B. Tech. Computer Science & Engineering (Third Year)
Batch: 2017 -2021

Trimester – VII

Sr. No	Course Code	Name of Course	Category	Weekly Workload, Hrs			Credits		Assessment Marks**			
				Theory	Tutorial	Lab	Th	Lab	CCA	LCA	ETT	Total
1	CS311	Computer Networks	PC	3	-	2	2	1	50	50	50	150
2	CS312	Database Management Systems	PC	3	-	2	2	1	50	50	50	150
4	CS313	Software Modeling & Design	PC	3	-	2	2	1	50	50	50	150
5	CS314	Theory of Computation	PC	3	1	-	3	-	100	-	50	150
5	CS315	Embedded and IOT Lab	PC	-	-	4	-	2	-	100	-	100
6	WPC 5	Indian Tradition, Culture & Heritage	WP	3	-	-	2	-	70	-	30	100
		Total :		15	1	10	11	05	320	250	230	800

**Assessment Marks are valid only if Attendance criteria are met

COURSE STRUCTURE

Course Code	**CS311**			
Course Category	**Professional Core**			
Course Title	**Computer Networks**			
Teaching Scheme and Credits	**L**	**T**	**Laboratory**	**Credits**
Weekly load hrs	**3**	**-**	**2**	**2 + 1 = 3**

Pre-requisites:

- C Programming
- Data and Mobile Communication

Course Objectives:

1. To understand the basic knowledge of network topologies, standards and protocols
2. To learn network layer protocols
3. To explore services offered by transport layer
4. To understand protocols of application layer

Course Outcomes:

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

1. Analyze and apply different types of network topologies and standards
2. Apply the knowledge of network protocols to design and analyze networks
3. Identify and use transport layer based communication
4. Apply the standards and protocols learned for designing client server based applications

Mapping of COs to Programme Outcomes (Course Articulation Matrix)

	a	b	c	d	e	f	g	h	i	j	k	l
CO1	**3**	**1**										**1**
CO2			**2**	**1**	**2**		**2**					**1**
CO3			**2**	**1**	**2**		**1**					**1**
CO4			**3**	**2**	**2**						**1**	**2**

1: Low 2: Medium and 3: High

Course Contents:

1. Introduction and Medium Access Control.
2. Network layer.
3. Transport layer.
4. Application Layer .

Laboratory Exercises / Practical:

1. Configure network using Dynamic Host Configuration Protocol.
2. Virtual LAN, Packet Tracker
3. Subnetting
4. Distance Vector Algorithm
5. Network setup
6. TCP Socket
7. UDP socket

Learning Resources:

Text Books:

1. Tanenbaum A. S., 'Computer Networks', Pearson Education , 4th Edition, 2008, ISBN-978-81-7758-165-2
2. Behrouz A. Forouzan, 'Data Communications and Networking', 5th Edition, McGraw-Hill Publishing Company

Reference Books:

1. James F. Kurose and Keith W Ross 'Computer Networking, A Top-Down Approach', 5th Edition, Pearson Education, ISBN- 978-81-317-9054-0
2. W. Richard Stevens, Unix Network Programming, The Sockets Networking API, Vol 1, 3rd Edition, PHI Learning Pvt. Ltd., ISBN

Supplementary Reading:

1. William Stallings, 'Data and Computer Communications', 6th Edition, Prentice Hall of India Pvt.

Web Resources:

https://nptel.ac.in/courses/106105080/
https://nptel.ac.in/courses/106106091/

Weblinks:

https://nptel.ac.in/courses/106105081/
https://nptel.ac.in/courses/106105183/
https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-829-computer-networks-fall-2002/index.htm

MOOCs:

https://alison.com/course/diploma-in-computer-networking

Pedagogy:

- Power Point Presentation
- Two Teacher Method
- Video Lectures
- Flipped Classroom Activity
- Group Discussion
- Chalk and Board

Assessment Scheme:

Class Continuous Assessment (CCA)- 50 Marks

Assignments	Mid Term Test	Tutorial	MCQ	Attendance
30%	30%	-	30%	10%

Laboratory Continuous Assessment (LCA)-50 Marks

Performance of Experiment	Oral Exam	Site Visit	Mini Project	Any other	Attendance
60%	--	-	-	30%	10%

Term End Examination: 50 Marks (100% weightage)

Theory Syllabus:

Module No.	Contents	Workload in Hrs	
		Theory	Lab
1	**INTRODUCTION COMPUTER NETWORKS AND MEDIUM ACCESS CONTROL** Types of Networks (Introduction of LAN, MAN,WAN,PAN, Ad-hoc Network) Network Architectures: Client-Server, Peer-to-Peer, Distributed and SDN, OSI Model, TCP/IP Model. Network topologies, Network addressing (Physical address, IP address and Port address).Channel allocation, Multiple Access Protocols: ALOHA, CSMA/CD, CSMA/CA, Ethernet: Frame format, IEEE 802.3, Fast and Gigabit.	07	--
2	**NETWORK LAYER** Network Layer Design Issues, Internet Protocol: IPv4 and IPv6 addressing schemes, Subnetting, CIDR, NAT, ICMP, Routing Algorithms: Distance Vector, Link State, Routing Protocols: RIP, OSPF, BGP, Congestion control, Quality of Service.	08	--
3	**TRANSPORT LAYER** Transport Layer Services: Transport layer functionalities, Sockets, Transport Layer Protocols: UDP, RTP, TCP: 3- way Handshake, TCP Transmission Policy (Sliding Window), TCP Congestion Control Algorithms: Leaky Bucket, Token Bucket, Congestion Avoidance, Quality of Service .	07	--
4	**APPLICATION LAYER** Dynamic Host Control Protocol (DHCP), Domain Name System (DNS), Hyper Text Transfer Protocol (HTTP), Simple Mail Transfer Protocol: POP3, IMAP, MIME. File Transfer Protocol (FTP), TELNET, Simple Network Management Protocol (SNMP).	08	--

Laboratory:-

Module No.	Contents	Workload in Hrs
1	Configure network using Dynamic Host Configuration Protocol (DHCP). Use Ping utility to test connectivity.	02
2	Design and configure a virtual LAN using Packet Tracer.	02
3	Write a (C++/Python/Java) program to implement subnetting to find subnet mask	04
4	Write a (C++/Python/Java) program to simulate Distance Vector Routing algorithm.	02
5	Set up a network - configure interfaces, IP addresses and routing protocols (RIP/OSPF/BGP) using Packet Tracer (Network Simulator)	02

6	Write a C program for wired network using TCP socket to demonstrate a)Message transfer from one machine to another machine. (50% students of the batch should implement) b) File transfer application / Mathematical operations. (Remaining 50% students of the batch should implement)	04
7	Write a C program for wired network using UDP socket to perform any one of the following operations a. String Conversion from Upper Case to Lower Case. b. Conversion from String to ASCII. c. Conversion from Hex to Decimal.	04

COURSE STRUCTURE

Course Code	**CS312**			
Course Category	**Professional Core**			
Course Title	**Database Management Systems**			
Teaching Scheme and Credits	**L**	**T**	**Laboratory**	**Credits**
Weekly load hrs	**3**	**------**	**2**	**2+1=3**

Pre-requisites:

- Discrete Structure
- Data Structures

Course Objectives:

1. Understand and successfully apply logical database design principles
2. Learn Database Programming languages and apply in DBMS application
3. Understand transaction processing and concurrency control in DBMS
4. Learn database architectures, DBMS advancements and its usage in advance application

Course Outcomes:

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

1. Design ER-models to represent simple database application scenarios and improve the database design by normalization.
2. Design Database Relational Model and apply SQL, PLSQL concepts for database programming.
3. Describe Transaction Processing and Concurrency Control techniques for databases.
4. Identify appropriate database architecture for the real world database application.

Mapping of COs to Programme Outcomes (Course Articulation Matrix)

	a	b	c	d	e	f	g	h	i	j	k	l
CO1			**2**	**3**								**1**
CO2		**2**			**3**							**1**
CO3			**3**	**2**								**1**
CO4		**3**			**2**							**1**

1: Low, 2: Medium and 3: High

Course Contents:

1. Introduction to DBMS and Data Modelling
2. Database Languages and Programming
3. Transaction Management and Concurrency Control
4. Advanced techniques, Databases and applications

Laboratory Exercises / Practical:

1. ER Model
2. Introduction to MySQL :Database Modelling, DDL commands (Create, Alter, Drop, Truncate, Rename, Describe) DCL(Grant, Revoke), TCL(Rollback, Commit, Savepoint)
3. SQL Commands :DML(Insert, Update, Delete)
4. SQL Queries with Select command : Simple Select, Data Sorting, Subquery , Joins(Inner, Outer, Natural, Self), Group by-Having, Set Operations
5. PLSQL Procedures and Functions
6. PLSQL Triggers and Cursors
7. Mini Project: SQL-Java Connectivity (2 Tier)

Learning Resources:

Text Books:

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Database System Concepts 6th Ed, McGraw Hill, 2010.
2. Elmasi, R. and Navathe, S.B., "Fundamentals of Database Systems", 4th Ed., Pearson Education.

Reference Books:

1. Ramakrishnan, R. and Gherke, J., "Database Management Systems", 3rd Ed., McGraw-Hill.
2. Connally T, Begg C.,"Database Systems",Pearson Education
3. Pang, N. T., Steinbach, M. and Kumar, V., "Introduction to Data Mining", Pearson Education.
4. MongoDB: The Definitive Guide by Kristina Chodorow
5. Big Data Analytics with R and Hadoop by Vignesh Prajapati

Supplementary Reading:

Chuck Lam, "Hadoop in action"

Web Resources:

Big Data: Principles and Paradigms – Rajkumar Buyya , Rodrigo N. Calheiros, Amir Vahid Dastjerdi [PDF Available online]

Web Links:

https://www.mysql.com/
http://www.oracletutorial.com/
https://www.mongodb.com/

MOOCs:

https://nptel.ac.in/syllabus/106106095/

Pedagogy:

- White Board
- Power Point Presentations
- Expert Lectures
- Blended Teaching Learning :Flipped Classroom, TPS, LBDs

Assessment Scheme:

Class Continuous Assessment (CCA):50 Marks

Assignments	Mid Term Test	Presentations	Case study	MCQ	Oral	Attendance
30%	30%	-	-	30%	-	10%

Laboratory Continuous Assessment (LCA):50 Marks

Practical Performance	Oral based on practical	Site Visit	Mini Project	Problem based Learning	Any other (Practical exam)
50%	-	-	10%	-	40%

Term End Examination: 50 Marks (100% weightage)

Theory Syllabus

Module No.	Contents	Workload in Hrs	
		Theory	Lab
1	**INTRODUCTION TO DBMS AND DATA MODELING** DBMS Vs File Systems, Database System Architecture, Data Abstraction, Data Independence, Data Definition and Data Manipulation Languages, Database System Internals-Components of a database system, Data Models , E-R diagram: Components of E-R Model, conventions, Keys, EER diagram Components, E-R diagram into tables, Relational Model, Relational Integrity, Referential Integrities, Enterprise Constraints, Schema Diagram, Relational Algebra- Basic Operations, Normalization, Functional Dependency, Normal Forms	**8**	--
2	**DATABASE LANGUAGES AND PROGRAMMING** Introduction to SQL, Characteristics and advantages of SQL, SQL Data Types, DDL Commands, DCL Commands. SQL Queries: DML Queries with Select Query Clauses, Creating, Modifying, Deleting. Views: Creating, Dropping, Updating, Indexes, SQL DML Queries, Set Operations, Predicates and Joins, Set membership, Grouping and Aggregation, Aggregate Functions, Nested Queries, PL/SQL Concepts: PL/SQL Functions and Procedures, Cursors, Database Triggers. Query Processing and Optimization.	**7**	--
3	**TRANSACTION MANAGEMENT AND CONCURRENCY CONTROL** ACID properties, transactions, schedules and concurrent execution of transactions, Serializability: View, Conflict. Concurrency control lock based protocol (simple, 2 phase: Rigorous 2 phase, Strict 2 phase), Cascade-less Schedule, Recoverable Schedule, Deadlocks: Prevention Techniques (Wait Die, Wound Wait), Detection Techniques, Database Recovery: Failure classification Recovery and atomicity: Log-based recovery, Shadow paging.	8	--
4	**ADVANCED TECHNIQUES, DATABASES AND APPLICATIONS** Database Architecture: Centralized, Client-Server, Parallel, Distributed. Database Connectivity. Decision Support Systems: Introduction of Data Warehousing, Data Mining and Knowledge discovery, Business Intelligence. Big Data & NoSQL: Introduction, Application, Challenges, Hadoop, XML, JSON, Structured Vs Unstructured Databases, NoSQL Databases.	**7**	--

Laboratory:

Module No.	Contents	Workload in Hrs
		Lab
1	Case Study on ER	2
2	SQL- DDL commands(Create, Alter, Drop, Truncate Rename, Describe) ,DCL(Grant, Revoke)	2
3	SQL- DML (Insert, Update, Delete), SQL Select- Logical IN, Negation , NULL, Comparison Operators. Where Clause, Between AND, Exists, ALL, LIKE	2
4	SQL Queries on: Functions-Single Row, Aggregate Functions, Data Sorting, Subquery, Joins(Inner, Outer, Natural, Self), Group by-Having, Set Operations, View.TCL Commands (Rollback, Commit, Savepoint)	2
5	PLSQL Procedures and Functions	4
6	PLSQL Triggers and Cursors	4
7	Mini Project : SQL-Java Connectivity (2 Tier)	4

COURSE STRUCTURE

Course Code	**CS313**			
Course Category	**Professional Core**			
Course Title	**Software Modelling & Design**			
Teaching Scheme and Credits	**L**	**T**	**Laboratory**	**Credits**
Weekly load hrs	3	-	2	2+1=3

Pre-requisites:

- Software Engineering and Project Management

Course Objectives:

1. To specify, analyse and organise requirements for a software product.
2. To transform Requirement document to Appropriate design.
3. Apply appropriate UML diagrams and notations to design the product.
4. To understand the testing techniques in the software development.

