DEPARTMENT OF COMPUTER SCIENCE

RATHINAM COLLEGE OF ARTS AND SCIENCE (AUTONOMOUS)

Rathinam Techzone, Pollachi Road, Eachanari,

Coimbatore – 641021

Syllabus for

M.Sc. Information Technology

(M.Sc. IT)

(I - IV Semester)

2021 – 2022 Batch onwards

Approved in the BOS Meeting Held on 30.04.2021

Vision and Mission of the Institution:

VISION

To emerge as a world-renowned Institution that is integrated with industry to impart Knowledge, Skills, Research Culture and Values in youngsters who can accelerate the overall development of India.

MISSION

To provide quality education at affordable cost, build academic and research excellence maintain eco-friendly and robust infrastructure, and to create a team of well qualified faculty who can build global competency and employability among the youth of India

MOTTO

Transform the youth into National Asset.

Vision and Mission of the Department:

Vision

To be renowned it as a reputed organization in education and research aimed towards industrial and societal needs

Mission

To provide quality education to meet the need of profession and society. Establish Industry Institute Interaction program to enhance the entrepreneurship skills.

Program Educational Objectives (PEO)

PEO1	:	To prepare the graduates as successful professionals ready for Industry, Government sectors, Academia, Research, Entrepreneurial Pursuit and Consultancy firms.
PEO2	:	Apply and continuously acquire knowledge, theoretical and applied, related to core areas of Information Technology.
PEO3	:	Demonstrate the ability to work effectively as a team member and/or leader in an ever-changing professional environment
PEO4	:	To prepare the graduates to adapt themselves for life-long learning through professional activities on latest technology and trends needed for a successful career
PEO5	:	To prepare graduates the ability to gain multidisciplinary knowledge through real-time projects and industry internship training and providing a sustainable competitive edge in R&D and meeting industry needs.

Mapping of Institute Mission to PEO

Institute Mission	PEO's
To provide quality education at affordable cost, build academic and research excellence maintain eco-friendly and robust infrastructure, and	PEO1, PEO2
To create a team of well qualified faculty who can build global competency and employability among the youth of India.	PEO2, PEO5

Mapping of Department Mission to PEO

Department Mission	PEO's
To provide quality education to meet the need of profession and society.	PE01, PE02
Establish Industry Institute Interaction program to enhance the entrepreneurship skills.	PEO3, PE04, PE05

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Program Outcomes (PO):

PO01	:	Acquire knowledge of Computing Fundamentals, Basic Mathematics, Computing Specialization, and Domain Knowledge of proper computing models from defined problems.
PO2	:	Apply Research based knowledge and methodologies to design, analyze and interpretation of data and find the solutions for complex problems by applying right tools
PO3	:	Capable of evaluating personal and professional choices in terms of codes of ethics and ethical theories and understanding the impact of their decisions on themselves, their professions, and on society.
PO4	:	Find out right opportunity for entrepreneurship and create and add value for the betterment of an individual and society at large
PO5	:	Function effectively as a team member or a leader to accomplish a common goal in a multidisciplinary team
PO6	:	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
PO7	:	Engage in independent and life-long learning for continuous professional development.
PO8	:	Confidence for self and continuous learning to improve knowledge and competence as a computing professional
PO9	:	Identify, invent, research activities to provide solutions for complex computing problems using fundamental concepts of Mathematics, Computing Science and Relevant Domains

Program Specific Outcomes (PSO):

PSO1	:	All theoretical concepts are implemented in practical which make a student industry ready.
PSO2	:	Content of the course prepare a student for self entrepreneurship.
PSO3	:	The syllabi of the course are a good platform for higher level course in computer science.
PSO4	:	The course is designed to support automation and digitization in all walks of life.

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Correlation between the PO/PSO and the PEOs

Program Outcomes		PEO1	PEO2	PEO3	PEO4	PEO5
PO1	:	3	2	2	2	1
PO2	:	2	3	1	3	3
PO3	:	1	3	3	2	2
PO4	:	3	3	1	3	3
PO5	:	2	1	3	3	3
PO6	:	3	3	2	2	3
PO7	:	3	1	3	3	2
PO8	:	2	2	1	2	3
PO9	:	3	3	3	1	2
PSO1	:	3	2	2	2	1
PSO2	:	2	3	2	3	2
PSO3	:	2	2	3	3	2
PSO4	:	1	3	3	2	3

Components considered for Course Delivery is listed below:

1. Class room Lecture

2. Laboratory class and demo

3. Assignments

4. Mini Project

5. Project

6. Online Course

7. External Participation

8. Seminar

9. Internship

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Mapping of POs with Course Delivery:

Program Outcomes	Course Delivery								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
PO1	1	2	3	3	1	2	3	3	2
PO2	2	3	2	2	3	2	1	3	3
PO3	3	3	3	3	3	2	3	2	2
PO4	2	1	3	2	3	2	2	1	2
PO5	3	2	2	1	2	3	3	2	2
PO6	2	3	1	3	2	3	2	3	3
PO7	1	2	3	3	1	3	2	2	3
PO8	3	3	2	3	3	3	3	3	3
PO9	3	3	3	2	3	3	1	3	3
PSO1	3	2	2	3	1	2	2	2	3
PSO2	3	3	2	2	3	1	3	3	2
PSO3	3	2	3	3	2	2	3	1	2
PSO4	3	3	3	1	3	3	2	3	3

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M.Sc. Information Technology Curriculum Structure – Regulation - 2021
(For the students admitted in the Batch during 2021onwards)

S.No	Sem	Part	Type	Subject	Credit	Hour	Int	Ext	Total
1	1	III	Theory	Core– I	4	5	50	50	100
2	1	III	Theory	Core– II	4	5	50	50	100
3	1	III	Theory	Core– III	4	5	50	50	100
4	1	III	Theory	Core– IV	4	5	50	50	100
5	1	III	Practical	Core Practical – I	4	5	50	50	100
6	1	III	Practical	Core Practical – II	4	5	50	50	100
7		ALC1		ALC	2				100
8		ALC2		ALC	2				100
					28	30			
1	2	III	Theory	Core– V	4	5	50	50	100
2	2	III	Theory	Core– VI	4	4	50	50	100
3	2	III	Theory	Core– VII	4	4	50	50	100
4	2	III	Theory	Core– VIII	4	5	50	50	100
5	2	III	Practical	Core Practical – III	4	4	50	50	100
6	2	III	Practical	Core Practical – IV	4	4	50	50	100
7	2	III	Practical	Core Practical – V	4	4	50	50	100
8		ALC3		ALC	2				100
9		ALC4		ALC	2				100
					32	30			
1	3	III	Theory	Core– IX	4	5	50	50	100
2	3	III	Theory	Core– X	4	5	50	50	100
3	3	III	Theory	Core– XI	4	4	50	50	100
4	3	III	Theory	Elective - I	4	4	50	50	100
5	3	III	Theory	Elective - II	4	4	50	50	100
6	3	III	Practical	Core Practical – V	4	4	50	50	100
7	3	III	Practical	Core Practical VI	4	4	40	60	100
8		ALC 5		ALC	2		40	60	100
9	3	III	Practical	Core Practical – VII – Industrial Training Report	2	-	50	-	50
					32	30			

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1	4	III	Theory	Core– XII	4	5	50	50	100
2	5	III	Theory	Core– XIII	4	5	50	50	100
3	4	III	Theory	Elective- III	4	5	50	50	100
4	4	III	Project	Core Project	8	15	100	100	200
					112	**120**	**1300**	**1250**	**3050**

Core				
S.No	**Course Code**	**Course**	**Pre-requesite**	**Offering Department**
		Pro-Python Programming		
		Data Structures and Algorithms		
		Python Programming & Algorithms Lab		
		Shell Programming		
		Modern Operating System		
		Shell Programming & OS Lab		
		Web Application Hackers		
		Web Applications Lab		
		Advanced Database System		
		Database Lab		
		Research Methodology		
		Advanced Computer Network		
		Computer Network Lab		
		Internet of Things		
		Big Data Analytics		
		Data Analytics Lab		
		Cryptography & Network Security		
		Network Security Lab		
		Soft Computing		
		Block Chain Technology		

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Elective	Subject Name
Elective – I	Distributed Networks
	Social Network Analytics
	Computer Graphics and Multimedia
	Software Testing
	Cloud Management and Security
Elective – II	Wireless Network Security
	Streaming Analytics
	3D Animation Essentials
	Tools for Software Testing
	Deploying and Managing a Cloud Infrastructure
Elective – III	VMware Network Virtualization
	Business Intelligence and Data Analytics
	Virtual Reality
	Agile Testing
	Hybrid Cloud

ADVANCED LEARNER COURSE:

ALC	COURSE
ALC1	Data Visualization Tools
ALC2	Data Mining Tools
ALC3	Ethical Hacking
ALC4	Cloud Computing
ALC5	Software Quality Assurance

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SYLLABUS

SEMESTER - I

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Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Core– I – Pro-Python Programming	4	5	5	0	Theory

Introduction:

To provide an introduction to Python. The course will discuss topics necessary for the participant to be able to create and execute Python programs. The lectures and presentations are designed to provide knowledge and experiences to students that serve as a foundation for continued learning of presented areas.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To acquire programming skills in core Python.
CO2	:	To acquire Object Oriented Skills in Python
CO3	:	To be able to read data from a text file using Python
CO4	:	Discover the need for working with the Documentation and Utilities
CO5	:	Plot data using appropriate Python visualization libraries

Unit I: [12 Periods]

Principles and Philosophy – The Zen of Python – Advanced Basics – General Concepts – Control Flow – Iteration – Collections – Importing Code – Functions – Arguments – Decorators – Function Anntations – Generators – Lambdas – Introspection – Exciting Python extensions: Statistics.

Unit II: [12 Periods]

Classes - Inheritance – How Classes are Created – Attributes – Methods – Magic Methods –
Exciting Python extensions: Iterators – Common Protocols – Basic Operations – Numbers – Iterables – Sequences – Mappings – Callables – Context Managers – Exciting Python Extensions: Scrapy.

Unit III: [12 Periods]

Object Management – Namespace Dictionary – Garbage Collection – Pickling – Copying – Exciting Python Extensions: Beautiful Soup – Strings – Bytes – Text – Simple Substitution – Formatting – Exciting Python Extensions: Feedparser.

Unit IV: [12 Periods]

Documentation – Proper Naming – Docstrings – Documentation Outside the Code – Documentation Utilities – Exciting Python Extensions: NumPy – Testing – Test-Driven Development – Doctests – The Unittest Module – Providing a custom Test class.

Unit V: [12 Periods]

Distribution – Licensing – Packaging – Exciting Python Extensions: Secrets Module – Sheets: A CSV Framework – Building a Declarative Framework – Building the Framework – Ordering Fields – Building a Field Library – Getting Back to CSV.

Textbook:

1. J.Burton Browning, Marty Alchin,"Pro Python 3 – Features and Tools for Professional Development", Third Edition, Apress (2019).

Reference Books:

1. Jonathan Yates, "Python Programming Practical Python Programming for Beginners and Experts", (2017).
2. Adam Stewart, "Python Programming Python Programming for Beginners", (2016).
3. Allen B. Downey- ``Think Python: How to Think Like a Computer Scientist ''- 2nd edition- Updated for Python 3- Shroff/O 'Reilly Publishers, (2016).
4. Shroff "Learning Python: Powerful Object-Oriented Programming; Fifth edition, (2013).
5. David M. Baezly "Python Cookbook" O'Reilly Media; Third edition (2013).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	2	3			3		1		1	1	1		
CO2		3	1	3				1	2		2	3	2
CO3	2	2			1	1		2	1		2	2	
CO4	1	3	2		1		3	1		2	3		2
CO5	3			2	3			3	3			1	3

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Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Core–II – Data Structures and Algorithms	4	5	5	0	Theory

Introduction:

To impart the basic concepts of data structures and algorithms and searching and sorting techniques. To understand basic concepts about stacks, queues, lists, trees and graphs. The writing algorithms and step by step approach in solving problems with the help of fundamental data structures

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To analyze algorithms and an algorithm correctness
CO2	:	To describe queue operation and Heaps & Binary Heaps.
CO3	:	To summarize searching and sorting techniques
CO4	:	To have knowledge of symbol tables and Hashing
CO5	:	To know about the greedy Algorithm and Dynamic Strategy

Unit I: [12 Periods]

Introduction – What is an Algorithm – What is Rate of Growth – Asymptotic Notation – Recursion and Backtracking – What is Recursion – What is Backtracking – Linked Lists – Linked Lists ADT-Stacks – How stacks are used.

Unit II: [12 Periods]

Queues – What is a Queue – Trees – What is a Tree – Priority Queues and Heaps – What is a Priority Queue – Heaps and Binary Heaps – Disjoint Sets ADT – Introduction –Equivalence Relations and Equivalence Classes.

Unit III: [12 Periods]

Graph Algorithms – Introduction – Applications of Graphs – Sorting – What is Sorting – Comparison of Sorting Algorithms – Searching – What is Searching – Selection Algorithms.

Unit IV: [12 Periods]

Symbol Tables Introduction – What are Symbol Tables – Hashing – What is Hashing – Hash Table – String Algorithms – Introduction– String Matching Algorithms – Algorithms Design Techniques

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Unit V: [12 Periods]

Greedy Algorithms – Introduction – Greedy Strategy – Divide and Conquer Algorithms – Dynamic Programming – What is Dynamic programming Strategy – Complexity Classes – Polynomial / Exponential.

Textbook:
1. Narasimha Karumanchi, "Data Structures and Algorithmic Thinking with Python", CareerMonk Publications, (2016).

