



# PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR

Faculty of Engineering & Technology

Structure of B.E. Computer Science and Engineering wef. 2019-2020

Choice Based Credit System Syllabus

## Semester I

Course Code	Theory Course Name	Hrs./week			Credits	Examination Scheme			
		L	T	P		ISE	ESE	ICA	Total
CS411	Advanced Computer Architecture	3	1	--	4	30	70	25	125
CS412	Distributed Systems	3	--	--	3	30	70	--	100
CS413	Modern Database Systems	4	--	--	4	30	70	--	100
CS 414A to CS 414C	Elective –I	3	--	--	3	30	70	--	100
CS 415A to CS 415C	Elective-II	3	1	--	4	30	70	25	125
CS416	# Programming with Python	2	--	--	2	--	--	25	25
	<b>Sub Total</b>	<b>18</b>	<b>02</b>		<b>20</b>	<b>150</b>	<b>350</b>	<b>75</b>	<b>575</b>
	<b>Laboratory</b>						<b>POE</b>	<b>OE</b>	
CS412	Distributed Systems	--	--	2	1	--	--	25	25
CS413	Modern Database Systems	--	--	2	1	--	50	25	75
CS416	Programming with Python	--	--	2	1	--	50	--	50
CS417	Project Phase-I	--	--	4	2	--	50	25	75
CS418	Vocational Training	--	--		1	--	--	25	25
	<b>Sub Total</b>				<b>6</b>		<b>150</b>	<b>100</b>	<b>250</b>
	<b>Grand Total</b>	<b>18</b>	<b>02</b>	<b>10</b>	<b>26</b>	<b>150</b>	<b>500</b>	<b>175</b>	<b>825</b>

Abbreviations: L- Lectures, P –Practical, T- Tutorial, ISE- In Semester Exam, ESE - End Semester Exam, ICA- Internal Continuous Assessment, ESE - University Examination (Theory &/ POE &/Oral examination)

## Semester II

Course Code	Theory Course Name	Hrs./week			Credits	Examination Scheme			
		L	T	P		ISE	ESE	ICA	Total
CS421	Management Information System	3	1	--	4	30	70	25	125
CS422	Information and Cyber Security	3	--	--	3	30	70	--	100
CS423A to CS423C	Elective-III	3	--	--	4	30	70	25	125
CS424A to CS424C	Elective-IV	3	--	--	3	30	70	--	100
CS425	# Web Technology	2	--	--	2	25	--	--	25
	<b>Sub Total</b>	<b>14</b>	<b>02</b>		<b>16</b>	<b>145</b>	<b>280</b>	<b>50</b>	<b>475</b>
	<b>Laboratory</b>						<b>POE</b>	<b>OE</b>	
CS422	Information and Cyber Security	--	--	2	1	--	50	25	75
CS425	Web Technology	--	--	4	2	--	50	25	75
CS424	Elective-IV	--	--	2	1		--	25	25
CS426	Project Phase-II	--	--	6	3	--	100	75	175
	<b>Sub Total</b>				<b>7</b>		<b>200</b>	<b>150</b>	<b>350</b>
	<b>Grand Total</b>	<b>14</b>	<b>02</b>	<b>14</b>	<b>23</b>	<b>145</b>	<b>480</b>	<b>200</b>	<b>825</b>

Abbreviations: L- Lectures, P –Practical, T- Tutorial, ISE- In Semester Exam, ESE - End Semester Exam, ICA- Internal Continuous Assessment, ESE - University Examination (Theory &/ POE &/Oral examination)

<b>Elective I</b> CS414A : Internet of Things CS414B : Wireless Adhoc Networks CS414C : Artificial Intelligence	<b>Elective II</b> CS415A : Business Intelligence CS415B : Data Mining CS415C : Object Oriented Modeling and Design
<b>Elective III</b> CS423A : Big data Analytics CS423B : Human Computer Interaction CS423C : Artificial Neural Network	<b>Elective IV</b> CS424A : Software Testing and Quality Assurance CS424B : Cloud Computing CS424C : Machine Learning

**Note:** Appropriate electives may be added or deleted as and when required.

**Note :**

- Batch size for the practical /tutorial shall be of 15 students. On forming the batches, if the strength of remaining student exceeds 7, then a new batch shall be formed.
- Vocational Training (evaluated at B.E. Part-I) of minimum 15 days shall be completed in any vacation after S.E. Part-II but before B.E. Part-I & the report shall be submitted and evaluated in B.E. Part-I
- Appropriate Elective I & II Subjects may be added when required.
- Curriculum for Humanities and Social Sciences Self Learning Modules is common for all under graduate programmes of faculty of Engineering and Technology
- Project group for B.E.(CSE) Part I and Part II shall be of size 4 to 5 students
- Term work assessment shall be a continuous process based on student's performance in – class tests, assignments, homework, subject seminars, quizzes, laboratory books and their interaction and attendance for theory and lab sessions as applicable





**PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR**  
**B.E. (COMPUTER SCIENCE & ENGINEERING)**  
**SEMESTER I**

**CS 411 : Advanced Computer Architecture**

**Teaching Scheme**

Lectures- 3 Hr/Week, 3 Credits

Tutorial-1 Hr/Week, 1 Credit

**Examination Scheme**

ESE -70 Marks

ISE - 30 Marks

ICA- 25 Marks

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**Introduction**

This course introduces the concepts of Advanced Computer Architecture such as parallel computer models, pipelining & superscalar techniques. It also focuses on multiprocessor, multicomputer, data parallel architecture, parallel models, languages and compilers.

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**COURSE PREREQUISITE :**

Students shall have the knowledge of Digital System, Microprocessor and Computer Organization.

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**COURSE OBJECTIVE :**

1. To distinguish multiprocessors and multicomputers.
2. To compare the performance of conventional linear and non linear pipelines.
3. To organize several interconnection models.
4. To classify parallel programming models.

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**COURSE OUTCOME :**

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

1. Compare multiprocessors and multicomputer.
2. Elaborate the performance of conventional linear and non linear pipelines.
3. Identify several interconnection model.
4. Compare parallel programming models.

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**SECTION I**

**Unit 1: Parallel Computer Models**

(6)

The State of Computing: Evolution of Computer Architecture, System Attributes to Performance. Multiprocessors and Multicomputers: Shared Memory Multiprocessors, Distributed Memory Multicomputers. Multivector and SIMD Computers: Vector Supercomputers, SIMD Supercomputers.

**Unit 2: Processor and Memory Hierarchy**

(10)

Advanced Processor Technology: Design Space of Processors, Instruction Set Architecture, CISC and RISC Scalar Processors. Super scalar and Vector Processor: Superscalar Processors, The VLIW Architecture, Vector and Symbolic Processors. Memory Hierarchy Technology, Inclusion, Coherence and Locality, Memory Capacity Planning. Virtual Memory Models, TLB, Paging and Segmentation, Memory Replacement Policies.

**Unit 3: Pipelining and Superscalar Techniques**

(7)

Linear Pipeline Processors: Asynchronous and Synchronous Models, Clocking and Timing Control, Speedup, Efficiency and Throughput. Nonlinear Pipeline Processor: Reservation and Latency Analysis, Collision-Free Scheduling, Pipeline Schedule Optimization. Superscalar and Super

pipeline Design: Superscalar Pipeline Design, Super pipelined Design, Super symmetry and Design Tradeoffs

## SECTION II

### Unit 4: Multiprocessors and Multicomputers

(8)

Multiprocessor System Interconnects: Hierarchical bus systems, Crossbar switch and Multiport memory, Multistage and Combining Networks. Cache Coherence and Synchronization Mechanisms: The cache coherence problem, Snoopy bus protocol, Directory based protocols, Hardware synchronization mechanisms. Three generation of computers: Design choices in the past, present and future development

### Unit 5: Introduction to Data Parallel Architecture and SIMD Architecture

(7)

Introduction, Connectivity: Near neighbors, Tree and graphs, The pyramid, The hypercube, Reconfigurable networks. SIMD Architectures: Introduction, Design Space, Fine grained SIMD architectures (Overview, Massively Parallel Processor, Programming and applications), Coarse grained SIMD architecture(Overview,CM5,Programming and applications)

### Unit 6: Parallel Models, Languages and Compilers

(7)

Parallel Programming Models: Shared variable model, Message passing model, Data Parallel Model, Object Oriented Model, Functional and Logic Models. Parallel Languages and Compilers: Language Features for parallelism, Parallel Language Constructs, Optimizing Compilers for Parallelism.

**Internal Continuous Assessment (ICA):** In tutorial sessions, students of different batches should be assigned exercise problems and should be guided for the solution.

*ICA shall consist of minimum ten assignments from the below list.*

1. Explain the architectural evolution from sequential scalar computers to vector processors and parallel computers.
2. Explain Flynn's classification of computer architecture and Bell's taxonomy of MIMD computers.
3. Differentiate between CISC and RISC Scalar Processors.
4. Explain the following Page Replacement Policies:  
Least recently used (LRU), Optimal (OPT), First-in-first-out(FIFO), Least frequently used(LFU), Circular FIFO, Random replacement
5. Consider the following reservation table for a four stage pipeline with a clock cycle  $\tau = 20\text{ns}$

	1	2	3	4	5	6
S1	X					X
S2		X		X		
S3			X			
S4				X	X	

- (a) What are the forbidden latencies and the initial collision vector ?
- (b) Draw the state transition diagram for scheduling the pipeline.
- (c) Determine the MAL associated with the shortest greedy cycle.
- (d) Determine the pipeline throughput corresponding to the MAL and given  $\tau$ .
- (e) Determine the lower bound on the MAL for this pipeline. Have you obtained the optimal latency from the above state diagram?



6. Consider the five stage pipelined processor specified by the following reservation table:

	1	2	3	4	5	6
S1	X					X
S2		X			X	
S3			X			
S4				X		
S5		X				X

- List the set of forbidden latencies and collision vector.
  - Draw the state transition diagram showing all possible initial sequences (cycles) without causing a collision in the pipeline.
  - List all the simple cycles from the state diagram.
  - Identify the greedy cycles among the simple cycles.
  - What is the minimum average latency (MAL) of this pipeline?
- Explain broadcast capability of an Omega network built with 4x4 switches.
  - Explain the following terms:  
Network stages, Blocking versus Non blocking Networks, Crossbar Network, Cross point Switch Design, Crossbar limitations and Multiport Memory.
  - With neat diagram explain the different connectivity between the processing elements.
  - With neat diagram explain the Massively Parallel Processor (MPP) processing element and CM5 processing element.
  - With neat diagram explain the two basic mechanisms for inter process communication (IPC)
  - Explain the following three major phases of parallelizing compiler.  
Flow analysis, Optimizations and Code generation.

#### Text Books

- Advanced Computer Architecture - Parallelism, Scalability, Programmability-Kai Hwang-Tata McGraw Hill (Unit 1,2,3,4,6)
- Advanced Computer Architectures-A design Space Approach-Dezso Sima,Terence Fountain, Peter Karsuk - PEARSON (Unit 5)

#### Reference Books

- Computer Architecture and Parallel Processing, Hwang Briggs, McGraw-Hill
- Computer Architecture - A Quantitative Approach, John L. Hennessy and David A.Patterson, Elsevier



**PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR**  
**B.E. (COMPUTER SCIENCE & ENGINEERING)**  
**SEMESTER - I**  
**CS 412 : DISTRIBUTED SYSTEMS**

**Teaching Scheme**

Lectures : 3 Hours /Week, 3 Credits  
Practical – 2 Hours/week, 1 Credits

**Examination Scheme**

ESE – 70 Marks  
ISE – 30 Marks  
ICA - 25 Marks

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**COURSE OBJECTIVES :**

1. Provide the fundamental concepts of Distributed operating systems, its design issues and challenges in modes of communication of distributed systems and their implementation.
2. Expose students to current technology for enhancement of distributed computing infrastructures with various computing principles and paradigms.
3. Provide experience in analyzing a distributed computing model and implementing typical algorithms related to Synchronization, deadlock detection and avoidance used in distributed systems.
4. Enhance students' understanding of key issues related to principles of Distributed file systems and provides case study of stand-alone general purpose distributed file system of Hadoop.