Course Outcomes:

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

1. Analyse the problem statement and choose proper design technique for designing application
2. Use a modelling language as a means to communicate realistic problems and their solutions.
3. Design and analyse an application using UML modelling as fundamental tool.
4. Identify different testing methodologies and its significance.

Mapping of COs to Programme Outcomes (Course Articulation Matrix)

Course Outcomes	Program Outcomes											
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**
CO1		**2**									**1**	**3**
CO2		**3**			**1**							**2**
CO3		**3**		**1**	**3**			**3**			**2**	**3**
CO4		**2**			**2**			**2**				**2**

1: Low, 2: Medium and 3: High

Course Contents:

1. Introduction
2. Static Modeling
3. Dynamic Modelling
4. Testing

Laboratory Exercises/ Practical:

1. Use Case Diagram and Activity Diagram
2. Class Diagram and Object Diagram
3. Sequence Diagram and State Chart
4. Deployment Diagram
5. Test Case Preparation
6. Mini Project

Learning Resources:

Text Books:

1. Jim Arlow, Ila Neustadt, ―UML 2 and the unified process –practical object-oriented analysis and design‖ Addison Wesley, Second edition, ISBN 978-0201770605
2. Gopalaswamy Ramesh, Srinivasan Desikan, Software Testing: Principles and Practices, Pearson, ISBN: 9788177581218

Reference Books:

1. Gardy Booch, James Rambaugh, Ivar Jacobson, ―The unified modeling language user guide‖ , Pearson Education, Second edition, 2008, ISBN 0-321-24562-8
2. Dan Pilone, Neil Pitman "UML 2.0 in a Nutshell", (In a Nutshell (O'Reiily)) paperback)

Web Resources:

https://www.pdfdrive.com/uml-uml-20-tutorial-e16736680.html

Web links:

http://www.mhhe.com/engcs/compsci/pressman/

MOOCs:

https://nptel.ac.in/courses/106105153/33
https://nptel.ac.in/courses/106105153/35

Pedagogy:

- Power Point Presentation
- White-board / Pen
- Two Teacher method

Assessment Scheme:

Class Continuous Assessment (CCA)- 50 Marks

Mid term test	Theory Assignment	Case study	MCQ	Attendance
30%	20%	10%	20%	20%

Laboratory Continuous Assessment (LCA)-50 Marks

Practical(Laboratory)	Oral	Site Visit	Mini Project	Problem based Learning	Any other (Mock 1 and Mock2)
60%	10%	-	10%	-	20%

Term End Examination: 50 Marks (100% weightage)

Theory Syllabus:-

Module No.	Contents	Workload in Hrs	
		Theory	Lab
1	**INTRODUCTION** Introduction to software design, Unified Process, From analysis to Design. Concept of Modelling , 4+1 view Architecture, Introduction to OMG standards MDA,UML 2.0, Introduction to UML -Basic building blocks, Extensibility mechanisms like stereotypes, tagged values, constraints.	07	
2	**STATIC MODELING** Class diagrams , Object diagrams, Composite structure diagrams, Package diagrams, Component Diagram - Interfaces and Components, Deployment Diagram	08	
3	**DYNAMIC MODELING** Use case diagram, Activity diagram, Advance state machine diagram, Interaction : Interaction overview diagram, sequence diagram, Timing diagram, Communication diagram	08	
4	**TESTING** Testing concepts, Principles of software testing, verification and validation, V-test model, defect management Testing strategies, unit, integration and system testing , acceptance, alpha, beta, performance, security testing ,white box and black box testing, basis path testing, equivalence testing, graph base testing, Test cases and test plan	07	

Laboratory:-

Module No.	Contents	Workload in Hrs
1	For the given problem statement draw Use Case Diagram and Activity Diagram using Rational rose	04
2	For above problem statement draw Class Diagram and Object Diagram	04
3	For the same problem draw Sequence Diagram and State Chart	04
4	Draw Component Diagram and Deployment Diagram for the above problem statement	04
5	Write the test plan, test cases and generate test scripts using any automated testing tool	04
6	Mini Project	--

COURSE STRUCTURE

Course Code	**CS314**			
Course Category	**Professional Core**			
Course Title	**Theory of Computation**			
Teaching Scheme and Credits	**L**	**T**	**Laboratory**	**Credits**
Weekly load hrs	**3**	**2**	**-**	**2+1=3**

Pre-requisites:

- Discrete Structures

Course Objectives:

1. To understand the basics of automata theory and its operations.
2. To understand problem classification and problem solving by machines.
3. To study computing machines by describing, classifying and comparing different types of computational models.
4. To understand the fundamentals of decidability and computational complexity.

Course Outcomes:

After completion of this course students will be able:

1. To construct finite state machines to solve problems in computing.
2. To build mathematical expressions and syntax verification for the formal languages.
3. To construct and analyze Push Down Automata and Turing Machine for formal languages.
4. To classify the understanding of decidability and complexity.

Mapping of COs to Programme Outcomes (Course Articulation Matrix)

	a	b	c	d	e	f	g	h	i	j	k	l
CO1	1	2	3	2								1
CO2		3	3	2			1					1
CO3		3	3	2								1
CO4		3	3	3	1		1					1

1: Low 2: Medium and 3: High

Course Contents:

1. Formal Languages and Finite Automata
2. Regular Expression
3. CFG & PDA
4. Pushdown Automata
5. Turing Machine

Learning Resources:

Text Books:

1. John C. Martin, Introduction to Language and Theory of Computation, TMH, 3rd Edition, ISBN: 978-0-07-066048-9
2. Vivek Kulkarni, Theory of Computation, Oxford University Press, ISBN-13: 978-0-19-808458-7

Reference Books:

1. K.L.P Mishra, N. Chandrasekaran, Theory of Computer Science (Automata, Languages and Computation), Prentice Hall India, 2nd Edition.
2. Michael Sipser, Introduction to the Theory of Computation, CENGAGE Learning, 3rd Edition, ISBN:13:978-81-315-2529-6
3. Daniel Cohen, Introduction to Computer Theory, Wiley India, 2nd Edition, ISBN: 9788126513345
4. Kavi Mahesh, Theory of Computation: A Problem Solving Approach, 1st Edition, Wiley-India, ISBN: 978-81-265-3311-4

Supplementary Reading:

1. Hopcroft Ullman, Introduction to Automata Theory, Languages and Computations, Pearson Education Asia, 2nd Edition, ISBN: 9788131720479

Web Resources:

Michael Sipser, Introduction to the Theory of Computation, CENGAGE Learning, 3rd Edition, ISBN:13:978-81-315-2529-6 [PDF Available online]

Web links:

https://gatecse.in/theory-of-computation
https://www.youtube.com/watch?v=eqCkkC9A0Q4
https://www.youtube.com/watch?v=58N2N7zJGrQ
https://www.slideshare.net/Shiraz316/theory-of-computation-69977770

MOOCs:

https://onlinecourses.nptel.ac.in/noc19_ma15/course
https://onlinecourses.nptel.ac.in/noc17_cs34/preview

Pedagogy:

- Chalk and Board
- PPT
- Video Lectures
- Think-Pair-Share Activity
- Flipped Classroom Activity

Assessment Scheme:

Class Continuous Assessment (CCA): 50 Marks

Assignments	Mid Term Test	MCQ	Attendance
30%	30%	30%	10%

Tutorial : 50 Marks

Term End Examination: 50 Marks (100% weightage)

Theory Syllabus

Module No.	Contents	Workload in Hrs	
		Theory	Lab
1	**FORMAL LANGUAGES AND FINITE AUTOMATA** Introduction to Formal language, Basic concepts: Symbol, Alphabet, String, Introduction to Finite Automata, State transition graph, Transition table, Acceptance of a string, Acceptance of a Language, Deterministic finite Automata (DFA)-Formal Definition, Non Deterministic finite Automata (NFA)-Formal Definition, Non Deterministic finite Automata (NFA) with epsilon transition, Equivalence of NFA and DFA, Conversion from NFA to DFA, Conversion from NFA with epsilon transition to DFA, Minimization of FA, Finite Automata with output: Moore and Mealy Machine, Moore to Mealy conversion, Mealy to Moore conversion	9	--
2	**REGULAR EXPRESSION** Formal definition and Identities of Regular Expressions, Construction of Regular Expression of the given Language, Construction of Language from the RE, FA and RE, DFA to RE Using Arden's Theorem, RE to DFA (RE to e-NFA to DFA and RE to DFA Direct Method), inter-conversion between Left Linear and Right linear Grammar, Closure properties of RLs, Pumping Lemma for RL, Applications of Regular Expressions	6	--
3	**CONTEXT FREE GRAMMAR(CFG) & PUSH DOWN AUTOMATA(PDA)** Formal definition of Grammar, Chomsky Hierarchy, CFG : Formal definition of CFG, Derivations, Parse Tree, Ambiguity in grammars and languages, Language Specification using CFG, Normal Forms: Chomsky Normal Form and Greibach Normal Form. Closure properties of CFL. Pushdown Automata : Definition, Acceptance of PDA by final State and Empty Stack, Designing PDA, Equivalence of Pushdown Automata and CFG, Deterministic Pushdown Automata, Nondeterministic Pushdown Automata	8	--
4	**TURING MACHINE** Formal definition of a Turing Machine, Recursive Languages and Recursively Enumerable Languages, Design of Turing Machines, Universal Turing Machine, Nondeterministic Turing machines. Designing TM , Concept of Decidability, Un-decidability, Halting Problem of TM	7	--

COURSE STRUCTURE

Course Code	**CS315**			
Course Category	**Professional Core**			
Course Title	**Embedded And Internet of Things Laboratory**			
Teaching Scheme and Credits	**L**	**T**	**Laboratory**	**Credits**
Weekly load hrs.	**-**	**-**	**04**	**02**

Prerequisites:

- Basic Programming Logic
- Processor Architecture and Interfacing
- Computer Network Technology

Laboratory Objectives:

1. To understand IoT development boards and Operating systems
2. To understand sensor interfacing with development boards
3. To understand actuators interfacing with development boards
4. To understand architecture protocols to disseminate sensor data
5. To understand web and cloud technologies use to empower IoT applications
6. To understand integration and deployment issues through Mini real life IoT project

Laboratory Outcomes:

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

1. Demonstrate IoT platforms and installations, such as Raspberry-Pi/Beagle board//Node MCU ESP/ Arduino.
2. Demonstrate use of sensors with Raspberry-Pi/Beagle board//Node MCU ESP/ Arduino.
3. Demonstrate use of actuators with Raspberry-Pi/Beagle board//Node MCU ESP/ Arduino.
4. Use protocols such as MQTT/ CoAP and tools to demonstrate architecture of IOT system.
5. Demonstrate cloud and database systems to log IoT data such as Amazon / Google / MySQL etc.
6. Proof of concept for real life social or business IoT project which displays abilities such as requirements, design, implementation, analysis and deployment concerns.

Laboratory Exercises/ Practical:

1. Study of IoT Architecture and ARM SOC installations
2. Interfacing Sensors
3. Interface Simple Actuators such as Stepper Motor
4. Traffic Control Using Raspberry-Pi
5. Obstacle Detection using IR Sensors
6. MQTT/COAP/XMPP protocol
7. Cloud System Interface
8. Web server installation and access in IoT platform

Learning Resources

Reference Books

1. Beginning Arduino by Micheal McRoberts Publishers: Technology in Action
2. IoT Fundamental by Devid Hanes Publishers: CISCO
3. Raspberry Pi Cookbook for Python Programmers by Tim Cox Publishers: PACKT
4. The Official RaspberryPi ProjectBook
5. Beginning Sensor Networks with Arduino and Raspberry Pi by Charles Bell Publishers: Technology in Action
6. The Internet of Things by Hakima Chaouchi Publishers: ISTE and Willey

Web Resources:

Web links:

https://gatecse.in/theory-of-computation
https://www.youtube.com/watch?v=eqCkkC9A0Q4
https://www.youtube.com/watch?v=58N2N7zJGrQ
https://www.slideshare.net/Shiraz316/theory-of-computation-69977770

MOOCs:

https://onlinecourses.nptel.ac.in/noc19_ma15/course
https://onlinecourses.nptel.ac.in/noc17_cs34/preview

Web Links for IoT Laboratory

https://www.tutorialspoint.com/internet_of_things/
http://raspberrypi.org/magpi
https://dzone.com/iot-developer-tutorials-tools-news-reviews
http://beagleboard.org/getting-started
https://randomnerdtutorials.com/getting-started-with-the-beaglebone-black/
http://www.toptechboy.com/beaglebone-black/
https://www.edureka.co/blog/iot-tutorial/
https://data-flair.training/blogs/iot-tutorials-home/
https://www.javatpoint.com/iot-healthcare
https://tutorials-raspberrypi.com/
https://core-electronics.com.au/tutorials/raspberry-pi-workshop-for-beginners.html
https://www.arduino.cc/en/Tutorial/HomePage?from=Main.Tutorials

Assessment Scheme:

Laboratory Continuous Assessment (LCA) 100 marks (100%)

Understanding and Performance of Experiment	Oral and Journal Submission	Attendance/ Discipline/ Ethics	Mini Project Demo and Presentation
30%	30%	10%	30%

Syllabus

Lab	Experiment Statement	Workload in Hrs
		Lab
1	Study of IoT architecture, development platforms and various ARM SOCs such as Raspberry Pi/ ESP8266 boards/ Beagle board/ Arduino Uno etc. To perform OS installations used to build IoT devices.	4
2	To Interface following sensors such as Temperature or Ultrasonic or Gas sensors with Raspberry-Pi/Beagle board/ Arduino etc. and display readings on console.	4
3	To interface simple actuators such as stepper motor, relays etc. with Raspberry Pi/ ESP8266 boards / Beagle board/ Arduino Uno.	4
4	Consider a suitable scenario of traffic signalling considering a crossroad and demonstrate traffic control using Raspberry-Pi/Beagle board/ Arduino etc.	4
5	To simulate an operation of obstacle detection and notifying it with buzzer or LED. You may additionally modify this to count objects entering the room	4
6	To demonstrate MQTT/COAP/XMPP protocols using message broker to subscribe and publish sensor data.	4
7	To sense the data from sensors and send it to cloud system in simple text files, excel sheets or databases system	4
8	To install web server such as Apache Web Server in IoT platform and write web application to access the server (IoT device as Web Server)	4
9	Mini Project: Real life IoT application Students are required to design and build a mini project for any suitable IoT application domains such as in the Healthcare, Manufacturing, Agriculture and Food, Insurance, Governance, Forest conservation, Transportation and Vehicles, Process management, Real estate and land records, Energy, Retails, Logistics, Education etc. Students should give the demonstration and prepare the 15-20 page plagiarism free report.	8

B. Tech. Computer Science & Engineering (Third Year) Batch: 2017 -2021

Trimester – VIII

Sr. No.	Course Code	Name of Course	Category	Weekly Workload, Hrs			Credits		Assessment Marks**			
				Theory	Tutorial	Lab	Th	Lab	CCA	LCA	ETT	Total
1	CS321	Design & Analysis of Algorithms	PC	3	1	-	3	-	100	-	50	150
2	CS322	Data Warehousing & Data Mining	PC	3	-	2	2	1	50	50	50	150
3	CS323	Information Security	PC	3	-	2	2	1	50	50	50	150
4	CS324	High Performance Computing	PC	3	-	2	2	1	50	50	50	150
5	CS325	Web Technology Lab	PC	--	-	4	-	2		100		100
6	FAC321	Finance and Costing	HSS	3	-	-	2	-	50	-	50	100
		Total :		15	1	10	11	05	300	250	250	800

Dr. Vishwanath Karad
MIT WORLD PEACE UNIVERSITY | PUNE
TECHNOLOGY, RESEARCH, SOCIAL INNOVATION & PARTNERSHIPS

COURSE STRUCTURE

Course Code	**CS321**			
Course Category	**Professional Core**			
Course Title	**Design and Analysis of Algorithms**			
Teaching Scheme and Credits	**L**	**T**	**Laboratory**	**Credits**
Weekly load hrs	**03**	**01**	**--**	**02+01=03**

Pre-requisites:

- Data Structure II

Course Objectives:

- Study the performance analysis of algorithms.
- Select algorithmic strategies to solve given problem.
- Explore solution space to solve the problems.
- Provide the knowledge about complexity theory.

Course Outcomes:

After completion of this course students will be able to:

1. Analyze the algorithm complexity using asymptotic notations and describe the divide-and-conquer paradigm and recite algorithms that employ this paradigm.
2. Describe greedy and dynamic programming algorithmic strategies and analysis algorithms that employ this paradigm.
3. Illustrate the solution space using backtracking and branch and bound algorithmic techniques.
4. Describe the concept of complexity theory.

Mapping of COs to Programme Outcomes (Course Articulation Matrix)

	a	b	c	D	E	f	g	h	i	j	k	L
CO1	3	3										3
CO2	3	2										3
CO3	3	2										3
CO4	3	2										3
	3	2										3

1: Low 2: Medium 3: High

Course Contents:

1. Fundamentals Of Algorithms & Divide and Conquer Strategy
2. Greedy Strategy and Dynamic Programming
3. Backtracking and Branch–N-Bound
4. Complexity Theory

Tutorial:

1. Problem Solving/ Questions on ALGORITHMS ANALYSIS
2. Problem Solving/ Implementation DIVIDE AND CONQUER
3. Problem Solving/ Implementation on GREEDY STRATEGY
4. Problem Solving/ Implementation on DYNAMIC PROGRAMMING
5. Problem Solving/ Implementation on BACKTRACKING
6. Problem Solving/ Questions on BRANCH –N-BOUND
7. Problem Solving/ Questions On COMPLEXITY THEORY

Learning Resources:

Text Books:

1. Thomas H Cormen and Charles E.L Leiserson, "Introduction to Algorithm" Third Edition, PHI
2. Horowitz, Sahni & Rajasekaran, "Fundamentals of Computer Algorithms", 2ND Edition. University Press.

Reference Books:

1. Gilles Brassard and Paul Bartley, "Fundamental of Algorithms", PHI, New Delhi.
2. Anany Levitin, "Introduction to the Design and Analysis of Algorithms" Pearson Education
3. Parag Dave **,** Himanshu B Dave ,"Design and analysis of Algorithms",2/e Pearson
4. S. Dasgupta, C. H. Papadimitriou, and U. V. Vazirani," Algorithms", 1 edition, McGraw-Hill Education;

Supplementary Reading:

1. Jon Kleinberg, Evas Tardos, "Algorithm Design", Pearson Education
2. S. Srihar , " Design and Analysis of Algorithm", Oxford University Press

Web Resources:

- https://nptel.ac.in/courses/106106131/
- https://nptel.ac.in/syllabus/106101060/
- https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-046j-design-and-analysis-of-algorithms-spring-2015/lecture-notes/

Web links:

- https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-046j-design-and-analysis-of-algorithms-spring-2015/lecture-videos/

MOOCs:

- https://swayam.gov.in/nd1_noc19_cs47/preview
- https://www.edx.org/course/algorithm-design-analysis-pennx-sd3x
- https://www.coursera.org/specializations/algorithms

Pedagogy:

- Power Point Presentation
- Video Lectures
- Flipped Classroom Activity
- Think Pair & Share
- Model Based Learning
- Chalk and Board

Assessment Scheme:

Class Continuous Assessment (CCA)- 100 Marks (100%)

Assignments	Test	Tutorial	MCQ	Attendance
15%	15%	50%	15%	05%

Term End Examination: 50 Marks (100% weightage)

Theory Syllabus:

Module No.	Contents	Workload in Hrs	
		Theory	Tut
1	**Fundamentals of Algorithms** The Role of Algorithms in Computing, Algorithmic specifications, Analyzing algorithm, asymptotic notations, order of growth. Algorithm design strategy, Divide and conquer - Merge Sort, Quick sort, Large Integer multiplication, solving recurrences (substitution method & Master's theorem).	**08**	**2**
2	**Greedy Strategy And Dynamic Programming** Greedy strategy: Principle, control abstraction, Knapsack problem, Job sequencing with Deadlines, Huffman Encoding. Dynamic Programming: Principle of optimality, 0/1 Knapsack, Largest Common Subsequence, Traveling Salesman Problem.	**08**	**2**
3	**Backtracking And Branch –N-Bound** General method backtracking, 8-Queen problem, Hamiltonian Cycle, 0/1 Knapsack Problem. Branch–N-Bound method, Control abstractions for Least Cost Search, Bounding, FIFO branch and bound, LC branch and bound.	**07**	**2**
4	**Complexity Theory** Computational Complexity: P, NP, NP Complete, NP Hard, Satisfiability problem, NP Complete Problems: Clique, Vertex Cover. Basics of approximation, Randomised algorithm, Parallel Algorithms.	**07**	**1**

Tutorials:-

Sr No.	Contents	Workload in Hrs
1	Problem Solving/ Questions on ALGORITHMS ANALYSIS	02
2	Problem Solving/ Implementation DIVIDE AND CONQUER	02
3	Problem Solving/ Implementation on GREEDY STRATEGY	02
4	Problem Solving/ Implementation on DYNAMIC PROGRAMMING	02
5	Problem Solving/ Implementation on BACKTRACKING	02
6	Problem Solving/ Questions on BRANCH –N-BOUND	02
7	Problem Solving/ Questions On COMPLEXITY THEORY	02

COURSE STRUCTURE

Course Code	**CS322**			
Course Category	**Professional Core**			
Course Title	**DATA WAREHOUSING AND DATA MINING**			
Teaching Scheme and Credits	**L**	**T**	**Laboratory**	**Credits**
Weekly load hrs	**3**	**-**	**2**	**2+1=3**

Pre-requisites:

1. Database Management Systems

Course Objectives:

This course will

1. To understand the various Data Preprocessing Methods.
2. To introduce the concepts, techniques, design and applications of Data Warehousing
3. To understand and implement data mining algorithms
4. To learn how to analyze the data, identify the problems, and choose the relevant algorithms to apply on reallife datasets.

Course Outcomes:

After completion of this course students will be able to:

1. Apply Preprocessing techniques for data cleaning
2. Understand stages in building a Data Warehouse
3. Appreciate the strengths and limitations of various Data Mining
4. Analyze and evaluate performance of Classification and Clustering algorithms

Course Outcomes and Graduate Attributes Mapping:

	1	2	3	4	5	6	7	8	9	10	11	12
CO1	**H**											**M**
CO2												
CO3		**H**	**M**			**L**						
CO4	**H**	**H**		**H**			**M**					**M**

H- High M-Moderate L- Low

Course Contents:

1. Data Pre-processing: An Overview
2. Data Warehousing
3. Data Mining
4. Classification And Clustering

Laboratory Exercises:

1. Data Pre-processing
2. DW Schemas
3. Apriori Algorithm
4. Decision Tree Classification
5. K Means Clustering
6. Data Visualization

Learning Resources:

Books:- (Text)

1. Jiawei Han and M Kamber, Data Mining Concepts and techniques, Third Edition, Elsevier Publications, 2011; chapters 1-8

Books:- (Reference)

1. Alex Berson and Stephen J. Smith "Data Warehousing, Data Mining & OLAP", Tata McGraw – Hill Edition, Tenth Reprint 2007
2. Michael J. Corey, Michael Abbey, Ben Taub, Ian Abramson Oracle 8i Data Warehousing McGraw-Hill Osborne Media, 2nd edition

Supplementary Reading:

1. Pang-Ning Tan, Michael Steinbach, and Vipin Kumar, "Introduction to Data Mining", Pearson Addison Wesley, 2005, ISBN: 0-32- 132136-7
2. Adriaans, P. (1996). Data mining. Addison-Wesley
3. Weiss, Sholom M.."Predictive Data Mining: A Practical Guide", Sholom M. Weiss, Nitin Indurkhy. - San Francisco, Calif. : Morgan Kaufmann Publishers, 1998 – 1558604030
4. G. K. Gupta , "Introduction to Data mining with case studies", PHI, second edition

Web Resources:

1. http://164.100.133.129:81/econtent/Uploads/DATA_WAREHOUSING.pdf
2. http://myweb.sabanciuniv.edu/rdehkharghani/files/2016/02/The-Morgan-Kaufmann-Series-in-Data-Management-Systems-Jiawei-Han-Micheline-Kamber-Jian-Pei-Data-Mining.-Concepts-and-Techniques-3rd-Edition-Morgan-Kaufmann-2011.pdf

Weblinks:

1. www.kdnuggets.com: Data mining resources
2. ocw.mit.edu/ocwweb/slon-School-ofmanagement/15-062Data-MiningSpring2003/coursehome/index.htm: MIT Data mining open courseware

MOOCs:

1. https://onlinecourses.nptel.ac.in/noc18_cs14
2. https://www.coursera.org/specializations/data-mining
3. https://ocw.mit.edu/courses/sloan-school-of-management/15-062-data-mining-spring-2003/

Pedagogy:

- Power Point Presentation
- Video Lectures
- Flipped Classroom Activity
- Think Pair & Share
- Model Based Learning
- Chalk and Board

Assessment Scheme:

Class Continuous Assessment (CCA)- 50 Marks (*with % weights***)**

Assignment	Mid-Term test	Case study	MCQ	Attendance
10 Marks 20 %	15 Marks 30 %	5 Marks 10 %	10 Marks 20 %	10 Marks 20 %

Term End Examination: 50 Marks

Lab Continuous Assessment (LCA):50 Marks *(with % weights)*

Practical Performance (Lab Rubric)	Attendance	Site Visit	Mini Project	Practical Examination
20 40%	5 10%	-	5 10%	20 40%

Theory Syllabus

UNIT NO.	Contents	Workload in Hrs
UNIT I	**DATA PREPROCESSING: AN OVERVIEW** Introduction to KDD, Data Preprocessing: An Overview, Data Cleaning: Missing Values, Noisy Data, Data Cleaning as a Process, Data Integration: Entity Identification Problem, Redundancy and Correlation Analysis, Tuple Duplication, Data Value Conflict Detection and Resolution, Data Reduction: Attribute Subset Selection, Histograms, Sampling, Data Transformation and Data Discretization	7
UNIT II	**DATA WAREHOUSE** Introduction to Data Warehouse, OLTP and OLAP, Data Warehouse architecture, Data Warehouse Modeling: A Multidimensional Data Model, Data Warehouse Design: Stars, Snowflakes, and Fact Constellations Schemas, Dimensions: The Role of Concept Hierarchies, Measures: Their Categorization and Computation, Typical OLAP Operations, ROLAP, MOLAP, Materialized views, Integration of Data Warehouse with other technologies	8
UNIT III	**DATA MINING** Introduction to Data Mining, Data Mining Techniques, Supervised, Semi-Supervised, and Unsupervised Methods, Basic concepts of Association Rule Mining, **Frequent Item set mining**: Apriori Algorithm, Generating Association Rules from Frequent Itemset, FP-growth Algorithm	6