Reference Books:
1. Ellis Horowitz,Sartaj Sahniand Anderson, "Fundamentals of Data Structure in C, University Press, Second Edition,(2008).
2. T.H.Cormen, CharlesE. Leiserson, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms, PHI Learning, Third Edition,(2009).
3. G. A. V. Pai, "Data Structures and Algorithms", TMH, (2010).
4. Sarnanta, "Classic Data Structures", Debasis, Second Edition, PHI,(2009).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1		3			3	3	2		1	1	2		
CO2	1	2	1					2			2		2
CO3	3			1	2	2			1	2		3	
CO4	2	2	3		1		3	2	3		3	2	2
CO5				2	3		1		2	3		1	3

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Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Core– III – Shell Programming	**4**	**5**	**5**	**0**	**Theory**

Introduction:
To give students knowledge about File systems and use of basic Commands and Shell programming

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	Understanding the basic set of commands and utilities in Linux/UNIX systems.
CO2	:	To learn to develop software for Linux/UNIX systems.
CO3	:	To learn the important Linux/UNIX library functions and system calls
CO4	:	To obtain a foundation for an advanced course in operating systems
CO5	:	To understand the concept of web processing and file systems in linux.

Unit I: [12 Periods]
Introduction - Displaying in the terminal - Using with variables and environment variables - Playing with file descriptors and redirection - Arrays and associative arrays - Visiting aliases - Grabbing information about the terminal - Debugging the Script - Functions and arguments - Reading n characters without pressing the return key - Concatenating with cat - Recording and playing back of terminal sessions - Playing with xargs - Translating with tr - Checksum and verification - Cryptographic tools and hashes - Sorting unique and duplicates - Splitting files and data - Slicing filenames based on extension - Renaming and moving files in bulk - Spell checking and dictionary manipulation - Automating interactive input - Making commands quicker by running parallel processes.

Unit-II: [12 Periods]
Generating files of any size - Making files immutable - Generating blank files in bulk - Finding symbolic links and their targets - Enumerating file type statistics - Using loopback files - Creating ISO files and hybrid ISO - Listing only directories – alternative methods - Fast command-line navigation using pushd and popd - Printing the directory tree – Manipulating video and image files - Texting and Driving – Using regular expressions - Searching and mining a text inside a file with grep - Cutting a file column-wise with cut - Using sed to perform text replacement - Using awk for advanced text processing - Printing text between line numbers or patterns - Printing lines in the reverse order - Parsing e-mail addresses and URLs from a text - Text slicing and parameter operations.

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Unit-III: [12 Periods]

Downloading from a web page - Downloading a web page as plain text - A primer on cURL-
Accessing unread Gmail e-mails from the command line - Parsing data from a website - Image
crawler and downloader - Posting to a web page and reading response - Summarizing text with OTS
- Creating a new git repository - Cloning a remote git repository - Creating and merging branches
with git - Pushing a branch to a server - Checking the status of a git repository - Viewing git history
- Finding bugs - Tagging snapshots - Committing message ethics - Using fossil - Opening a fossil
project - sharing your work with fossil - Updating your local fossil repository- viewing fossil
history.

Unit-IV: [12 Periods]

Archiving with tar - Archiving with cpio - Compressing data with gzip - Archiving and
compressing with zip - Faster archiving with pbzip2 - Creating filesystems with compression -
Backup snapshots with rsync - Differential archives - Creating entire disk images using fsarchiver -
The Old-Boy Network - Let us ping - Tracing IP routes - Running commands on a remote host with
SSH - Connecting to a wireless network – Password-less auto-login with SSH – Port forwarding
using SSH – Mounting a remote drive at a local mount point - Network traffic and port analysis -
Measuring network bandwidth - Creating artbitrary sockets - Building a bridge - Sharing an
internet Connection – Basic firewall using iptables – Creating a virtual private network.

Unit-V: [12 Periods]

Gathering information about processes - Killing processes, sending and responding to signals -
sending messages to user terminals - The/Proc filesystem - gathering system information -
Scheduling with a cron - Databases styles and users - Writing and reading MySQL database from
Bash - Bulk image resizing and format conversion - Taking screenshots from the terminal -
Managing multiple terminals from one - Tracing the clues - Tracing packets with tcpdump -
Tracing network routes with ip - Tracing system calls with strace - Tracing dynamic library
functions with trace - tuning a Linux system.

Text Book:
1. Clif Flynt, ShantanuTushar, SarathLakshman "Linux Shell Scripting - Cookbook", Packt
   Publishing Ltd., Third Edition, (2017).

Reference Book:
1. Eric Foster Johnson, John C. Welch and Micah Anderson, "Beginning Shell
   Scripting",Wiley, (2005).
2. Carl Albing, JP Vossen and Cameron Newham, "Bash Cookbook", O'Reilly Media, (2007).
3. Richard Blum, "Linux Command Line and Shell Scripting Bible", Wiley, (2008).

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Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	3		1	3		3	1	3	1	3			3
CO2	3				1	2		2		2	3	2	
CO3	2					1	2	3	2		2		2
CO4	1	2	3	3			2		2	1		3	
CO5		3	2	1	3						1		

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Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Core–IV– Modern Operating System	4	5	5	0	Theory

Introduction:

To design and understand the following OS components: System calls, Schedulers, Memory management systems, Virtual Memory and Paging systems. To evaluate, and compare OS components through instrumentation for performance analysis.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To understand the fundamental concepts and techniques of Operating Systems.
CO2	:	To study the concepts in process management and concurrency control mechanisims
CO3	:	To understand the concepts in memory managements and deadlocks
CO4	:	To study on Virtualization and the Cloud
CO5	:	An ability to compare Various file Security with Interface design

Unit I: [12 Periods]

Introduction – What is an Operating System – History of Operating System – Computer Hardware Review – The Operating System – Operating System Concepts – System Calls – Operating System Structure – The World According to C – Processes and Threads – Interprocess Communication – Scheduling – Classical IPC Problems.

Unit II: [12 Periods]

Memory Management – No Memory Abstraction – A Memory Abstraction: Address Spaces – Virtual Memory –Page Replacement Algorithms – Design Issues for Paging Systems – Implementation Issues – Segmentation – File Systems – Files – Directories – File-System Implementations - File-System Management and Optimization.

Unit III: [12 Periods]

Input/Output – Principles of I/O Hardware – Principles of I/O Software – I/O Software Layers – Disks – Clocks – User Interfaces: keyboard, Mouse, Monitor – Thin Clients – Power Management – Deadlocks – Resources – Introduction to Deadlocks – The Ostrich Algorithm – Deadlock Detection and Recovery – Deadlock Avoidance – Deadlock Prevention – Other Issues.

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Unit IV: [12 Periods]

Virtualization and the Cloud – History – Requirements for Virtualization – Type1 and Type2 Hypervisors – Techniques for Efficient Virtualization – Are Hypervisors Microkernels done Right? – Memory Virtualization – I/O Virutalization – Virtual Appliances – Virtual Machines on Multicore CPUs – Licensing Issues – Clouds.

Unit V: [12 Periods]

Security –The Security Environment – Operating System Security – Case Study: Unix, Linux, Android and Window – Operating System Design – The Nature of the Design Problem – Interface Design – Implementation – Performance – Project Management – trends in Operating System Design.

Textbook:
1. Andrew S.Tanenbaum, "Modern Operating Systems", Fourth Edition, Pearson, (2015).

Reference Books:
1. Jonathan Levin, "Mac OS X and iOS Internals: To the Apple's Core", John Wiley & Sons,(2012).
2. MikeEbbers, JohnKettner, WayneO ̋Brien, BillOgden, "Introduction to the New Mainframe:OS Basics", International Business Machines Corporation, Third Edition, (2011).
3. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, "Operating System Concepts", Wiley,Eighth edition, (2008).
4. Abraham Silberstaz, Peter B Galvin, Greg Gagne, "Operating Systems", 7th edition, John Wiley, (2004).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	2	3		1		2		1		3			1
CO2	1		2		3	1	2		2		3	2	
CO3		1		3	2	3		2	1	1	2	1	1
CO4	2		1	2	1		1		3	2		3	3
CO5		2	3				3	2		3	1		2

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Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Core Practical – I – Python Programming & Algorithms Lab	4	0	0	5	Practical

1. a) To write a python program that takes in command line arguments as input and print the number of arguments.

b) To write a python program find the square root of a number (Newton's method)

2. a) To write a python program exponentiation (power of a number).

   b) To write a python program to compute the GCD of two numbers.

   c) To write a python program first n prime number.

3. a) To write a python program find the maximum of a list of numbers.

    b) To write a python program to perform Matrix Multiplication.

4. To write a python program to find the most frequent words in a text file.

5 a) To write a python program linear search.

   b) To write a python program Binary search

6. a) To write a python program selection sort.

    b) To write a python program Insertion sort.

7. To write a python program merge sort.

8. To write a python program simulate bouncing ball in Pygame.

9. a) To demonstrate working of classes and objects

   b) To demonstrate constructors

   c) To demonstrate class method and static method

10. a) Concept of polymorphism in python (method overloading and overriding)

     b) To demonstrate inheritance

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
CO1		2	1		1		3	2		3			2
CO2	2		2	3		2	1		3	2	1	1	
CO3			1		2	1	2		2		3		1
CO4	1	3		1		3		1		3	2	3	3
CO5	3	1		2	2			3	1			2	

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Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Core Practical – II – Shell Programming & OS Lab	4	0	0	5	Practical

1. Write programs using the following system calls of UNIX operating system: fork, exec, getpid, exit, wait, close, stat, opendir, readdir

2. Write programs using the I/O system calls of UNIX operating system (open, read, write, etc)

3. Write C programs to simulate UNIX commands like ls, grep, etc.

4. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for FCFS and SJF. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.

5. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for Priority and Round robin. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.

6. Developing Application using Inter Process communication (using shared memory, pipes or message queues)

7. Implement the Producer – Consumer problem using semaphores (using UNIX system calls).

8. Implement some memory management schemes – I

9. Implement some memory management schemes – II

10. Implement any file allocation technique (Linked, Indexed or Contiguous)

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
CO1	3	2				1	3		3	3			2
CO2			1	2		3	3	2		1	1	3	
CO3	2		3		3				3		2	2	3
CO4	1	2	2		2		1	3	1	3	3	1	
CO5	3	3		3	3	2				2			3

Approved in the BOS Meeting held on 30.04.2021

SEMESTER - II

Rathinam College of Arts & Science (Autonomous), Coimbatore-21.
Admitted in M.Sc. Information Technology from the academic year 2021 – 2022 Onwards

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Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Core– V – Web Application Hackers	4	5	5	0	Theory

Introduction:
It is a practical guide to discovering and exploiting security flaws in web applications. By "web applications" we mean those that are accessed using a web browser to communicate with a web server. To learn how to run port scans, attack firewalls, or break into servers in other ways. To know how to hack into a web application, steal sensitive data, and perform unauthorized actions.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To address the fundamental problem that all user input is untrusted.
CO2	:	To implemented within web applications the most mechanisms
CO3	:	To advanced exploitation techniques involving out-of-band channels, inference, and time delay
CO4	:	To become a truly accomplished web application hacker
CO5	:	To defects in their configuration and security flaws within the web server software

Unit I: [12 Periods]
Web Application in Security - The Evolution of Web Applications – Web Application Security – Core Defense Mechanisms – Handling User Access – Handling User Input – Handling Attackers – Web Application Technologies – The HTTP Protocol – Web Functionality –Encoding Schemes – Mapping the Application – Enumerating Content and Functionality – Analyzing the Application.

Unit II: [12 Periods]
Bypassing Client-Side Controls – Transmitting Data Via the Client – Capturing User Data: HTML Forms – Capturing User Data: Browser Extensions – Handling Client-Side Data Securely – Attacking Authentication – Authentication Technologies – Design Flaws in Authentication Mechanisms – Implementation Flaws in Authentication – Securing Authentication – Attacking Session Management – Attacking Access Controls

Unit III: [12 Periods]
Attacking Data Stores – injecting into Interpreted Contexts – Injecting into SQL – Injecting into NoSQL –injecting into MongoDB - Injecting into XPath – Injecting into LDAP – Attacking Back-End Components – Injecting OS Commands - Injecting into XML Interpreters - Injecting into Back-end HTTP Requests - Injecting into Mail Services - Attacking Application Logic - Attacking Users: Cross-Site Scripting

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Unit IV: [12 Periods]

Attacking Users: Other Techniques - Capturing Data Cross-Domain - The Same-Origin Policy Revisited - Other Client-Side Injection Attacks - Local Privacy Attacks - Attacking ActiveX Controls - Attacking the Browser - Automating Customized Attacks - Enumerating Valid Identifiers - Harvesting Useful Data - Fuzzing for Common Vulnerabilities - Exploiting Information Disclosure - Exploiting Error Messages - Attacking Native Compiled Applications - Buffer Overflow Vulnerabilities.

