Qubit	000	001	010	011	100	101	110	111	100	101	110	111
000	1	2	3	4	5	6	7	8	9	10	11	12
001	1	4	3	2	5	6	7	8	9	10	11	12
010	1	3	4	2	5	6	7	8	9	10	11	12
011	1	4	3	2	5	6	7	8	9	10	11	12
100	1	3	4	2	5	6	7	8	9	10	11	12
101	3	4	2	1	5	6	7	8	9	10	11	12



Srinivas Deekonda University
Fourth Year of Computer Engineering (C09)
Course/Elective IV
41525ME: Open Elective

Tracking Scheme	Credits	Examination Scheme:
TE: 60Hours/1200	03	Ex-Sem (Paper): 20 Marks End-Sem (Paper): 10 Marks
Companion Course: Laboratory Practice VI (41525L)		

This open elective is created, so as to give the student a wide choice of subjects from which to complete the program. It encourages the use of free thinking and to find the qualitative nature of the subject the idea of open elective is used at the time.

Flexibility is extended with the choice of open elective allows the learner to choose

interdisciplinary or a future technology related courses to expand the knowledge to various

With this the learner gets the course without any boundaries to choose the approved by students council and board of studies.



Savitribi Phule Pune University
Home
Fourth Year of Computer Engineering (2019 Course)
(IC255) Laboratory Practice V

Teaching Scheme	Credit	Examination Scheme
Practical: I	06	Term: 10 Marks
Home Work		Personal: 10 Marks

Competitive Content: High Performance Computing (IC255), Deep Learning (IC255)

Course Objectives:

- To understand and implement searching and sorting algorithms.
- To learn the fundamentals of GPU Computing in the CUDA environment.
- To illustrate the concepts of Artificial Intelligence/Machine Learning (AIML).
- To understand Hardware Acceleration.
- To implement different deep learning models.

Course Outcome:

- CO1: Analyse and measure** performance of sequential and parallel algorithms.
- CO2: Design and implement** solutions for real-time distributed environments.
- CO3: Identify and apply** the suitable algorithms to solve AIML problems.
- CO4: Apply** the technique of Deep Neural Networks for implementing Linear regression and linear functions.
- CO5: Apply** the technique of Convolutional (CNN) for implementing Deep learning models.
- CO6: Design and develop** Recurrent Neural Network (RNN) for prediction.

Guidelines for Instructor's Manual

Laboratory Practice V is for practical hands-on for course content High Performance Computing and Data Learning. The instructor's manual is to be developed as a hands-on resource and as ready reference. The instructor's manual need to include preface about University/department institute department/course/ subject etc., University syllabus, introduction and assessment guidelines, topics under consideration, concept, algorithm, exercises, set of typical applications, assignments, guidelines, rubric/answer among others.

Guidelines for Student's Laboratory Journal

The laboratory assignment are to be submitted by student in the form of journal. Journal may

consists of portfolio, Certificate, table of contents, and handwritten work-up of each assignment (Task Objectives, Problem Statement, Outcomes, software and Hardware requirements, Date of Completion, Assessment grade/marks and assessment sign, Theory, Concept in brief, Algorithm/Module design, test cases, conclusion/analysis). Program code with sample output of all performed assignments also to be submitted as software.

Guidelines for Laboratory /Term Work Assessment

Continuous assessment of laboratory work is to be done based on overall performance and lab assignments performance of student. Each lab assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include: timely completion, performance, innovation, efficient code, practicality and business covering weightage for successful two-project completion and related documentation.

Guidelines for Practical Examination

- This internal and external examination should primarily focus on viable problem statements for practical examination based on the term work completed.
- During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement.
- The supplementary and relevant questions may be asked at the time of evaluation to test the student's **for advanced learning, understanding of the fundamentals, effective and efficient implementation.**
- Encouraging efforts, transparent evaluation and fair approach of the evaluator will not cause any uncertainty or doubt in the minds of the students. In adhering to these principles, all assessors must put efforts in the performing better to the student's satisfaction.

Guidelines for Laboratory Evaluation

- List of recommended programming assignments and sample mini projects is provided for reference.
- Relying them, Course Teacher or Lab instructor can frame the assignments/mini project by understanding the prerequisites, technological aspects, safety and social needs related to the respective courses.
- Preferably, there should be multiple sets of assignments/mini project and distribute among batches of students.
- Real world problem/solving based assignments/mini projects create interest among learners serving as foundation for future research or working of future projects.
- Assignment can be completed in group of 2 to 3 students.

- Software Engineering approach with proper documentation is to be strictly followed.
- Use of open-source software is to be encouraged.
- Instructional help shall not take assignment or mini-project Out is suitable to respective interest across the scope of syllabus.

Operating System recommended :- 64 bit Ubuntu Linux or its derivative.

Programming Languages: Object Oriented Languages

C++/JAVA/Python

Programming tools recommended: Visual Studio, Java IDE, PHP, Python IDE, etc., Hadoop.

Mapreduce/HDFS/SQL Tools, Database Connectivity :- JDBC, JDBC

Suggested List of Laboratory Experiments/Assignments

68218: High Performance Computing

Ass 4 Assignment and 3 Mini Project is Compulsory

Group 1

1. Design and implement Fast Fourier Transform and FFT algorithm. Search based on existing algorithms using OpenMP. Use a Trivial or an unclustered graph for MPI and GPU.
2. Write a program to implement Parallel Bubble Sort and Merge sort using OpenMP. Use existing algorithms and measure the performance of sequential and parallel algorithms.
3. Implement Min, Max, Sum and Average operations using Parallel Hadoop.
4. Write a C/C++ Program for :
 1. Addition of two large vectors
 2. Matrix Multiplication using FLOPS.
5. Implement MPI application for GMM, dotprod.