	Applications and Trends in data Mining: Visual Data Mining, Text Mining, Web Mining	
UNIT IV	**CLASSIFICATION AND CLUSTERING** **Classification:** Basic Concepts, Decision Tree Induction, Bayesian Classification, **Clustering Techniques**: Basic concepts, Partition based Clustering: k-Medoids, k-Means, Hierarchical clustering: Divisive and Agglomerative	9

Laboratory Assignments

Sr.No	Problem Statement	Workload in Hrs
		Lab
0.	DWDM Mini Project: Ideas, overview	2
1.	Data Pre-Processing using Python	2
2.	Demonstrate Data Warehouse Schema Using OLAP tool	2
3.	Implement the Apriori algorithm by determining Frequent Itemsets using Python.	2
4.	Write a program in Python to implement the Decision Tree Algorithm.	4
5.	Implement k-means clustering using Python.	2
6.	Review the data and make a visualization(s) on given data set	4
7.	Mini Project Submission	4

Dr. Vishwanath Karad
MIT WORLD PEACE UNIVERSITY | PUNE
TECHNOLOGY, RESEARCH, SOCIAL INNOVATION & PARTNERSHIPS

COURSE STRUCTURE

Course Code	**CS323**			
Course Category	**Professional Core**			
Course Title	**Information Security**			
Teaching Scheme and Credits	**L**	**T**	**Laboratory**	**Credits**
Weekly load hrs	**3**	**-**	**2**	**2+1**

Pre-requisites:

Basics of Computer Systems,
Basic Data Communication and Networks

Course Objectives:

1. To understand foundations of security architecture and classical crypto system.
2. To recognize mathematical foundations and its use in advanced cryptography.
3. To comprehend authentication and key management issues.
4. To understand network attacks, defense and web security tools.

Course Outcomes:

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

1. Use basic security principles and techniques in secured application programming.
2. Mathematically prove security solutions in cryptography applications.
3. To handle key management and authentication protocols.
4. To deploy network security tools and solutions of web information security.

Mapping of COs to Programme Outcomes (Course Articulation Matrix)

	a	b	c	d	e	f	g	h	i	j	k	l
CO1	**3**	**2**	**2**									
CO2			**2**		**3**	**1**						
CO3			**3**	**2**	**1**		**1**					
CO4						**1**	**3**	**1**				

1: Low 2: Medium and 3: High

Course Contents:

1. Information Security Foundations
2. Mathematical Foundations and Cryptography.
3. Key management and Authentication protocols
4. Network Security Mechanisms

Laboratory Exercises:

1. Core level security programming in C# or Python or Java
2. API level security programming in C# or Python or Java
3. Tools level security configurations & deployments

Learning Resources:

Text Books:

1. Cryptography and Network Security, William Stallings, Pearson Education 5th Edition, ISBN 13: 978-0-13-609704-4
2. Computer Security : Principles and Practices, Willaim Stallings and Lawrie Brown, Pearson Education, ISBN 13-9780134794396

Reference Books:

1. Cryptography and Network Security, Berouz Forouzan 2 edition, TMH, ISBN :9780070702080
2. Applied Cryptography, BruiceSchneier, 2nd Edition, Wiely India Pvt Ltd, ISBN 978-81-265-1368-0
3. Computer Security: Art and Science, by Matt Bishop, Pearson Education, ISBN:9788177584257

Supplementary Reading:

Web Resources:

E-books

https://www.cengage.com/resource_uploads/downloads/1111138214_259146.pdf
https://www.cmu.edu/iso/aware/presentation/tepperphd.pdf
https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.800-12r1.pdf
https://www.cs.unibo.it/babaoglu/courses/security/resources/documents/intro-to-crypto.pdf

Web links:

http://www.cca.gov.in/cca/
https://www.verisign.com/en_IN/
https://meity.gov.in/content/information-technology-act-2000

MOOCs:

https://onlinecourses.nptel.ac.in/noc19_cs28/preview
https://nptel.ac.in/courses/106105031/
https://www.edx.org/professional-certificate/uwashingtonx-essentials-cybersecurity

Pedagogy:

Power Point Presentation, White-board / Pen, Demos of Security tools, Online Quizes, Video Clips, Oral Questions and Answers.

Assessment Scheme:

Assessment Marks (150 Marks)			
CCA	LCA	ETT	Total
50	50	50	150

Class Continuous Assessment (CCA)- 50 Marks

Assignments	Mid Term	Tutorial	MCQ	Attendance	Total
30%	30%	-	30%	10%	100%

Laboratory Continuous Assessment (LCA)-50 Marks

Practical Demonstration	Journal Submission	Understanding (Orals)	Attendance	Total
30%	30%	30%	10%	100%

Term End Examination: 50 Marks

Theory Syllabus – Information Security

Module No.	Contents	Workload Hrs	
		Theory	Lab
1	**Unit 1: Foundations of Information Security** Background of security, Security attacks, Defence Mechanisms, Goals of Security, Various security domains. Security Design Principles. Classical Cryptography: Caesar cipher, One Time Pad, Mono alphabetic cipher, Transposition ciphers. Symmetric Cryptosystems: Block Ciphers, Stream Ciphers, Basics of DES and AES. Cipher modes of operations. Introduction to Cryp Tool.	08	-
2	**Unit 2: Mathematical Foundations and Public Key Cryptography** Mathematics for Security: Modular Arithmetic, Euclidean Algorithm, Chinese Remainder Theorem, Discrete Logarithm, Fermat Theorem, Secret Splitting and Sharing with polynomials Asymmetric key Cryptography: RSA. Hash algorithms: SHA1, Digital Signatures: Symmetric Key Signatures, Public Key Signatures.	08	-
3	**Unit 3: Key Management and Authentication** Pseudo Random numbers, Key Management: Types of Keys, Generation, Distribution, Cryptographic Key Infrastructures, Diffie-Hellman Key Exchange, Digital Certificates x509. Authentication Protocols: Remote, Mutual Authentication, Passwords attacks & defence, Symmetric key and Asymmetric key Authentication, Federated Authentication.	07	-
4	**Unit 4: Networks and Web security**: Layer wise Security concerns, Firewalls: Packet filtering, Stateless and Stateful, Intrusion detection systems: host based, network based IDS, Secured Socket Layer Security, IP level IPSEC security, Kerberos Security System. Wireless Security.	07	-

Laboratory Assignments			
Lab No.	**Contents (Any six Laboratories)**	**Workload in Hrs**	
		Theory	**Lab**
A	**Core Level security (Any two)**		
1	Implement any classical cryptographic technique using java or python or C++	-	02
2	Implement simple DES symmetric key algorithm using python or java or C++	-	02
3	Implement simple RSA asymmetric key algorithm using python or java or C++	-	02
B	**API Level - (Using Libraries) (Any two)**		
1	To program asymmetric key cryptography such as RSA cryptography using JAVA API, Python or C++ API.	-	02
2	To program basic cryptography hash algorithm SHA1 or MD5 Use Java or Python or C++ API. Additionally demonstrate client server authentication using socket programming.	-	02
3	Write program for demonstration of digital signature and its verification using Java or Python or C++.	-	02
C	**Security Tools Level – (Any two)**		
1	Demonstrate use of PGP open source security tool for Confidentiality, Authentication and Integrity.	-	02
2	Demonstrate secured web applications system using SSL certificates and its deployment in Apache tomcat server	-	02
3	Implement Intrusion Detection System using Snort IDS tool	-	02
4	Install and configure and demonstrate NESSUS tool of vulnerability assessment	-	02

COURSE STRUCTURE

Course Code	**CS324**			
Course Category	**Professional Core**			
Course Title	**High Performance Computing**			
Teaching Scheme and Credits	**L**	**T**	**Laboratory**	**Credits**
Weekly load Hrs	**3**	**-**	**2**	**2 + 1 = 3**

Pre-requisites:

- Data Structures
- Computer Organization & Architectures

Course Objectives:

1. To study the parallel computing hardware architectures.
2. To develop acumen for parallel programming design.
3. To demonstrate parallel programming tools for solving problems.
4. To be conversant with performance analysis and modeling of parallel programs.

Course Outcomes:

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

1. Describe different parallel architectures, interconnect networks, programming models.
2. Develop an efficient parallel algorithm to solve problem.
3. Build the logic to parallelize the programming task using OpenMP.
4. Analyze and measure performance of modern parallel computing systems

Mapping of COs to Programme Outcomes (Course Articulation Matrix)

Course Outcomes	Program Outcomes											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	3											
CO2	3	2										
CO3	3	2	3	2	3							2
CO4	3	2	3	2	3							2

1: Low, 2: Medium and 3: High

Course Contents:

1. Introduction to High Performance Computing.
2. Parallel Algorithm Designing.
3. Analysis of Parallel Programming.
4. CUDA programming.

Laboratory Exercises / Practical:

- Presentation of any application case study of HPC [supported by simple program of your choice]
- Conversion of a serial program to parallel code.
- Write optimized Bubble Sort
- Design parallel algorithm to add two large vectors. Write a program for the same using OpenMP
- Write parallel Quick Sort using OpenMP
- Write a CUDA program such that, given an N-element vector, find- The maximum/minimum element in the vector

Learning Resources:

Text Books:

1. Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, "Introduction to Parallel Computing", 2nd edition, Addison-Wesley, 2003, ISBN: 0-201-64865-2
2. Jason Sanders, Edward Kandrot, "CUDA by Example", Addison-Wesley, ISBN-13: 978-0-13-138768-3

Reference Books:

1. Kai Hwang, "Scalable Parallel Computing", McGraw Hill 1998, ISBN:0070317984

Supplementary Reading:
Web Resources:
E-books
http://parallelcomp.uw.hu/

Web links:
http://parallelcomp.uw.hu/

MOOCs:
https://www.coursera.org/courses?query=high%20performance%20computing
https://www.udemy.com/learn-to-use-hpc-systems-and-supercomputers/
https://www.udacity.com/course/high-performance-computing--ud281

Pedagogy:

- Power Point Presentation
- White-board / Pen
- Two Teacher method

Assessment Scheme:

Class Continuous Assessment (CCA)- 50 Marks

Assignments	Mid Term	MCQ	Attendance	Tutorial
30%	30%	30%	10%	-

Laboratory Continuous Assessment (LCA)-50 Marks

Practical	Any other (Mock 1 and Mock2)	Attendance	Mini Project	Problem based Learning	Oral based on practical
60%	30%	10%	-	-	-

Term End Examination: 50 Marks (100% weightage)

THEORY

Module No	Content	Workload in Hrs [Theory]
1	**Introduction to High Performance Computing:** **Evolution of HPC:** **Hardware evolution:** superscalar architectures & Multi-core architecture, Limitations of Memory, Dichotomy of Parallel Computing Platforms. **Software Evolution:** Concept of Serial program, Concept of parallelism & parallel program, basic introduction to OpenMP Significance of HPC, Performance Metrics for Parallel Systems – SpeedUp, Execution time, total parallel overhead, response time, efficiency and cost. **Applications of HPC**: Real-time applications, Case study.	**7**
2	**Parallel Algorithm Design:** Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, parallel computing model.	**8**
3	**Analysis of Parallel Programming:** The effect of Granularity on Performance, Scalability of Parallel Systems, and Interconnection Networks*: Bus, Ring, Star, Crossbar, Minimum execution time and minimum cost.	**7**

4	**CUDA programming:** The Age of Parallel Processing, the Rise of GPU Computing, A Brief History of GPUs, Early GPU. CUDA: CUDA Architecture, Using the CUDA Architecture, Applications of CUDA, Writing a basic CUDA program.	8

Laboratory Assignment:-

Sr No	Assignments	Work Load In Hrs
1	Demonstration of an application case study of High Performance Computing	4
2	Write a C program and convert it into parallel using OpenMP directive.	4
3	Write a C program for bubble sort. Calculate it's time complexity. Identify the hotspots in the program. Write an optimized code for bubble sort using OpenMP.	4
4	Write a C program for parallel algorithm to add/subtract/multiply two large vectors.	4
5	Write a C Program for parallel Quick Sort/ Breadth First Search/ Depth first Search of a large array of integers using OpenMP.	4
6	Write a CUDA program to find the maximum/minimum element in the N-element vector. (where N is large number)	4

COURSE STRUCTURE

Course Code	**CS325**			
Course Category	**Professional Core**			
Course Title	**Web Technologies Lab**			
Teaching Scheme and Credits	**L**	**T**	**Laboratory**	**Credits**
Weekly load hrs	**-**	**-**	**04**	**2**

Pre-requisites:

1. Basic Programming Logic
2. Database Management System
3. Computer Network Technology

Course Objectives:

1. To understand basics of web technologies.
2. To apply style sheets in order to design web pages.
3. To develop dynamic web site
4. To familiarize with the recent trends in web technologies

Course Outcomes:

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

1. Design web pages using HTML and CSS
2. Build appropriate client side validation using Javascript
3. Develop dynamic web site using PHP.
4. Demonstrate the use of recent web technologies

Mapping of COs to Programme Outcomes (Course Articulation Matrix)

	a	b	c	D	e	f	g	h	i	j	k	l
CO1	**1**		**3**									
CO2	**1**		**3**									
CO3	**1**		**3**	**1**						**1**		**2**
CO4			**3**	**2**								**2**

1: Low 2: Medium 3: High

Laboratory Exercises / Practical:

1. Design web pages using HTML(Hypertext Markup Language) and CSS (Cascading Style Sheets)
2. XML(eXtensible Markup Language), DTD (Document Type Definition), XML Schema and XSLT(eXtensible Stylesheet Language Transformations)
3. Client Side Form Validations using JavaScript
4. DOM (Document Object Model)
5. PHP form handling and database operations
6. CMS (Content Management System)
7. Node JS
8. Mini Project

Learning Resources:

Text Books:

1. Achyut Godbole & Atul Kahate 'Web Technologies: TCP/IP to Internet Application Architecture', McGraw Hill Education publications

Reference Books:

1. Ralph Moseley & M. T. Savaliya, "Developing Web Applications", Wiley publications, ISBN 13 : 9788126538676
2. HTML & CSS: The Complete Reference, Fifth Edition (English, Paperback, Powell Thomas)
3. Jeremy McPeak& Paul Wilton," Beginning JavaScript", Wrox Publication, ISBN-13: 978-0470525937
4. McGrath M. (2007). XML in Easy Steps.