Unit V: [12 Periods]

Attacking Application Architecture - Attacking the Application Server - Finding Vulnerabilities in Source Code - Approaches to Code Review - The Java Platform - ASP.NET – PHP – Perl – JavaScript - Database Code Components - Tools for Code Browsing - A Web Application Hacker's Toolkit - Web Browsers - Integrated Testing Suites - Standalone Vulnerability Scanners - Other Tools - A Web Application Hacker's Methodology

Textbook:
1. Dafydd Stuttard, marcus Pinto, "The Web Application Hacker's Handbook: Finding and Exploiting Secuirty Flaws", Wiley Publishing, Second Edition, (2011)

Reference Books:
1. Joel Scambray, Vincent Liu, Caleb Sima, "Hacking Exposed Web Applications: Web Application Security Secrets and Solutions, Mc Graw Hill, Third Edition, (2011).
2. Michal Zalewski, "The Tangled Web: A guide to securing Modern Web Applications" San Francisco, (2012).
3. John Paul Mueller, "Security for Web Developers", O'Reilly, First Edition (2016).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2		1				1	3	2	3	
CO2		1		2			2	1	2		1		2
CO3	3	2	3		2	2	3		3	2		1	
CO4	1			3				3			3		3
CO5	2		1	1		3	1			1	3	2	

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Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Core– VI – Advanced Database System	4	4	4	0	Theory

Introduction:

An introduction to database management systems, with an emphasis on how to organize, maintain and retrieve, efficiently and effectively, information from a DBMS.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To identify advance database concepts and database models
CO2	:	To Apply and analyze various terms related to transaction management in centralized and Relational database Model
CO3	:	To normalization and ER modeling are used concurrently to produce a good database design
CO4	:	To understand the Concurrency Control is and what role it plays in maintaining the databases Integrity
CO5	:	To understand business Intelligence is a comprehensive framework to support business decision making

Unit I: [12 Periods]

Database Concepts: Database Systems – Data Vs Information – Introducing the Database – Why database design is important – Evolution of file system data processing – Problems with file System data processing – Database Systems. – Data Models – Data Modeling and Data Models – The importance of Data Models – Data Model Basic Building Blocks – Business Rule – The Evolution of Data models – Degrees of Data Abstraction.

Unit II: [12 Periods]

Design Concepts: The Relational Database Model – A Logical view of data – Keys – Relational Algebra – The Data Dictionary and The System Catalog – Relationships within the Relational Database – Data Redundancy Revisted – Codd's Relational Database Rules – Entity Relationship (ER) Modeling – Database design challenges: Conflicting Goals – Advanced Data Modeling – The Extended Entity relationship model – Entity Clustering – Entity Integrity – Design Cases -

Unit III: [12 Periods]

Design Concepts: Normalization of Databases Tables – The need of Normalization – The Normalization Process – Normalization and Database Design. – Advanced Design and Implementation: Introduction to Structured Query language – Data Manipulation Commands – Advanced SQL – SQL Join Operators – Subqueries and correlated Queries – SQL Functions – Relational Set Operators – Oracle Sequences – Procedural SQL – Embedded SQL – Database Design – The Database Life Cycle – Conceptual Design – Database Design Strategies.

Unit IV: [12 Periods]

Advanced Database Concepts: Transaction Management and Concurrency Control – Concurrency Control – Concurrency Control with locking methods – Concurrency Control with Optimistic Methods – ANSI levels of Transaction Isolation – Database Recovery management. – Database Performance Turning and Query Optimization – Query Processing – Indexes and Query Optimization – SQL Performance Tuning – Query Formulation – DBMS Performance Tuning – Distributed Database Management System.

Unit V: [12 Periods]

Advanced Database Concepts: Business Intelligence – Business Intelligence Architecture – Decision Support Data – Star Schemas – Online Analytical Processing – SQL Extension for OLAP – Databases and the Internet – Database Connectivity – Extensible Markup language – Database Administration: Database administration and Security – Data as a Corporate Asset – The need for a Database and its Role in an Organization – Introduction of a database Special Considerations – The Evolution of Database Administration – The Database Environment's Human Component – Security.

Textbook:
1. Carlos Coronel, Steven Morris, Peter Rob, "Database Systems Design, Implementation and Management", 12th Edition, Cengage Learning All rights reserved. (2016)

Reference Books:
1. Abraham Silberchatz, Henry F.Korth, S.Sudarshan , "Database System Concepts", McGraw-Hill, 6th Edition, (2013)
2. Peter Rob and Coronel, "Database Systems: Design, Implementation and Management", Thomson Learning, Ninth edition, (2009).
3. C.J.Date, Longman, "Introduction to Database Systems", Pearson Education. 7th Edition, (2008).
4. Dennis Shasha, "Advanced Database Systems transactions, database tuning, and advanced topics", (2017).

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Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	3	3		3		2			3	2	1	2	3
CO2		1	2		1			2	1		2		2
CO3	2			2	2	3	2		3	1	3	2	
CO4		2	1	3		1	3	1		2		3	1
CO5	1		3		3		1	3		3			

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Core– VII – Research Methodology	**4**	**4**	**4**	**0**	**Theory**

Introduction:
To give an introduction about the research methods and design and make the students to know the how to collect the data and create a report on research

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	Defining a problem and techniques involves
CO2	:	To Studying the different types of design in research.
CO3	:	To develop skills to collect the data for research and writing a research report
CO4	:	To Understanding the basics of design pattern
CO5	:	Studying the OOSD life cycle and development

Unit I: [12 Periods]
Research: a way of thinking – The research process: its characteristics and requirements – Types of research – The mixed/multiple methods approach - The research process: a quick glance – Step one: Formulating a Research Problem: Reviewing the literature – Formulating a research problem – Identifying variables – Constructing hypothesis.

Unit II: [12 Periods]
Step Two: Conceptualizing a Research Design – Selecting a study design – Quantitative research - Qualitative design. Step Three: Constructing an instrument for Data Collection – Selecting a method of data collection – Methods of data collection in qualitative research – Collecting data using secondary sources. Collecting data using attitudinal scales – Establishing the validity and reliability of a research instrument.

Unit III: [12 Periods]
Step Four: Selecting a Sample – Step Five: Writing a Research Proposal – Step Six: Collecting Data – Considering ethical issues in data collection – to consider concerning research participants – Regarding the sponsoring organization. Step Seven: Processing and Displaying data – Step Eight: Writing a research Report – Developing a draft outline

Unit IV: [12 Periods]

Leveraging Object-oriented Concepts through Design Patterns – Singleton Design Pattern – One and Only One – Singleton in ABAP – Strategy Design Pattern – The right tool for the job – A family of interchangeable features – Strategy in ABAP – Observer Design Pattern – Adapter Design Pattern – Change in Inevitable – Adapter in ABAP.

Unit V: [12 Periods]

Decorator Design Pattern – Extending functionality with Decorator – Decorator in ABAP – Iterator Design Pattern – Programming on a Need-to-know basis – Iterator helps out – Iterator in ABAP – Template Method Design Pattern – Template Method in ABAP – Command Design Pattern – Null Object Pattern – State Design Pattern.

Textbooks:
1. Ranjit Kumar, "Research Methodology – a step-by-step guide for beginners", Sage Publications, Fifth Edition, 2019. (Unit I – Unit III)
2. James E.Mc Donough, "Object-Oriented Design with ABAP – A Practical Approach", Apress. 2017 (Unit IV – Unit V)

Reference Books:
1. C.R.Kothari,"ResearchMethodologyMethods&Techniques"2ndEdition,Wishwa Prakashan Publishers.
2. Dr.Rajammal P.Devadas, "A.Handbook on Methodology of Research-Sri Ramakrishna Mission Vidyalaya College of Rural Higher Education".

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
CO1		1		1		1		2	2		3	1	
CO2			3		2		2	1		2	1		2
CO3	1	2		3		2	3	3		3		3	1
CO4	3		2		1	3			3	1		2	3
CO5		3		2			1		1		2	3	

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Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Core– VIII –Advanced Computer Network	4	5	5	0	Theory

Introduction:

This aims to provide advanced background on relevant computer networking topics to have a comprehensive and deep knowledge in computer networks.

Course Outcome

CO1	:	To learn about integrated and differentiated services in network architectures.
CO2	:	To understand the working of wireless network protocols.
CO3	:	To design the new protocols for modern networks.
CO4	:	To get familiarized with next generation networks.
CO5	:	To develop highly analytical and qualified IT engineers by imparting training on cutting edge technology professional ethics

Unit I: [12 Periods]

Introduction to Optical Networking – SONET/SDH Standards – Dense Wavelength Division Multiplexing (DWDM) – ATM: The WAN Protocol – Introducing ATM Technology – Introducing Faces to ATM – ATM / B-ISDN Reference Model – Physical Layer – ATM Layer – ATM Adaption Layer – ATM Cell Format – ATM QoS – ATM Bit Rate – ATM Traffic Management - Packet Switching Protocols.

Unit II: [12 Periods]

Protocols and Interfaces in Upper layers of TCP/IP – Introducing TCP/IP Suite – Explaining Network Layer Protocols – Explaining Transport Layer Protocols – Explaining Application Layer Protocols – Electronic Mail – Routing in the Internet – Routing – Unicast Routing Protocols – Multicast Routing Protocol.

Unit III: [12 Periods]

Other Routing Techniques –Introduction to Traffic Engineering – IP over ATM – Multiprotocol Label Switching – Storage Area Network – Network Management and Services – Introducing Network Management – network management Model – Network Management Architecture – Structure of Management Information (SMI) – Management Information Base (MIB) – SNMP - A Framework – SNMPv2 – SNMPv3.

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Unit IV: [12 Periods]
Traffic Engineering Basics – Introducing Traffic Engineering – Requirement Definition for Traffic Engineering – Traffic Sizing – Traffic Characteristics – Protocols – Time and Delay Considerations – Connectivity – Availability, Reliability – Multimedia Over Internet – Multimedia Service Requirements – Multimedia Service Applications – Streaping Stored Audio/Video – Protocols for Real-Time Interactive Applications – RSVP – VOIP.

Unit V: [12 Periods]
Introduction to the CISCO IOS – Router Components – Cisco Router User Interface – Command Line Interface (CLI) – Router and Switch Administrative Function – Router Interfaces – Viewing and Saving Configurations –IP Routing – Dynamic Routing Protocols – Routing Protocols Basics – RIP – IGRP – Layer 2 Switching.

Textbooks:
1. Vilas S.Bagad, Iresh A.Dhotre, " Advance Computer Networks", Technical Publications, ISBN 9789350993026, (March 2019).

Reference Books:
1. James F. Kuros and Keith W. Ross, "Computer Networking: A Top-Down Approach", Pearson, 6th Edition, (2012).
2. Jeffrey S. Beasley and PiyasatNilkaew, "A Practical Guide to Advanced Networking" Pearson, 3rd Edition, (2012).
3. Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks", Prentice, 5th Edition, (2010).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
CO1	2		3		3		1		3		3		1
CO2	1	3	2	3		1	3			2		3	
CO3			1		2		1	2	2		1	2	2
CO4		1		1	2	2			1	3	2	1	3
CO5	3		2			3		3		1			3

Approved in the BOS Meeting held on 30.04.2021

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Core Practical – III – Web Applications Lab	4	0	0	4	Practical

1. Write a JavaScript to design a simple calculator to perform the following operations: sum, product, difference and quotient

2. Write a JavaScript that calculates the squares and cubes of the numbers from 0 to 10 and outputs HTML text that displays the resulting values in an HTML table format.

3. Write a JavaScript code that displays text "TEXT-GROWING" with increasing font size in the interval of 100ms in RED COLOR, when the font size reaches 50pt it displays "TEXT-SHRINKING" in BLUE color. Then the font size decreases to 5pt.

4. Develop and demonstrate a HTML5 file that includes JavaScript script that uses functions for the following problems:

   a. Parameter: A string Output: The position in the string of the left-most vowel

   b. Parameter: A number Output: The number with its digits in the reverse order

5. Design an XML document to store information about a student in an engineering college affiliated to VTU. The information must include USN, Name, and Name of the College, Branch, Year of Joining, and email id. Make up sample data for 3 students. Create a CSS style sheet and use it to display the document.

6. Write a PHP program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings.

7. Write anASP program to display a digital clock which displays the current time of the server.

8. Write the PHP programs to do the following:

   a. Implement simple calculator operations.

   b. Find the transpose of a matrix.

   c. Multiplication of two matrices.

   d. Addition of two matrices.

9. Write a PHP program named states.py that declares a variable states with value "Mississippi Alabama Texas Massachusetts Kansas". write a PHP program that does the following:

   a. Search for a word in variable states that ends in xas. Store this word in element 0 of a list named states List.

b. Search for a word in states that begins with k and ends in s. Perform a caseinsensitive comparison. [Note: Passing re.Ias a second parameter to method compile performs a case-insensitive comparison.] Store this word in element1 of statesList.

 c. Search for a word in states that begins with M and ends in s. Store this word in element 2 of the list.

d. Search for a word in states that ends in a. Store this word in element 3 of the list.

10. Write a PHP program to sort the student records which are stored in the database by NoSQL using selection sort.

11. Project: Develop a web application project using the languages and concepts learnt in the theory and exercises listed in part A with a good look and feel effects. You can use any web technologies and frameworks and databases.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1			1	2			1			3			3
CO2	2			2	3	2		3		1	2	3	
CO3	1	3	2	3	1	3			3		1		3
CO4		1	3		3		3	1	1	2		1	2
CO5	3			1		2		2			3	2	

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Core Practical – IV – Database Lab	4	0	0	4	Practical

1. Distributed Database forBookstore.

2. Deadlock Detection Algorithm for distributed database using wait- forgraph.

3. Object Oriented Database – Extended Entity Relationship(EER).

4. Parallel Database – University Counselling for Engineeringcoleges.

5. ParallelDatabase–ImplementationofParallelJoin&ParallelSort.

6. Active Database – Implementation of Triggers & Assertions for BankDatabase.

7. Deductive Database – Constructing Knowledge Database for Kinship Domain (FamilyRelations).

8. Study and workingof WEKATool.

9. Query Processing – Implementation of an Efficient QueryOptimizer.

10. Designing XML Schema for CompanyDatabase.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
CO1			1	2			1			3			3
CO2	2			2	3	2		3		1	2	3	
CO3	1	3			1	3			3		1		3
CO4		1	3		3		3	1	1	2		1	2
CO5	3		2	1		2		2			3	2	

Approved in the BOS Meeting held on 30.04.2021

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Core Practical V – Computer Network Lab	4	0	0	4	Practical

1. Configuration and logging to a CISCO Router and introduction to the basic user Interfaces. Introduction to the basic router configuration and basic commands.