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**COURSE OUTCOME :**

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

1. Describe the basics of distributed systems and middleware.
2. Design and simulate distributed system software modules using various methods, strategies, and techniques presented in the course that fulfils requirements for desired properties.
3. Apply principles of distributed systems in a real world setting across multidisciplinary areas.
4. Apply knowledge of Hadoop Distributed File system, its architecture and working for active research at the forefront of these areas.

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**SECTION – I**

**Unit 1 : Fundamentals**

**(4)**

Fundamentals of OS, What is Distributed System? Evolution of Distributed Computing System, Distributed Computing System Models , Distributed Computing Gaining Popularity, Issues in Designing Distributed System, Introduction to Distributed Computing Environment, Protocols for Distributed Systems – FLIP and VMTP

**Unit 2: Message Passing**

**(6)**

Introduction, Desirable features of Good Message-Passing System, Issues in IPC by Message Passing, Synchronization, Buffering, Multidatagram Messages, Encoding and Decoding of Message Data, Process Addressing, Failure Handling, Group communication, Case Study: RMI, CORBA

**Unit 3 : Remote Procedure Calls**

**(6)**

Introduction, The RPC Model, Transparency of RPC, Implementing RPC mechanism, Stub Generation, RPC Messages, Marshalling Arguments and Results, Server Management, Parameter-Passing Semantics, Call Semantics, Communication Protocols for RPCs, Client-Server Binding, Exception Handling, Security

#### **Unit 4 : Synchronization in Distributed Systems**

(6)

Introduction, Process Migration, Threads, Clock Synchronization, Event Ordering, Mutual Exclusion, Deadlock, Election Algorithms, Issues in Designing Distributed System and role of middleware in Distributed System

### **SECTION – II**

#### **Unit 5 : Distributed Mutual Exclusion**

(5)

Introduction, Classification of Mutual Exclusion Algorithms, Preliminaries, A simple solution to Distributed Mutual Exclusion, Non-Token-Based Algorithms, Lamport's Algorithm, The Ricart-Agrawala Algorithm, Token-Based Algorithms, Suzuki-Kasami's Broadcast Algorithms

#### **Unit 6 : Distributed Deadlock Detection**

(5)

Introduction, Preliminaries, Deadlock handling strategies in Distributed Systems, Issues in Deadlock Detection and Resolution, Control organizations for distributed deadlock detection, Centralized deadlock detection algorithms, Distributed deadlock detection algorithms, Avoidance and Prevention algorithms, Hierarchical deadlock detection algorithms

#### **Unit 7 : Distributed File Systems**

(6)

Distributed Resource Management, Concepts of File System, Distributed File Systems - Introduction, Architecture, Mechanisms for building Distributed File System, Design issues, Log-Structured file systems, Case studies - Google FS

#### **Unit 8 : Distributed Shared Memory**

(6)

Introduction, Architecture and Motivation, Algorithms for implementing DSM, Memory Coherence, Coherence Protocols, Design issues, Case studies-Linda

#### **Internal Continuous Assessment (ICA) :**

Minimum 10 assignments on above topics which will ensure assessment of Course outcomes listed.

#### **Text books:**

1. Distributed O.S Concepts and Design, P.K.Sinha, PHI ( Unit 1,2,3,4 )
2. Advanced concepts in Operating Systems, Mukesh Singhal & N.G.Shivaratri, TMH ( Unit 5,6,7,8 )
3. Distributed Computing, Sumita Mahajan, Seema Shah, OXFORD University Press ( Unit 1, Case studies 7,8 )

#### **Reference Books:**

1. Distributed System Principles and Paradigms, Andrew S. Tanenbaum, 2nd edition, PHI
2. Distributed Systems, Colouris, 3rd Edition



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**B.E. (COMPUTER SCIENCE & ENGINEERING)**  
**SEMESTER - I**

**CS 413 : MODERN DATABASE SYSTEMS**

**Teaching Scheme**

Lectures— 4 Hours/week, 4 Credits

Practical – 2 Hour/week, 1 Credit

**Examination Scheme**

ESE – 70 Marks

ISE – 30 Marks

ICA - 25 Marks

POE – 50 marks

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**COURSE OBJECTIVES:**

- 1) Introduce different databases like distributed, parallel & object oriented databases.
- 2) Acquaint with Query processing and its phases including query optimization.
- 3) Illustrate data mining & warehousing with OLAP implementations.
- 4) Demonstrate Bigdata with Hadoop & its components.

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**COURSE OUTCOME:**

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

- 1) Differentiate between Distributed & Parallel databases.
- 2) Implement object oriented databases, mining concepts.
- 3) Implement different query processing algorithms.
- 4) Tabulate SQL, NoSQL & New SQL with its applications.
- 5) Articulate technologies like Hadoop, MongoDB, Cassandra, Pig, Hive

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**SECTION-I**

**Unit 1 : Database System architectures**

**(8)**

Centralized & C/S architectures, Server systems, Distributed systems, Distributed databases – homogeneous & heterogeneous databases, Distributed data storage, Distributed transactions, Commit protocols, Concurrency control in distributed databases, Availability, Distributed query processing, Heterogeneous distributed databases

**Unit 2 : Parallel Databases**

**(7)**

Introduction, I/O parallelism, Inter-query parallelism, Intra-query parallelism, Intra-operation parallelism, Inter-operation parallelism

**Unit 3 : Data Analysis and Mining**

**(8)**

Introduction to decision support, OLAP: Multidimensional Data Model, Multidimensional Aggregation Queries, Window Queries in SQL: 1999, Implementation Techniques for OLAP, Data Warehousing, Introduction to data mining, The knowledge Discovery Process, Counting co-occurrences, Mining for rules, Clustering, Similarity search over sequences

**SECTION-II**

**Unit 4 : Object Based Databases**

**(6)**

Overview, Complex Data Types, Structured Types and Inheritance in SQL, Table Inheritance, Array and Multisets Types in SQL, Object Identity and Reference Types in SQL, Object Oriented DBMS versus Object Relational DBMS



## **Unit 5 : Query Processing & Optimization**

**(6)**

Overview of query processing, Measure of query cost, Selection Operation, Sorting, Join Operation, Other Operation, Evaluation of Expression, Overview of optimization, Transformation of Relational Expressions, Estimating Statistics of Expression Results, Choice of Evaluation plans

## **Unit 6 : BIG data and HADOOP & No SQL**

**(8)**

Big data, characteristics of Big data, introduction to HADOOP, High level architecture of HADOOP, HDFS file system architecture, special feature of HADOOP, working with HAD OOP commands, working of MAP reduce with an example. Getting started with NoSQL, Key value stores, Document databases, New SQL, Postgre SQL

### **Internal Continuous Assessment (ICA) :**

#### **Practical Assignments (minimum 10 to be implemented):**

1. Implement 2 PC protocol.
2. Implement join operation on n relations using parallelism approach.
3. Implement the Round Robin partitioning for parallel database environment.
4. Implement the Hash partitioning for parallel database environment.
5. Implement the Range partitioning for parallel database environment.
6. Implement Interquery parallelism in parallel databases.
7. Implementation of intraquery parallelism using multithreading
8. Implement Range partitioning Sort algorithm using intraquery parallelism through interoperation
9. Implementation of Asymmetric fragment & replicate join
10. Write a program to join r1  $\bowtie$  r2  $\bowtie$  r3  $\bowtie$  r4 using Independent Parallelism for Inter-operation parallelism.
11. Implement OLAP queries.
12. Implement algorithm for finding Frequent Itemsets for a given minimum support.
13. Implement algorithm for finding association rules for given minimum support and confidence.
14. Implement queries in SQL: 1999 that work on Complex Data types, Array and Multisets.
15. Implement queries for type inheritance and table inheritance.

#### **Text Book :**

- 1) Data base System Concepts sixth Edition, by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Sixth Edition, McGraw Hill Publication.
- 2) Data base Management Systems Third Edition, by Raghu Ramakrishnan and Johannes Gehrke, McGrawhill Education
- 3) MongoDB, The Definitive Guide, Kristina Chodorow, O'Reilly, Shroff Publishers and Distributors Pvt. Ltd., ISBN : 978-93-5110-269-4

#### **Reference Books:**

1. Hadoop in Action, Chuck Lam, Dreamtech Press, ISBN : 978-81-7722-813-7.



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**B.E. (COMPUTER SCIENCE & ENGINEERING)**  
**SEMESTER - II**  
**CS414 A: ELECTIVE – I : Internet of Things**

**Teaching Scheme**

Lectures : 3 Hours /week, 3 credits

**Examination Scheme**

ESE : 70 Marks

ISE : 30 Marks

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**PREREQUISITES :**

1. Fundamentals of Communication and computer network
2. Micro controller, Network Security and Web programming

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**COURSE OBJECTIVES:**

- 1) To acquaint with Internet of Things.
- 2) To identify the Architecture and various elements of an IoT System
- 3) To understand the IoT standards and connectivity protocols
- 4) To make students aware of security concerns and challenges while implementing IoT solutions

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**COURSE OUTCOME:**

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

- 1) Explain what Internet of Things is
- 2) Describe components of IoT Architecture and platforms of IoT ecosystem
- 3) Describe and choose Sensors and Actuators

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**SECTION – I**

**Unit 1: Introduction to IoT**

**(6)**

Definition, Applications and characteristics of IoT, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies, IoT Levels

**Unit 2: IoT Architecture and Communication Technologies**

**(7)**

IoT Architecture by Oracle, Sources of IoT, M2M Communication, IoT/M2M systems, layers and design standards, Communication Technologies

**Unit 3: Elements of IoT**

**(8)**

Sensor Technology, Participatory Sensing – Industrial IoT and Automotive IoT, Actuator, Sensor Data Communication Protocols, RFID, WSN Technology

**SECTION – II**

**Unit 4: IoT Standards and Connectivity**

**(8)**

Constrained Application Protocols (CoAP), Representational State Transfer (REST), Zigbee / IEEE 802.15.4, Bluetooth and its low energy profile, IEEE 802.15 WPAN, 6LoWPAN

**Unit 5: IoT Security and Business model**

**(7)**

Introduction to IoT Privacy, Security and Vulnerabilities, Use case and Misuse cases, IoT Security Tomography and Layered attacker model, Business model and business model innovation for IoT, Value Creation in the IoT, Business model scenarios for IoT

## Unit 6: Case Studies

(6)

Domain Specific IoTs: Home Automation, Smart Cities, Environments, Energy, Agriculture, Industry, Health and Lifestyle

### Text Book :

1. Internet of Things: A Hands-on approach, Arshdeep Bahga, Vijay Madisetti, Universities Press (Unit 1 and 6)
2. IoT Architecture and Design Principles, Raj Kamal, McGraw Hill Education (Unit 2, 3 & 5)
3. Building the IoT with IPv6 and MIPv6, Daniel Minoli, Wiley Publication ( Unit 4)

### Reference Books:

1. The Internet of Things: Applications and Protocols, Wiley publications. Author(s): Oliver Hersent, David Boswarthick, Omar Elloumi





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**B.E. (COMPUTER SCIENCE & ENGINEERING)**  
**SEMESTER I**

**CS 414 B : Elective-I : Wireless Ad-hoc Network**

**Teaching Scheme**

Lectures– 3 Hours/week, 3 Credits

**Examination Scheme**

ESE – 70 Marks

ISE – 30 Marks

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**Introduction:**

This course introduces Fundamentals and basic knowledge of Wireless networks. It also covers the details MAC protocol, Routing protocol, Multicast routing, TLP, QOS, Energy management of ad-hoc network.

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**COURSE PREREQUISITE:** Students should have knowledge of Data Communication and Computer Network

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**COURSE OBJECTIVES:**

1. To introduce fundamentals of wireless ad-hoc networks.
2. To learn design constraints of MAC and routing protocol for wireless ad-hoc networks.
3. To learn security challenges at transport layer of wireless ad-hoc networks.
4. To learn Quality and energy management parameters in wireless ad-hoc networks.

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**COURSE OUTCOME :**

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

1. Explain the concept of ad-hoc and sensor networks, their applications and typical node and network architectures.
2. Explain routing protocol design issues (especially energy-efficiency) and protocol designs for wireless ad-hoc networks
3. Identify the issues in designing Security Protocols for Ad-hoc networks focusing on the working performance of various security protocols.
4. Differentiate protocol designs in terms of their energy-efficiency and Quality of service.