Supplementary Reading:

1. Java EE and HTML 5 Enterprise Application Development by John Brock ,Arun Gupta, Geertjan Wielenga Oracle Express.

Web Resources:

E-books

(On Safari)Core PHP Programming: Using PHP to Build Dynamic WebSites. Prentice Hall.

HTML5 Canvas, O'Reilly Steve Fulton and Jeff Fulton (2nd Edition)

Weblinks:

https://codeburst.io/100-free-resources-to-learn-full-stack-web-development-5b40e0bdf5f2

https://www.w3schools.com/angular/

https://www.w3schools.com/nodejs/nodejs_intro.asp

MOOCs:

Coursera, NPTEL on Web Development

Pedagogy:

- Power Point Presentation
- Video Lectures
- Flipped Classroom Activity
- Crosswords
- Chalk and Board

Assessment Scheme:

Laboratory Continuous Assessment (LCA)-100 Marks

Performance of Experiment	Oral and Journal Submission	Attendance/ Discipline/ Ethics	Mini Project Demo and Presentation
30%	30%	10%	30%

Laboratory Assignment:-

Lab	Assignment Statement	Workload in Hrs Lab
0	Information about the Web Application Architecture. Mini Project Specifications and team formation	-
1	Develop informative web pages using HTML5 (Use all possible formatting for example font, colour etc.). Web page should include various images, links within the page, links to other pages for navigation, new tabs. Use Cascaded Style Sheets (CSS) to style the web pages designed. Make use of border, margins, padding, navigation, dropdown list etc.	4
2	a) Encode the given information using XML document b) Construct an external DTD for the XML document c) Convert DTD to XML Schema and validate the document	4
3	Write a program to design registration form by using HTML, CSS & JavaScript and perform following validations: a) All fields mandatory, b) Phone number and email address validation etc.	4
4	Write a client-side code with JavaScript to access and manipulate Document Object Model (DOM) objects in an HTML web page.	2
5	Write server side script in PHP to perform form validation and create database application using PHP and MySQL to perform insert, update, delete and search operations.	8
6	Create and manage an online blog with CMS (Content Management Systems) – WordPress/DRUPAL/JOOMLA a) Creating and managing posts b) Setting up post categories c) Creating and managing pages	4
7	Node JS/Angular JS/React JS: Front end and Backend management a) Creating HTTP server b) Creating simple static file server c) Using Express framework develop a website using Node JS and MySQL	6
8	Mini Project: Web Application Development Example topics: Matrimonial Site, Online Tiffin Ordering System, Online Grocery Store, Dance Academy etc.	8

Course Structure

Dr. Vishwanath Karad
MIT WORLD PEACE UNIVERSITY | PUNE

COURSE STRUCTURE

Course Code	**FAC321**			
Course Category	**Professional Elective**			
Course Title	**Finance and Costing**			
Teaching Scheme and Credits Weekly load hrs	**L(Contact Hr.)**	**T**	**Lab**	**Credits**
	3	**0**	**0**	**2+0+0**

Pre-requisites:

Course Objectives:

1.**Knowledge**

i) To understand the concepts of Financial Accounting and Financial Management and its application for Managerial decision making.

ii) To provide an in depth study of the Generally Accepted Cost Accounting.

2.Skills

i) To develop capability for analyzing financial and costing principles.

3.Attitude

i) To develop abilities for determining analysis and classification of cost components to facilitate managerial decision making.

Course Outcomes:

Upon the completion of this course, the student will be able to:

1. Understand and explain the conceptual framework of Financial , Cost & Management Accounting (CL-II)
2. Explain the basic concepts and processes in determination of product cost. (CL-II)
3. Identify and apply the concepts of Financial Accounting, Cost Accounting and Financial Management(CL-I)

Course Contents:

Introduction to Financial Accounting: Concept of Accounting, Introduction to Forms of Business Organization, Concepts and Conventions of Accounting, Accounting Process, Types of Accounts, Golden rules of accounting, Journal Entries, Ledger, Trial Balance and Financial Statement of Sole Proprietor, Trading Account, Profit and Loss Account and Balance Sheet.

Introduction to Cost Accounting

Cost, Elements of Cost; Material Cost, Labour Cost and Overheads, Classification of cost and overheads, Cost Centre, Cost Unit: Preparation of Cost Sheet.

Dr. Vishwanath Karad
MIT WORLD PEACE UNIVERSITY | PUNE

Cost Control Techniques :-
Concept, Marginal Costing, Use of Marginal Costing, Cost Volume Profit Analysis, Concept of Break-Even, P/V Ratio and Margin of Safety. Budgets & Budgetary Control: Types of Budget, Flexible Budget and Cash Budget. Introduction to Variance analysis.

Introduction to Financial Management :- Introduction of Finance, Financial Management, Financial Planning, Capital Structure, Internal and External Sources of Finance, Shares, Debentures, Public Deposit, Borrowings from banks. Concept and design of Working Capital, types of working capital, sources of working capital, Factors affecting working Capital Requirement.

Reference Books:

1. Prasanna Chandra, "Financial Management– Theory and Practice", Edition 8, 2011, Tata McGraw Hill Education,
2. Sumit Gulati and Y. P. Singh, "Financial Management" McGraw Hill Education Pvt. Ltd., Chennai, 2013
3. Amitabha Mukherjee, and Mohammed Hani, "Modern Accountancy", Edition 2, 2002, Tata McGraw Hill Education
4. Bhattacharya A. K., "Principles and Practice of Cost Accounting", Prentice Hall India.
5. B K Bhar, "Cost Accounting – Methods and Problems", Academic Publishers
6. S.P.Jain and K.L.Narang – Cost Accounting – Kalyani Publication

Supplementary Readings:

1. Paresh P. Shah, Financial Management, Reprint No. 2 2011, Biztantra, New Delhi,
2. Colin Drury, "Management and Cost Accounting", English Language Book Society,. International Thomson Business; 6th Revised edition, Chapman and Hall London

CCA:

CCA shall consists of following:

1. Preparation of Journal Entries and Ledger
2. Preparation of Cost Sheet.
3. Practical Problems on Marginal Costing.
4. Practical Problems on Flexible Budget.

Web Resources:
Web links:

MOOCs / NPTL Lectures:
https://www.mooc-list.com/course/financial-planning-open2study

Pedagogy: Chalk and talk, PPT, NPTEL Videos, e- resources

Assessment Scheme:
Class Continuous Assessment (CCA): 50 marks.

Dr. Vishwanath Karad
MIT WORLD PEACE UNIVERSITY | PUNE

Assignments (2 Nos.)	Test	Presentations	Attendance
20	15	10	05

Term End Examination: 50 marks.

Syllabus:

Module No.	Contents	Workload in Hrs		
		Theory	Lab	Assess
1	Introduction to Financial Accounting	8	-	-
2	Introduction to Cost Accounting	8	-	-
3	Cost Control Techniques	8	-	-
4	Introduction to Financial Management	6	-	-

Prepared by:

Prof. Shreeya Rajpurohit
Assistant Professor
Commerce

Checked by:

Prof. Ashish S. Kathale
Course Head, Commerce

Approved by:

Prof. Hemant Bhise
Head School of Commerce

Prof. Dr. Sanjay N. Havaldar, T.Y.B.Tech. Coordinator for Engineering and Technology, MIT-WPU, Pune.	Prof. Dr. Prasad Khandekar, Dean, Engineering and Technology, MIT-WPU, Pune.	Chairman, Board of Studies, MIT - World Peace University, Pune

Prof. Dr. Srihari Honwad, Pro-VC, Engineering and Technology, MIT-WPU, Pune.	Prof. Dr. S. Parasuraman, Vice Chancellor, MIT - World Peace University, Pune

B. Tech. Computer Science & Engineering (Third Year)
Batch: 2017 -2021
Trimester – IX

Sr. No	Course Code	Name of Course	Category	Weekly Workload, Hrs			Credits		Assessment Marks**			
				Theory	Tutorial	Lab	Th	Lab	CCA	LCA	ETT	Total
1	CS331	System Software and Compilers	PC	3	-	2	2	1	50	50	50	150
2	CS332	Artificial Intelligence	PC	3	-	2	2	1	50	50	50	150
4	CSP3XX	Professional Elective I	PE	3	-	2	2	1	50	50	50	150
5	CSO3XX	Open Elective-1	OE	3	--	-	2		100	-	-	100
6	CS335	Seminar/ Mini Project	PR	-	-	2	-	1	-	50	-	50
7	WPC6	Humanities – Ethical, Moral and Social Sciences	WP	3	-	-	2	-	70	-	30	100
		Total :		15	--	8	10	04	320	200	180	700

List of Professional electives [PE1]

Sr. No.	Subject Name	Subject Code /University Code
1	Big data Analytics	CSP31A
2	Parallel Programming	CSP32A
3	Wireless and Mobile Security	CSP33A
4	Software Testing and Quality Assurance	CSP34A

List of Open electives [OE1]

Sr. No.	Subject Name	Subject Code /University Code
1	Bioinformatics	CSO33A
2	Python	CSO33B
3	Introduction to Machine Learning and Applications	CSO33C
4	Data Science	CSO33D
5	R Programming	CSO33G
6	Computer Graphics and Multimedia Techniques	CSO33H
7	Advanced Operating System	CSO33I

****

COURSE STRUCTURE

Course Code	**CS331**			
Course Category	**Professional Core**			
Course Title	**System Software and Compiler**			
Teaching Scheme and Credits	**L**	**T**	**Laboratory**	**Credits**
Weekly load hrs	**3**	**-**	**2**	**2 + 1 = 3**

Pre-requisites:

- Data Structure1 [CS221] and Data Structure2 [CS231]
- Theory of Computation [CS314]

Course Objectives

1. To understand data structures and fundamentals of system softwares.
2. To learn linking and loading concepts.
3. To comprehend the basic concepts of lexical analysis.
4. To construct syntax analyzer using compiler tools.

Course Outcomes

1. To analyse and synthesize a translator.
2. To design linker and loader schemes.
3. Ability to design and write a scanner for any high level language.
4. Apply tools like LEX and YACC for compiler design.

Laboratory Exercises / Practical:

1. Assembler Pass 1.
2. Assembler Pass 2.
3. Macro Pass 1
4. Macro Pass 2
5. Scanner for JAVA.
6. Validation of compound statement.
7. Design Calculator Using LEX and YACC.
8. Recursive Descent Parsing

Learning Resources:

Text Books:

1. Dhamdhere D., "Systems Programming and Operating Systems", McGraw Hill, ISBN 0 - 07- 463579 – 4.
2. A V Aho, R Sethi, J D Ullman, \Compilers: Principles, Techniques, and Tools", Pearson Edition, ISBN 81-7758-590-8.
3. John Donovan, "System Programming", McGraw Hill, ISBN 978-0--07-460482-3.

Reference Books:

1. John. R. Levine, Tony Mason and Doug Brown, "Lex and Yacc", O'Reilly, 1998, ISBN: 1- 56592-000-7.
2. Leland L. Beck, "System Software An Introduction to Systems Programming" 3rd Edition,Person Education, ISBN 81-7808-036-2.
3. Adam Hoover, "System Programming with C and Unix", Pearson,2010

Supplementary Reading:

Terence Parr, "Language Implementation Patterns", SPD, 2009.