2. Configuration of IP addressing for a given scenario for a given set of topologies.

3. Configure a DHCP Server to serve contiguous IP addresses to a pool of four IP devices with a default gateway and a default DNS address. Integrate the DHCP server with a BOOTP demon to automatically serve Windows and Linux OS Binaries based on client MAC address.

4. Configure, implement and debug the following: Use open source tools for debugging and diagnostics. a. ARP/RARP protocols b. RIP routing protocols c. BGP routing d. OSPF routing protocols e. Static routes (check using netstat)

5. Configure DNS: Make a caching DNS client, and a DNS Proxy; implement reverse DNS and forward DNS, using TCP dump/Wireshark characterize traffic when the DNS server is up and when it is down.

6. Configure FTP Server on a Linux/Windows machine using a FTP client/SFTP client characterize file transfer rate for a cluster of small files 100k each and a video file of 700mb.Use a TFTP client and repeat the experiment.

7. Configure a mail server for IMAP/POP protocols and write a simple SMTP client in C/C++/Java client to send and receive mails.

8. Implement Open NMS+ SNMPD for checking Device status of devices in community MIB of a linux PC. Using yellow pages and NIS/NFS protocols implement Network Attached Storage Controller (NAS). Extend this to serve a windows client using SMB. Characterise the NAS traffic using wireshark.

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Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	2			3		2		3	2		2		3
CO2		2	3	1	2		1	2		1	3	2	
CO3	1		2			1	2		3	3		1	1
CO4	3	2	3		3	1		1	3		1	2	2
CO5		3		3			3			2		3	

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Rathinam College of Arts & Science (Autonomous), Coimbatore-21.
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SEMESTER -III

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Core– IX – Internet of Things	4	5	5	0	Theory

Introduction:
The Internet of Things (IoT) is everywhere. It provides advanced data collection, connectivity, and analysis of information collected by computers everywhere taking the concepts of Machine-to-Machine communication farther than ever before. This course gives a foundation in the Internet of Things, including the components, tools, and analysis by teaching the concepts behind the IoT and a look at real-world solutions.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To Provide introduction to Internet of Things (IoT)
CO2	:	To enable people to convert their IoT product idea into a working prototype
CO3	:	To provide thorough working knowledge of the Blockchain-based Secuirty Solutions
CO4	:	To Bring-up Smart Connected Homes and innovators by supporting them with investment and mentorship
CO5	:	To recognize the factors that contributed to the emergence of IoT

Unit I: [12 Periods]
Introduction - Internet of Things Concepts – Who works on the Internet of Things – Framework – Information and Communication Technology Infrastructure – Derived Qualities of Modern ICT – Potential for Product, Process and Business Model Innovations –Technical Revolutions – Cyber-Physical-Social Systems – Environment –Time – People – Reasoning from Data – Overview of IoT Architecture –Enabling technologies – IoT Platforms and Operating Systems – Cloud and Fog Computing in the Internet of Things.

Unit II: [12 Periods]
RFID in the Internet of Things – Emergent Issues - A Tutorial introduction to IoT Design and Prototyping with examples – Main Features of IoT Hardware Development Platforms – Design and Prototyping of IoT Applications – On Standardizing the Internet of Things and its Appications – Current Status - The Standardization Environment – Security Mechanisma and Technologies for Constrained IoT Devices – Security Issues and Solutions.

Unit III: [12 Periods]
Blockchain-based Secuirty Solutions for IoT Systems – Regulatory Requirements – Challenges and Future Research – The Internet of Things and IT Auditing – Risks Associated with IoT – IT Auditing – Use Cases of IoT in IT Auditing – Protecting the Business Network – The Industrial –

Internet of Things – Market Overview – Interoperability and Technologies – Alliances – Internet of Things Applications for Smart Cities.

Unit IV: [12 Periods]

Smart Connected Homes – The Smart Connected home Domain – Systems – Architectures – Smart Connected Home Challenges and Research Directions – The Emerging "Energy Internet of Things – Power Management Trends and EIoT Support – Implementing the Internet of Things for Renewable Energy – The Internet of Things and People in Health Care – The Smart Health Care Ecosystem – Dimensions of IoT Applications in Health Care – Challenges.

Unit V: [12 Periods]

Internet of things in Smart Ambulance and Emergency Medicine – Integration and Compatibility – Smart Ambulance Challenges – IoT Applications for Agriculture – IoT-based Precision Agriculture – Agriculture Irrigation – Agriculture Fertilization – Precision Livestock Farming – The Internet of Flying Things – Flying Things – An Internet of Things Approach to "Read" the Emotion of Children with Autism Spectrum Disorder – IoT Environment for Emotion Recognition.

Textbook:
1. Qusay F. Hassan, "Internet of Things A to Z – Technologies and Applications", IEEE Press, Published by John Wiley & Sons. (2018)

Reference Books:
1. Vijay Madisetti, Arshdeep Bahga, "Internet of Things: A Hands-OnApproach", All rights reserved, (2014).
2. Oliver Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things", Wiley, First Edition, (2012).
3. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", Wiley, First Edition, (2014).
4. Pethuru Raj and Anupama C.Raman, " The Internet of Things", CRC Press, (2017).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
CO1		1		3			2	1			1		3
CO2	3		3		1	2	2	2	3		3	2	
CO3	2		2	1	2		3	1		2	2		1
CO4		3		2		1				1	2	1	
CO5	1	2				3	1		1	3		3	3

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Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Core– X – Big Data Analytics	**4**	**5**	**5**	**0**	**Theory**

Introduction:
This course helps to understand, and practice big data analytics and machine learning approaches, which include the study of modern computing big data technologies and scaling up machine learning techniques focusing on industry applications. Mainly the course objectives are: conceptualization and summarization of big data and machine learning, trivial data versus big data, big data computing technologies, machine learning techniques, and scaling up machine learning approaches.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	Ability to understand the Big Data Platform and its Use cases
CO2	:	Provide an overview of Apache Spark
CO3	:	Provide Real-Time Concepts and Structured Streaming
CO4	:	Provide hands on Hodoop Eco System and Hivemalls
CO5	:	Access and Process Data on Graph Analytics with GraphX

Unit I: [12 Periods]
Big Data Analytics and the role of Hadoop and Spark – Big Data Science and the role of Hadoop and Spark – A typical Data Science Project Life Cycle – Tools and Techniques – Getting Started with Apache Hadoop and Apache Spark – Introducing Apache Hadoop – Introducing Apache Spark – Why Hadoop plus Spark.

Unit II: [12 Periods]
Deep Dive into Apache Spark – Starting Spark Daemons – Learning Spark core Concepts – Resilient Distributed Dataset – Spark Context – Lifecycle of Spark Program – Spark Applications – Persistence and Caching – Spark Resource Managers – Standalone, YARN and Mesos – Big Data Analytics with Spark SQL, DataFrames and Datasets.

Unit III: [12 Periods]
Real-Time Analytics with Spark Streaming and Structured Streaming – Introducing real-time Processing – Architecture of Spark Streaming – Spark Streaming transformations and actions – Input Sources and Output Stores – Spark Streaming with Kafka and HBase – Advanced Concepts of Spark Streaming –Monitoring Applications – Notebooks and Dataflows with Spark and Hadoop

Approved in the BOS Meeting held on 30.04.2021

Unit IV: [12 Periods]
Machine learning with Spark and Hadoop – Introducing Machine Learning – Machine Learning on Spark and Hadoop – Machine Learning Algorithms – An example of Machine Learning Algorithms – Building Machine Learning Pipelines – Machine Learning with H2O and Spark – Introducing Hivemall – Introducing Hivemall for Spark – Building Recommendation Systems with Spark and Mahout.

Unit V: [12 Periods]
Graph Analytics with GraphX – Introducing Graph Processing – Getting Started with GraphX– Transforming Graphs- GraphX Algorithms – Analyzing Flight Data Using GraphX – Introducing GraphFrames – Interactive Analytics with SparkR – introducing R and SparkR – Getting Started with SparkR – Using DataFrames with SparkR – Using SparkR with RStudio – machine Learning with SparkR – Using SparkR with Zeppelin.

Textbook:
1. Venkat Ankam, "Big Data Analytics", Packt, Kindle Edition, (2016).

Reference Books:
1. Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013)
2. Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop", McGraw-Hill/Osborne Media (2013), Oracle press.
3. Anand Rajaraman and Jef rey David Ulman, "Mining of Massive Datasets", Cambridge University Press, (2012).
4. ArvindSathi, "BigDataAnalytics: Disruptive Technologies for Changing the Game", MC Press, (2012).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
CO1	3			1		1		2		2	3		1
CO2	1	2	3		2		3	3		3		2	
CO3	2	1		2		2		2			2	3	2
CO4		3	2		1		1		3	1			3
CO5			1		3		2	1			1		

Approved in the BOS Meeting held on 30.04.2021

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Core– XI– Cryptography & Network Security	4	4	4	0	Theory

Introduction:

This Course focuses towards the introduction of network security using various cryptographic algorithms. Underlying network security applications. It also focuses on the practical applications that have been implemented and are in use to provide email and web security.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To understand basics of Cryptography and Network Security
CO2	:	To be able to secure a message over insecure channel by various means
CO3	:	To learn about how to maintain the Confidentiality, Integrity and Availability of a data.
CO4	:	To understand various protocols for network security to protect against the threats in the networks
CO5	:	Be able to configure simple firewall architectures

Unit I: [12 Periods]
Computer and Network Security Concepts – Computer Security Concepts – Fundamental security design principles – Introduction to Number Theory – Classical Encryption Techniques – Block Ciphers and the Data Encryption standard.

Unit II: [12 Periods]
Finite Fields – Finite fields of the form - Advanced Encryption Standard – Block Cipher Operation – Multiple Encryption and Triple DES – Electronic Codebook – Random Bit Generation and Stream Ciphers – RC4.

Unit III: [12 Periods]
Public-Key Cryptography and RSA – The RSA Algorithm – Other Public-Key Cryptosystems – Diffie-Hellman Key Exchange - Cryptographic Hash Functions – Applications of Cryptographic Hash Functions - Message Authentication Codes.

Unit IV: [12 Periods]
Digital Signatures – Elgamal Digital Signature Scheme - Key Management and Distribution – Public-Key Infrastructure – User Authentication – Remote User-Authentication Principles – Network Access Control and Cloud Security.

Approved in the BOS Meeting held on 30.04.2021

Unit V: [12 Periods]

Transport-Level Security – Web Security Considerations – Wireless Network Security – IEEE 802.11 Wireless LAN Overview - Electronic Mail Security – Pretty Good Privacy – DNSSEC - IP Security – Cryptographic Suites.

Textbook:
1. William Stallings, "Cryptography and Network Security – Principles and Practice", Eight Edition, Global Edition, Pearson Education, (2020).

Reference Book:
1. Wenbo Mao," Modern Cryptography: Theory and Practice", Prentice Hall PTR.
2. William Stallings, "Network Security Essentials: Applications and Standards", Prentice Hall
3. Douglas R. Stinson, "Cryptography: Theory and Practice", CRC press.
4. C.K. Shyamala, N Harini, Dr T R Padmanabhan, "Cryptography and Network Security", Wiley India, 1st Edition.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1		2		3		3	1	3		1		3	1
CO2	1		2		3	2			2		3	2	2
CO3		3	1		2		1	2	1	3			
CO4	3	1		2	1	1		3		2	1	1	
CO5	1		3				3		3		2		3

Approved in the BOS Meeting held on 30.04.2021

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Core Practical – V– Big Data Analytics Lab	4	0	0	4	Practical

1. Implement the followings in Java

i) Linked Lists ii) Stacks iii) Queues iv) Set v) Map

2. Perform setting up and Installing Hadoop in its three operating modes:

a) Standalone, Pseudo distributed, Fully distributed.

3. Implement the following file management tasks in Hadoop:

• Adding files and directories

• Retrieving files

• Deleting files Hint: A typical Hadoop workflow creates data files (such as log files) elsewhere and copies them into HDFS using one of the above command line utilities.

4. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.

5. Write a Map Reduce program that mines weather data. Weather sensors collecting data every hour at many locations across the globe gather a large volume of log data, which is a good candidate for analysis with MapReduce, since it is semi structured and record-oriented.

6. Implement Matrix Multiplication with Hadoop Map Reduce.

7. Install and Run Pig then write Pig Latin scripts to sort, group, join, project, and filter your data.

8. Install and Run Hive then use Hive to create, alter, and drop databases, tables, views, functions, and indexes.

9. Solve some real life big data problems.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
CO1	3		3	3		1		3		2		2	2
CO2		1	1		2	2	3			1	2	3	
CO3	1	2		2		1		1	1				1
CO4	2		3	1	1		1	2	3		3	1	3
CO5		3			3	3			2	3	1		3

Approved in the BOS Meeting held on 30.04.2021

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Core Practical VI – Network Security Lab	4	0	0	4	**Practical**

1. Write a C program that contains a string (char pointer) with a 1 value \Hello World'. The program should XOR each character in this string with 0 and displays the result.

2. Write a C program that contains a string (char pointer) with a 2 value \Hello World'. The program should AND or and XOReach character in this string with 127 and display the result.

3. Write a Java program to perform encryption and decryption 3 using the following algorithms:

a) Ceaser Cipher

b) Substitution Cipher

c) Hill Cipher

4 Write a Java program to implement the DES algorithm logic

5 Write a C/JAVA program to implement the Blowfish algorithm logic

6 Write a C/JAVA program to implement the Rijndael algorithm logic.

7 Using Java Cryptography, encrypt the text "Hello world" using Blowfish. Create your own key using Java key tool.

8 Write a Java program to implement RSA Algorithm

9 Implement the Diffie-Hellman Key Exchange mechanism 9 using HTML and JavaScript. Consider the end user as one of the parties (Alice) and the JavaScript application as other party (bob).