Group 2

6. Mini Project: Analyze performance characteristics of parallel Quicksort Algorithm using MPI
7. Mini Project: Implement Huffman Encoding on GPU
8. Mini Project: Implement Parallelization of Hashmap Query optimization
9. Mini Project: Implement Horizontal/Vertical Dynamic Programming with GPU Parallelization

68220: Course Code: Deep Learning

Ass 3 Assignment and 1 Mini Project is Compulsory

Group 1

- Linear regression by using Deep Neural networks: implement linear regression prediction problem by linear regression using Deep Neural network. Use known linear regression dataset.
- Classification using Deep neural network** (Any One from the following)
 - Multiclass classification using Deep Neural Networks: Example: Use the CIF-100 letter recognition datasets: create an artificial dataset for letter recognition.
 - Binary classification using Deep Neural Networks: Example: Classify "happy" versus "sad" pictures" versus "negative" versus "positive" based on the text content of the videos. Use IMDB dataset.
- Convolutional neural network (CNN) (Any One from the following)
 - Use any dataset of plant diseases and design a plant disease detection system using CNN.
 - Use MNIST (Fashion Dataset) and create a classifier to classify fashion clothing items using CNN.
- Recurrent neural network (RNN)** Use the Google word2vec dataset and design a chat bot to analyze and produce sentences using RNN.

Group 2

- Mini Project: Human Face Recognition
- Mini Project: Gender and Age Detection: predict if a person is a male or female and also their age
- Mini Project: Cropping / Like / Dislike / reject / save deletion and other images to selected images

The CO-PO Mapping Matrix

CIPN	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
	1	4	0		4	0		0	0	8		0
		2	3		5	6		8	8			12
PO1	1	—	1	1	—	2	1	—	—	—	—	—
PO2	1	2	1	—	—	1	—	1	—	—	—	1
PO3	—	1	1	1	0	2	—	—	—	—	—	—
PO4	1	1	1	—	1	—	—	—	—	—	—	—
PO5	2	2	2	2	2	—	—	—	—	—	—	2
PO6	1	0	1	1	1	—	—	—	—	—	—	—
PO7	2	2	2	2	2	—	—	—	—	—	—	—

Savitribi Phule Pune University
Fourth Year of Computer Engineering (2019 Course)
400166: Laboratory Practice VI

Teaching Scheme
Practical: 05 hours/Week

Credit
01

Examination Scheme and Marks
Term Work: 50 Marks

Compulsory Course: Elective Courses 400111, 400113

Course Objectives

- To understand the fundamental concepts and techniques of natural language processing (NLP)
- To understand digital image processing concepts
- To learn the fundamentals of software architecture
- Explore the knowledge of adaptive filtering and Multi-rate DSP
- To be familiar with the various applications areas of soft computing
- To introduce the concepts and components of Business Intelligence (BI)
- To study Decision Algorithms and apply them in solving hybrid solutions

Course Outcomes

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

- CO1: Apply basic principles of electronic circuits to problem solving and modeling.
 CO2: Use tools and techniques in the area of software development to build small projects.
 CO3: Design and develop applications on subjects of their choice.
 CO4: Evaluate and manage deployment, administration & security.

Guidelines for Laboratory Manual

List of recommended programming assignments and sample sub-projects is provided for reference. Following is those, Course Faculties or Lab Instructors may Refer for assignments/sub-projects by understanding the purpose, the, technological aspects, ability and recent trends related to the respective streams. Preferably there should be multiple sets of assignment/work project and distributed among batches of students. Real world problem applications based assignment/sub-projects is more interest among learners serving as foundation for future research in variety of business projects. All projects can be completed in group of 2 to 3 students. Software engineering approach with proper documentation is to be strictly followed. Use of open source software is to be encouraged. Instructor may also set any assignment or sub-project that is suitable to the respective course beyond the scope of reference.

Operating System recommended: - 14-bit Open source Linux or its derivative **Programming Language:** C++/JAVA/Python

Programming tool recommended: Visual Studio, Java IDE, Python IDE, etc. **Backend:**

MySQL/MySQLi/MySql, Database Connectivity: JDBC/JDBC, **Additional Tools:** Xcode, Matlab, WIX/Apache

Guidelines for Students Laboratory Journal

The laboratory assignments are to be submitted by students in the form of a journal. Actual copy written of program, Comments, table of contents, and handwritten writing up of each assignment (Title, Objectives, Problem Statement, Outcomes, software and hardware requirements, Flow of Completion, Assessment guidelines and student's sign). Theory, Concept in brief, A simplified flowchart design, and codes, conclusions/analysis. Program's codes with sample output of all performed assignments are to be submitted in software.

In a systematic effort and little contribution towards Green IT and environment awareness, attaching printed paper as part of write-ups and program listing in journal may be avoided. Use of digital storage media like CD containing videos, programs, recorded by lab Instructors is highly encouraged. For reference use or for projects that be evaluated with program print at Laboratory.

Guidelines for Laboratory Term Work Assessment

Continuous assessment of laboratory work is to be done based on Journal performance and lab House Faculty of Engineering Samartha Shiksha Park University.