Web Resources:

1. https://shraddhasshinde.files.wordpress.com/2017/12/spos-by-dhamdhere.pdf
2. http://web.mit.edu/jjd/www/documents/Instructors%20Manual%20to%20accompany%20Systems%20Programming%20by%20John%20J.%20Donovan.pdf

Web links:

http://www.uotechnology.edu.iq/ce/Lectures/Dr-Shaima-Sys-Prog/lec1-2-3-4.pdf

MOOCs:

https://onlinecourses.nptel.ac.in/noc19_cs01/unit?unit=6&lesson=32

Pedagogy:

- Power Point Presentation
- White-board / Pen
- Two Teacher method

Assessment Scheme:

Class Continuous Assessment (CCA)- 50 Marks

Assignment	Midterm	Active Learning	Tutorial	MCQ/ Active learning	Attendance
20% 10Mks	30% 15Mks	20% 10 Mks	-	20% 10Mks	10% 5 Mks

Laboratory Continuous Assessment (LCA)-50 Marks

Practical	Oral based on practical	Attendance	Mini Project	Problem based Learning	Any other (Mock Practical)
60% 30Mks(20)	-	10% 5 Mks	-	-	30% 15Mks

Term End Examination: 50 Marks (100% weightage)

Syllabus:

Theory:-

Module No.	Contents	Hrs
1	**Introduction to System Software and Assembler Design** Need and Components of system software: Assembler, Compiler, Interpreter, Macro processor, Linker, Loader, debugger, text editor, Microservices and containers. Assembler: Elements of Assembler language programming, Machine dependent and machine independent assembler features, Design of 2 pass Assembler.	7
2	**Macros, Loaders and Linkers** Macro Processor: Macro Definition, macro expansion and nested macros. Loaders: Loader schemes: Types of loaders, direct linking loaders.Linkers: Relocation and linking concepts, self-relocating programs, Static and dynamic link libraries.	8
3	**Introduction to compilers** Passes, phases, symbol table. Lexical Analyzer: Role of LEX Analyzer, Specification of tokens, Recognition of tokens, input buffering. LEX: Specification and generation using LEX tool, Lexical errors.	7
4	**Syntax Analysis and Semantic Analysis** **Syntax Analysis:** RDP, Predictive parser, SLR, LR (1), LALR parsers, using ambiguous grammar, Error detection and recovery. **YACC**: automatic construction of parsers using YACC, Introduction to Semantic analysis, Intermediate code Generation, Code generation, Code optimization.	8

Laboratory Experiment List

Module No.	Contents
1	**Assembler Pass 1** Design suitable data structures and implement Pass 1 of 2 Pass Assembler for pseudo machine in JAVA.
2	**Assemble pass 2** Design suitable data structures and implement Pass 2 of 2 Pass Assembler for pseudo machine in JAVA.
3	**Macro pass 1** Design suitable data structures and implement Pass 1 of 2 Pass Macro processor.
4	**Macro Pass 2** Design suitable data structures and implement Pass 2 of 2 Pass Macro processor.
5	**Scanner For JAVA** Write a program using LEX specifications to implement lexical analysis phase of compiler to generate tokens of subset of Java program and create symbol table.

6	**Validation of compound statement/variable Declaration Statement** Write a program using LEX and YACC specifications to implement syntax analysis phase of compiler to validate compound statement and type and syntax of variable declaration in JAVA.
7	**Parser using YACC** Write a program using LEX and YACC to create Parser for sample language. (Design Calculator).
8	**Recursive Descent Parser** Implement Recursive Descent parser for sample language.

****

COURSES TRUCTURE

Course Code	CS332			
Course Category	Professional Core			
Course Title	Artificial Intelligence			
Teaching Scheme and Credits	L	T	Laboratory	Credits
Weekly load hrs.	3 Hrs/week	-----	2 Hrs/week	2+1= 3

Pre-requisites

- Mathematics
- Data Structure –I

Course Objectives:

1. To understand the concepts of Artificial Intelligence (AI)
2. To learn various peculiar search strategies for AI
3. To develop a mind to solve real world problems unconventionally with optimality

Course Outcomes:

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

1. Identify and apply suitable Intelligent agents for various AI applications
2. Design smart system using different informed search / uninformed search or heuristic approaches.
3. Identify knowledge associated and represent it by ontological engineering to plan a strategy to solve given problem.

Course Contents:

1. Introduction
2. Knowledge Representation and Planning
3. Knowledge Inference and Expert System
4. Advanced topics and Applications of AI

Laboratory Exercises / Practical:

1. Solve 8-puzzle /15-puzzle problem using A* algorithm
2. Implement Tic-Tac-Toe using Minimax algorithm
3. Implementation of Constraint Satisfaction Problem
4. Implementation of Unification algorithm
5. Assignment on Mini Expert System or Artificial Neural Network (ANN)
6. Mini Project

Learning Resources:

Text Books:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson, Education, 2003.
2. E. Rich and K. Knight, Artificial Intelligence, Tata McGraw Hill, 1992.
3. Carl Townsend, Introduction to Turbo Prolog, BPB Publications, 1988.

Reference Books:

1. Ethem Alpaydin, Introduction to Machine Learning, PHI, 2013
2. Santanu Patttanayak, Intelligent Projects using Python, Packt Publications

Supplementary Reading:

Web Resources:

https://www.cse.iitk.ac.in/users/cs365/2016/
https://www.khanacademy.org/computing/computer-science/
https://www.hackerrank.com/contests

Weblinks:

www.nptel.ac.in/course.php,
https://videoken.com,
https://www.tutorialspoint.com

MOOCs: https://www.edx.org/course/artificial-intelligence-ai-columbiax-csmm-101x-0

Pedagogy:

- PPT presentations.
- White board teaching.
- Few video lecturers (ex. NPTEL AI lecture Videos)

Assessment Scheme:

Class Continuous Assessment (CCA): 50 marks

Assignments	Mid-term	Presentations	Case study	MCQ	Oral	Attendance
30%	30%	-	-	30%	-	10%

Laboratory Continuous Assessment (LCA): 50 marks

Practical	Oral based on practical	Site Visit	Mini Project	Problem based Learning	Practical Exam.
50 %	-	-	20 %	-	30 %

Term End Examination: 50 Marks (100% weightage)

Syllabus:

Module No.	Contents	Hrs.
1	**Introduction to Artificial Intelligence and Search Strategies** History and Introduction to AI, Intelligent Agent, Types of agents, Environment and types, Typical AI problems Search Strategies: Problem solving and formulating a problem, State Space Search - Uninformed and Informed Search Techniques, Heuristic function, A*, AO* algorithm, Hill climbing, Constraint satisfaction method Game Playing: Minimax algorithm, alpha beta cut offs	7
2	**Knowledge Representation and Planning** Propositional logic and predicate logic, Knowledge Representation structure such as frame, Conceptual dependencies, Semantic networks and script, Resolution in predicate logic, Unification algorithm, Forward and Backward chaining, Planning: Forward and Backward planning, Goal Stack Planning, Hierarchical Planning.	8
3	**Knowledge Inference and Expert System** Basics of Probability, Markov Model, Statistical reasoning, Bayes' Theorem and its use, Bayesian learning and network. Expert systems: Architecture of Expert system, Role of Expert system, Inference engine, Knowledge acquisition, Typical Expert systems- MYCIN, Expert systems shells, Applications of Expert systems.	7
4	**Advanced topics and Applications of AI** Applications of AI, Artificial Neural Network, Deep learning, Fuzzy logic, Natural Language Processing, Introduction to Machine Learning, Introduction to Robotics and Computer Vision, Applications of AI in Business.	8

Laboratory:

Sr. No.	Contents
1	Write a program to solve 8-puzzle /15-puzzle problem using A* algorithm
2	Write a program to implement Tic-Tac-Toe using Minimax algorithm
3	Write a program to solve Constraint Satisfaction problem like i) SEND+MORE=MONEY ii) CROSS+ROADS=DANGER
4	Write a program to implement Unification algorithm
5	Write a program to build simple artificial neural network / Write a program to develop mini-expert system using Prolog
6	Mini Project

****

COURSE STRUCTURE

Course Code	**CSP31A**			
Course Category	**Professional Elective 1**			
Course Title	**Big Data Analytics**			
Teaching Scheme and Credits	**L**	**T**	**Laboratory**	**Credits**
Weekly load hrs	**3**	**-**	**2**	**2+1=3**

Pre-requisites:

- **Data Warehousing and Data Mining**

Course Objectives:

1. Understand the various aspects of Big Data.
2. Learn the concepts of NoSQL for Big Data.
3. Design an application for distributed systems on Big Data.
4. Explore the various Big Data visualization tools.

Course Outcomes:

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

1. Apply the insights of Big Data in business applications.
2. Illustrate the application of MongoDb in real world applications.
3. Build hadoop based distributed systems for real world problem.
4. Apply and utilize big data visualization tools for real world applications.

Course Contents:

1. Introduction to Big Data.
2. NoSQL databases for Big Data.
3. Technologies and tools for Big Data.
4. Big Data visualization techniques.

Laboratory Exercises/Practicals:

1. Create a database using MongoDB and implement the CRUD operations.
2. Execute at least 10 queries on any suitable MongoDB database to demonstrate various query criteria.
3. Perform database connectivity with MongoDb as backend and any front end from PHP/python/Java for a suitable application domain.
4. Install MapReduce in Hadoop and perform analysis of performance gain.
5. Implement MapReduce in Hadoop and perform file handling in HDFS for any domain such as agriculture / healthcare / e-commerce.
6. For suitable datasets of any application domain demonstrate Big Data analytics using D3.js or any other big data visualization tool.
7. Mini Project: Design and implement any distributed (hadoop) database application for Big Data using PHP/python/Java as front end and MongoDB as back end.

Learning Resources:

Text Books:

1. G. Sudha Sadhasivam, Thirumahal Rajkumar. Big Data Analytics. Oxford University Press
2. Kevin Roebuck. Storing and Managing Big Data - NoSQL, HADOOP and More, Emereopty Limited, ISBN: 1743045743, 9781743045749
3. Kristina Chodorow, Michael Dirolf. MongoDB: The Definitive Guide, O'Reilly Publications, ISBN: 978-1-449-34468-9

Reference Books:

1. David Dietrich, Barry Hiller. Data Science and Big Data Analytics, 6th edition, EMC education services, Wiley publications, 2015, ISBN0-07-120413-X
2. Maheshwari Anil, Rakshit, Acharya. Data Analytics, McGraw Hill, ISBN: 789353160258.
3. Carlo Vercellis. Business Intelligence - Data Mining and Optimization for Decision Making. Wiley Publications. ISBN: 9780470753866.

Supplementary Reading:

1. Evgeniy Yurevich Gorodov, Vasiliy Vasilevich Gubarev. Analytical Review of Data Visualization Methods in Application to Big Data. Journal of Electrical and Computer Engineering. Volume 2013, DOI http://dx.doi.org/10.1155/2013/969458
2. Michael Berthold, David J. Hand. Intelligent Data Analysis. Springer, 2007. DOI 10.1007/978-3-540-48625-1
3. Jay Liebowitz. Big Data and Business Analytics. Auerbach Publications, CRC press (2013) ISBN 9781466565784 - CAT# K16118

Web Resources:

1. https://www.rug.nl/research/portal/files/49574299/Big_data_for_development.pdf
2. https://swayam.gov.in/nd2_arp19_ap60/
3. https://hadoop.apache.org/

Weblinks:

1. https://www.qubole.com/big-data-analytics/
2. https://www.sas.com/en_in/insights/analytics/big-data-analytics.html

Pedagogy:

- Power point presentation
- Two teacher method
- Video lectures
- Flipped classroom activity
- Group discussion

Assessment Scheme:

Class Continuous Assessment (CCA)-50 marks

Theory assignments	Test (Mid term)	Active learning	MCQ	Attendance
20%	30%	10%	30%	10%
10marks	15 marks	5 marks	15 marks	5 marks

Laboratory Continuous Assessment (LCA) - 50 marks

Laboratory assignments	Mini Project	Practical exam	Attendance
40%	10%	40%	10%
20 marks	5 marks	20 marks	5 marks

End Term Examination: 50 marks (100% weightage)

Theory syllabus:

Module No.	Contents	Hrs
1	**Introduction to Big Data:** What is Big Data, overview of Big Data Analytics, traditional database systems vs big data systems, 5 V's of Big Data, importance of Big Data and real world challenges. Architecture of Big Data systems, Big Data applications, Data Analytics Life Cycle.	7
2	**NoSQL databases for Big Data:** Types of databases, structured versus unstructured data, NoSQL movement and concept of NoSQL database, comparative study of SQL and NoSQL, Types and examples of NoSQL database- key value store, document store, columnar databases, graph databases. Characteristics of NoSQL, NoSQL data modeling, advantages of NoSQL, CAP theorem, BASE properties, Sharding – characteristics, advantages, types.NoSQL using MongoDB - mongoDB shell, data types, CRUD operations, querying, aggregation framework operators, indexing.	8
3	**Technologies and tools for Big Data:** Distributed Processing Frameworks - Big Data use cases, Map Reduce, Apache Hadoop. The Hadoop Ecosystem - PIG, HIVE, HBase. Overview of - Apache Spark Ecosystem. Case study: Google Analytics /Twitter Analytics.	7
4	**Big Data Visualization Techniques:** Introduction to Big Data visualization, challenges in Big Data visualization, analytical techniques used in Big Data visualization, Big Data visualization approaches and methods, introduction to D3.js Big Data visualization tool. Case study: Google Analytics /Twitter Analytics.	8

Laboratory:-

No.	Contents	Work load (Hrs)
1	Create a sample database using MongoDB and implement the CRUD operations.	2
2	Execute any 10 queries on suitable sample MongoDB database to demonstrate various query criteria.	2

3	Perform database connectivity with MongoDb as backend and any front end from PHP/python/Java for a suitable application domain.	2
4	Install MapReduce in Hadoop and perform analysis of performance gain.	2
5	Implement MapReduce in Hadoop and perform file handling in HDFS for any domain such as agriculture / healthcare / e-commerce	2
6	For suitable datasets of any application domain demonstrate big data analytics using D3.js or any other big data visualization tool.	2
7	Mini Project: Design and implement any distributed (hadoop) database application for Big Data using PHP/python/Java as front end and MongoDB as backend. Demonstrate database operations and illustrate visualization using suitable tools.	2

****

COURSE STRUCTURE

Course Code	**CSP33A**			
Course Category	**Professional Elective -I**			
Course Title	**Wireless and Mobile Security**			
Teaching Scheme and Credits	**L**	**T**	**Laboratory**	**Credits**
Weekly load hrs	**3**	**-**	**2**	**2+1**

Pre-requisites:

- Basics of Computer Networks,
- Basics of Information Security

Course Objectives:

1. To understand wireless networks technologies and applications
2. To study Ad-Hoc wireless networks architecture and challenges
3. To know Sensor networks architecture and applications.
4. To understand basic security needs and issues in wireless networks

Course Outcomes: After completion of this course students will be able to

1. Compare different wired and wireless technologies
2. Examine impact of traffic simulation in wireless and ad-hoc networks
3. Organize the issues while implementing wireless sensor networks applications
4. Analyze difference in security arrangement for wired and wireless networks

Course Contents:

1. Introduction Wireless Networks
2. Ad-Hoc Wireless Networks
3. Wireless Sensor Networks
4. Security in Wireless Networks

Learning Resources:

Text Books:

1. C. Siva Ram Murthy, B.S. Manoj, "Adhoc Wireless Networks Architectures and Protocols", PHI, ISBN - 9788131706885, 2007.