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**SECTION-I**

**Unit 1: Introduction**

**(6)**

Fundamentals of wireless technology, Electromagnetic spectrum, Radio propagation Mechanisms, Characteristics of the Wireless Channel, Applications, and Issues in Ad hoc wireless networks. Cellular and Ad Hoc wireless networks

**Unit 2 : MAC for wireless ad-hoc network**

**(6)**

Introduction, Issues in designing MAC protocol, Design goals of MAC protocol, Classification of MAC protocols, Contention based protocols.

**Unit 3 : Routing protocols**

**(6)**

Introduction, Issues in designing a routing protocol for ad hoc wireless networks, Classification of routing protocols,

- Table driven protocols :- Destination Sequenced Distance Vector (DSDV) , Wireless Routing Protocol (WRP)
- On-demand routing protocol :- Dynamic Source Routing (DSR), Ad Hoc On-Demand Distance Vector Routing (AODV),
- Hybrid routing protocol :-Zone Routing Protocol (ZRP)



## SECTION-II

### Unit 4 : Multicast Routing in Ad hoc wireless networks

(5)

Introduction, Issues in designing a multicast routing protocol, Operation of multicast routing protocols, An architecture reference model for multicast routing protocols, Classification of multicast routing protocols, Tree-based, Mesh-based multicast routing protocols.

### Unit 5 : Transport Layer and Security Protocols

(7)

Introduction, Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks,. Classification of Transport Layer Solutions, TCP Over Ad Hoc Wireless Networks, Security in Ad Hoc Wireless Networks, Network Security Requirements, Issues and challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad Hoc Wireless Networks.

### Unit 6 : Quality of service and Energy management

(6)

Introduction, Issues and challenges, Classification of QoS solutions, MAC layer solutions, Network layer solutions, QoS framework. Introduction, Need, Classification of energy management schemes, Battery Management, Transmission Power Management, System Power Management schemes.

#### **Text Books:**

1. C. Siva Ram Murthy and B.S. Manoj —Ad Hoc Wireless Networks: Architectures and Protocols, Prentice Hall PTR, 2004

#### **Reference Books:**

1. AdHoc Networking by Charles E. Perkins (Pearson Education)
2. Ad Hoc Wireless Networks – A communication Theoretic perspective by O.K.Tonguz & G.Ferrari, Wiley India.
3. Ad Hoc Mobile Wireless Networks – Protocols and Systems by C. K. Toh (Pearson Education)
4. AIntroduction to Wireless and Mobile Systems, 2nd Edition, by Dharma Prakash Agrawal & Qing-An Zeng (CENGAGE Learning)





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**B.E. (COMPUTER SCIENCE & ENGINEERING)**  
**SEMESTER - I**  
**CS 414 C : ELECTIVE – I : ARTIFICIAL INTELLIGENCE**

**Teaching Scheme**

Lectures : 3 Hours /week, 3 credits

**Examination Scheme**

ESE : 70 Marks

ISE : 30 Marks

**Introduction :**

Artificial Intelligence is a major step forward in how computer system adapts, evolves and learns. It has widespread application in almost every industry and is considered to be a big technological shift, similar in scale to past events such as the industrial revolution, the computer age, and the smart phone revolution.

This course will give an opportunity to gain expertise in one of the most fascinating and fastest growing areas of Computer Science through classroom program that covers fascinating and compelling topics related to human intelligence and its applications in industry, defence, healthcare, agriculture and many other areas.

**Course Prerequisite:** Knowledge of Data Structures and Algorithms.

**COURSE OBJECTIVE :**

The course will give the students a rigorous, advanced and professional graduate-level foundation in Artificial Intelligence.

**COURSE OUTCOMES:**

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

1. Build intelligent agents for search and games
2. Learning optimization and inference algorithms for model learning
3. Design and develop programs for an agent to learn and act in a structured environment.

**Unit 1 Introduction**

**(03)**

Concept of AI, history, current status, scope, agents, environments, Problem Formulations, Review of tree and graph structures, State space representation, Search graph and Search tree.

**Unit 2 Search Algorithms**

**(09)**

Random search, Search with closed and open list, Depth first and Breadth first search, Heuristic search, Best first search, A\* algorithm, Game Search.

**Unit 3 Probabilistic Reasoning**

**(12)**

Probability, conditional probability, Bayes Rule, Bayesian Networks- representation, construction and inference, temporal model, hidden Markov model.

**Unit 4 Markov Decision process**

**(12)**

MDP formulation, utility theory, utility functions, value iteration, policy iteration and partially observable MDPs.

**Unit 5 Reinforcement Learning**

**(09)**

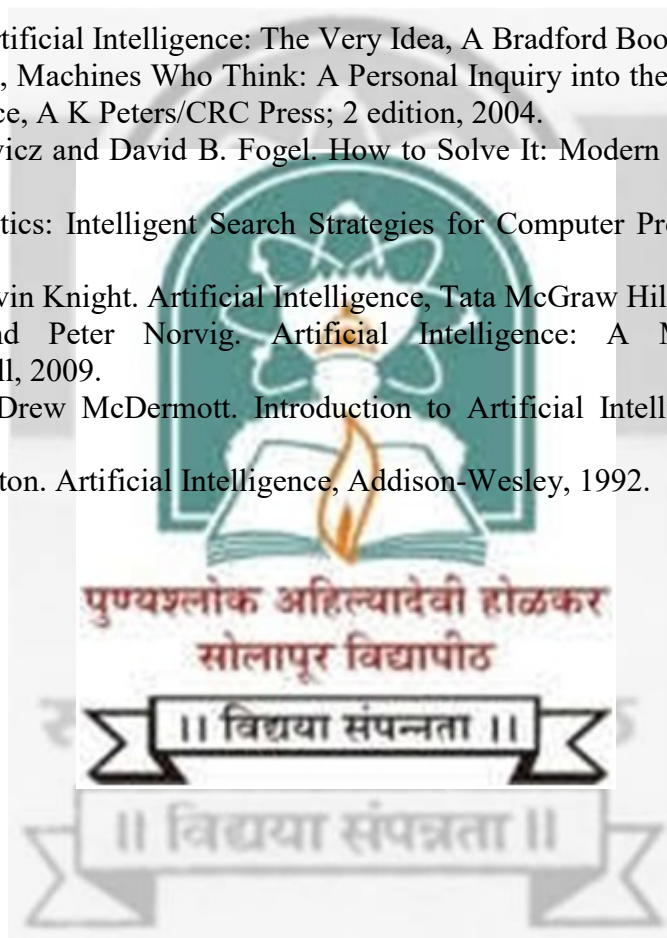
Passive reinforcement learning, direct utility estimation, adaptive dynamic programming, temporal difference learning, active reinforcement learning- Q learning.

**Text Books:**

1. Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach” , 3rd Edition, Prentice Hall
2. Elaine Rich and Kevin Knight, “Artificial Intelligence”, Tata McGraw Hill
3. Trivedi, M.C., “A Classical Approach to Artificial Intelligence”, Khanna Publishing House, Delhi.
4. Saroj Kaushik, “Artificial Intelligence”, Cengage Learning India, 2011
5. David Poole and Alan Mackworth, “Artificial Intelligence: Foundations for Computational Agents”, Cambridge University Press 2010.

**Reference Books:**

1. Stefan Edelkamp and Stefan Schroedl. Heuristic Search: Theory and Applications, Morgan Kaufmann, 2011.
2. John Haugeland, Artificial Intelligence: The Very Idea, A Bradford Book, The MIT Press, 1985.
3. Pamela McCorduck, Machines Who Think: A Personal Inquiry into the History and Prospects of Artificial Intelligence, A K Peters/CRC Press; 2 edition, 2004.
4. Zbigniew Michalewicz and David B. Fogel. How to Solve It: Modern Heuristics. Springer; 2nd edition, 2004.
5. Judea Pearl. Heuristics: Intelligent Search Strategies for Computer Problem Solving, Addison-Wesley, 1984.
6. Elaine Rich and Kevin Knight. Artificial Intelligence, Tata McGraw Hill, 1991.
7. Stuart Russell and Peter Norvig. Artificial Intelligence: A Modern Approach, 3rd Edition, Prentice Hall, 2009.
8. Eugene Charniak, Drew McDermott. Introduction to Artificial Intelligence, Addison-Wesley, 1985.
9. Patrick Henry Winston. Artificial Intelligence, Addison-Wesley, 1992.





**PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR**  
**B.E. (COMPUTER SCIENCE & ENGINEERING)**  
**SEMESTER - I**

**CS 415 A : ELECTIVE – II : BUSINESS INTELLIGENCE**

**Teaching Scheme**

Lectures : 3 Hours /week, 3 credits

Tutorial : 1 Hour/Week, 1 credit

**Examination Scheme**

ESE : 70 Marks

ISE : 30 Marks

ICA : 25 Marks

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**COURSE OBJECTIVE:**

1. To acquaint the students with advanced database techniques.
2. To develop skills to build business intelligence using data mining
3. To optimize decision making in business.

---

**COURSE OUTCOME:**

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

1. Demonstrate concepts of business intelligence and data mining.
2. Apply theoretical and practical skills to address different data types.
3. Apply data mining techniques in business context.
4. Design a data model and use relevant techniques for data analysis.
5. Implement conventional data mining software, and evaluate its strength and limitations.

---

**SECTION – I**

**Unit 1 : Introduction to Business Intelligence: (08)**

Effective and timely decisions, role of mathematical models, BI architectures, ethics on BI. Introduction to data warehouse, architecture, OLAP

**Unit 2 : Decision Support System: (07)**

Representation of decision making system, evolution of information system, definition and development of decision support system, mathematical models for decision making,

**Unit 3 : Analysis of Data Mining: (10)**

Definition and applications of data mining, data mining process, analysis methodologies, data preparation, data validation, data transformation, data reduction, data exploration, Univariate analysis, Bivariate analysis, Multivariate analysis.

**SECTION – II**

**Unit 4 : Machine learning and Data analysis (06)**

Regression, simple and multiple regression, validation of regression models, time series, evaluating and analysis of time series, exponential smoothing models, autoregressive models

**Unit 5 : Data mining Techniques for BI: (10)**

Classification and its problems, evaluating classification models, classification trees, Bayesian methods, neural networks, structure of association rules, Apriori algorithm, general association rules, clustering methods, partition methods and hierarchical methods

**Unit 6 : Business Intelligence Applications: (10)**

Marketing models: Relational marketing, Salesforce management, Business case studies, supply chain optimization, optimization models for logistics planning, revenue management system, Logistics business case studies



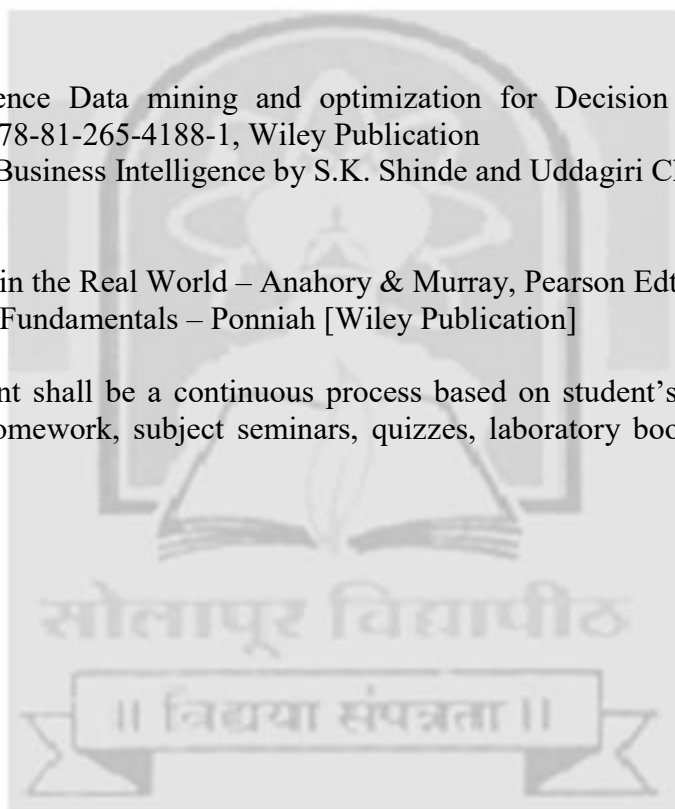
**Text Book:**

1. Business Intelligence Data mining and optimization for Decision making by Carlo Vercellis, ISBN:978-81-265-4188-1, Wiley Publication
2. Data Mining and Business Intelligence by S.K. Shinde and Uddagiri Chandrashekhar

**Reference Books:**

1. Data Warehousing in the Real World – Anahory & Murray, Pearson Edt.
2. Data Warehousing Fundamentals – Ponniah [Wiley Publication]

Term work assessment shall be a continuous process based on student's performance in – class tests, assignments, homework, subject seminars, quizzes, laboratory books and their interaction during theory





**PUNYASHLOK AHILYADEVJI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR**  
**B.E. (COMPUTER SCIENCE & ENGINEERING)**

**SEMESTER - I**

**CS 415 B : ELECTIVE – II : DATA MINING**

**Teaching Scheme**

Lectures : 3 Hours /week, 3 credits

Tutorial : 1 Hour/Week, 1 credit

**Examination Scheme**

ESE : 70 Marks

ISE : 30 Marks

ICA : 25 Marks

---

**COURSE OBJECTIVES:**

1. To acquire the basic concepts and techniques of Data Mining
2. To Understand the usage of Data Mining
3. To Learn Different data Pre processing techniques.
4. To Learn and Analyze different data mining algorithms.
5. To apply the data mining algorithms for problem solving.