Following are Month Wise of Computer Engineering assignments performance of student. Each lab assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include: timely completion, performance, innovation, efficient codes, punctuality and consistent learning weightage for successful assignment completion and related documentation.

Guidelines for Practical Examination

It is recommended to consider examinations based on Mini Projects (4 hours duration) and related skill learned. Teams of 2 to 3 students may work on this project. During the assessment, the expert evaluator should give the maximum weighting to the satisfactory implementation and software engineering approach followed. The supplementary and relevant questions may be asked at the time of evaluation to test the student's for advanced learning, understanding, effective and efficient implementation and demonstration skills. Encouraging efforts, transparent evaluation and fair approach of the evaluator will not cause any uncertainty or doubt in the minds of the students. So adhering to these principles will ensure transparent and fair efforts in the preliminary part of the student's academic.

Guidelines for Laboratory Evaluation

The instructor's manual is to be developed in a hands-on scenario and as study reference. The instructor's manual need to include pre-laboratory (University program) lecture preparation (towards profile one), University syllabus, curriculum and assessment guidelines, topics under consideration, concepts, objectives, outcomes, set of typical applications/assignments/ guidelines, references/reading references.

3A2T-2 410012: Elective V

Recommended: Sample set of assignments and mini projects for reference for their courses offered for Elective III and for few courses offered for Elective II. Respective Semester has to complete laboratory work for Elective III and IV that before has spent.

410012(4): Natural Language Processing

Assn & Assignments and 1 Mini Project & compulsory

Group 1

1. Perform tokenization (Whitespace, Punctuation, word, root, word, NMF) using nltk library. Use python documents and a small corpus for extracting. Use any technique for visualization.
Input: Dataset - use any sample dataset
2. Perform bag-of-words approach (count co-occurrence, normalized count co-occurrence). Build an index. Create embeddings using Word2Vec.
Dataset to be used: <https://www.kaggle.com/datasets/competitions/wmt2020>
3. Perform text clustering, perform hierarchical clustering methods, identify any word-frequency method, label encoding. Create representations using TF-IDF, Spine on topic.
Dataset: https://github.com/FNKT/NLPDE_NLP_Elective/blob/main/3_FrequencyProcessing/News_dataset.pickle
4. Create a transformer from scratch using the Pytorch library

3. Morphology is the study of how words are built up from and by meaning-bearing units. Study and understand the concepts of morphology by the use of add/delete table.
6. Mini Project (You have to submit your mini project only)
Submit a personal transformation for any of the following tasks on any relevant dataset of your choice:
- Neural Machine Translation
 - Classification
 - Recommendation

Visual Language: <http://tkriddle.com>

410253(B): Image Processing

Any 5 Assignments and 1 Mini Project is Compulsory

Group 1

Implement any five assignments from 1 to 7. Assignment no. 3 is compulsory within a group of 2 to 3 students.

Programming language: Python/C/C++ using OpenCV

1. Consider any image with size 1024×1024 . Modify the image to the sizes 512×128 , 256×256 , 128×128 , 64×64 and 32×32 using subsampling technique. Extract the original image from all the above subsampled images using resampling technique. Read any image. Display the histogram, Equalized histogram, and image with equalized histogram.
2. Consider any image with size 1024×1024 . Modify the image to the sizes 512×128 , 256×256 , 128×128 , 64×64 and 32×32 using subsampling technique. Extract the original image from all the above subsampled images using resampling technique.
3. Read any image. Display the histogram, Equalized histogram, and image with equalized histogram.
4. Read any image. Display the output of various thresholding, binary level slicing.
5. Compare the results of any three edge detection algorithms on the same image dataset and do the analysis of the result.
6. Compare the result of any two image segmentation algorithms on the same image dataset.
7. Write a program for image compression using any three compression techniques and compare the results.

Group 2:

8. Make project implement, visual surveillance applications and detect moving objects using object detection and tracking algorithm.
Or
Implement any medical image processing application for freely available medical image dataset.

4/02/2022: Endsem Defined Networks

Any 3 Assignments and 1 Mini Project is Compulsory

Group 1

1. Prepare using the Virtual network creation environment with the help of VirtualBox and Mininet. Demonstrate the basic commands in Mininet and creating different custom network topology (Ring, Line, and Tree) from scratch.
2. After creating any custom PCN and the topology, install controller and run custom topology using custom controller like POX and the single controller. Redesign network flow by controller.
3. Create a SDN environment on Mininet and configure a switch to provide a Remote Host/Interface using P4V Controller.
Ref: <https://github.com/sonnypath/sonnypath/wiki/4.1-Setup-Remote>
4. Using Mininet as an Internet and P4V controller, build your own network status. Write simple code with a status monitoring table. The code will monitor raw Internet flows and process the packet flow using OpenFlow to control outgoing interface. You must check the attached flows are received and the forwarding logic is created or packet go to the correct interface.
Ref: <https://github.com/sonnypath/sonnypath/wiki/4.2-Flow-Status>
5. Install and manage a Cloud Center via a Cloud Network Controller, create a multi-tiered multi-tier Cloud topology to Mininet to emulate a data center. Implement a specific SDN applications on top of the network controller in order to enhance multi-tier network status, create a data center environment in the context of network virtualization and management.
Ref: <https://github.com/sonnypath/sonnypath/wiki/4.3-Cloud-Topology>
6. Study experiments: Study in detail Clouds and network flows using SDN and a high-performance network flow, design SDN framework.