10 Calculate the message digest of a text using the SHA-1 algorithm in JAVA.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
CO1	3	2	3	1		3		1		3	1	3	
CO2			1		3		3		2			1	3
CO3	1	3		2		1	2	3			2	3	2
CO4	2		2	3		2		2		1		2	1
CO5		1			2		3		3	1	3		

Approved in the BOS Meeting held on 30.04.2021

SEMESTER –IV

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Core– XII – Soft Computing	**4**	**5**	**5**	**0**	**Theory**

Introduction:
To introduce the concepts in Soft Computing such as Artificial Neural Networks, Special Network, Fuzzy logic-based systems, genetic algorithm-based systems and their hybrid.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To analyze various neural network architectures
CO2	:	Understand the concepts of Special Network and fuzzy sets
CO3	:	To knowledge representation using fuzzy rules, approximate reasoning, and fuzzy inference systems
CO4	:	Comprehend the fuzzy logic and the concept of fuzziness involved in various systems and fuzzy set theory.
CO5	:	Analyze the genetic algorithms and their applications

Unit I: [12 Periods]
Introduction – Neural Networks – Artificial Neural Network: An Introduction – Fundamental Concept – Supervised Learning Network – Associative Memory Networks - Unsupervised Learning Network.

Unit II: [12 Periods]
Special Networks – Third-Generation Neural Networks – Clustering of Self-Organizing Feature Maps – Stability Analysis of a Class of Artificial Neural Network Systems – Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets.

Unit III: [12 Periods]
Classical Relations and Fuzzy Relations – Introduction – Membership Function – Fuzzification – Defuzzification – Fuzzy Arithmetic and Fuzzy Measures – Fuzzy Rule Base and Approximate Reasoning.

Unit IV: [12 Periods]
Fuzzy Decision Making – Fuzzy Logic Control Systems – Fuzzy Cognitive Maps Cognitive Maps – Base for FCM – Type-2 Fuzzy Sets and Embedded Fuzzy Sets – Stability Analysis of Certain Classes of Fuzzy Systems.

Approved in the BOS Meeting held on 30.04.2021

Unit V: [12 Periods]
Genetic Algorithm – Differential Evolution Algorithm – Hybrid Soft Computing Techniques – Applications of Soft Computing – Soft Computing Techniques Using C and C++ – MATLAB Environment for Soft Computing Technique

Textbook:
1. S.N.Sivanandam, S.N.Deepa, "Principles of Soft Computing ", Wiley, Third Edition, (2019)

Reference Book:
1. S.Rajasekaran and G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications", Prentice-Hall of India Pvt. Ltd., (2006).
2. David E. Goldberg, Genetic Algorithm in Search Optimization and Machine Learning Pearson Education India, (2013).
3. N.K.Sinha and M.M. Gupta, " Soft Computing & Intelligent Systems: Theory & Applications", Academic Press, Elsevier,(2009)

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
CO1		3		1	3		1	1		1	2		
CO2		2	3			2			2		3	2	1
CO3	2			2		1	2	3		2	2	1	
CO4	1		3		3		3	2	1	2		3	3
CO5	3	1	1			3	1		3		1	1	

Approved in the BOS Meeting held on 30.04.2021

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Core– IX – Block Chain Technology	4	5	5	0	Theory

Introduction:
This Block Chain Technology course has been designed to explain what the technology is and how it works at a high level. You will build an awareness of Block Chain Technology and how it can be used to process crypto currency transactions across an open and distributed ledger.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To understand what Blockchain is and why it is used
CO2	:	To be able to explain the different components involved within Blockchain
CO3	:	To know when and why you may want to use Blockchain within your environment
CO4	:	Learn security measures, and various types of services that allow people to trade and transact with Bitcoins
CO5	:	To Exploit applications of Blockchain in real world systems and Regulations

Unit I: [12 Periods]
Say you want a Revolution: The Trust Protocol – How this Worldwide Ledger works – A Rational Exuberance for the Blockchain – Achieving Trust and the Black box of Identity – A Plan for Prosperity - Promise and Peril of the New Platform – Bootstapping the future: Seven Design Principles of Blockchain Economy – The Seven Design Principles – Designing the Future.

UnitI II: [12 Periods]
Transformations: Reinventing Financial Services – The Golden Eight – The Bank App – Reputation – The Blockchain IPO – Re-architecting the Firm: The Core and the Edges – New Business Models: Making it Rain on the Blockchain – bAirbub versus Airbub – Global Computing: The Rise of Distributed Applications – The DApp Kings – The Big Seven – Hacking Your Future.

Unit III: [12 Periods]
The Ledger of Things: Animating the Physical world – The Evolution of Computing – From Mainframes to Smart Pills – The Twelve Disruptions – Animating Things – The Economic Payoff – The Future: From Uber to Suber – Solving the Prosperity Paradox: Economic Inclusion and Entrepreneurship – Road Map to prosperity – Remittances – The story of Analie Domingo.

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Unit IV: [12 Periods]

Rebuilding Government and Democracy – High-Performance Government Services and Operations – Empoering People to serve selves and others – Blockchain Voting – Alternative Models of Politics and Justice – Wielding Tools of Twent-first-century Democracy – Freeing Culture on the Blockchain – Music to Era – Fair Trade Music – Getting the Word Out.

Unit V: [12 Periods]

Promise and Peril: Overcoming Showstoppers – Ten Implementation Challenges – Reasons Blockchain will Fail or Implementation Challenges – Leadership for the Next Era – The Blockchain Ecosystem – A Cautionary Tale of Blockchain Regulation – The Senator Who would change the world – Central Banks in a Decentralized economy – Regulation Versus Governance.

Textbook:
1. Dan Tapscott and Alex Tapscott, "Blockchain Revolution", portfolio / Penguin trade paperback edition, (2018).

Reference Books:
1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press, (2016).
2. DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger," Yellow paper, (2014).
3. Josh Thompsons, "Blockchain for beginners guide to Blockchain technology and leveraging Blockchain Programming", Copyright, (2017).
4. Daniel Drescher, "Blockchain basics: A Non-Technical Introduction in 25 steps", Apress, (2017).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
CO1			2	3		1	2	3	2			3	1
CO2		2	3		2	3		2		3	3	2	
CO3		3			3		1		1	2	2	1	2
CO4	2	1		2	1			3		1	1		
CO5	1		1	1		1	3		3		3	2	3

Approved in the BOS Meeting held on 30.04.2021

Rathinam College of Arts & Science (Autonomous), Coimbatore-21.
Admitted in M.Sc. Information Technology from the academic year 2021 – 2022 Onwards

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ELECTIVES

SEMESTER –III

ELECTIVE -I

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Elective I - Distributed Networks	4	4	4	0	Theory

Introduction:

The goal of a distributed network is to share resources, typically to accomplish a single or similar Network. Usually, this takes place over a computer network, however, internet-based computing is rising in popularity. Typically, a distributed networking system is composed of processes, threads, agents, and distributed objects. A merely distributed physical component is not enough to suffice as a distributed network, typically distributed networking uses concurrent program execution.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To understand how to successfully incorporate them into distributed systems and services.
CO2	:	To support the distributed embedded systems with real-time systems
CO3	:	To include intrusion tackling and peer-to-peer traffic detection Future wireless networking scenarios
CO4	:	To include the use of software sensors instead of hardware sensor
CO5	:	To maintain their own distributed network under the traditional of Cloud computing model

Unit I: [12 Periods]

Distributed Network Intelligence and Systems: Cooperative Regression-based forecasting in Distributed Traffic Networks – A Sensor Data Aggregation System Using Mobile Agents – Underlay-Aware Distributed Service Discovery Architecture with Intelligent Message Routing.

Unit II: [12 Periods]

System-Level Performance Simulation of Distributed Embedded Systems via ABSOLUT – Self-Organizing Maps: The Hybrid SOM-NG Algorithm – A Semi-supervised and Active Learning Method for Alternatives.

Unit III: [12 Periods]

Distributed Network Security: Trackling Intruders in Wireless Mesh Networks – Semi-Supervised Learning NitTorrent Traffic Detection – Developing a Content Distribution System over a Secure Peer-to-Peer Middleware.

Approved in the BOS Meeting held on 30.04.2021

Rathinam College of Arts & Science (Autonomous), Coimbatore-21.
Admitted in M.Sc. Information Technology from the academic year 2021 – 2022 Onwards

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Unit IV: [12 Periods]

Applications and Trends in Distribution Enterprises: User Activity Recognition through Software Sensors – Multi-Agent Framework for Distributed Leasing-Based Injection Mould Remanufacturing – The Smart Operating Rooms: smartOR.

Unit V: [12 Periods]

Distributed Online Safety Monitor based on Multi-Agent System and AADL Safety assessment Model – State of the Art of Service-level Agreements in Cloud Computing – Used Products Return Service based on Ambient Recommender System to promote Sustainable Choices.

Textbook:
1. Qurban A.Memon, "Distributed networks – Intelligence, Security and Applications", CRC Press Taylor & Francis Group, (2017).

Reference Books:
1. Coulouris, Dollimore, Kindberg, Blair, "Distributed System: Concepts and Design", Fifth Edition, Pearson Ed.
2. A.D. Kshemkalyani, M. Singhal, "Distributed Computing: Principles, Algorithms, and Systems", ISBN: 9780521189842, Cambridge University Press, (2011).
3. Andrew S. Tanenbaum and Maarten Van Steen, "Distributed Systems: Principles and Paradigms", 2nd edition, Pearson Education, (2016).
4. M. L. Liu, Distributed Computing Principles and Applications, Pearson Addison Wesley, (2004).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	1		1		3			3		2	1		3
CO2		2		2				1		2		2	
CO3	2	1	3			1	3	2			3	1	
CO4			2	1	3			2	1	2	2		2
CO5	3				2				3	1		3	1

Approved in the BOS Meeting held on 30.04.2021

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Elective I - Social Network Analytics	4	4	4	0	Theory

Introduction:

This course will enable students to grasp the analytics tools to leverage social media data. The course will introduce tools such as engagement analytics, sentiment analysis, topic modeling, social network analysis, identification of influencers and evaluation of social media strategy. It will involve lots of hands-on exercises.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To Know basic notation and terminology used in network science
CO2	:	To Understand and apply key concepts in social media metrics using Graph
CO3	:	To Understand basic principles behind Clusters and components algorithms
CO4	:	To be capable of analyzing mode of networks in real world
CO5	:	To be capable of analyzing real world networks using Big Data

Unit I: [12 Periods]

Introduction: Analyzing Relationships to Understand People and Groups – From Relationships to Networks – More than Meets the Eye – Social Networks Vs. Link Analysis – The power of Informal networks – Terrorists and Revolutionaries: The Power of Social Networks

Unit II: [12 Periods]

Graph Theory – A quick Introduction – What is a Graph? – Graph Traversals and Distances – Graph Distance – Why this Matters – 6 Degrees of Separation is a Myth – Small World Networks – Centality, Power and Bottlenecks.

Unit III: [12 Periods]

Cliques, Clusters and Components – Components and Subgraphs – Subgraphs – Ego Networks – Triads – Cliques – Hierarchical Clustering – Traids, Network Density and Conflict.

Unit IV: [12 Periods]

2-Mode Networks – Does Campaign Finance Influence Elections – Theory of 2-Mode Networks – Expanding Multimode Networks – Going Viral! Information Diffusion – Anatomy of a Viral Video – How Does Information Shape Networks – A Simple Dynamic Model in Python

Unit V: [12 Periods]
Graph Data in the Real World – Medium Data; The Tradition – Big Data: The Future, Starting Today – "Small Data"– Flat File Representations – "Medium Data"-Database Representation – Working with 2-Mode Data – Social Networks and Big Data – Big Data at Work.

Textbook:
1. MakismTsvetovat& Alexander Kouznetsov," Social Network Analysis for Startups", O'Reilly Media, Inc., (2011).

Reference Books:
1. Reza Zafarani, Mohammed Ali Abbasi, Huan Liu. "Social Media Mining: An Introduction". Cambridge University Press, (2014).
2. Eric Kolaczyk, Gabor Csardi. "Statistical Analysis of Network Data with R (Use R!)". Springer, (2014).
3. Maarten van Steen, "Graph Theory and Complex Networks. An Introduction", (2010).
4. Jared Lander, "R for Everyone: Advanced Analytics and Graphics", Addison-Wesley, (2013).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
CO1	1		1		3		2	3	1	2	1		3
CO2	3	2		2		2		1			2	2	1
CO3	2	1	3		1	1	3	2	3			1	
CO4		3	2	1			2		1	2	2		2
CO5				3	2	3			2	1		3	1

Approved in the BOS Meeting held on 30.04.2021

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Elective –I Computer Graphics and Multimedia	4	4	4	0	Theory

Introduction:
To develop an understanding and awareness of computer graphics how issues such as content, information architecture, motion, sound, design, and technology merge to form effective and compelling interactive experiences for a wide range of audiences and end users. To become familiar with various software programs used in the creation and implementation of multimedia.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To understand the structure of an interactive computer graphics system, and the separation of system components.
CO2	:	To understand the two-dimensional graphics and their transformations.
CO3	:	To understand of techniques for representing 3D geometrical objects and 3D Viewing
CO4	:	To appreciate illumination and color models for animation
CO5	:	To Create time-based and interactive multimedia components

Unit I: [12 Periods]
Introduction to Computer Graphics – History and Evolution – Survey of Computer Graphics – Graphics Hardware and Software – Overview of Graphics Systems – GKS Programs – Opengl Programs – Vrml Programs – Graphics Primitives – Basic Concepts – Line Drawing Algorithms – Loading the Frame Buffer – Line Function – Circle drawing Algorithms – Bresenham's Midpoint Ellipse Algorithm – Polygon-Fill Algorithms – OpenGL Algorithm.