---

**COURSE OUTCOMES:**

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

1. Examine the types of the data to be mined for a particular application.
2. Apply preprocessing statistical methods for any given raw data.
3. Select and apply proper data mining algorithms to build analytical applications
4. Comprehend the roles that data mining plays in various fields and manipulate different data mining techniques.
5. Demonstrate and apply a wide range of Clustering, Classification and association rule mining algorithms

---

**SECTION- I**

**UNIT 1: Introduction**

Why data Mining, What is Data Mining?, Basic data mining tasks, What kind of Data can be mined, What kinds of Patterns can be mined?, technological support for data mining, target applications of data mining, major issues in data mining, KDD process, Data mining Vs Knowledge Discovery in Databases. (4)

**UNIT 2: Data Preprocessing**

Need to Preprocess the data, major tasks in Data Preprocessing, Data Cleaning, Data integration, Data Reduction, Data Transformation and Data Discretization. (4)

**UNIT 3: Classification**

Issues in Classification, Statistical-Based Algorithms: Regression, Bayesian Classifiers. Distance Based Algorithms: K -Nearest Neighbors Classifiers, Decision Tree Based Algorithms, Neural Network-Based Algorithms, Rule Based Algorithms. (8)

**SECTION II**

**UNIT 4: Cluster Analysis- Basic Concept and Methods**

Cluster Analysis : What is Cluster Analysis?, Requirements for Cluster Analysis, Overview of Basic Clustering Methods, (8)

**Partitioning Methods:** k-Means: A Centroid-Based Technique, k-Medoids: A Representative Object-Based Technique,

**Hierarchical Methods** : Agglomerative Algorithms and Divisive Clustering, BIRCH: Multiphase Hierarchical Clustering Using Clustering Feature Trees, Evaluation of Clustering.

**UNIT 5: Association Rules**

(8)

Introduction, Large Item sets, Basic Algorithms: Apriori Algorithm, Sampling Algorithm, Partitioning Algorithm, Parallel and Distributed Algorithms, Comparing Approaches, Incremental Rules, Advanced association rule-Techniques, Measuring the quality of rules.

**UNIT 6: Web Mining**

(4)

Introduction, Web Content Mining: Crawlers, Harvest System, Virtual Web View, personalization. Web Structure Mining: PageRank, Clever. Web Usage Mining: Preprocessing, Data Structures, Pattern Discovery Pattern Analysis.

**Internal Continuous Assessment (ICA) :**

Minimum 8 to 10 assignment based on above topics.

**Text Books:**

1. Margaret H. Dunham, "DATA MINING Introductory and Advanced Topics", PEARSON (Units 3,5,6)
2. Han, Kamber, Pei, "DATA MINING Concept and Techniques", 3<sup>rd</sup> Edition, ELSEVIER (Units 1,2,4)
3. Tan, Vipin Kumar, Steinbach, "Introduction to Data Mining", PEARSON (Unit 3)

**Reference Books:**

1. Galit Shmueli, Nitin Patel, Peter Bruce, "Data mining For Business intelligence" Wiley Student Edition.
2. M.Berry and G. Linoff, "Mastering Data Mining", Wiley Student Edition





**PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR**  
**B.E. (COMPUTER SCIENCE & ENGINEERING)**  
**SEMESTER - I**

**CS 415 C : ELECTIVE – II : OBJECT ORIENTED MODELING & DESIGN**

**Teaching Scheme**

Lectures - 3 Hours/Week, 3 Credits

Tutorial - 1 Hours/Week, 1 Credit

**Examination Scheme**

ESE -70 Marks

ISE - 30 Marks

ICA- 25 Marks

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**COURSE OBJECTIVE :**

1. Model and design real world problems.
2. Analyze the risk factor for software development project.
3. Develop the skills to determine which process of object oriented Analysis and design technique should be applied to a given project.

---

**COURSE OUTCOME:**

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

1. List the objects of Unified Modeling Language for a given problem statement.
2. Explain the working understanding of the object oriented analysis and design.
3. Apply the knowledge of object oriented modeling and design to the given software development project.
4. Devise the real world problem using object oriented modeling technique.

---

**SECTION-I**

**Unit 1 : Introduction**

**(4)**

Object Oriented development and themes, evidence for usefulness, modeling as a Design Technique.

**Unit 2 : Object Modeling**

**(6)**

Objects, classes, links and associations, generalization and inheritance, grouping constructs, aggregation, abstract classes, generalization as extension and restriction, multiple inheritance, metadata, candidate keys and inheritance.

**Unit 3 : Dynamic and Functional Modeling**

**(6)**

Events, states, operations, concurrency, nested state diagrams, advanced dynamic modeling concepts, relation of object and dynamic models, DFD, relation of functional to object and dynamic models

**Unit 4 : Methodology preview and Analysis**

**(4)**

OMT as a Software Engineering Methodology, The OMT Methodology, Impact of an Object-Oriented Approach, Overview of Analysis, Problem Statement, Automated Teller Machine Example, Object Modeling, Dynamic Modeling, Functional Modeling, Adding Operations, Iterating the Analysis

**SECTION-II**

**Unit 5 : Behavioral Modeling using UML**

**(6)**

Interactions, Use cases, Use case diagram, Interaction Diagrams and Activity diagrams, Events and signals, State Machines, Processes and Threads, Time and space, State chart diagrams.

**Unit 6 : Architectural Modeling using UML**

**(6)**

Components, Deployment, Collaboration, Patterns and Frame works, Component diagrams and Deployment Diagrams



## Unit 7 : Implementation of OMT

(6)

Use of programming language and database system, Object oriented style, feature of object oriented languages, Applications of OMT like object diagram compiler, Computer animation, Case study of Hotel management system, course management system

## Unit 8 : Design Patterns – 1

(4)

What is a pattern and what makes a pattern? Pattern categories; Relationships between patterns; Pattern description Communication Patterns: Forwarder-Receiver; Client-Dispatcher-Server;

### ICA :

1. Describe object oriented methodology and themes.
2. Prepare a list of objects that you would expect each of the following system to handle also draw the class and object diagram for the same.
  - a. Arithmetic expression
  - b. Air transportation system.
3. Dynamic and Functional Modelling
  - a. Draw the state diagram for telephone answering machine. The machine should answer after five rings. If the telephone is answered before five rings, the machine should do nothing.
  - b. Design functional model for flight simulator.
4. Draw Object Model with attributes and inheritance for Automated Teller Machine (ATM).
5. Draw Use case Diagram for Student Registration System.
6. Draw Sequence and collaboration diagram for buying online product.
7. Draw Deployment diagram for Home Network. (Hint: Modern homes usually have a network of interconnected devices of different kinds and with various types of connections and communication protocols. It contains cable modem, wireless router, various computers and devices.)
8. Draw Component diagram for online examination system.
9. What is a Design pattern and what makes a pattern? Describe Pattern categories and Relationships between patterns.

### Textbook:

1. Object oriented Modeling and Design: Rambaugh, Premerlani, Eddy, Lorenson (PHI )
2. The Unified Modeling Language User Guide: Grady Booch, James Rambaugh, Ivar Jacotson (Addison Wesley)

### Reference Books:

1. Brahma Dathan, Sarnath Ramnath: Object-Oriented Analysis, Design, and Implementation, Universities Press, 2009.
2. Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado: UML 2 Toolkit, Wiley-Dreamtech India, 2004
3. Simon Bennett, Steve McRobb and Ray Farmer: Object-Oriented Systems Analysis and Design Using UML, 2nd Edition, Tata McGraw-Hill, 200
4. Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal: Pattern-Oriented Software Architecture, A System of Patterns, Volume 1, John Wiley and Sons, 2007.
5. Object Oriented Analysis and design using UML, D. Jeya Mala, S. Geetha, McGraw Hill Publication, ISBN : 978-1-25-900674-6



**PUNYASHLOK AHILYADEVJI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR**  
**B.E. (COMPUTER SCIENCE & ENGINEERING)**

**Semester I**

**CS 416 : PROGRAMMING WITH PYTHON**

**Teaching Scheme**

Lectures: 2 Hours/Week, 2 Credit

Practical : 2 Hours/Week, 1 Credit

**Examination Scheme**

POE : 50 Marks

ICA : 25 Marks

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**COURSE OBJECTIVES :**

1. Introduce procedural and object-oriented style for writing Python scripts.
2. Introduce standard library packages and modules in Python.
3. To teach debugging and profiling of Python scripts.

---

**COURSE OUTCOME:**

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

1. Use Python standard library modules in writing Python scripts for problem solving.
2. Write Python scripts in procedural and object-oriented style.
3. Write Python scripts to perform database, network and web related operations.
4. Debug and profile Python scripts.

---

**SECTION - I**

**Unit 1 : Introduction to Python**

**(03)**

Introducing the Python Interpreter, Program Execution, Execution Model Variations, The Interactive Prompt, System Command Lines and Files. Syntactic and semantic differences between Python 2.x and Python 3.x.

**Unit 2 : Introduction to procedural programming in Python**

**(04)**

Data types, Collection data types, Control structures and functions, Exception Handling, Custom Functions

**Unit 3 : Modules and packages**

**(06)**

String handling, command line programming, time and dates, JSON handling, File and directory handling, Create, read, write delete, and rename files. Traverse directories, Concurrent Execution, Internationalization, PyPI: Python Package Index, [pypi.python.org/pypi](http://pypi.python.org/pypi), Using pip to install python packages from PyPI

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**SECTION - II**

**Unit 4 : Object oriented programming**

**(04)**

Classes, Instance Objects, Method Objects, Class and Instance Variables, Attributes and methods, Inheritance and polymorphism

**Unit 5 : Database connectivity in Python**

**(04)**

DBM databases, Executing Queries, SQL databases

**Unit 6 : Network and Web Programming**

**(04)**

Networking and Interprocess Communication, Interacting with HTTP services as a client, Creating TCP, UDP Server, Creating Simple REST based interface, Authenticating Clients, Understanding Event-Driven I/O.

## Unit 7: Testing, Debugging and exceptions

(05)

Testing output, Unit tests in Python, Handling Multiple exceptions, creating custom exceptions, Debugging programs, Unit testing and profiling

### ISE Evaluation :

ISE Evaluation for the course will consists of three programming tests based on above topics.

### ICA :

Minimum 20 assignments based on above topics.