4/02/2022: Advanced Digital Signal Processing

Any 3 Assignments and 1 Mini Project is Compulsory

Group 1

File

A) MATLAB or other equivalent software working with speech and image signal file and for analysis purpose.

B) C++ or JAVA for working with sampled data (x = pure data samples of D/Digital signal).

C) JAVA or other for image processing software.

1. Apply 1-D DFT to observe spectral leakage and frequency analysis of different window sequences, plot the frequency spectrum.
2. Adaptive FIR and IIR Filter design.
 A) Steepest descent and Newton method, LMS method.
 B) Adaptive IIR Filter design: Padé Approximation, Least square design.
3. Power spectrum estimation and analysis.
 Take a speech signal and perform:
 A) Non parametric method: Bartlett and window sequences.
 B) Parametric methods: AR model parameters.
4. Multi-rate DSP and applications = Decimation, Interpolation, sampling rate conversion.
 A) Take a speech signal with specified sampling frequency. Decimate by factor (D), e.g. factor 4.
 B) Take a speech signal with specified sampling frequency. Interpolate by factor (I), e.g. factor 4.
 C) Sampling rate conversion by factor of 1/4.
5. Write a program to calculate LPC coefficients, reflection coefficients using Levinson-Durbin algorithm.
6. Feature Extraction of speech signal.
 A) Using LPC and other methods.
 B) Apply different coding methods: Huffman coding, vector quantization.

Week 2:

1. Min-Project : Discrete Cosine Transform (DCT)
 - A) To find DCT of 8x8 image block.
 - B) To plot spectrum of the speech signal using DCT and find the correlation of DCT transformed signal.
 - C) Image Stepping using DCT - LPT, edge detection.
 - D) Image compression using DCT, Image coding.
- OR
- Min-Project : Image Processing
 - A) Histogram and Equalization.
 - B) Image Enhancement Techniques.
 - C) Image Filtering: LPF, HPF, Sobel/Roberts Masks.
 - D) Image Smoothing with special filters: Median, Wiener, Homomorphic filters.

4.02132: Open-Ended

1. Variable set of programming assignments Mini-projects for open elective Opted

PART II: 410215 - Elective VI

410215(A) - Pattern Recognition

Any 4 Assignments are Compulsory

1. For Face Recognition
 - Implement PCA and multiclass LDA.
 - Using Eigenfaces and Fisherfaces to recognise faces in the old faces datasets.
2. Perform sentiment analysis on the IMDB movie reviews dataset.
3. Perform a classification task on a dataset of handwritten digits.
4. Perform image segmentation on the Berkeley Segmentation dataset.

410215(B) - Soft Computing

Any 4 Assignments and 1 Mini Project is Compulsory

Group I

1. Design an SVM Classifier with feed-forward neural network (also popularly known as a multilayer perceptron) classifier.
2. Symmetric and Asymmetric implementation of Particle Swarm Optimization for Travelling Salesman Problem.
3. Implement Union, Intersection, Complement and Difference operations on fuzzy sets. Also create fuzzy relation by Cartesian product of any two fuzzy sets and perform max-min composition on any two fuzzy relations.
4. Implement Union, Intersection, Complement and Difference operations on fuzzy sets. Also create fuzzy relation by Cartesian product of any two fuzzy sets and perform max-min composition on any two fuzzy relations.
5. Implement genetic algorithm for benchmark function (eg., Square, Rosenbrock function) and include the population from the standard Normal Distribution. Evaluate the fitness of all the individuals. Then you will do multiple generations of a genetic algorithm. A generation consists of applying selection, crossover, mutation, and replacement.
 - Tournament selection without replacement with tournament size = 4
 - One point crossover with probability P_c
 - Bit flip mutation with probability P_m
 - one full replacement strategy

Group 2:

6:

Mini Project – Create a small hybrid system for solving a chosen problem by following the given steps below.

1. Display on one page the main characteristics of hybrid systems.
2. For the task chosen from the list below, create a mathematical block diagram of a possible solution to the problem.
3. Choose appropriate techniques for solving each sub problem represented as a module. What alternatives are there for each of them?
4. Create subprograms for solving each of the sub problems. Complete the whole hybrid system.
5. Make experiments with the hybrid system and validate the results.

1) Handwritten digit recognition

2) Bank loan approval decision-making system

3) Service market prediction

4) Insurance premium prediction

5) Spoken words recognition, for example, "on"/"off", "yes"/"no", "stop"/"go"

6) Loan approval

412214673: Data Mining Challenges

Assignment 5 and 1 Mini Project in Computer

1

Import the legacy data from different sources such as (Excel, .txt, .csv, Oracle etc.) and load in the target system. (You can choose any sample datasets such as Advertising, Marketing, Weather, Insurance etc.)

2

Perform the first task: Transformation and Loading (ETL) process to convert the datasets in the target system.

3

Create the cube with suitable dimensions and fact tables based on ROLAP, MOLAP and HROLAP model

4

Import the data, transform the data in the target system and create the Warehouse and Fact Cube

5

Perform the data classification using a classification algorithm. Or Perform the data clustering using clustering algorithms.