Unit II: [12 Periods]
Two-Dimensional Transformation – Transformation – Basic Transformations – Composite Transformations – Other Transformations – Rigid body and Affine Transformations – Properties of Transformation – OpenGL Programs – Two-Dimensional Viewing and Clipping – Viewing Pipeline – Interior Clipping – OpenGL Programs – Graphical User Interfaces and Interactive Input devices – User Dialogue – Interactive Picture Construction Techniques.

Unit III: [12 Periods]
Three-Dimensional Concepts – Display Methods – Three Dimensional and Stereoscopic Views – Object Representations – OpenGL Programs – Three-Dimensional Transformations – Basic Transformations – OpenGL Programs – Three-Dimensional Viewing – 2D and 3D Graphics – Viewing Pipeline – Viewing Coordinate – Projections – View Volume – Clipping.

Approved in the BOS Meeting held on 30.04.2021

Unit IV: [12 Periods]

Visible Surface Detection Methods – Introduction – Back-Face Detection Method – Z-buffer Method – A-Buffer Method – Scan line Method – Painter's Algorithm – Binary Space Partitioning Method – Ray Casting Method – Warnock's Alogrithm – Floating Horizon Method – Octree Method – Wireframe Methods – Illuminaton and Color Models – Computer Animation and Realism.

Unit V: [12 Periods]

Multimedia Systems – Introduction – Multimedia System Architecture – Defining Objects for Multimedia Systems – Multimedia Data Interface Standards – Multimedia Databases – Multimedia Input and Output Technologies – Data and File Formats – Multimedia Compression and Decompression – Multimedia Authoring, User Interface and Hypermedia Messaging: Multimedia Authoring – User Interface Design – Hypermedia Messaging.

Textbook:
1. D.Evangeline, S.Anitha, " Computer Graphics and Multimedia – Insights, Mathematical Models and Programming Paradigms, PHI Learning Private limted, (2016)

Reference Book:
1. Donald Hearn and Pauline Baker M, Computer Graphics", Prentice Hall, New Delhi, (2007).
2. Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard, KelvinSung, and AK Peters, Fundamentals of Computer Graphics, CRC Press, (2010).
3. effrey McConnell, Computer Graphics: Theory into Practice, Jones and Bartlett Publishers, (2006).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
CO1	1		2	1	2		2	1	2	1			1
CO2		1	3			2		3		2	1	3	2
CO3		3		2	3		3		1		2		3
CO4	2	2		1	2	1	1		3	3		2	
CO5	3		3			3		2			3	1	3

Approved in the BOS Meeting held on 30.04.2021

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Elective – I Software Testing	**4**	**4**	**4**	**0**	**Theory**

Introduction:

To study concepts in software testing. Testing is the most time consuming and expensive part of software development. To discuss various software testing issues and solutions in software to expose the students for different software testing tools and techniques. To expose the advanced software testing topics, such as technical testing, Reviews etc.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To Select and apply appropriate structural design techniques so tests provide adequate levels of confidence, via code coverage and design coverage.
CO2	:	The Technical test analyst is concerned with analytical techniques for both static and dynamic Analysis
CO3	:	Effectively participate in technical reviews with developers and architects for quality
CO4	:	To find defects in that work product before it serves as a basis for further project activity, though other goals can also apply
CO5	:	This Test tools that might be used by all testers by using tools and techniques

Unit I: [12 Periods]

The Technical Test Analyst's Tasks in Risk-based Testing – Structure-Based Testing – Introduction – Conditional Coverage – Decision Condition Coverage – Modified Condition – Multiple Condition Coverage – Path Testing – API Testing – Selecting a Structure-Based Technique – A Final Word on Structural Testing.

Unit II: [12 Periods]

Analytical Techniques – Introduction – Static Analysis – Control flow Analysis – Data flow Analysis – Static Analysis to improve Maintainability – Call Graphs – Dynamic Analysis – Memory Leak Detection – Wild Pointer Detection – Dynamic Analysis.

Unit III: [12 Periods]

Quality Characteristics for Technical Testing – Introduction – Security Testing – Security Issues – Reliability Testing – Maturity – Fault Tolerance – Recoverability - Efficiency Testing – Modeling the System – Maintainability Testing – Portability Testing – General Planning Issues.

Unit IV: [12 Periods]

Reviews – Introduction – Using Checklists in Reviews – Some General Checklist items for design and Architecture Reviews – Deutsch's Design Review Checklist – Some General Checklist Items for Code Reviews – Marick's Code Review Checklist – The open Laszlo Code Review Checklist.

Unit V: [12 Periods]

Test Tools and Automation – Integration and Information Interchange between Tools – Defining the Test Automation Project – Preparing for a Test Automation Project – Automation architectures – Fault Seeding and Fault injection Tools - Specific Test Tools – Tools for Web Testing.

Textbook:

1. Jamie L. Mitchell, Rex Black, "Advanced Software Testing – Vol.3", 2nd Edition, Rocky Nook, (2015).

Reference Books:

1. Limaye L G, "Software Testing – Principles, Techniques and Tools", Tata Mc-Graw Hill Education Pvt. Ltd., New Delhi, (2009).
2. Srinivasan Desikan, Gopalaswamy Ramesh, "Software Testing – Principles and Practices", Pearson Publisher, Pearson India, (2005).
3. Naresh Chauhan, "Software Testing – Principles and Practices", Oxford HED, Second edition, (2016).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
CO1	1	3	2	1	2		2	1	2	1			1
CO2	3	1	3			2		3		2	1	3	2
CO3				2	3		3	2	1		2	3	
CO4		2		1	2	1	1		1	3		2	
CO5	3		3			3		2		2	3	1	3

Approved in the BOS Meeting held on 30.04.2021

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Elective – I - Cloud Management and Security	4	4	4	0	Theory

Introduction:

To analyses the problem of establishing trustworthy Cloud, for addressing this problem focusing on mechanisms for treating the security challenges, discusses foundation frameworks and mechanisms for remote attestation in Cloud and establishing Cloud trust anchors, and lastly providing a framework for establishing a trustworthy provenance system and describes its importance in addressing major security challenges such as forensic investigation, mitigating insider threats and operation management assurance.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcomes

CO1	:	To Presents a high-level view for Clouds and federated Clouds which is useful for professionals, decision makers and students
CO2	:	To Includes illustrations and real-life deployment scenarios to bridge the gap between theory and practice
CO3	:	To Extracts, defines and analyses the desired properties and management services of Cloud computing and its associated challenges and disadvantages
CO4	:	To Analyses the risks associated with Cloud services and deployment types and what could be done to address the risk for establishing a trustworthy Cloud computing
CO5	:	To Provides a research roadmap for establishing the next generation trustworthy Cloud computing

Unit I: [12 Periods]
Introduction – Cloud Management – Cloud Structure – Infrastructure Components – Cloud Layers – Cloud Relations – Cloud Dynamics –Data Types – Fundamentals of Cloud management – Cloud Management Services – Virtual Control Center – Prerequisite Input Data for Management Services – Management of User Requirements.

Unit II: [12 Periods]
Cloud properties – Introduction – Adaptability Property – Resilience Property – Scalability Property – Availability Property – Reliability Property – Security and Privacy Property – Business Model – Automated Management Services – Virtual Layer Self-managed Services – Virtual Services Interdependency – Application Layer Self-managed Services – Application Services Interdependency – Security and Privacy by Design – Multi-tier Applications Deployment in the cloud – Main Challenges and Requirements.

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Unit III: [12 Periods]
 Cloud Security Fundamentals – Background – Topics Flow – Trusted Computing – Challenges for Establishing Trust in Clouds – Effects of Cloud Dynamics on Trust Relationships – Challenges – Establishing Trust in Clouds – Organization Requirements – Framework Requirements – Device Properties – Framework Architecture – Required Software Agents – Framework Workflow – Discussion and Analysis.

Unit IV: [12 Periods]
Clouds Chains of Trust – Introduction – Software Agents Revision – Roots of and Chains of Trust Definition – Intra-Layer Chains of Trust – Trust Across Layers – Provenance in Clouds – Motivating Scenarios – Log Records Management and Requirements – Framework Domain Architecture – Framework Software Agents – Framework Workflow – Threat Analysis – Discussion and Future Directions.

Unit V: [12 Periods]
Insiders – Introduction – Insiders Definition – Conceptual Models – Practical Examples: Real-Life Examples – OpenStack – Amazon Web Services – Component Architecture – Prototype – Case Study – Scenario – Home Healthcare Architecture in the Cloud – Insiders Analysis for Home Healthcare – Cloud Threats.

Textbook:
1. Imad M.Abbadi, "Cloud Management and Security", John Wiely& Sons, Ltd, First Edition, (2014).

Reference Book:
1. Dan C.Marinescu," Cloud Computing: Theory and Practice Solutions to Exercises and Problems", (2013).
2. Kief Morris, "Infrastructure as Code: Managing Servers in the cloud", O'Reilly, First Edition, (2016).
3. Raghuram Yeluri, "Building the Infrastructure for Cloud Security: A Solutions view", First edition, Apress, (2014).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
CO1	3	2		3		3		3			2		3
CO2	1		3		2		3		2	3	2	3	2
CO3		2	1		1	3		2	1		3		2
CO4	1			2		2				2		1	
CO5	2	3		3	2		1		3	1		3	1

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ELECTIVE - II

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Elective II – Wireless Network Security	4	4	4	0	Theory

Introduction:
This course presents network security protocols and cryptographic communication mechanisms for realizing specified security properties in wireless and mobile networks, such as secrecy, integrity, authentication, privacy, crypto key distribution, and access control. The course will study a selection of security functionalities and principles, adapted from current best practice in personal area networks, local area networks, and global mobile networks. In addition, we seek to include interesting security protocols and mechanisms emerging in the Internet developments.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To identify some of the factors driving the need for network security
CO2	:	To provide knowledge of information security technology and methods for communication systems that provide services for mobile users by wireless access networks.
CO3	:	Bluetooth devices will eliminate the need for cables and provide a bridge to existing networks.
CO4	:	To knowledge and understanding of security mechanisms and protocols in wireless communication networks.
CO5	:	To appreciate the contribution of Wireless Communication networks to overall technological growth.

Unit I: [12 Periods]
Network Security: Introduction – Weaknesses in Network Security – Relevant Resources – Objectives of a Security Strategy – Security Aspects Concerning the Internet. WLAN: WLAN Basic Principles – IEEE 802.11 Overview – Wireless Fidelity – WMAN – Key Terminology – Architecture and Components – Security Requirements – Recent Developments – Applications – Checklist.

Unit II: [12 Periods]
Mobile Phones: Context – Basic Principles – Communication Structure – Device Architecture – Smartphones - Communication Protocols – GMS – GPRS – UMTS – Services – SMS/EMS/MMS – WAP – i-mode – Mobile Phones and WLAN – Infrastructure – Terminal devices – Threats and Protection – Special Case Blackberry – VoIP – Security Check.

Unit III: [12 Periods]

Bluetooth: Introduction – Technical Basics – Protocols – System Topology – Connecting to the Network – Version 5.0 – Security Aspects – Instruments – Risk Potentials Countermeasures. Infra-Red: Background – IrDA – General Considerations – Protocol – Applications – Terminal Devices – Preconditions – Communicating – Security Aspects.

Unit IV: [12 Periods]

Near Field Communication: Introduction – Technology – Specifications – Security Aspects. Security Policy: Introduction – Security Requirements – Risks – Measures – Scope – Normative References – Information and Communication Security – Physical Security – Documentation – Processes – Commitment – Wireless Security.

Unit V: [12 Periods]

Emergency management in Communicaton Networks: Emergency Management Systems – Standards – ISO 22301 – Further Standards and Methodologies Concerning IT Security – Requirements for Businesses – Analysis before Planning – Management Responsibilities – BCM Overview – Training and Testing – Intermediate Conclusions – The Emergency Process.

Textbook:
1. Wolfgang Osterhage, "Wireless Network Security," CRC Press, A Science Publishers Book, Second Edition, (2018).

Reference Book:
1. Y. Xiao, X. Shen, D. Z.Du, "Wireless Network Security", Springer International, Edition, (2005).
2. Lei Chen, JiahuangJi, Zihong Zhang, "Wireless Network Security", Springer Science & Business Media, (2013).
3. Levente Buttyán and Jean-Pierre Hubaux, "Security and Cooperation in Wireless Networks", Cambridge University Press,(2012).
4. James Kempf, "Wireless Internet Security: Architectures and Protocols", Cambridge University Press, (2008).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	3	2				1		3			2		3
CO2	1		3		3		3		2	3	1	3	2
CO3		1	1	1	2			2	1			2	1
CO4	2		2	2	1	2		1		2		1	
CO5			3		3		3	1		3	1	2		1

Approved in the BOS Meeting held on 30.04.2021

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Elective II – Streaming Analytics	**4**	**4**	**4**	**0**	**Theory**

Introduction:
The collection and processing of this data has a number of application areas for require an infrastructure and method of analysis specific to streaming data. To allow a fairly broad range of potential users and implementers in an organization to gain comfort with the complete stack of applications. Real time streaming applies as much to the development of new analyses as it does the data itself.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To Understand the need for stream computing and comprehend the architecture of Steam Analytics
CO2	:	To building data flow management pipelines for streams.
CO3	:	Processing streaming data.
CO4	:	Delivering the results of streaming analytics
CO5	:	To allow for maintaining sets and histograms with real-time updates.

Unit I: [12 Periods]
Introduction to Streaming Data: Sources of Streaming Data – Why Streaming Data is Different – Infrastructures and Algorithms. Streaming a Analytics Architecture: Designing Real-Time Streaming Architectures – Real-Time Architecture Components – Features of a Real-Time Architecture – Languages of Real-Time Programming – A Real-Time Architecture Checklist.