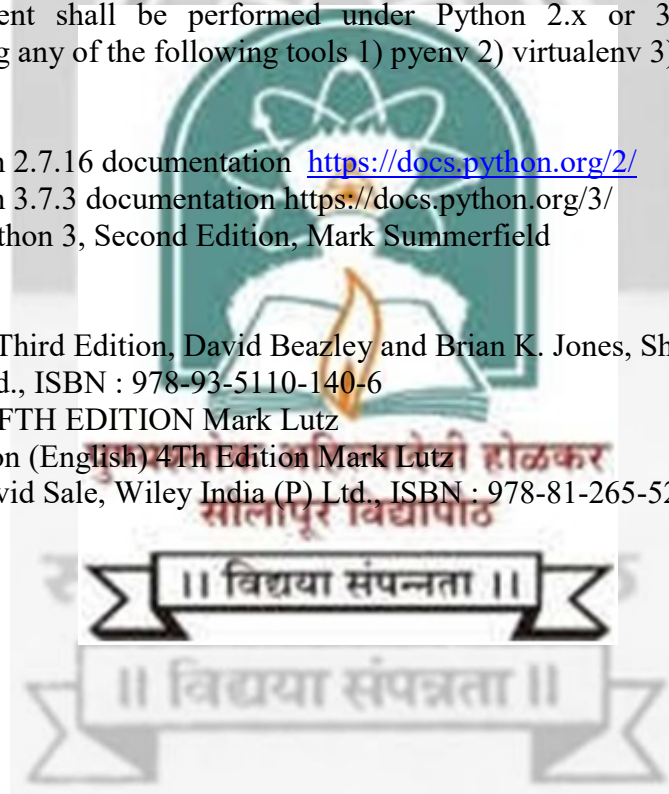
- Students should undertake minimum of 20 practical assignments based on each above topic.
- The assignments should test and develop student's practical proficiency and ability to use Python standard library modules and packages efficiently in writing effective code for varied applications scenarios & requirements, use cases.
- Use of IDEs like PyCharm, Eclipse with PyDev, Jupyter Notebook for Interactive development and debugging of Python applications is highly recommend to enhance hands on skills in Python Programming of Students.
- Every assignment shall be performed under Python 2.x or 3.x runtime environment configured using any of the following tools 1) pyenv 2) virtualenv 3) Anaconda

### Text Book:

1. e-Resource : Python 2.7.16 documentation <https://docs.python.org/2/>
2. e-Resource : Python 3.7.3 documentation <https://docs.python.org/3/>
3. Programming in Python 3, Second Edition, Mark Summerfield

### Reference Books:

1. Python Cookbook, Third Edition, David Beazley and Brian K. Jones, Shroff Publishers & Distributors Pvt. Ltd., ISBN : 978-93-5110-140-6
2. Learning Python FIFTH EDITION Mark Lutz
3. Programming Python (English) 4Th Edition Mark Lutz
4. Testing Python, David Sale, Wiley India (P) Ltd., ISBN : 978-81-265-5277-1





**PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR**  
**B.E. (COMPUTER SCIENCE & ENGINEERING)**

**Semester II**

**CS 421 - MANAGEMENT INFORMATION SYSTEMS**

**Teaching Scheme**

Lectures: 3 Hours/Week

Tutorial : 1 Hour/Week

**Examination Scheme**

ESE : 70 Marks

ISE: 30 Marks

ICA : 25 Marks

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**COURSE OBJECTIVES:**

1. To understand basic infrastructure and strategy for information systems.
2. To make student learn professional ethical codes of conduct as appropriate to industry and organizational environments
3. To introduce the Communication Technology required for IT
4. To make student learn to develop secure information system.

---

**COURSE OUTCOME:**

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

1. Elaborate basic infrastructure and strategies used in information systems.
2. Apply professional ethical codes of conduct as appropriate to industry and organizational environments
3. Design information systems using principles of Communication Technologies
4. Develop secure information systems.

---

**SECTION-I**

**Unit 1: Information Systems in Global Business Today (08)**

The Role of Information Systems in Business Today, How information systems are transforming business, What is new in information system. Business Processes and Information systems, Systems for collaboration and social business, Tools and technologies for collaboration and social business

**Unit 2: Information Systems, Organizations, and Strategy (06)**

Organizations and its features, How Information Systems Impact on Organizations, Competitive strategies using information systems, Challenges posed by strategic information systems

**Unit 3 : Ethical and Social Issues in Information Systems (06)**

Understanding Ethical, Social, political issues raised by information systems, principles for conduct in ethical decisions, Contemporary information systems technology. Challenges to the protection individual privacy and intellectual property.

**SECTION-II**

**Unit 4: IT Infrastructure and Emerging Technologies (05)**

IT Infrastructure, Infrastructure Components, Contemporary Hardware Platform Trends, Contemporary Software Platform Trends, Management Issues

**Unit 5 : Foundations of Business Intelligence: Databases and Information Management (08)**

Organizing Data in a Traditional File Environment, Major Capabilities of Database Management Systems, Using Databases to Improve Business Performance and Decision Making, Managing Data Resources, Telecommunications, the internet, and Wireless Technology: Principles Components of



Telecommunications Network & Network Technologies, Different types of networks, principle technologies and standards for wireless networking, communication, internet access.

#### **Unit 6: Securing Information Systems**

**(06)**

System Vulnerability and Abuse, Business Value of Security and Control, Organizational Framework for Security and Control, Technologies and Tools for safeguarding Information Resources

#### **Unit 7: E-commerce: Digital Markets, Digital Goods**

**(06)**

Features of e-commerce. Digital Markets, Digital Goods, principles e-commerce business and revenue models, e-commerce transformed marketing, e-commerce business-to-business transaction, Role of M-commerce in business & its applications, issues related building e-commerce.

#### **Internal Continuous Assessment (ICA) :**

Teacher should prepare a group of 4-5 students (or based on their project group) assign them any case study based on the above chapters and tell them to collect and present that case study in the form of seminar. Evaluation will be done by teacher by considering different factors.

These are few topics for case study, teacher can suggest any other topic for case study

1. IT application in Management: BSNL CDR project (Call-Data-Record)
2. Information System Software: Case study on DSS for ITC, Big Bazaar, Raymond Clothing's
3. Application of MIS in different Functional Area: AADHAR Based Biometric Attendance System implemented in all government organizations. [www.attendance.gov.in](http://www.attendance.gov.in)
4. Information system resource management: IRCTC next Generation Ticketing System
5. Ecommerce: A comprehensive case study on FLIPKART, SNAPDEAL, MYNTRA etc
6. ERP: One Case study on each module of ERP
7. Mc Donald's supply chain management (SCM)
8. Cognizant implementation of People soft (Human Resource Management System)
9. Tata Motors CRM DMS Project (CRM)
10. AICTE, New Delhi (SAP CRM Project)
11. VRL Implementation of SCM (Logistics & Supply Chain Management)

#### **Text Book:**

1. Management Information Systems : Managing the Digital Firm, 15th Edition by Kenneth C.Laudon and Jane Laudon, Pearson Education
2. Management Information Systems: Sashikala Parimi, Kogent Learning Solutions Inc.

#### **Reference Books:**

1. Information Technology for Management: Transforming Organizations in the Digital Economy, Efraim Turban, 6th Edition, Wiley Edition
2. Management Information Systems: Shubhalakshmi Joshi, Smita Vaze, Biztantra

**Note:** Teacher can make a group of 4-5 students (or based on their project group) & assign Case Study given in the textbook (Sr.No.1) Evaluation will be done by teacher by considering different factors.



**PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR**  
**B.E. (COMPUTER SCIENCE & ENGINEERING)**

**Semester II**

**CS 422 – INFORMATION and CYBER SECURITY**

**Teaching Scheme**

Lectures: 3 Hours/Week, 3 credits

Practical : 2 Hour/Week, 1 credit

**Examination Scheme**

ESE : 70 Marks

ISE: 30 Marks

ICA : 25 Marks

POE : 50 Marks

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**COURSE OBJECTIVES:**

1. Provide an understanding of principal concepts, major issues, technologies, and basic approaches in information security.
2. Provide concept-level hands-on experience in specific topic area.
3. Provide the ability to examine and analyze real-life security cases.

---

**COURSE OUTCOME:**

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

1. Explain different security technology and policies
2. Identify & evaluate Information security threats & vulnerabilities in information system and apply security measures to real time scenario
3. Demonstrate the use of standards and cyber laws to enhance information security in the development process and infrastructure protection
4. Demonstrate application of block chain technology

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**SECTION – I**

**Unit 1: Symmetric Ciphers**

**(5)**

Overview – Services, Mechanism and Attacks, OSI Security Architecture, A model for Network security, Classical Encryption techniques – Symmetric Cipher model, Substitution. Techniques, Transposition techniques, Rotor Machines.

**Unit 2: Block Cipher and Data Encryption Standard**

**(6)**

Simplified DES, Block Cipher principles. The Data Encryption Standard, The strength of DES, Differential and Linear Cryptanalysis, Block Cipher design principles, Block Cipher Mode of Operation.

**Unit 3 : Public Key Cryptography**

**(5)**

Public Key Cryptography and RSA – Principles of Public Key Cryptosystems, The RSA Algorithm, Key management - Other public key cryptosystems – Key Management, Diffie-Hellman Key Exchange.

**Unit 4 : Message Authentication and HASH Functions:**

**(5)**

Authentication requirements, Authentication Functions, Message Authentication Codes, Hash Functions, security of Hash Functions and MACS Digital Signatures. Authentication Protocols– Digital Signatures, Authentication Protocols, Digital Signature Standard.

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**SECTION – II**

**Unit 5: IP Security and E-Mail Security**

**(7)**

IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security payload, Combining Security Associations, Key Management, Secure Socket Layer and Transport

Layer Security.

Electronic Mail Security – Secure Electronic Transaction, Pretty Good Privacy, S/MIME

### **Unit 6: Introduction to block chain**

(7)

Overview of block chain, public ledgers, bit coin, smart contracts, block in a block chain, transactions, DISTRIBUTED CONSENSUS, public vs private clock chain, understanding cryptocurrency in block chain, permissioned model of block chain, overview of security aspect of block chain

### **Unit 7: Cyber law and forensic**

(7)

Introduction, Cyber security regulation, role of International law, the state and private sector in cyberspace, cyber security standards, the Indian cyberspace

Introduction to forensic, cyber evidence, web attack investigation, internet crime investigation, internet forensics

### **Internal Continuous Assessment (ICA) :**

It should consist of the 08-10 practical based on following guidelines

- 1) Implementation of Substitution Cipher
- 2) Implementation of Poly alphabetic Cipher (Vigenere Cipher and Vernam Cipher)
- 3) Implementation of Transposition Cipher
- 4) Implementation of Play fair Cipher
- 5) Implementation of Secure file transfer in Client/Server environment (use any one of above method for encryption and decryption).
- 6) Write a program to simulate RSA algorithm.
- 7) Install and understand docker container
- 8) Create and deploy a block chain network
- 9) Study different cybercrimes and implement a system to detect any one cyber crime

### **Text Book:**

1. Williams Stallings–Cryptography and Network security principles and practices. Pearson Education (LPE) ( Unit I to V)
2. Melanie Swan :Blockchain: Blueprint for a New Economy :2015
3. Neena godbole “information system security” सपन्नता ॥

### **Reference Books:**

1. Behroz A. Forozan, Debdeep Mukhopadhyay, “Cyber and Network Security” McGraw Hill Education, 2<sup>nd</sup> Edition.
2. Atul Kahate, “Cryptography and Network Security” McGraw Hill Education 3<sup>rd</sup> Edition
3. Schneir, Bruce, “Applied Cryptography: Protocols and Algorithms”



**PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR**  
**B.E. (COMPUTER SCIENCE & ENGINEERING)**  
**SEMESTER - II**

**CS 423 A : ELECTIVE – III : BIG DATA ANALYTICS**

**Teaching Scheme**

Lectures : 3 Hours /week

Tutorial : 1 Hour/Week

**Examination Scheme**

Theory: 70 Marks

ISE: 30 marks

ICA : 25 Marks

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**COURSE OBJECTIVES :**

- 1) Explain need for Big Data Analytics
- 2) Develop ability to analyze and process Big Data.
- 3) Build necessary skills to write Map Reduce programs for analyzing Big Data problems.

---

**COURSE OUTCOME :**

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

- 1) Identify need for Big Data analysis
- 2) Analyze and identify Big data processing technology for analyzing the Big data.
- 3) Write Map Reduce programs to process Big Data by identifying the use case.