6

Business Intelligence Mini Project: Each group of 4 Students (must) assigned one case study for this:

1. A report must be prepared including the following steps:
a) Problem definition, identifying which data mining task is needed
b) Identify and use a standard data mining dataset available for the problem

412214673: Quantum Computing

Any 2 assignments are compulsory

1	Analyse simple states of superposition and the effect of doing fix measurements in different bases states.
2	Build simple quantum circuits with single and two-qubit gates
3	Learn how to use the QASM infrastructure to write quantum programs in QASM (Quantum Assembly) language.
4	Analyse quantum circuits with measurements
5	Analyse the efficiencies of single shot interactive schemes
6	Implement quantum programs in NISQ models of computing

AF021914 - Open Elective

1	Suitable set of programming assignments/Mini-projects for open elective Coped												
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COURSE (i)	EC1	EC2	EC3	EC4	EC5	EC6	EC7	EC8	EC9	EC10	EC11	EC12
EC1	2	-	-	-	2	-	-	-	-	-	-	-
EC2	-	2	-	-	-	-	-	-	-	-	-	-
EC3	-	-	-	2	-	-	-	-	2	-	-	-
EC4	2	-	2	-	-	2	-	-	-	-	-	-



Savitribi Phule Pune University
Fourth Year of Computer Engineering (2018 Course)
48256: Project Work Stage II

Teaching Scheme**TE: 00 Hours/Week****Credit****04****Examination Scheme:****Term work: 100 Marks
 Presentation: 50 Marks****Prerequisite Course:****Comp course:****Course Objectives:**

- To follow IEEE methodology and meet the objectives of proposed work
- To test experiment before deployment of system
- To validate the work undertaken
- To communicate the work as finished report

Course Outcome:

On completion of the course, students will be able to:-

- CO1: Show evidence of independent investigation
- CO2: Critically analyze the results and their interpretation
- CO3: Report and present the original results in an orderly way, and placing the proper perspective in the right perspective
- CO4: Link technology and results from literature as well as actual research and future research from within research
- CO5: appreciate practical implications and consequences of the particular subject

Guidance

In Project Work Stage-II, the student shall complete the remaining project work which consists of selection of technology and tools, simulation, UML, implementation, testing, results, performance discussion using data tables per parameter considered for the improvement with learning/known algorithms/systems and comparative analysis and validation of results and conclusion. The student shall prepare and submit the report of Project work in standard format for satisfactory completion of the work that is fully certified by the concerned guide and head of the Department/Institution.

Table 2.6.1.1.1 and 2.6.1.2 as mentioned in Section Two Work are submitted to Board of Studies



Savitribi Phule Pune University
Fourth Year of Engineering (2019 Course)
403067: Audit Course II



In addition to credits, it is recommended that there should be audit courses, as preferably in each semester starting from second year in order to supplement students' overburden and debts. Students will be awarded the bachelor's degree if he/she earns specified total credit [1] and clears all the audit courses specified in the curriculum. The student will be awarded grade as AP on successful completion of audit course. The student may opt for one of the audit courses per semester, starting in second year first semester. Though not mandatory, such a selection of the audit courses helps the student to explore the subject of interest in greater detail, resulting in achieving the very objective of audit courses inclusion. List of options offered is provided, each student has to choose one audit course from the list per semester. Evaluation of audit course will be done at Institute level itself. Method of evaluation and method of assessment for audit courses are suggested.

Criteria

The student registered for audit course shall be awarded the grade AP (Audit Course Pass) and shall be included with AP grade in the Semester grade sheet for that course, provided student has the minimum attendance as prescribed for the Savitribi Phule Pune University and satisfactory performance and obtained a passing grade in that audit course. No grade points are associated with this AP grade and performance in these courses is not accounted in the calculation of the performance index (GPA and CGPA). Evaluation of audit course will be done at Institute level itself [1].

Guidelines for Coursework and Assessment: Any one or more of following but not limited to:

- | | |
|---|---|
| <ul style="list-style-type: none"> • Lecture/ Guest Lecture • Video (Social Field) and reports • Demonstration/ Presentation | <ul style="list-style-type: none"> • Seminars • Mini-Project • Hands-on experience on the real topic |
|---|---|

Course Guidelines for Assessment: Any one or more of following but not limited to:

- Written Exam
- Homebased/Online Practical Exam
- Presentation of Report

Audit Course I Options

Audit Course Code	Audit Course Title
AESE-I	Language Engineering
AESE-II	Environmental Education
AESE-III	Social Media and Analytics
AESE-IV	MOOC & open Source Models
AESE-V	Emotional Intelligence



**Sardarbal Phdip Faza University, Phase Fourth
Year of Computer Engineering (2019 Course)
CE257: Audit Course I
ACB – E-Usability Engineering**

In this course you will have a hands-on experience with usability evaluation and user-centered design. This course will not help to learn how to implement user interfaces, but rather how to design based on the needs of users, which you will determine, and how how evaluate your designs rigorously. This helps to knowing more about the usability, human computer interaction, the psychological aspects of computing, evaluation.

Course Objectives:

1. To understand the human centered design process and usability engineering process and how they relate to system design and development.
2. To know usability design guidelines, their foundations, assumptions, advantages, and weaknesses.
3. Understand the user interface based on analysis of human needs and propose a prototype system.

Course Outcome:

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

- CO1: Describe the human centered design process and usability engineering process and illustrate its system design and development.
- CO2: Discuss usability design guidelines, their foundations, assumptions, advantages, and weaknesses.
- CO3: Design a user interface based on analysis of human needs and propose a prototype system.
- CO4: Assess user interface using different usability engineering techniques.
- CO5: Present the design decision.

Course Content:

1. What is Usability? Usability and Other Considerations, Definition of Usability, Examples: Measuring the Usability of Icons, Usability Trade-Offs, Comparison of Users and Individual User Differences.
2. Usability in Software Development / The Emergence of Usability, Human Computer Interaction, Usability Engineering.
3. The usability engineering lifecycle: Requirements Analysis, Design, Testing, Development.
4. Usability Assessment Methods beyond Testing.
5. Interaction Model Interfaces.