Unit II: [12 Periods]
Service Configuration and Coordination: Motivation for Configuration and Coordination Systems – Maintaining Distributed State – Apache Zookeeper. – Data-Flow Management in Streaming Analysis: Distributed Data Flows – Apache Kafka: High-Throughput Distributed Messaging – Apache Flume: Distributed Log Collection.

Unit III: [12 Periods]
Processing Streaming Data: Distributed Streaming Data Processing – Processing Data with Storm – Processing Data with Samza. – Storing Streaming Data: Consistent Hashing – "NoSQL" Storage Systems – Other Storage Technologies – Choosing a Technology – Warehousing.

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Unit IV: [12 Periods]
Analysis and Visualization: Delivering Streaming Metrics – Streaming Web Applications – Visualizing Data – Mobile Streaming Applications. – Exact Aggregation and Delivery: Timed Counting and Summation – Multi-Resolution Time-Series Aggregation – Stochastic Optimization – Delivering Time-Series Data – Statistical Approximation of Streaming Data.

Unit V: [12 Periods]
Approximating Streaming Data with Sketching: Registers and Hash Functions – Working with Sets – The Bloom Filter – Distinct Value Sketches – The Count-Min Sketch – Other Applications. – Beyond Aggregation – Models for Real-Time Data – Forecasting with Models – Monitoring – Real-Time Optimization – Introduction – End User License Agreement.

Textbook:
1. Byron Ellis, "Real-Time Analytics: Techniques to Analyze and Visualize Streaming Data", Wiley, First Edition, (2014).

Reference Books:
1. Sherif Sakr, "Large Scale and Big Data: Processing and management, CRC Press, (2014).
2. Bill Franks, "Taming the Big Data Tidal Wave Finding Opportunities in Huge Data Streams with Adavnced Analytics", Wiley, (2012).
3. Jure Leskovec, Anand Rajaraman, Jeffrey D.Ullman, "Mining of assive Datasets, Cambridge University Press, (2014).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
CO1		2	3			1		2	3			1	3
CO2		1		3	2	3		1		3	2	3	1
CO3	2		2	1	1		2		2	1	1		2
CO4	1	3		2		1	1	3		2		1	
CO5	2		1		3	2	2		1		3	2	

Approved in the BOS Meeting held on 30.04.2021

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Elective – II 3D Animation Essentials	4	4	4	0	Theory

Introduction:

3D is everywhere in video games, movie and television special effects, mobile devices, etc. Many aspiring artists and animators have grown up with 3D and computers, and naturally gravitate to this field as their area of interest. Bringing a blend of studio and classroom experience to offer you thorough coverage of the 3D animation industry to create compelling and realistic 3D imagery.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	Serves as the first step to understanding the language of 3D and computer graphics (CG)
CO2	:	Covers 3D animation basics: pre-production, modeling, animation, rendering, and post-production
CO3	:	Dissects core 3D concepts including design, film, video, and games
CO4	:	Examines what artistic and technical skills are needed to succeed in the industry
CO5	:	Offers helpful real-world scenarios and informative interviews with key educators and studio and industry professionals

Unit I: [12 Periods]
3D Animation Overview – Defining 3D Animation – Exploring the 3D Animation Industry – The History of 3D Animation – The Essentials and beyond – Understanding the Production Pipeline's Components – Working in 3D Animation Preproduction – Working in 3D Animation Production – Working in 3D Animation Postproduction – Using Production Tools – The Essentials and Beyond.

Unit II: [12 Periods]
Understanding Digital Imaging and Video – Understanding Digital Imaging – Pixels – Raster Graphics vs. Vector Graphics – Anti-Aliasing – Basic Graphic-File Formats – Bit Depth – Color Calibration – Understanding Digital Video – The Essentials and Beyond – Using Principles of Fine Art and Traditional Animation – Building a Good story.

Unit III: [12 Periods]
Using Pre-visualization Techniques – Basic Shot Framing – Camera Movements – Editing – Modeling – Polygons –Subdivision Surfaces –Modeling Workflows – Texturing – Shaders – Texture Maps – Texturing Workflows.

Unit IV: [12 Periods]
Rigging – Parenting – Pivot Positions – Skeleton System – Forward and Inverse Kinematics – Deformers – Constraints – Scripting – Expressions – The Basic Rigging Workflow – Animation – The Basic Animation Workflow – Animation Techniques – Creating Visual Effects – Lighting – Rendering.

Unit V: [12 Periods]
Choosing a computer – Using Monitors/Displays – Working with Graphics Tablets – Using 3D Scanners – Setting up Render Farms – Finding Data Storage solutions – Choosing Software – Using Motion Capture – Creating Stereoscopic 3D – Integrating Point-Cloud Data – Providing Real-Time Capabilities – Working in Virtual Studios.

Textbook:
1. Andy Beane "3D Animation Essentials", John Wiley & Sons, Inc., (2012)

Reference Book:
1. Williams, R, "The Animator's Survival Kit", Faber and Faber Ltd, First Edition, (2001).
2. Scott, J, "How to write for Animation", The Overlook Press, First Edition, (2002).
3. Ranjit Singh, "The Art of Animation Production Management", MacMillan India, First Edition, (2013).
4. Kupeeberg, M, "A Guide to Computer Animation", Focal Press, First Edition, (2002).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
CO1			2		3	2	1		1	3		1	
CO2	2	2		3			3	3		1	3	3	3
CO3		1			1	2	2		2		2		2
CO4	3		3		2	3		1		3		1	3
CO5		3	1	1			2		1			3	

Approved in the BOS Meeting held on 30.04.2021

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Elective – II - Tools for Software Testing	4	4	4	0	Theory

Introduction:
Selenium WebDrivers integration with development and build tools due to its neat and clean object-oriented design. It integration with development and build tools such as Ecllipse, Maven and Microsoft visual studio. These tools provide an easy way to develop test automation frameworks and extend the capabilities of Selenium.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To find elements on a Web page and interact with these elements
CO2	:	To provide a very comprehensive API for working with different types of web elements performing user interactions
CO3	:	To build a great user interface, developers use features similar
CO4	:	To build a highly flexible and robust API to extend the features and commands
CO5	:	The combination of various other tools to build test automation Frameworks.

Unit I: [12 Periods]
Getting Started – Introduction – Finding Elements – Using Browser tools for inspecting elements and page Structure – Finding elements using the find elements method – Finding links – Locating elements using text – Using JQuery selectors.

Unit II: [12 Periods]
Working with elements – Introduction – Automating dropdowns and lists – Working with Selenium API – Introduction – Checking an element's presence – Synchronizing Tests – Synchronizing a test with custom-expected conditions.

Unit III: [12 Periods]
Working with Alerts, Frames and Windows – Introduction – Identifying and handling frames – Data-Driven Testing – Introduction – Creating a data-driven test using JUnit – Using the Page Object Model – Using the Loadable Component class.

Unit IV: [12 Periods]
Extending Selenium – Introduction – Creating an extension class for web tables – Comparing images in Selenium – Testing HTML5 Web Applications – Web storage-testing local storage – Behavior-Driven Development.

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Unit V: [12 Periods]
Integration with Other Tools – Introduction – Configuring Jenkins for continuous integration – Cross-Browser Testing – Introduction – Setting up Selenium grid server for parallel executions – Testing Applications on Mobile Browsers

Textbook:
1. Unmesh Gundecha, "Selenium Testing Tools Cookbook", Second Edition, Packt Publishing ltd., (2015).

Reference Book
1. Glenford J. Myers, Corey Sandler, Tom Badgett, "The Art of software testing", 3rd Edition,John Wiley & Sons, (2021).
2. James A.Whittaker, " How to break software: A Practical guide to testing", Addison Wesley,(2002).
3. Vijay Shinde, "A Software Tester's Journey from getting a job to becoming a Test Leader", All right reserved, (2013).
4. Lee Copeland, "A Practitioner's Guide to Software Test Design", Artech House Computing library, (2003).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
CO1	2		1		3		2		2		1	1	2
CO2		1		2		1		2	3	3	2		
CO3	1	3			2	2		1		2		1	3
CO4	3		2	1	1		3		1		3	3	
CO5		2	3			3	1	3		1		2	1

Approved in the BOS Meeting held on 30.04.2021

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Elective - II - Deploying and Managing a Cloud Infrastructure	4	4	4	0	Theory

Introduction:

It is an excellent resource for IT professionals seeking to tap into the demand for cloud administrators. It provides the latest expert perspectives on enterprise-level mobile computing, and covers the most essential topics for building and maintaining cloud-based systems.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To know the fundamentals of cloud computing in the context of virtualization technology
CO2	:	It covers the open-source and proprietary solutions and cloud implementation
CO3	:	It includes performance metrics across compute, network, storage and resources
CO4	:	It provides hands-on practical knowledge of the intricacies of setting up and managing your own cloud infrastructure
CO5	:	To create and configure multiple virtual networks within the same cloud

Unit I: [12 Periods]

Understanding Cloud Characteristics – Basic Terms and Characteristics – Objects Stroage Concepts – To Grasp the Cloud-Fundamental Concepts – The True Nature of the Cloud – Virtualization and Scaability – The Cloud Hpervisor – Key Benefits of Implementing Hypervisors – Foundations of Cloud Computing.

Unit II: [12 Periods]

Within the Cloud: Technical Concepts of Cloud Computing – Technical basics of Cloud and Scalable Computing – The Cloud Infrastructure – Cloud Management – Understanding Cloud Management Platforms – Service-Level Agreements – Policies and Procedures – Managing cloud Workloads – Managing Devices.

Unit III: [12 Periods]

Diagnosis and Performance Monitoring – Performance Concepts – Disk Performance – Impact of Configuration Changes – Cloud Delivery and Hosting Models – On-Premises vs. Off-Permises Hosting – Accountability and Responsibility based on Delivery Models – Security Differences between models – Functionality and Performance validation.

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Unit IV: [12 Periods]
Practical Cloud Knowledge: Install, Configure and Manage – Setting up the Cloud – Virtual Resource Migration – Virtual Components of the cloud – Hardware Management – Cloud Hardware Resources – Management Differences between Public, Private and Hybrid Clouds – Tiering – File Systems.

Unit V: [12 Periods]
Storage Provisioning and Networking – Cloud Storage Concepts – Cloud vs SAN Storage – Cloud Provisioning – Cloud Storage Technology – Cloud Storage Gateway – Cloud Security and Privacy – Testing and Deployment – Overview of Deployment Models – Cloud management Strategies – Cloud Architecture – Cloud Deployment Options – Creating and Deploying Cloud Services.

Textbook
1. Zafar Gilani, Abdul Salam, Salman UI Haq, "Deploying and Managing a Cloud Infrastructure", Sybex,(2015).

Reference Book:
1. Greg Schulz, "Cloud and Virtual Data Storage Networking", Auerbach Publications, [ISBN: 978-1439851739], (2011).
2. Marty Poniatowski, "Foundations of Green IT" Prentice Hall, 1st edition, [ISBN: 978-0137043750], (2009).
3. EMC, "Information Storage and Management" Wiley, 2nd edition, [ISBN: 978-0470294215], (2012).
4. Volker Herminghaus, Albrecht Scriba, "Storage Management in Data Centers" Springer; editioN [ISBN: 978-3540850229], (2009).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
CO1		3	1		3	2	2		2		1	1	2
CO2	1		3	2		1		2	3	3	2		
CO3		1		3	3	2	2	1		2		3	3
CO4	2		2	1	1		3		1	1	3	2	
CO5		2				3	1	3		2			1

Approved in the BOS Meeting held on 30.04.2021

SEMESTER –IV

ELECTIVE - III

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Elective III - VMware Network Virtualization	4	5	5	0	Theory

Introduction:
It introduces the concept of Software Defined Data Center. The course is designed to introduce basic and fundamental concepts associated with SDDC, Network Virtualization, Security, and the types of business challenges the solution solves by illustrating several use cases. It understands VMware NSX use cases.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To understand the VMware Network Virtualization Fundamentals
CO2	:	To associate with networking concepts such as firewall rules, demilitarized zones, VLANs and access control lists
CO3	:	To presents an alternative address for this challenge with simplicity and familiarity to these contending areas
CO4	:	To define the model of on-demand networking and security services for automated environment
CO5	:	To focus on the design and operation of their data center network as a single enitity

Unit I: [12 Periods]
What is Network Virtualization – Virtualization as the New Reality – The server Virtualization Revolution – Virtualization in Network Technology – Defining Network Virtualization – VMware NSX Architecture. – Rethinking Network Constructs – Layer 2 Connectivity – Layer 3 Connectivity – Introducing Distributed Logical Routing – Introducing Logical Load Balancing.

Unit II: [12 Periods]
Virtualization as Security Control – The Evolution of Firewalls – Statefulness Defined – Demilitarized Zone – Classic Data Center Security Designs – Anatomy of a Modern Cyber Attack – The Zero Trust Model – A Real World Analogy: Secure Airport – Introducing the VMware – NSX Distributed Firewall – Security On-Demand: Service Composer – SpoofGuard.

Unit III: [12 Periods]
Virtual Networks, Real Extensions – The Evolution of Secondary – The Cold Site – The Warm Site – The Hot-Backup Site – The Virtualized Hot Site – The Active Site – Networking Challenges in Active-Standby Sites – Spanning Tree Protocol and Failure Domains – Layer 2 Extension and

Traffic Behavior – Provisioning Complexity – Vmware NSX for Active-Active Sites – Layer 2 VPNs.

Unit IV: [12 Periods]
Industrializing Networks – Automating IT- Pre-Provisioned Networks – Challenges and Limitations – Automating Physical Networks – Example of an automated Network Topology – Network Automation with VMware NSX – VMware NSX integration with Automation stacks – vRealize Automaton – OpenStack.

Unit V: [12 Periods]
One Network – Data Center Network Evolution – Three-Tier Design – Three-Tier Design with Multi-Chassis link Aggregation – Ethernet Fabrics – Data Center Consolidation through Network Virtualization – An Open Data Center Network Architecture – Consolidated NETWORK Operations – VmwarevRealize Log Insight – VmwarevRealize Network Insight.