---

**SECTION – I**

**Unit 1: Introduction to Types of Digital Data**

**(4)**

Classification of Digital Data, Structured Data, Sources of structured data, Ease with Structured data, Semi-Structured data, sources of semi-structured data, Unstructured data, sources of unstructured data, Issues with terminology, Dealing with unstructured data, Place me in the basket.

**Unit 2: Introduction to Big Data**

**(4)**

Big data, What is big data? Why big data?, Other characteristics of data which are not definitional traits of big data, Challenges with big data, Big data stack, Exercises - Puzzle, Fill in the blanks.

**Unit 3: Big Data Analytics**

**(6)**

Big Data Analytics, Analytics 1.0, Analytics 2.0, Analytics 3.0, Traditional BI vs. Big Data Environment, Terminologies used in Big Data Environment, Big Data Technology Landscape, NoSQL Databases, NoSQL Vs. RDBMS, NewSQL, Hadoop, Hadoop 1.0 vs. Hadoop 2.0, Exercises, Data Science is multidisciplinary, Data Scientist - Your new best friend.

**Unit 4: Introduction to Hadoop**

**(10)**

Introducing Hadoop, Why not RDBMS, Distributed Computing Challenges, A Brief History of Hadoop, Hadoop Overview, Hadoop Components, High Level Architecture of Hadoop, Hadoop Distributed File System, HDFS Architecture, Daemons Related to HDFS, Working with HDFS Command, Special Features of Hadoop, Processing Data With Hadoop, Introduction How Map Reduce Works, Map Reduce Example, Word Count Example using Java Managing Resources and Applications with YARN Introduction, Limitation of Hadoop 1.0, Hadoop 2: HDFS, Hadoop 2: YARN, Interacting with Hadoop EcoSystem Hive, Pig, HBase, Sqoop.

**SECTION – II**

**Unit 5: Introduction to MongoDB**

**(4)**

Recap of NoSQL databases, MongoDB – CRUD, MongoDB- Arrays, Java Scripts, Cursors, Map Reduce Programming, Aggregations.



## **Unit 6: Introduction to Cassandra**

(4)

Features of Cassandra, CQLSH - CRUD, Collections, Counter, List, Set, Map, Tracing.

## **Unit 7: Introduction to Hive**

(8)

What is Hive? History of Hive and Recent Releases of Hive, Hive Features, Hive Integration and Work Flow, Hive Data Units, Hive Architecture, Hive Primitive and Collection Data Types, Hive File Format, Hive Query Language(HQL)–Statements – DDL,DML. Hive Partitions – Bucketing, Views, Sub Query, Joins, Hive User Defined Function, Aggregations in Hive, Group by and Having, Serialization and Deserialization, Hive Analytic Functions.

## **Unit 8: Introduction to Pig**

(4)

Introducing Pig, History and Anatomy of Pig, Pig on Hadoop, Pig Philosophy, ETL Processing, Pig Latin Overview, Word count example using Pig.

### **Internal Continuous Assessment (ICA) :**

1. Objective of assignments should be to test students understanding and assess their ability to put into practice the concepts and terminologies learned.
2. Assignments must be of nature, which require students to identify the use case scenarios for using technologies mentioned in syllabus.

### **Text Book :**

1. Big Data and Analytics, Seema Acharya, Subhashini Chellappan, - Wiley India Pvt. Ltd.
2. Hadoop: The Definitive Guide, 3rd Edition, Tom White , - O'reilly Media.
3. Programming Hive, Edward Rutherglen, Dean Wampler, Jason Rutherglen, Edward Capriolo. - O'reilly Media.
4. The Definitive Guide to MongoDB: A Complete Guide to Dealing with Big Data Using MongoDB (Definitive Guide Apress) 2e by David Hows, Eelco Plugge, Peter Membrey, Tim Hawkins.
5. Programming Pig, by Alan Gates - O'reilly Media.
6. Cassandra: The Definitive Guide, Eben Hewitt - O'reilly Media.

### **Reference Book :**

1. Big Data For Dummies, Judith Hurwitz, Alan Nugent , Dr. Fern Halper, Marcia Kaufman, by Wiley Brand.
2. Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses (Wiley CIO), Michael Minelli, Michele Chambers, Ambiga Dhiraj : John Wiley & Sons.
3. Mining of Massive Datasets, Anand Rajaraman, Jure Leskovec, Jeff rey D. Ullman, Cambridge University Press.
4. Hadoop in Action, Chuck Lam, Dreamtech Press, ISBN : 978-81-7722-813-7.



**PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR**  
**B.E. (COMPUTER SCIENCE & ENGINEERING)**  
**SEMESTER - II**

**CS 423 B : ELECTIVE – III : HUMAN COMPUTER INTERACTION**

**Teaching Scheme**

Lectures : 3 Hours /week

Tutorial : 1 Hour/Week

**Examination Scheme**

Theory: 70 Marks

ISE: 30 marks

ICA : 25 Marks

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**COURSE OBJECTIVES:**

1) Know how to analyze and consider user's need in the interaction system 2) Understand various interaction design techniques and models 3) Understand the theory and framework of HCI 4) Understand and analyze the cognitive aspects of human – machine interaction

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**COURSE OUTCOME :**

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

- 1) To develop good design for human machine interaction system
  - 2) Analyze the user's need in interaction system
  - 3) To design new interaction model to satisfy all types of customers
  - 4) Evaluate the usability and effectiveness of various products
  - 5) To know how to apply interaction techniques for systems
- 

**SECTION-I**

**Unit 1**

Introduction, The human, The computer, The interaction, Paradigms, Usability of Interactive Systems, Guidelines, Principles, and Theories. (5)

**Unit 2**

Design Process - Interaction design basics, HCI in the software process, Design rules, Implementation support, Evaluation techniques, Universal design, User support (5)

**Unit 3**

Models and Theories0 Cognitive models, Socio-organizational issues and stakeholder requirements, Communication and collaboration models, Task analysis, Dialogue notations and design, Models of the system, Modelling rich interaction (5)

**Unit 4**

Interaction Styles- Direct Manipulation and Virtual Environments, Menu Selection, Form Filling and Dialog Boxes, Command and Natural Languages, Interaction Devices, Collaboration and Social Media Participation (6)

**SECTION-II**

**Unit 5**

Design Issues- Quality of Service, Balancing Function and Fashion, User Documentation and Online Help, Information Search, Information Visualization (5)

**Unit 6**

Outside the Box- Group ware, Ubiquitous computing and augmented realities, Hypertext, multimedia, and the world wide web Text (5)

**Unit 7****(6)**

Information Search and visualization - Introduction, Search in Textual Documents and Database Querying, Multimedia Document Searches, Advanced Filtering and Search Interfaces, Information Visualization, OAI Model for Website Design.

**Unit 8****(5)**

Hypertext, Multimedia and the world wide web, Introduction, Understanding hypertext, Web technology and issues, Static web content, dynamic web content

**Internal Continuous Assessment (ICA) :**

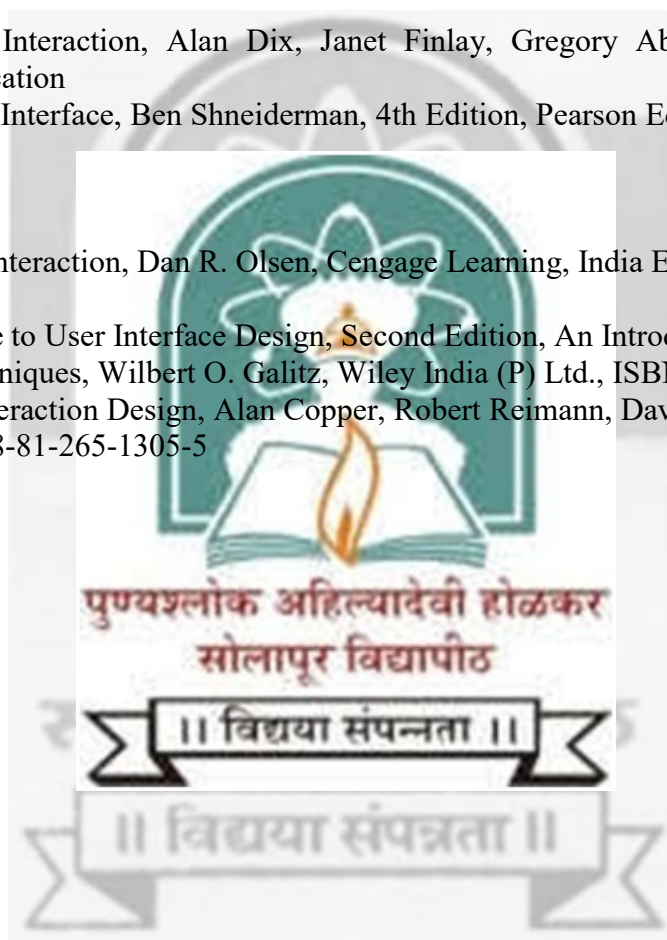
Minimum 10 to 12 assignments based on above topics.

**Text Books :**

1. Human Computer Interaction, Alan Dix, Janet Finlay, Gregory Abowd and Russel Beale, Prentice Hall Publication
2. Designing the User Interface, Ben Shneiderman, 4th Edition, Pearson Education, 2008, ISBN 81-7808-262-4

**Reference Book :**

1. Human Computer Interaction, Dan R. Olsen, Cengage Learning, India Edition, ISBN No.978-81-315-1137-4
2. The Essential Guide to User Interface Design, Second Edition, An Introduction to GUI Design Principles and Techniques, Wilbert O. Galitz, Wiley India (P) Ltd., ISBN : 81- 265-0280-0
3. The Essential of Interaction Design, Alan Copper, Robert Reimann, David Cronin, Wiley India (P) Ltd., ISBN : 978-81-265-1305-5





**PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR**  
**B.E. (COMPUTER SCIENCE & ENGINEERING)**  
**SEMESTER - II**

**CS 423 C : ELECTIVE – III : ARTIFICIAL NEURAL NETWORKS**

**Teaching Scheme**

Lecture : 3 Hours /week

Tutorial : 1 Hour/Week

**Examination Scheme**

Theory: 70 Marks

ISE: 30 marks

ICA : 25 Marks

**COURSE OBJECTIVES:**

1. To study different learning rules and compare them.
2. To calculate the performance of neural networks.
3. To apply different optimization techniques to improve learning.
4. To create prototype applications of real world using artificial neural networks.

**COURSE OUTCOMES :**

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

1. Demonstrate different learning rules and compare them.
2. Calculate the performance of neural networks using defined parameters.
3. Apply different optimization techniques to achieve better results of learning.
4. Create prototype applications of real world with the use of artificial neural networks.

**SECTION – I**

**Unit 1 Introduction**

**(4)**

Biological neuron, Models of artificial neural networks, neural processing, neural network learning rules

**Unit 2 Learning & adaptation**

**(5)**

Classification Neural learning rules-Hebbian, perceptron, Delta, Widrow Hoof, Winner take all outstar learning rule.

**Unit 3 Perceptron**

**(4)**

Discrete perception as a classifier, Decision and discriminant functions, Linearly non separable patterns. Perceptron training for two class and multiclass dichotomizer.

**Unit 4 Multilayer networks**

**(4)**

Delta learning rule for multiperceptron layer, Generalized Delta learning rule, Feed forward recall and error back-propagation, Training algorithm.

**Unit 5 Performance**

**(4)**

Madeline, Network pruning, Marchands, Neural tree and filing algorithm, Prediction network

**SECTION – II**

**Unit 6 Unsupervised learning**

**(5)**

Winner take all networks, Hamming networks, Max net, competitive learning K-means clustering and LVQ algorithms, Adaptive resonance theory, ARTI, ALGORITHM, SELF ORGANIZING Kohanens map, Naocognitron.



**Unit 7 Associative memories****(5)**

Non iterative procedures for association hop field networks, Discrete Hop field Networks storage capacity of Hop field networks. Continuous Hop field networks. Brain state in a box (B B networks Boltzmann machines Hetero associations.

**Unit 8 Optimization techniques****(5)**

Optimization using Hop field networks. Travelling salesperson problem, Iterated gradient descent techniques. Simulated annealing technique, Random search technique genetic algorithm for optimization problems.