Books:

1. Steve Dark, Rebecca, John Miller, Usability, "Usability Engineering: A systematic approach to development of Human-Computer Interaction".
2. Jakob Nielsen, "Usability Engineering".
3. Bernard J. Markow, "The usability engineering lifecycle".

Technische Universität München
Fourth Year of Computer Engineering (2019 Course)
410257- Audit Course 8
ACS – II: Conversational Interface

Effective information activity in the dialogue level requires perception, planning, and production. It is an ongoing effort that requires management and staff to work together from the onset until tomorrow. The information security community has developed a variety of resources, methods, and best practices to help modern enterprises address this challenge. Unfortunately, employing these tools demands a high degree of awareness, understanding, and skill attributes that must be obtained through constant awareness and training.

Course Objective:

- To understand the basics of conversation
- To know the interactive environments for conversational skills
- To improve with the speech system and use to speech technology

Course Outcome:

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

- CO1: Develop an effective interface for conversation
- CO2: Develop advanced concepts in user interface

Course Content:

1. **Introduction to Conversational Interface:** Preliminaries, Developing a speech-based conversational interface, Conversational interface and devices
2. **A technology of Conversation:** Introduction, Conversation as Action, The structure of Conversation, The language of Conversation.
3. **Developing a Speech-Based Conversational Interface:** Implementing Text-to-Speech Text Analysis, Voice Synthesis, Implementing Speech Recognition, Language Model, Acoustic Model, Decoding, Speech Synthesis, Marking Language.
4. **Advanced voice user interface design**

Books

1. Colin Fook, "Developing Voice User Interface: Principles of Conversational Engineering"
2. Michael McClos, "VoiceCallaps, David Gold, "The Conversational Interface: Talking to Smart Devices"
3. Naveen Muralid, "Developing Conversational Interfaces for iOS, Android, Voice Control"
4. Internationalization, "Voice for Children and Conversational AI Development, Build solutions"



Jayrathm Phile Pooe University, Pune
Fourth Year of Computer Engineering(2019C course)
410257: Audit Course
ACS-III: Social Media And Analytics

Prerequisite : Advantages of Social Media Networking

Course Objectives:

- Get strategic understanding of Digital Marketing and Social Media Marketing.
- Understand how to use it for branding and sales.
- Understand its strategic role in business.
- Become familiar with new Practices, Tools & Technologies.
- Blend Digital and social marketing with offline marketing.
- Plan and manage digital marketing budget.
- Manage Reporting & Tracking Metrics.
- Understand the future of Digital Marketing and prepare for it.

Course Outcome:

On completion of this course, student will be able to:

- CO1: Develop the deeper understanding of the changing digital landscape.
 CO2: Identify some of the most digital marketing trends and will soon needed for today's business.
 CO3: Successful planning, production, and management of digital marketing campaigns.
 CO4: Assess and understand different social media programming techniques.
 CO5: Implement smart management of different digital assets for marketing needs.
 CO6: Assess digital marketing as a long-term career opportunity.

Course Content:

1. Digital Marketing, History of Digital Marketing, Importance of Digital Marketing, Effectiveness of Digital Marketing, Effects of using Digital Marketing, Digital Marketing to develop brands, Digital Marketing for sales, Digital Marketing for product and service development.
2. Techniques for effective Social Marketing and public. Various online social marketing platforms such as Campaign Monitor and Mail Chimp, Web content, rich usability, navigation and design, Bookmarking and News Aggregators, Really Simple Syndication (RSS) Feeding, Live Chat, User Generated Content (Wikipedia/Multi-media - Video (Video Streaming, YouTube etc), Multi-media - Audio & Podcasting (iTunes etc), Mobile media - WhatsApp, Google Alerts and Caps Alert (brand, product and service monitoring online) & social marketing 2.0 and beyond.
3. Search Engine Optimization (SEO), Search Engine Optimization (SEM) tips and techniques, Google Adwords, Google various applications such as Google Analytics, Maps, Places etc to enhance a brand's products, services and operations.
4. Personalized and customized content for social marketing, Influencer marketing, Mobile Advertising functionality and Applications, Brand reputation management techniques, Systems for brand monitoring to brands, product manufacturers and their public relations and PR to brand reputation management.

Reference:

1. YouTube /Vlogs, "Digital marketing", (Download from: <https://bit.ly/3wz3t1n>), ("Youtube).
2. Wiley, Janney, McLean, David David, David Sharma, "Social Marketing: An Introductory", (ISBN: 978-0-470-58075-6), ("Youtube).



Srikrishna Padmakumar University
Fourth Year of Engineering (2019 Course)
AI0357: Audit Course 5
ACR – IV: MOOC-based New Skill

This course aims to ensure awareness among the students regarding various courses available under MOOC and learn new skills through these courses.

Course Objectives:

- To promote awareness among students to support a community interaction among students, professors, and experts.
- To promote learn with good skills exposure and experience.
- To enhance teaching and learning on campus and online.

Course Outcome:

On completion of the course, students will be able to
 CO1: To acquire additional knowledge and skill.