Reference Books:

1. KiaMakki, Peter Reiher, "Mobile and Wireless Network Security and Privacy ", Springer, ISBN 978-0-387-71057-0, 2007.
2. NoureddineBoudriga, "Security of Mobile Communications", ISBN 9780849379413, 2010.
3. Kitsos, Paris; Zhang, Yan , "RFID Security Techniques, Protocols and System-On-Chip Design", ISBN 978-0-387-76481-8, 2008.
4. Johny Cache, Joshua Wright and Vincent Liu," Hacking Wireless Exposed: Wireless Security Secrets & Solutions ", second edition, McGraw Hill, ISBN: 978-0-07-166662-6, 2010

Supplementary Reading:

Web Resources:

http://whatis.techtarget.com/definition/mobile-security
http://techgenix.com/security/mobile-wireless-security/

Weblinks:

https://en.wikipedia.org/wiki/Mobile_security

MOOCs:
1. https://www.ntnu.edu/studies/courses/TTM4137#tab=omEmnet
2. http://nptel.ac.in/courses/106105160/37
3. https://www.eccouncil.org/
4. https://www.csoonline.com/article/2122635/mobile-security/wireless-security--the-basics.html

Pedagogy:
Power Point Presentation, White-board / Pen, Demos of Security tools, Online Quizes, Video Clips, Oral Questions and Answers.

Assessment Scheme:

Assessment Marks (150 Marks)			
CCA	LCA	ETT	Total
50	50	50	150

Class Continuous Assessment (CCA)- 50 Marks

Assignments	Mid Term	Tutorial	MCQ	Attendance	Total
30%	30%	-	30%	10%	100%

Laboratory Continuous Assessment (LCA)-50 Marks

Practical Demonstration	Journal Submission	Understanding (Orals)	Attendance	Total
30%	30%	30%	10%	100%

Term End Examination: 50 Marks

Theory Syllabus

Module No.	Contents	Hrs
Unit 1	**Introduction Wireless Networks** Introduction to Wireless LAN, PAN, MAN, WAN- Technical issues, Network Architecture, Advantages. Overview of IEEE 802.11, 802.15, 802.16- Architecture, Features and applications. Mac protocols- CSMA-CA, Hidden station and exposed station problems. Mobile cellular networks - Generations overview, features and applications. Cellular architecture system, Handoffs and Handover.	08
Unit 2	**Ad-Hoc Wireless Networks** Ad-Hoc Wireless Networks: Properties and Challenges, Applications and Issues in MAC design in Ad-Hoc wireless networks, Design Goals of MAC. Routing design issues in Ad-Hoc networks. Classifications of Routing protocols, AODV and DSR protocol.	07

Unit 3	**Wireless Sensor Networks** Introduction, Applications, Challenges in design issues in sensor networks, Architecture of sensor networks, Overview of Data Dissemination techniques, Introduction to Data Gathering techniques. Overview of Positioning, Localization and Synchronization in Sensor networks.	07
Unit 4	**Security in Wireless Networks** Security in Ad Hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks and other attacks, Key Management in Adhoc Wireless Networks, Requirements of a Secure Routing Protocol for Ad Hoc Wireless Networks, Android Security architecture. Overview of WiFi security, Access Point security.	08

Laboratory

No.	Contents (Any six Laboratories)	Hrs
1	Install and Configure Network Simulator tool such as Network Simulator 2 or NetSim or QualNet and study its components and eco system.	**2**
2	Write a program to simulate two node wireless network. You may use NetSim or NS2 or QualNet for this experiment.	**2**
3	Write a program to simulate routing in mobile Ad-Hoc network with multiple nodes. You may use NetSim or NS2 or QualNet for this experiment.	**2**
4	Study the security permissions for applications in android phones. Either demonstrate Android security permission configurations or Write the android app to demonstrate permissions usage control in android phones.	**2**
5	Write an android program to encrypt and decrypt text file. Use Bouncy castle library API or Java cryptography API.	**2**
6	Write a program for user authentication application in Java or Python. Send OTP (one time passwords) to your mobile phones from this application and validate that OTP. It should tell of OTP is correct or wrong. Also add timing restriction in the application.	**2**
7	Configure access point and manage the access control for security. Access point is a networking hardware device that allows a Wi-Fi device to connect to a wired network.	**2**
8	Study, comparison and configuration of different types of Access points routers such CISCO, TP Link, DLink, Link Sys, NetGear. Study Technical specification of such a Wi-Fi routers.	**2**
9	Install, Configure and Demonstrate any one Wi-Fi traffic analyzer using sniffing tools such as WireShark, airCrack, AirSnort, etc.	**2**
10	Write a program to simulate wormhole/blackhole attack in mobile adhoc network. You may use NetSim or NS2 or QualNet for this experiment	**2**

****

COURSE STRUCTURE

Course Code	**CSO33A**			
Course Category	**Open Elective -1**			
Course Title	**Bioinformatics**			
Teaching Scheme and Credits	**L**	**T**	**Laboratory**	**Credits**
Weekly load hrs	**3**	**-**	**--**	**2**

Pre-requisites:

- **Introductory knowledge of Biology/Science subject.**

Course Objectives:

1. To introduce students to the importance, opportunities and challenges of Bioinformatics.
2. To impart the understanding of databases of Bioinformatics.
3. To learn and demonstrate tools of Bioinformatics.
4. To provide the opportunity to think, apply the tools and methods used in the course to solve real-time problems.

Course Outcomes:

After completion of the course the students will be able:

1. To explain the importance, opportunities and challenges of Bioinformatics.
2. To describe the understanding of databases of Bioinformatics.
3. To demonstrate tools of Bioinformatics like BLAST, FASTA, etc. to access various sequences for study.
4. To think, apply the tools and methods used in the course to solve real-time problems.

Course Contents:

1. Introduction to BioInformatics.
2. Various databases of Bioinformatics.
3. Tools for pattern matching/ sequence alignment.
4. Application of BioInformatics

Learning Resources:

Text Books:

1. Bioinformatics: Methods and Applications- Rastogi S. C., N. Mendiratta., P Rastogi.
2. Bioinformatics: Databases, Tools, Algorithms, Bosu Oripta, Thukral S.K., Oxford Univ Press , New Delhi
3. Fundamentals of Bioinformatics by S. Harisha, I K International Delhi.

Reference Books:

1. Bioinformatics: sequence and genome analysis by David Mount, cold springer harbour press, 2004.
2. Introduction to bioinformatics – T.K. Attwood and Parry-Smith D.J.

Supplementary Reading:

Web Resources:

https://nptel.ac.in
https://nptel.ac.in/courses/102/106/102106065/

Weblinks:
https://www.genome.gov/25019999/understanding-bioinformatics-and-sequencing

MOOCs:
Introduction to Bioinformatics (Coursera)

Pedagogy:

- Power Point Presentation
- Two Teacher Method
- Video Lectures
- Flipped Classroom Activity
- Group Discussion
- Chalk and Board

Assessment Scheme:

Class Continuous Assessment (CCA)- 100 Marks

Assignments	Mid Term Exam	Poster Presentation	MCQs	Attendance
40%	15%	20%	15%	10%

Theory Syllabus:

Module No.	Contents	Hrs
1	**Introduction to Bioinformatics** Biology – Basic Concepts (Cell, DNA, RNA, etc.), History of BioInformatics, Importance, opportunities and challenges of Bioinformatics.	07
2	**Biological Databases** Primary sequence databases, Secondary sequence databases, Composite sequence databases, Structural (Protein) databases, Taxonomic Databases, Derived database	08
3	**Sequence Alignment** Concept: Homology vs Similarity, Similarity vs Identity. Introduction of sequence alignment- Local and Global alignments, Types of Sequence alignment - Pairwise and Multiple sequence alignment, Alignment algorithms, Scoring matrices, Statistical significance of sequence alignment. FASTA, BLAST, PAM and BLOSUM Matrices.	08
4	**Applications of Bioinformatics** Human Genome Project, ExPASY(a resource portal), Homology Modelling, Molecular docking, Drug discovery, Chemo-informatics, Health-informatics, Microarray Technology, Plasmid Mapping, Primer design, Use of Clustal-W for Phylogenetic analysis.	07

****

COURSE STRUCTURE

Course Code	**CSO33B**			
Course Category	**Open Elective -1**			
Course Title	**Python**			
Teaching Scheme and Credits	**L**	**T**	**Laboratory**	**Credits**
Weekly load hrs	**3**	**-**	**-**	**2**

Pre-requisites:

- **Introductory knowledge of a programming language.**

Course Objectives:

1. To introduce core programming basics using python programming language.
2. To gain an understanding of basic data types, control flow structure, looping, functions in python.
3. To understand a range of object oriented programming, as well as in depth data and information processing techniques.

Course Outcomes:

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

1. To apply the fundamentals of python programming for problem solving.
2. To design and implement interdisciplinary applications using python programming.
3. To analyze and apply the tools & methods to solve real time problems.

Course Contents:

1. Fundamentals of Python Programming.
2. Advanced data types in Python.
3. Functions, Modules & Packages in Python.
4. Tools for application development.

Learning Resources:

Text Books:

1. Python Programming Fundamentals, Springer, second edition, ISBN: 9781447166412

Reference Books:

1. Python Cookbook: Recipes for Mastering Python 3 by David Beazley, Brian K. J, Oreilly

Supplementary Reading:

Web Resources:

https://nptel.ac.in

Weblinks:

https://www.python.org
https://www.tutorialspoint.com

MOOCs:

Introduction to Python Programming (Coursera, udemy etc.)

Pedagogy:

- Power Point Presentation
- Video Lectures
- Flipped Classroom Activity
- Group Discussion

Assessment Scheme:

Class Continuous Assessment (CCA)- 100 Marks

Programming Assignments	Theory Assignments	Mid Term Test	MCQ	Attendance
30	10	15	35	10

Theory Syllabus:

Module No.	Contents	Hrs
1	**Fundamentals of Python Programming** Python Character Set, Keywords, Identifiers, Literals, Operators, Variables and Assignments, Input and Output in Python, Basic Data Types: int, float, complex, Strings. Program flow control: Conditional statement, Looping and Iteration, Range Functions	08
2	**Advanced data types in Python** List, Tuples, Dictionary, Set, Bool, Mutable and Immutable Data types.	07
3	**Functions, Modules & Packages in Python** Built-in functions, User defined functions Modules & Packages: Built-in Modules, Importing Modules in Python Programs	08
4	**Object-Oriented Programming** Classes, Objects, Methods, Working with Instances, Inheritance. Error and Exceptions, File Operations.	07

****

COURSE STRUCTURE

Course Code	**CSO33C**			
Course Category	**Open Elective -1**			
Course Title	**Introduction to Machine Learning and Applications**			
Teaching Scheme and Credits	**L**	**T**	**Laboratory**	**Credits**
Weekly load hrs	**3**	**-**	**-**	**2**

Pre-requisites:

- Linear Algebra
- Probability Theory

Course Objectives:

1. Learn Data preparation techniques for Machine Learning
2. Understand nature of the problem and apply machine learning algorithm.
3. Understanding primitives and methods in Supervised Learning.
4. Understanding primitives and methods in Unsupervised Learning.

Course Outcomes:

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

1. Identify Machine Learning applications in real life.
2. Apply various Preprocessing methods to prepare data for ML applications
3. Design and Implement supervised learning methods for Machine learning
4. Design and Implement Unsupervised Learning Methods for Machine Learning

Course Contents:

1. Introduction to Machine Learning
2. Classification
3. Ensemble and Model Evaluation
4. Models based Clustering

Learning Resources:

Text Books:

1. Ethem Alpaydin: Introduction to Machine Learning, PHI 3rd Edition-2015.
2. Peter Flach: Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Cambridge University Press, Edition 2012.

Reference Books:

1. C. M. Bishop: Pattern Recognition and Machine Learning, Springer 1st Edition-2013.
2. Ian H Witten, Eibe Frank, Mark A Hall: Data Mining, Practical Machine Learning Tools and Techniques, Elsevier, 3rd Edition.