**Unit 9 Application of ANN****(4)**

Character recognition, Speech recognition, Signature verification application, Human face recognition

**Internal Continuous Assessment (ICA) :**

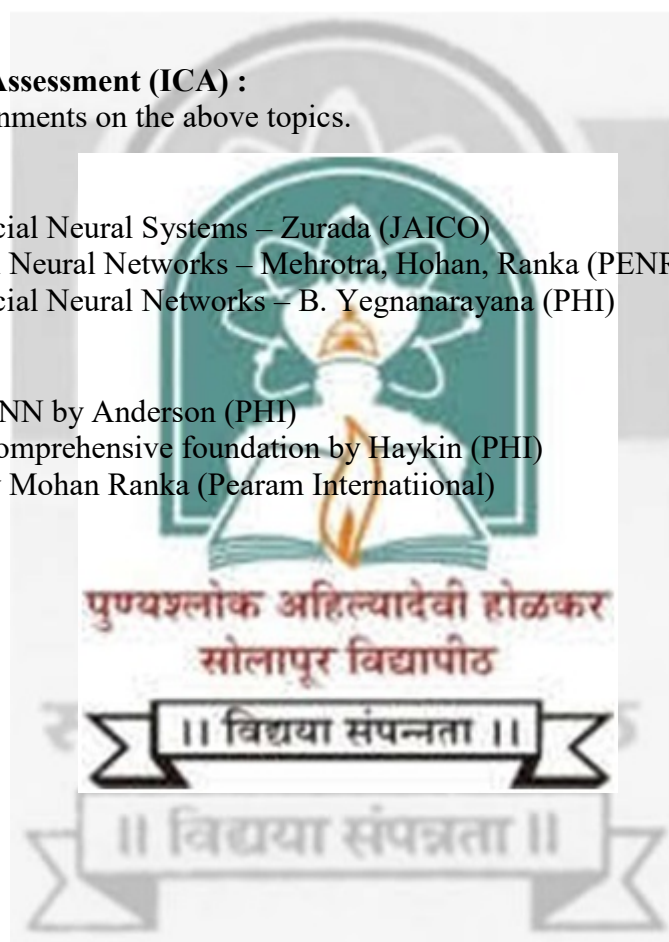
Minimum 8 to 10 assignments on the above topics.

**Text Books : -**

- 1 Introduction to Artificial Neural Systems – Zurada (JAICO)
- 2 Elements of Artificial Neural Networks – Mehrotra, Hohan, Ranka (PENRAM)
- 3 Introduction to Artificial Neural Networks – B. Yegnanarayana (PHI)

**Ref. Books :**

1. An introduction to ANN by Anderson (PHI)
2. Neural Networks a comprehensive foundation by Haykin (PHI)
3. Elements of ANN by Mohan Ranka (Pearam Internatiional)





**PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR**  
**B.E. (COMPUTER SCIENCE & ENGINEERING)**  
**SEMESTER - II**

**CS 424 A : Elective-IV : 1. SOFTWARE TESTING & QUALITY ASSURANCE**

**Teaching Scheme**

Lectures : 3 Hours /Week, 3 Credits

Practical : 2 Hours/ Week, 1 Credit

**Examination Scheme**

ESE – 70 Marks

ISE – 30 Marks

ICA – 25 Marks

**COURSE OBJECTIVES :**

1. To learn the principles, techniques and tools of software testing in order to improve the quality of software product.
2. To gain knowledge of the software testing process, various methods of testing, different levels of testing, software quality concepts, assurance & standards
3. To learn generation and execution of test plan, cases & scripts.
4. To learn manual and automatic software testing & various kinds of testing tools.
5. To discover correctness, completeness and quality of software.
6. To recognize the importance of software testing in Software Development Life Cycle.

**COURSE OUTCOME :**

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

1. Identify what a software bug is, how serious they can be, and why they occur.
2. Test software to meet quality objectives & requirements
3. Apply testing skills to common testing tasks
4. Perform the planning and documentation of test efforts
5. Describe software quality concepts, assurance & standards
6. Use testing tools to test software in order to improve test efficiency with automation.

**SECTION – I**

**Unit-1: Fundamentals of Software Testing**

**(8)**

Introduction, Basics of Software Testing, Approaches to Testing, Testing During Development Life Cycle, Essential of Software Testing, Features of Testing, Misconceptions About Testing, Principles of Software Testing, Test Policy, Defect Classification, Defect, Error, Mistake in Software, Defect Life Cycle, Defect Management Process, Developing Test Strategy, Developing Testing Methodologies

**Unit-2: Methods of Testing**

**(6)**

Software Verification and Validation, Black-Box and White-Box Testing, Static and Dynamic Testing, Black-Box Testing Techniques-Equivalence Partitioning, Data Testing, State Testing, Other Black Box Test Techniques. White-Box Testing Techniques-Data Coverage, Code Coverage, Other White Box Test Techniques.

**Unit-3: Levels of Testing**

**(6)**

Levels of Testing, Proposal Testing, Requirement Testing, Design Testing, Code Review, Unit Testing, Module Testing, Integration Testing, Big-Bang Testing, Sandwich Testing,

**Unit-4: System Testing**

**(6)**

GUI Testing, Compatibility Testing, Security Testing, Performance Testing, Volume Testing, Stress Testing, Load Testing, Installation Testing, Regression Testing, Smoke Testing, Sanity Testing, Ad hoc Testing, Usability Testing, Acceptance Testing-Alpha Testing, Beta Testing, Gamma Testing.

## SECTION – II

### **Unit 5: Test Planning & Documentation (8)**

Test Planning-The goal of Test Planning, Test Planning Topics, Writing and Tracking Test Cases-The Goal of Test Case Planning, Test Case Planning Overview, Test Case Organization and Tracking, Reporting Bugs- Getting Your Bugs Fixed, Isolating and Reproducing Bugs

### **Unit 6: Quality Concepts & Software Quality Assurance (6)**

Quality Concepts-What is Quality?, Software Quality, The Software Quality Dilemma, Achieving Software Quality, Software Quality Assurance-Background Issues, Elements of Software Quality Assurance, SQA Processes and Product Characteristics, SQA Tasks, Goals and Metrics

### **Unit-7 Formal Approaches to SQA (6)**

Statistical SQA, Software Reliability, The ISO 9000 Quality Standards, CMM, The SQA Plan.

### **Unit 8: Automated Testing and Testing Tools (8)**

Introduction, The Benefits of Automation and Tools, Test Tools, Software Test Automation, Random Testing, Realities of Using Test Tools and Automation Case Studies on Testing Tools-Selenium.

#### **Reference tutorials:**

1. Spoken Tutorials on Selenium Software Testing Framework at [http://spoken-tutorial.org/tutorial-search/?search\\_foss=Selenium&search\\_language=English](http://spoken-tutorial.org/tutorial-search/?search_foss=Selenium&search_language=English)

#### **Internal Continuous Assessment (ICA) :**

Minimum 8 assignments based on each topic of above syllabus.

Additionally two assignments on use of Selenium for software testing.

#### **Text books:**

1. Software Testing Principles, Techniques and Tools By M G Limaye, Published by Tata McGraw-Hill Education Private Limited, Published 2009, ISBN (13): 978-0-07-013990-9, ISBN (10): 0-07-013990-3 (Chapter 1 & 3)
2. Software Testing, Second Edition By: Ron Patton, Published by SAMS, ISBN-13: 978-0672327988 ISBN-10: 0672327988 (Chapter 2, 4 & 6)
3. Software Engineering: A Practitioner's Approach by Roger S Pressman, 8 th Edition, Publisher McGraw Hill (Chapter 5)

#### **Reference books:**

1. Software Testing Principle and Practices By Ramesh Desikan, Gopalaswamy Ramesh, Pearson Education, ISBN 978-81-7758-121-8
2. Software Testing Principles and Practices By Naresh Chauhan, Publisher OXFORD UNIVERSITY PRESS-NEW DELHI, ISBN 0-19-806184-6
3. Beautiful Testing: Leading Professionals Reveal How They Improve Software By Adam Goucher, Tim Riley, Publisher O'reilly
4. Foundations of Software Testing By Rex Black, Dorothy Graham, Erik Van Veenendaal, Isabel Evans, Published by Cengage Learning India Pvt Ltd.
5. Lessons Learned in Software Testing by Cem Kaner , James Bach , Bret Pettichord, Publisher Wiley
6. Testing Computer Software Cem Kaner, Jack Falk, Hung Q. Nguyen, Publisher Wiley
7. Selenium Testing Tools Cookbook By Unmesh Gundecha Published by Packt, ISBN: 978-1-84951-574-0
8. Dr. K.V.K.K. Prasad, "Software Testing Tools: Covering Win Runner, Silk Test, Load Runner, JMeter and Test Director With Case Studies", Dreamtech Publications ISBN:10:81-7722-532-4



**PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR**  
**B.E. (COMPUTER SCIENCE & ENGINEERING)**  
**SEMESTER - II**

**CS 424 B : Elective-IV : CLOUD COMPUTING**

**Teaching Scheme**

Lectures : 3 Hours /Week, 3 Credits

Practical : 2 Hours/Week, 1 Credit

**Examination Scheme**

ESE – 70 Marks

ISE – 30 Marks

ICA – 25 Marks

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**COURSE OBJECTIVES :**

1. Develop knowledge about Cloud computing model and associated concepts, terminologies.
2. Develop skills necessary to identify cloud deployment types and deploy them for various use cases.
3. Build necessary cognizance to identify benefits and challenges of cloud Computing for an IT Organizations in building IT solutions.

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**COURSE OUTCOME :**

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

1. Explain the concepts , benefits and challenges of Cloud Computing and the various deployment and service models of Cloud Computing
2. Explain about Virtualization and its types
3. Describe Private & public Cloud and its deployment models
4. Describe the Security concerns and future trends of Cloud Computing

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**SECTION I**

**Unit 1 : Overview of Cloud Computing**

**(10)**

Brief history and evolution – History of Cloud Computing, Evolution of Cloud Computing, Traditional vs. Cloud Computing. Why Cloud Computing, Cloud service models (IaaS, PaaS & SaaS). Cloud deployment models (Public, Private, Hybrid and Community Cloud), Benefits and Challenges of Cloud Computing

**Unit 2 : Virtualization**

**(8)**

Basics of virtualization, Server virtualization, VM migration techniques, Role of virtualization in Cloud Computing.

**Unit 3 : Working with Private Cloud**

**(8)**

Private Cloud Definition, Characteristics of Private Cloud, Private Cloud deployment models, Private Cloud Vendors – CloudStack, OpenStack, Benefits and Challenges. Implementation of Private Cloud using any one of OpenStack/CloudStack.

**SECTION II**

**Unit 4 : Working with Public Clouds**

**(12)**

What is Public Cloud, Why Public Cloud, When to opt for Public Cloud, Public Cloud Service Models, and Public Cloud Vendors and offerings ( IaaS, PaaS, SaaS). Basic compute, storage, networking and IAM services of any one of AWS/Microsoft Azure/Google Cloud platform

**Unit 5 : Overview of Cloud Security**

**(8)**

Explain the security concerns in Traditional IT, Introduce challenges in Cloud Computing in terms of Application Security, Server Security, and Network Security. Security reference model, Abuse



and Nefarious Use of Cloud Computing, Insecure Interfaces and APIs, Malicious Insiders, Shared Technology Issues, Data Loss or Leakage, Account or Service Hijacking, Unknown Risk Profile, Shared security model between vendor and customer in IAAS/PAAS/SAAS, Implementing security in AWS.

#### **Unit 6: Future directions in Cloud Computing**

**(4)**

When and not to migrate to Cloud, Migration paths for cloud, Selection criteria for cloud deployment, Issues/risks in cloud computing, Future technology trends in Cloud Computing.

#### **Internal Continuous Assessment (ICA) :**

Minimum 10 assignments must be of nature, which require students to identify and implement the use case scenarios for Cloud and Cloud enabled technologies mentioned above.