About Course

MOOCs (Massive Open Online Courses) provide affordable and flexible way to learn new skills, personalizing resources and deliver quality educational experiences at scale. Whether you're interested in learning for yourself, advancing your career or leveraging online content to advance your workforce, MOOCs, NPTEL, etc. can help you. TAMIL's largest SWAYAM MOOC, a new paradigm of education for anyone, anywhere, anytime, is preparing to revolutionize, aimed to provide digital education that is of just and to facilitate learning of all the interactive courses prepared by the best more than 1000 specially chosen faculty and teachers in the country. MOOCs And MOOCs enhance active learning for improving lifelong learning skills by providing easy access to global resources.

SWAYAM is a programme initiated by Government of India and designed to achieve the three central principles of Education Policy viz., access, equity and quality. The objectives of the efforts include the best teaching-learning resources to all, including the most disadvantaged. SWAYAM aims to bridge the digital divide for students who have hitherto remained alienated by the digital revolution and have not been able to join the mainstream of the knowledge economy. This is done through an independent development of platforms that facilitates learning of all the courses taught to students from this class of population to be accessed by anyone, anywhere at any time. All the courses are interactive, prepared by the best teachers in the country and are available, free of cost to the students in India. More than 1000 specially chosen faculty and teachers from across the Country have participated in preparing these courses.

The courses hosted on SWAYAM is generally in 4 quadrants – (i) video lecture, (ii) specially prepared reading material that can be downloaded/printed (iii) self-assessment tests through tests and quizzes and (iv) an online discussion forum for clearing the doubts. Steps have been taken to enrich the learning experience by using various media and their media and state of the art pedagogy/technology. In order to ensure best quality, courses are produced and delivered, under National Coordination have been assigned. They are NPTEL in engineering and UGC in post-graduate education.

Guidelines:

Instructors are requested to promote students to opt for course part and interactively with proper monitoring. The department will take care of providing necessary internet access and facilities for the learners.

References:

1. <http://www.mooc.in>
2. <http://www.nptel.ac.in>
3. <http://www.swayam.gov.in>



Savitribai Phule Pune University, Pune
Fourth Year of Computer Engineering
(2119 Course)
40048: Aash Course 2
AC3 - V: Emotional Intelligence

This Emotional Intelligence (EI) training course will focus on the five core competencies of emotional intelligence: self-awareness, self-regulation, motivation, empathy and interpersonal skills. Participants will learn to identify and implement those to enhance their relationships at work and life by increasing their understanding of social and emotional behaviors, and looking how to adapt and manage their responses in particular situations. Various models of emotional intelligence will be covered.

will be covered.

Course Objectives:

- To develop an awareness of all people
- To recognize the benefits of EI
- To understand how you use emotion to influence thought and behavior
- To know and utilize the difference between reaction and considered response

Course Outcomes:

On completion of this course, learners will be able to:-

- CO1: Expand your knowledge of emotional patterns in yourself and others
- CO2: Discover how you can manage your emotions, and positively influence yourself and others
- CO3: Build more effective relationships with people at work and at home
- CO4: Positively influence a difficult work colleague, team members, managers
- CO5: Increase the leadership effectiveness by creating an atmosphere that engages others

Course Contents:

1. **Introduction to Emotional Intelligence (EI)** : Emotional intelligence and various EI models, the 14 components of self-awareness, self-regulation, motivation, empathy, and interpersonal skills, Understanding EI and its significant influence on workplace
2. **Know and manage your emotions** : emotions, the different levels of emotional awareness, Increase your emotional knowledge of yourself, Recognize „negative“ and „positive“ emotions, The relationship between emotions, thought and behavior, Discover the importance of values, The impact of not managing and processing „negative“ emotions, Techniques to manage your emotions in challenging situations
3. **Recognize emotions in others** : The awareness of emotional responses, Learn how to enhance your ability to recognize and appropriately respond to others' emotions, Assessing emotions accurately is critical to build empathy
4. **Relate to others** : Applying EI in the workplace, the role of empathy and trust in relationships, Increase your ability to create effective working relationships with others (peers, subordinates, managers, clients, find out how to deal with conflict, Tools to build effective teams and create a high performing team.

Books:

1. Daniel Goleman, "Emotional Intelligence – Why It Matters More Than IQ", Harvardschool, ISBN: 061801712X, 9780618017129
2. Steven Stice, "The Little Book", Jossey-Bass, ISBN: 9780447154910,4
3. David Hall, "The Leader's Guide to Emotional Intelligence", ISBN: 978125070000



Acknowledgment

It is with great pleasure and honor that I state the contribution for Fourth Year of Computer Engineering (2019) Course on behalf of Board of Studies (BoS), Computer Engineering. We, members of BoS are giving our best to assemble the processes and standards designed for both (KG) and (PG) programs.

It is always the pleasure and to believe the curriculum with the best of our content, content development and courses to understand social and human values. By considering all the aspects with adequate practice the contents are designed satisfying most of the necessities as per AICTE guidelines and to make the graduate competent enough as far as employability is concerned. I sincerely thank all the friends and heads who made directly to monitor these rules. I really appreciate everyone's contribution and suggestions in finalizing the content.

Process is great, but it's easier when it's initiated through an individual, cooperation and collaboration. I am overjoyed and I feel very fortunate to be working with such a talented team- the Members of Board of Studies, Computer Engineering.

Ever in these anxious situations, during the time of this unfortunate pandemic, each and every person, including the course coordinator and first team members, have worked seamlessly to come up with this all-inclusive curriculum for Fourth Year of Computer Engineering.