Supplementary Reading:

1. Aurelien Geron, " Hands-on Machine Learning with Scikit-learn and Tensor flow, O'Reilly Media

MOOCs:

- https://swayam.gov.in/nd1_noc20_cs29/preview
- https://swayam.gov.in/nd1_noc20_cs44/preview

Pedagogy:

- Power Point Presentation
- White-board / Pen
- Flipped Classroom
- Active Learning Methods

Assessment Scheme:

Class Continuous Assessment (CCA)- 100 Marks

Programming Assignments	Mid Term Exam	Mini Project	Assignments (Active Learning, Online Tests, Exercises)	Attendance
30%	15%	30%	20%	5%

Syllabus:

Theory:-

Module No.	Contents	Hrs
1	**Introduction:** What is Machine Learning, Applications of Machine Learning, Need of Machine Learning, Machine Learning Vs Artificial Intelligence Vs Deep Learning, Types of Learning: Supervised, Unsupervised and Semi-Supervised Learning. Modern Tools for Machine Learning. **Data Preparation-**Imputer, Encoders, Feature Engineering, feature selection, dimensionality reduction-PCA	7
2	**Classification:** **Regression Analysis**: Linear Regression, Multiple Regression. **Distance Based Models:** Nearest Neighbor Classification **Tree Based Models:** Decision Trees **Probabilistic Model:** Naïve Bayes Classifier **News Classification Case Study**	8

3	**Ensemble classifiers,** Bagging and Boosting, **Training** versus Testing Samples, Positive and Negative Class, **Confusion Matrix for Model Evaluation,** Model Selection, Implementation and Evaluation using Scikit-learn library.	7
4	**Un-supervised learning techniques** Distance based clustering algorithms - K-means Clustering, Hierarchical clustering, K-Medoids and density-based clustering, Measures of quality of clustering. Implementation using SK Learn	8

****

COURSE STRUCTURE

Course Code	**CSO33D**			
Course Category	**Open Elective -I**			
Course Title	**Data Science**			
Teaching Scheme and Credits	**L**	**T**	**Laboratory**	**Credits**
Weekly load hrs	**3**	**-**	**-**	**2**

Pre-requisites:

- Mathematics Linear Algebra
- C Programming

Course Objectives:

1. To know different types of data and use of python basic concept
2. To provide students with the basic concepts of probability and statistics theory
3. Understand various methods of data preparation and analysis
4. To know basic concepts as well as the importance of data visualization

Course Outcomes:

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

1. Understand different forms of data and basics of python for data science
2. Apply probability and statistics concepts to solve real life examples of data science
3. Analyze different data transformations and analytics techniques on given examples
4. Understand and apply various data visualization tools and technique with real time data

Course Contents

1. Introduction to Data Science
2. Statistics for Data Science
3. Data Preparation and Analysis
4. Data Visualization

Learning Resources:

Text Books:

1. Cathy O'Neil, Rachel Schutt, Doing Data Science, Straight Talk from The Frontline. O'Reilly, 2013
2. Applied Statistics And Probability For Engineers – By Douglas Montgomery

Reference Books:

1. Foundations of Data Science By Avrim Blum, John Hopcroft, and Ravindran Kannan
2. Ward, Grinstein Keim, Interactive Data Visualization: Foundations, Techniques, and Applications. Natick: A K Peters, Ltd.
3. Glenn J. Myatt, Making sense of Data: A practical Guide to Exploratory Data Analysis and Data Mining, John Wiley Publishers, 2007.

Supplementary Reading:

https://swayam.gov.in/nd1_noc19_cs60/preview

Web Resources:
https://nptel.ac.in/courses/106/106/106106179/

Weblinks:
https://www.youtube.com/watch?v=MiiANxRHSv4
https://www.youtube.com/watch?v=y8Etr3Tx6yE&list=PLyqSpQzTE6M_JcleDbrVyPnE0PixKs2JE&index=5

MOOCs:
https://intellipaat.com/data-scientist-course-training/

Pedagogy:

- Power Point Presentation
- Video Lectures
- Flipped Classroom Activity
- Group Discussion

Assessment Scheme:

Class Continuous Assessment (CCA)- 100 Marks

Theory Assignments / Online MOOC	Programming Assignments	Mini Project	MCQ	Mid Test	Attendance
30%	20%	20%	10%	15%	5%

Theory Syllabus:

Module No.	Contents	Hrs
1	Introduction to Data Science Data Science Fundamentals , Types of Data , Raw and Processed Data, Data Summarization, Correlation Matrix, Data Extraction, Data Wrangling, Data Science Life Cycle Python for Data Science: Variables, Data Types, Loops, Tuples, List, Dictionary, Strings, Functions, Exception Handling, Debugging, Modules: Pandas and Numpy.	07
2	Statistics for Data Science Basic Probability Concepts, Random Variables, Mean, Variance, Covariance, Covariance Matrix ,Normal Distribution, Standard Normal Distribution (Z Distribution) , Binomial Distribution, QQ Plot, Population and Samples, Central Limit Theorem, Confidence Interval, Applying statistical concepts in Python	08
3	Data Preparation and Analysis Data Preprocessing: Data cleaning, Data Transformation, Scaling, Binning, Feature Engineering, Data Imputation, Linear Regression, Logistic Regression, Clustering Techniques , Support Vector Machine, Python libraries for Data Preparation and analysis, Case Study	08

4	Data Visualization Introduction to data visualization , Data for data graphics, Human Perception and Information Processing , Data Transformation into sources of knowledge through visual representation , The evaluation of the quality of visualizations and info graphics Data Visualization tools: Python libraries for visualization, Tableau, Plotly ,Case Study	07

****

COURSE STRUCTURE

Course Code	**CSO33G**			
Course Category	**Open Elective -1**			
Course Title	**R Programming**			
Teaching Scheme and Credits	**L**	**T**	**Laboratory**	**Credits**
Weekly load hrs	**3**	**-**		**2**

Advisable to have knowledge of the following:

- Fundamentals of Computers
- Computer Programming terminologies

Course Objectives:

- To understand basics of use of the R
- To Prepare Structured Data into R from various sources
- To understand How and when to use control statements while programming in R
- To familiarize with the process on graphics plots for R

Course Outcomes:

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

- Make use of data types and operations among them in R programming.
- Analyze Data collected from various sources.
- Design and develop data visualization techniques using R Programming plots.

Course Contents

- Introduction
- Data Preparation using R
- Programming in R
- Data Visualisation Using R

Learning Resources:

Text Books:

1. Seema Acharya, "R Programming for Beginners", McGraw Hill Education publications, 2018

Reference Books:

1. Sandip Rakshit , "R PROGRAMMING FOR BEGINNERS", McGraw Hill Education publications, 2017, 9352604555

Web Resources:

E-book: R Programming

https://d1b10bmlvqabco.cloudfront.net/attach/ighbo26t3ua52t/igp9099yy4v10/igz7vp4w5su9/OReilly_HandsOn_Programming_with_R_2014.pdf

Web links:

https://data-flair.training/blogs/r-tutorials-home/

https://www.tutorialspoint.com

https://www.javatpoint.com

https://intellipaat.com/blog/tutorial/r-programming/

MOOCs:

https://www.coursera.org › ... › Computer Science › R Programming

Pedagogy:

- Power Point Presentation
- White-board / Pen

Assessment Scheme:

Class Continuous Assessment (CCA)-100 Marks

Assignments	Mid-Term	MCQ	Attendance	Unitwise Q/A
20% 20 Marks	15% 15 Marks	20% 20 Marks	5% 5 Marks	40 % 40 Marks

Syllabus:

Theory:

Unit	Contents	Hrs
1	**Introduction to R Programming** Installation, R Programming Language Introduction & Basics: Math Variables and Strings, String Operations in R, Vectors and Factors, Vector Operations, Data Structures in R : Arrays and Matrices, Lists, Data Frames, R Programming Fundamentals: Conditions and Loops, Functions in R	07
2	**Exploring Data Preparation in R** R Data Frame: Create, Append, Select, Subset, List in R: Create, Select Elements with , Example, R Sort a Data Frame using Order(), R Dplyr Tutorial: Data Manipulation(Join) & Cleaning(Spread), Merge Data Frames in R: Full and Partial Match	08
3	**Programming in R** apply(), lapply(), sapply(), tapply() Function in R with Examples,Working with Data in R: Reading CSV, Excel, and Built-in Datasets, Reading Text (.txt) files in R, Writing and Saving to files in R, How to Replace Missing Values(NA) in R: na.omit & na.rm, R Exporting Data to Excel, CSV, SAS, STATA, Text File, Correlation in R: Pearson & Spearman with Matrix Example, R Aggregate Function: Summarise & Group_by() Example, R Select(), Filter(), Arrange(), Pipeline with Example	08
4	**Data Visualization with R** Basic Visualization Tools: Bar Charts, Histograms, Pie Charts, Scatter Plots, Line Plots and Regression, Specialized Visualization Tools : Word Clouds ,Radar Charts, Waffle Charts, Box Plots, Creating Maps in R, How to build interactive web pages, Introduction to Shiny, Creating and Customizing Shiny Apps, Additional Shiny Features	07

****

COURSE STRUCTURE

Course Code	**CSO33H**			
Course Category	Open Elective -1			
Course Title	Computer Graphics and Multimedia Techniques			
Teaching Scheme and Credits	**L**	**T**	**Laboratory**	**Credits**
Weekly load hrs	**3**	**-**	**-**	**2**

Pre-requisites:

- Basic Mathematics, Geometry, Linear Algebra, Vectors and Matrices.
- Data Structures, Algorithms and Files.

Course Objectives:

- To learn basic primitives and various algorithms for generating graphical figures.
- To get familiar with mathematics behind graphical transformations and apply various techniques regarding projections.
- To understand various multimedia file formats.
- To learn animation and multimedia creation.

Course Outcomes:

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

1. Apply knowledge of mathematics, logic and data structures to design computer graphics.
2. Apply various transformations to graphical objects.
3. Differentiate various multimedia file formats.
4. Use open source tools for animation and multimedia creation.

Laboratory Exercises / Practical:

- Draw line, circle and arc using standard library functions
- Implementation of DDA / Bresenham's line drawing algorithms
- Implementation of Bresenham's / Mid-point Circle Drawing algorithms
- Implementation of 2-D Transformations
- Create a gif image for bouncing ball
- Create a simple animation using OpenGL
- Mini Project

Learning Resources:

Text Books:

1. Computer Graphics – Donald Hearn & M. Pauline Baker, Pearson Education.
2. Computer Graphics – A Programming Approach – Steven Harrington – 2nd Ed, McGraw Hill International Editions.
3. Gonzalez, Woods, "Digital Image Processing" Addison Wesley.

Reference Books:

1. J. Foley, V. Dam, S. Feiner, J. Hughes, — Computer Graphics Principles and Practice, 2nd Edition, Pearson Education, 2003, ISBN 81 – 7808 – 038 – 9.
2. D. Rogers, J. Adams, — Mathematical Elements for Computer Graphics, 2nd Edition, Tata McGraw Hill Publication, 2002, ISBN 0 – 07 – 048677 – 8.
3. F.S. Hill JR, “Computer Graphics Using Open GL”, Pearson Education.
4. Alan H. Watt and Mark Watt, "Advanced Animation and Rendering Techniques: Theory and Practice", Addison-Wesley, ACM Press, ISBN: 0201544121.

Supplementary Reading:

Web Resources:

- https://www.geeksforgeeks.org/getting-started-with-opengl/

Web links:

- http://nptel.ac.in/courses/106102065/
- https://nptel.ac.in/courses/117/105/117105083/

MOOCs:

- https://www.edx.org/learn/computer-graphics

Pedagogy:

- Presentation slides
- White-board / Pen
- Two Teacher Method
- Flipped Classroom

Assessment Scheme:

Class Continuous Assessment (CCA)-100 Marks

Assignment 1	Mini Project	Mid-Term	MCQ	Attendance	Total
30 %	30 %	15 %	15 %	10 %	100 %

Syllabus:

Module No.	Contents	Hrs
1	**Basic Concepts of Computer Graphics:** Applications of computer graphics, concept of pixel, frame buffer, resolution, Graphics file format, aspect ratio. **Line Drawing Algorithms:** Digital Differential Analyzer (DDA), Bresenham algorithm. **Circle Drawing Algorithm:** Bresenham / Midpoint Circle algorithm. a) Write C/C++ program to draw line and basic geometric shapes using standard library functions. b) Write C/C++ program to draw line using DDA / Bresenham's line drawing algorithms. c) Write C/C++ program to draw circle using Bresenham's / Mid-point Circle Drawing algorithms.	07
2	**Transformations:** **2-D transformations:** Introduction, translation, scaling, shearing, rotation, homogeneous coordinates, Coordinate Transformations, composite transformations - Rotation about an arbitrary point and reflection about an arbitrary line/axis, other transformations. a) Write C/C++ program to perform following 2-D Transformations: 1. Scaling 2. Translation 3. Rotation 4. Reflection 5. Shearing	08
3	**Introduction To Multimedia:** **Text:** Text file formats: TXT, DOC, RTF, PDF **Image:** Basic Image fundamentals, Image File formats - (BMP, TIFF, JPEG, GIF) Image processing cycle- Image acquisition, storage, Communication and display, Image Enhancement, Image Compression: Types of Compression: Lossless & Lossy. **Audio file formats:** WAV, AIFF, AVI and MPEG. **Video file formats:** MOV, MPEG. a) Create a gif image for bouncing ball.	08
4	**Generating Multimedia:** **Animation:** Basics of animation, types of animation, principles of animation, Methods of controlling animation, frame-by-frame animation techniques, real-time animation techniques, Programming aspects in creating simple animation. a) Create a simple animation using OpenGL: i) Clock with pendulum or ii) Vehicle locomotion b) Mini Project: Animation using any open source tool.	07

****