#### **Text Book :**

1. Cloud Computing: Principles and paradigms By Raj Kumar Buyya, James Broberg, Andrezei M.Goscinski, 2011 Cloud Computing, By Michael Miller, 2008.
2. Cloud Computing for dummies, By Judith Hurwitz, Robin Bllor, Marcia Kaufman, Fern Halper, 2009.
3. Cloud Computing: A Practical Approach, By Anthony T. Velte, Toby J. Velte, and Robert Elsenpeter, McGraw Hill, 2010.
4. Handbook of Cloud Computing, By Borko Furht, Armando Escalante (Editors), Springer, 2010.

#### **Reference Book :**

1. Cloud Security, A comprehensive Guide to Secure Cloud Computing by Krutz, Ronald L.; Vines, Russell Dean
2. Cloud computing: Implementation, management and security By Rittinghouse, John, W.
3. Mastering Cloud Computing, Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, McGraw Hill, 2013





**PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR**  
**B.E. (COMPUTER SCIENCE & ENGINEERING)**  
**SEMESTER - II**

**CS 424 C : Elective-IV : MACHINE LEARNING**

**Teaching Scheme**

Lectures : 3 Hours /Week, 3 Credits

Practical : 2 Hours/Week, 1 Credit

**Examination Scheme**

ESE – 70 Marks

ISE – 30 Marks

ICA – 25 Marks

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**COURSE OBJECTIVES :**

1. To teach necessary fundamental concepts and terminologies used in Machine Learning
2. To develop sound understanding of mathematical fundamentals required to build, evaluate and analyze Machine learning models.

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**COURSE OUTCOMES :**

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

1. Interpret the need of machine learning and applications of machine learning.
2. Build machine learning models and validate them.
3. Analyze machine learning models to improve their accuracy.

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**Unit 1: Introduction to Machine learning**

**(4)**

- **Understanding Machine Learning:** What Is Machine Learning?, Leveraging the Power of Machine Learning, The Roles of Statistics and Data Mining with Machine Learning, Putting Machine Learning in Context.
- **Applying Machine Learning:** Getting Started with a Strategy, Applying Machine Learning to Business Needs, Understanding Machine Learning Techniques, Tying Machine Learning Methods to Outcomes

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**Unit 2: Offerings of Machine learning**

**(4)**

- **Looking Inside Machine Learning:** The Impact of Machine Learning on Applications, Data Preparation, The Machine Learning Cycle.
- **Getting Started with Machine Learning:** Understanding How Machine Learning Can Help, Focus on the Business Problem, Requirement of Collaboration in Machine Learning, Executing a Pilot Project, Determining the Best Learning Model.

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**Unit 3: Basic mathematics for Machine Learning**

**(10)**

- **Getting Started With The Math Basics:** Working with Data, Exploring the World of Probabilities, Describing the Use of Statistics, Interpreting Learning As Optimization, Exploring Cost Functions, Descending the Error Curve, Updating by Mini-Batch and Online.

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**Unit 4: Validating Machine Learning Models**

**(12)**

- **Validating Machine Learning:** Checking Out-of-Sample Errors, Getting to Know the Limits of Bias, Keeping Model Complexity in Mind and Solutions Balanced, Training, Validating, and Testing, Resorting to Cross-Validation. Looking for Alternatives in Validation., Optimizing Cross-Validation Choices, Avoiding Sample Bias and Leakage Traps, Discovering the Incredible Perceptron

- **Simplest learning strategies to learn from Data:** Discovering the Incredible Perceptron, Growing Greedy Classification Trees, Taking a Probabilistic Turn

#### **Unit 5: Improving Machine Learning Models (10)**

- **Improving Machine Learning Models:** Studying Learning Curves , Using Cross-Validation Correctly , Choosing the Right Error or Score Metric , Searching for the Best Hyper-Parameters , Testing Multiple Models , Averaging Models , Stacking Models, Applying Feature Engineering , Selecting Features and Examples , Looking for More Data

#### **Unit 6: Applications of Machine Learning (5)**

- **Applying Learning to Real Problems: Classifying Images, Scoring Opinions and Sentiments, Recommending Products and Movies, Using Machine Learning to Provide Solutions to Business Problems.** Future of Machine Learning.

#### **Internal Continuous Assessment (ICA) :**

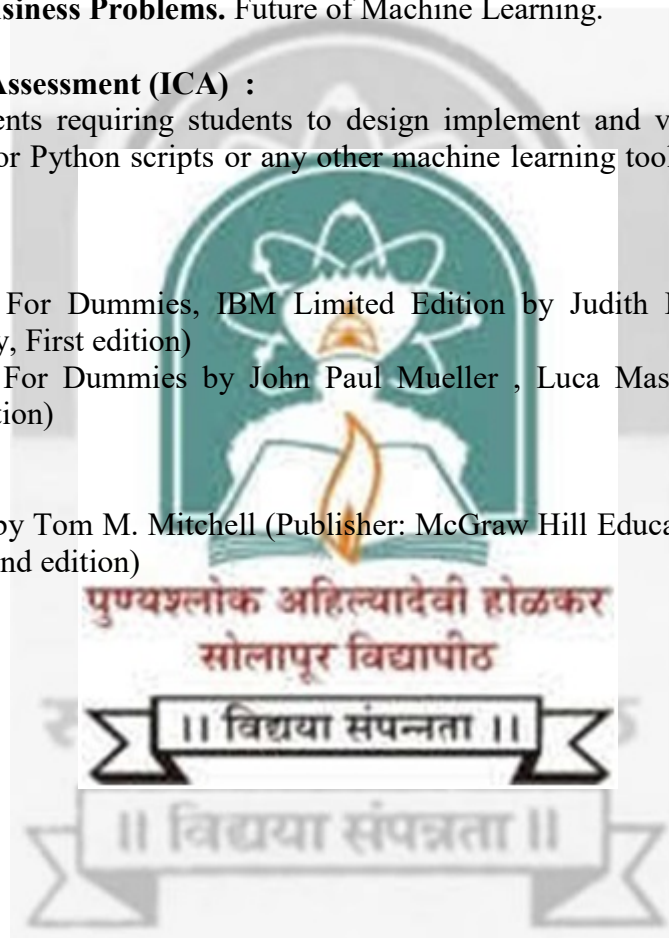
Minimum 15 assignments requiring students to design implement and validate machine learning models using either R or Python scripts or any other machine learning toolkits and frameworks like MATLAB, Octave.

#### **Text Books:**

1. Machine Learning For Dummies, IBM Limited Edition by Judith Hurwitz, Daniel Kirsch (Published by Wiley, First edition)
2. Machine Learning For Dummies by John Paul Mueller , Luca Massaron (Published by For Dummies; First edition)

#### **Reference Books:**

1. Machine Learning by Tom M. Mitchell (Publisher: McGraw Hill Education; First edition + New Chapters from Second edition)





**PUNYASHLOK AHILYADEVI HOLKAR SOLAPUR UNIVERSITY, SOLAPUR**  
**B.E. (COMPUTER SCIENCE & ENGINEERING)**  
**SEMESTER - II**  
**CS 425 : WEB TECHNOLOGY**

**Teaching Scheme**

Lectures : 2 Hours /week, 2 credits

Practical: 4 Hours/ week, 2 credit

**Examination Scheme**

POE: 50 Marks

ICA: 25 Marks

ISE : 25 Marks

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**COURSE OBJECTIVES :**

1. Inculcate skills necessary to design, develop and style a web based user interfaces.
2. Develop ability to identify use cases for applying client and server side scripting web technologies.
3. Develop skills necessary to develop efficient, scalable, web based APIs and applications
4. Develop skills required to create light weight browser based web applications using client side scripting.

---

**COURSE OUTCOMES :**

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

1. Design, develop and apply styling to a web based applications.
2. Analyze requirements of developing web applications and choose client or server side scripting technology.
3. Build efficient and scalable web APIs and applications.
4. Develop light weight browser based functionalities leveraging client side scripting frameworks.

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**SECTION – I**

**Unit 1: UI Design:**

**(3)**

HTML5: What is HTML5 - Features of HTML5 – Semantic Tags – New Input Elements and tags - Media tags (audio and video tags) – Designing Graphics using Canvas API - Drag and Drop features – Geolocation API - Web storage (Session and local storage).

CSS3: What is CSS3 –Features of CSS3 – Implementation of border radius, box shadow, image border, custom web font, backgrounds - Advanced text effects(shadow) - 2D and 3D Transformations - Transitions to elements - Animations to text and elements

**Unit 2: Responsive Web Design (RWD):**

**(4)**

Responsive Design: What is RWD – Introduction to RWD Techniques – Fluid Layout, Fluid Images and Media queries- Introduction to RWD Framework

Twitter Bootstrap – Bootstrap Background and Features - Getting Started with Bootstrap- Demystifying Grids – Off Canvas - Bootstrap Components - JS Plugins – Customization

**Unit 3: Introduction to JavaScript**

**(4)**

Introduction - Core features - Data types and Variables - Operators, Expressions and Statements - Functions & Scope - Objects - Array, Date and Math related Objects - Document Object Model - Event Handling –Browser Object Model - Windows and Documents - Form handling and validations.

Object-Oriented Techniques in JavaScript - Classes – Constructors and Prototyping (Sub classes and Super classes) – JSON –Introduction to AJAX.



#### **Unit 4: RESTful Web Services**

(4)

REST and the Rebirth of HTTP, RESTful Architectural Principles, The Object Model, Model the URIs, Defining the Data Format, Assigning HTTP Methods, JAX-RS.

#### **SECTION – II**

#### **Unit 5: Introduction to Server-side JS Framework – Node.js**

(3)

Introduction - What is Node JS – Architecture – Feature of Node JS - Installation and setup - Creating web servers with HTTP (Request & Response) – Event Handling - GET & POST implementation - Connect to NoSQL Database using Node JS – Implementation of CRUD operations.

#### **Unit 6: Introduction to Client-side JS Framework – Basics of Angular 4.0**

(5)

Introduction to Angular 4.0 - Needs & Evolution – Features – Setup and Configuration – Components and Modules – Templates – Change Detection – Directives – Data Binding - Pipes – Nested Components

#### **Unit 7: Introduction to Client-side JS Framework – Forms and Routing in Angular 4.0**

(3)

Template Driven Forms - Model Driven Forms or Reactive Forms - Custom Validators - Dependency Injection - Services - RxJS Observables - HTTP - Routing

#### **Unit 8: PHP and MySQL**

(4)

Introduction to PHP 5 and PHP 6, variables and constants, program flow, functions, arrays and files and directories, Forms and Databases, integration with MySQL applications on PHP

#### **Internal Continuous Assessment (ICA) :**

1. Objective of assignments should be to test students understanding and assess their ability to put into practice the concepts and terminologies learned.
2. Assignments must be of nature, which require students to identify the use case scenarios for using technologies mentioned in syllabus.

#### **Text Books /Reference Books:**

1. Harvey & Paul Deitel& Associates, Harvey Deitel and Abbey Deitel, “Internet and World Wide Web - How To Program”, Fifth Edition, Pearson Education, 2011.
2. Achyut S Godbole and Atul Kahate, “Web Technologies”, Second Edition, Tata McGraw Hill, 2012.
3. Thomas A Powell, Fritz Schneider, “JavaScript: The Complete Reference”, Third Edition, Tata McGraw Hill, 2013.
4. David Flanagan, “JavaScript: The Definitive Guide, Sixth Edition”, O'Reilly Media, 2011
5. Bear Bibeault and Yehuda Katz, “jQuery in Action”, January 2008
6. Web link for Responsive Web Design - <https://bradfrost.github.io/this-is-responsive/>
7. Ebook link for JavaScript - [https://github.com/jasonzhuang/tech\\_books/tree/master/js](https://github.com/jasonzhuang/tech_books/tree/master/js)
8. Nathan Rozentals, “Mastering TypeScript”, April 2015
9. Nate Murray, Felipe Coury, Ari Lerner and Carlos Taborda, “ng-book, The Complete Book on Angular 4” September 2016
10. AmolNayak, “MongoDB Cookbook Paperback” , November 2014
11. KrasimirTsonov, “Node.js by Example Paperback”, May 2015
12. Web link for TypeScript: <https://www.typescriptlang.org/>
13. Web link for Angular4.0: <https://angular.io/>
14. Web link for Node.js : <https://nodejs.org/en/>
15. Web link for MongoDB: <https://www.mongodb.com/>