Thank you to all of you for delivering such great teamwork. I don't think it would have been possible to achieve the goal without each and every one of your efforts! I would like to express my deep gratitude to Dr. Prasad H. Patil (Dr. H. V. Patel Institute of Technology, Pimpri), member BoS, Computer Engineering, for contributing the complete activity and giving it to us as per it is a smooth manner.

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I sincerely appreciate the hard work put in by the course coordinators and first team members, without your intellectual work and creative mind, and it would have not been possible to complete this draft. You have been a valuable member of our team!

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Professors (BoS): Dr. Varsha R. Patil, Chairman, and Members, Dr. Shreshth Sane, Dr. Sandeep Shrivast, Dr. Anshu Sharma, Dr. Prasad Patil, Dr. Gajendra Khilari, Dr. Vaidya Lulla, Dr. Parthiv Mahajan, Dr. Venkateshwar, Dr. Ganapathi Kulk, Dr. Subash Kumar, Dr. H. V. Patil, Dr. P. M. Vaidikar, and Dr. Anant S. Mishra.

Board of Studies (BoS), Computer Engineering, Faculty of Science and Technology, Savitribai Phule Pune University

Task Force at Curriculum Design

1. Advisors, the Teams of Board of Studies:

Dr. Yusef Fakhri-Chaharmal, Dr. Nilschik Hans, Dr. Frank Hübner, Dr. Norbert Effen, Dr. Michael Fahl, Dr. Rainer Pöschel, Dr. Frank Kötter, Dr. Stefan Lachka, Dr. Patrick Malsch, Dr. Volker Böhm, Dr. Christoph Kuhl, Dr. Sabina Jesi, Dr. H. V. April Dr. P. M. Yousaf, and Dr. Umut A. Dönmez.

1. Team Leader: Dr. Pramod D. Padi, Dr. D. V. Padi Institute of Technology, Pune

2. Team: Course Design

Names of Course	Team Coordinator	Team Members	
Design and Analysis of Algorithms	Dr. Anand V. Chole	Dr. Sandeep Shrivastava	Prof. Chandan
		Dr. Rakesh Prasad	Dr. Mahesh Joshi
		Prof. S. P. Purohit	
Machine Learning	Dr. Anand Kulkarni	Mr. Rajesh Kumar	Dr. Prashant Shrivastava
		Mr. Anil H. Joshi	Prof. Gaurav Joshi
		Dr. K. V. Sharma	Prof. Anand Kulkarni
		Prof. Anand Kulkarni	
Mobiles Technology	Dr. Sandeep Padi	Dr. Anand Kulkarni	Dr. Sandeep Padi
		Dr. Anand Kulkarni	Dr. Sandeep Padi
		Dr. Anand Kulkarni	
Elective III: Parallel Computing	Prof. D. V. Padi	Prof. Anand Kulkarni	Prof. Anand Kulkarni
		Prof. Anand Kulkarni	Prof. Anand Kulkarni
		Mr. Anand Kulkarni	
Elective III: Multimedia Technology	Dr. D. V. Padi	Dr. Anand Kulkarni	Dr. Anand Kulkarni
		Dr. Anand Kulkarni	Dr. Anand Kulkarni
		Dr. Anand Kulkarni	
Elective III: Cyber Security and Digital Forensics	Dr. D. V. Padi	Dr. Anand Kulkarni	Dr. Anand Kulkarni
		Dr. Anand Kulkarni	Dr. Anand Kulkarni
		Dr. Anand Kulkarni	
Elective III: Object Oriented Modeling and Design	Prof. Sandeep Padi	Dr. Anand Kulkarni	Dr. Anand Kulkarni
		Dr. Anand Kulkarni	Dr. Anand Kulkarni
		Dr. Anand Kulkarni	
Elective III: Signal Processing	Dr. D. V. Padi	Dr. Anand Kulkarni	Dr. Anand Kulkarni
		Dr. Anand Kulkarni	Dr. Anand Kulkarni
		Dr. Anand Kulkarni	
Elective IV: Information Retrieval	Dr. D. V. Padi	Dr. Anand Kulkarni	Dr. Anand Kulkarni
		Dr. Anand Kulkarni	Dr. Anand Kulkarni
		Dr. Anand Kulkarni	
Elective IV: GPU Programming and Architecture	Dr. D. V. Padi	Dr. Anand Kulkarni	Dr. Anand Kulkarni
		Dr. Anand Kulkarni	Dr. Anand Kulkarni
		Dr. Anand Kulkarni	

		Prof. Dr. A. Hamedy Fathy	
		Dr. H. V. Marbani	
Success Intelligence	Dr. A. Rajamani	Dr. Jyoti Prakash Verma	Mr. DUT Mishra
		Prof. V. A. Hasegao	Mr. Subhash Chandra Mishra
		Prof. Dr. D. K. G.	
		S. V. S. S. S. S.	
Advanced Digital Signal Processing			
Lab Session V	Dr. G. R. Shinde	Dr. Rajendra S. S. S.	
		Dr. Anil Kumar S. S.	
Lab Session VI	Dr. Kamal A. Shrivastava	Dr. N. K. Talasila	Dr. S. S. S. S.
		Prof. Dr. S. S. S. S.	Dr. S. S. S. S.
		Dr. S. S. S. S.	Dr. S. S. S. S.
		Dr. S. S. S. S.	Dr. S. S. S. S.
Project Step II	Dr. Kamal A. Shrivastava	Dr. Kamal A. Shrivastava	
Aviation Course II	Dr. S. S. S. S.	Dr. S. S. S. S.	