Textbook:
1. Gustavo A.A.Santana, VCIX-NV and CCIE 8806," VMware NSX Network Virtualization Fundamentals", vmware Press,(2017).

Reference Book:
1. Jonathan Morin, Shinie Shaw, "Network Virtualization for dummies", A Wiley & Sons, 2nd VMware Special Edition, (2018).
2. Dr.Balwinder Singh Sodhi, "Virtualization and Cloud Computing", CC BY-SA License: https://creativecommons.org/licenses/by-sa/3.0/, (2017).
3. Rajendra Chayapathi, Syed F Hassan, Paresh Shah, "Network Functions Virtualization (NFV): A touch of SDN", Ist Edition, (2016).
4. Nigel Cain, Alvin Morales, Michel Luescher, Damian Flynn ,"Building a Virtualized Network Solution Book", Series Editor, Microsoft,

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
CO1		1	21		3	2	2		3		1		2
CO2	1		3	1		1		2	2		2		2
CO3	3	2		3	2		1	1		3		3	3
CO4	2		1	2	1	3	3		1	1	3	2	
CO5		2			1		1	3		2		1	1

Approved in the BOS Meeting held on 30.04.2021

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Elective-III -Business Intelligence and Data Analytics	4	5	5	0	Theory

Introduction:
This course is designed to introduce students to business intelligence concepts and provide students with an understanding of data Analytics along with associated techniques and their benefits to organizations of all sizes.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To know the concepts and components of Business Intelligence
CO2	:	To the delivery of business value and competitive advantage in modern organizations.
CO3	:	Text Analytics and Text mining, to different organizational contexts.
CO4	:	To synthesize knowledge to address ethical dilemmas and resolutions.
CO5	:	To examine the knowledge Management and Collaborative Systems

Unit I: [12 Periods]
An Overview of Business Intelligence, Analytics and Data Science: Sports Analytics – Changing business environments and evolving needs for decision support and analytics – Evolution of computerized decision support to Analytics/Data Science – A framework for business intelligence – Analytics Overview – A brief introduction to Big Data Analytics – An overview of the Analytics Ecosystem – Resources and Links – Vendors, Products and Demos – Periodicals – Foundations and Technologies for Decision Making.

Unit II: [12 Periods]
Business Reporting, Visual Analytics and Business Performance Management: Self-Service Reporting Environment Saves Millions for Corporate Customers – Business Reporting Definitions and Concepts – Data and Information Visualization – Different Types of Charts and Graphs – The Emergence of Data Visualization and Visual Analytics – Performance Dashboards – Business Performance Management – Performance Measurement – Balanced Scorecard – Six Sigma as a Performance Measurement System – Techniques for Predictive Modeling.

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Unit III: [12 Periods]

Text Analytics, Text Mining, and Sentiment Analysis: Concepts and Definitions – Natural Language Processing – Text Mining Applications – Text Mining Process – Sentiment Analysis Overview – Sentiment Analysis and Speech Analytics – Web Mining Overview – Web Content and Web Structure Mining – Search Engines – Social Analytics and Social Network Analysis – Social Media Analytics.

Unit IV: [12 Periods]

Model-Based Decision Making: Optimization and Multi-Criteria Systems – Decision Support Systems Modeling – Structure of Mathematical Models for Decision Support – Mathematical Programming Optimization – Multiple Goals, Sensitivity Analysis, What-If Analysis, and Goal Seeking – Modeling and Analysis: Heuristic Search Methods and Simulation – Automated Decision Systems and Expert Systems.

Unit V: [12 Periods]

Knowledge Management and Collaborative Systems: Information Technology (IT) in Knowledge Management – Tools for Indirect Support of Decision Making – Big Data and Analytics – Fundamentals of Big Data Analytics – Big Data Technologies – Data Scientist – Big Data and Stream Analytics – Emerging Trends and Future Impacts – Location-Based Analytics for Organizations – Impacts of Analytics in Organizations: An Overview.

Textbook:
1. Ramesh Sharda, Dursun Delen, Efraim Turban, "Business Intelligence, Analytics and Data Science: A Managerial Perspective", Pearson Education, Fourth Edition, (2018).

Reference Book:

1. Carlo Vercellis, "Business Intelligence: Data Mining and Optimization for Decision Making", John Wiley & Sons, (2011).
2. David Loshin, "Business Intelligence: The Savvy Manager's Guide", Newnes, (2012).
3. Elizabeth Vitt, Michael Luckevich, Stacia Misner, "Business Intelligence", O'Reilly Media, Inc, (2010).
4. Rajiv Sabhrwal, Irma Becerra-Fernandez "Business Intelligence", John Wiley &Sons, (2010),
5. Swain Scheps, "Business Intelligence for Dummies", Wiley, (2013).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1	1			1		2	2		3		1		2
CO2	2	1	3		1			3	2		2	3	2
CO3		2	2	2		3	1	1		3		1	3
CO4		3			3	1	3		1	1	3	2	
CO5	3		1	3	2			2		2		1	1

Approved in the BOS Meeting held on 30.04.2021

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Elective –III - Virtual Reality	4	5	5	0	Theory

Introduction:
It can provide our minds with direct access to digital media in a way that seemingly has no limits. However, creating compelling VR experiences is an incredibly complex challenge. When VR is done well, the results are brilliant and pleasurable experiences that go beyond what we can do in the real world.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To describe imaginary worlds that only exist in computers and our minds
CO2	:	They can experience symptoms of motion sickness, which is referred to as VR sickness or cyber sickness
CO3	:	To develop using simple application that allows users to easily build their own ideas and explore in virtual settings
CO4		To design and iterative upon effective VR applications with human elements
CO5	:	To design an iterative process is to develop a prototype.

Unit I: [12 Periods]
What is Virtual Reality – History – Overview of various Realitiies – Perception: Objectives and subjective reality – Perceptual models and Processes – Perceptual Modalities – Perception of Space and Time – Perceptual stability, Attention and Action – Perception: Design Guidelines.

Unit II: [12 Periods]
Adverse Health Effects: Motion sickness – Eye Strain, Seizures and Aftereffects – Hardware Challenges – Latency – Measuring Sickness – Summary of factor that contribute to Adverse Effects – Examples of Reducing Adverse effects – Adverse health effects: Design Guidelines.

Unit III: [12 Periods]
Content Creation: High-level concepts of Content Creation – Environmental Design – Affecting Behavior – Personal Wayfinding Aids – Center of Action – Field of view – Transitioning to VR Content Creation – Content Creation: Design Guidelines.

Unit IV: [12 Periods]
Interaction: Human-centered interaction – Intuitiveness – Norman's Pricciples of Interaction Design – VR Interaction Concepts – Interaction Fidelity – Input Devices – Interaction Patterns and techniques – Interaction: Design Guidelines.

Approved in the BOS Meeting held on 30.04.2021

Unit V: [12 Periods]

Iterative Design: Philosophy of Iterative Design – VR is both an art and a science – The Define
Stage – Assessment and Feasibility – The Make Stage – The Learn Stage – Iterative Design: Design
Guidelines.

Textbook:
1. Jason Jerald, Ph.D., "The VR Book: Human-Centered Design for Virtual Reality", ACM
    Books series, First edition, (2016).

Reference Book:
1. Burdea, G. C. and P. Coffet," Virtual Reality Technology", Second Edition. Wiley-IEEE
    Press, (2003/2006).
2. Alan Craig, William Sherman and Jeffrey Will, "Developing Virtual Reality Applications",
    Foundations of Effective Design, Morgan Kaufmann, (2009).
3. John Vince, "Virtual Reality Systems ", Pearson Education Asia, (2007).
4. Grigore C. Burdea, Philippe Coiffet, "Virtual Reality Technology", Wiley Inter Science, 2nd
    Edition, (2006).

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Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1			2	1		3	2		3				3
CO2	2	1	3		1			3	2		3	3	2
CO3	1			3		2	1	2	1	3	2	1	
CO4		3		2	3	1	3			1		2	
CO5			1		2			1		2	1		1

Approved in the BOS Meeting held on 30.04.2021

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Elective – III Agile Testing	**4**	**5**	**5**	**0**	**Theory**

Introduction:
To understand where testing started in agile teams and how it has evolved to become the cornerstone of agile development and continuous delivery of products. Part of successful agile development is an organization's ability to learn what's most critical for long-range success with agile testing.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To keep up with fast-changing technology and new contexts for agile development
CO2	:	To consider the T-shaped skills needed to succeed with testing
CO3	:	To build your exploratory testing capabilities by practice
CO4	:	To manage test technical debt for especially as it relates to test automation
CO5	:	To provide living documentation that can help meet regulatory requirements

Unit I:　　　　　　　　　　　　　　　　　　　　　　　　　　　　[12 Periods]
How agile Testing has evolved – The importance of Organizational Culture – The importance of Organizational Culture – Roles and Competencies – T-Shaped Skill Set – Thinking Skills for testing – Facilitating – Solving Problems – Technical Awareness – Automation and Coding Skills.

Unit II:　　　　　　　　　　　　　　　　　　　　　　　　　　　[12 Periods]
How to learn – Learning Styles – Levels of Precision for Planning – Different Points of View – Using Models to help plan – Are we building the right thing? – Tools for Customer Engagement – The Expanding Testers Mindset – Business Analysis Skills.

Unit III:　　　　　　　　　　　　　　　　　　　　　　　　　　[12 Periods]
The Power of using Examples – Guiding Development with Examples – Exploratory Testing – Creating Test Charters – Other types of Testing – Concurrency Testing – Technical Debt in Testing – Work on the Biggest Problem – Pyramids of Automation.

Unit IV:　　　　　　　　　　　　　　　　　　　　　　　　　　[12 Periods]
Test Automation Design Patterns and Approaches – Involve the whole Team – Selecting Test Automation Solutions – Solutions for Teams in Transition – Agile Testing in the Entreprise - Agile Testing on Distributed Teams – Agile Testing for Mobile and Embedded Systems.

Unit V: [12 Periods]

Agile Testing in Regulated Environments – The "Lack of Documentation" Myth – Agile Testing for Data Warehouses and Business Intelligence Systems – Testing and DevOps – Visualize your Testing – Putting it all together – Confidence-Building practices.

Textbook:

1. Janet Gregory, Lisa Crispin, "More Agile Testing: Learning Journeys for the whole Team", Addison-Wesley, Pearson, (2015).

Reference Books:

1. Robert C. Marti," Agile Software Development, Principles, Patterns, and Practices", Alan Apt Series, (2011).
2. Chhavi Raj Dosaj, "Agile Testing: ISTQB Agile Tester Extension Certificate", SPD, (2017).
3. Lisa Crispin, Janet Gregory, "Agile testing: A practical guide for testers and agile teams", Addision-Wesley, 1st Edition, (2009).

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Course Outcomes	Program Outcomes												
	P01	**P02**	**P03**	**P04**	**P05**	**P06**	**P07**	**P08**	**P09**	**PS01**	**PS02**	**PS03**	**PS04**
CO1			2	1		2	3		3		1		3
CO2	2	1	3		1		1	3	2	1	3	3	2
CO3	3		1	3	2			2	1	3	2	1	
CO4		2		2	3	1		1		2		2	
CO5	1	3	1			3	2				1		1

Approved in the BOS Meeting held on 30.04.2021

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Elective – III - Hybrid Cloud	4	5	5	0	**Theory**

Introduction:
The cloud is dramatically reshaping the enterprise IT landscape. After an early rush to the public cloud, the majority of companies are settling on a hybrid cloud strategy that can utilize resources from traditional enterprise IT, private clouds, public cloud providers, and CSPs.

Course Focus on: Skill Development / Entrepreneurship / Employability / Research

Course Outcome

CO1	:	To support traditional enterprise applications versus cloud-native applications
CO2	:	To provides a prescription for creating a mature hybrid cloud.
CO3	:	To provides the glue that allows your hybrid cloud to operate as a single, cohesive unit.
CO4	:	To provides the glue that allows your hybrid cloud to operate as a single, cohesive unit.
CO5	:	To provides specific recommendations for choosing public clouds, CSPs, and SaaS providers.

Unit I: [12 Periods]
Is It Time Embrace Hybrid Cloud? – What this Report Covers – The Cloud is Reshaping Enterprise IT – What is a Hybrid Cloud? – Applications and the Hybrid Cloud – The state of Hybrid Cloud

Unit II: [12 Periods]
Understanding the Hybrid Cloud – What are the benefits of Hybrid Cloud? Why is Hybrid Cloud the Perferred Enterprise Model? – A Strategy for Hybrid Cloud Success.

Unit III: [12 Periods]
Assessing your Hybrid Cloud needs – Access the current state of your Operations – Access your Future Workload needs – Creating a Workload Decision Matrix – Seek Buy-In – Establish your High-Level Hybrid Cloud Goals.

Unit IV: [12 Periods]
Designing your Hybrid Cloud: On-Premises and Private Cloud – Choosing a Cloud Operating System – Modernizing Datacenters – Availability, Data Protection and Compliance – Designing your Hybrid Cloud: Public Clouds, CSPs and SaaS.

Approved in the BOS Meeting held on 30.04.2021

Unit V: [12 Periods]

Getting Serious about DevOps – What is DevOps – The importance of Infrastructure to DevOps – Adapting your Organization to Hybrid Cloud – Why Organizational Change is Necessary – Organizational Changes for DevOps.

Textbook

1. Philip Trautman, "Designing and Building a Hybrid Cloud", O'Reilly, (2018).

Reference Book:

1. Alok Shrivastwa, "Hybrid Cloud for Architects", Packt Publishing, first edition, (2018).
2. Judith S.Hurwitz, Marcia Kaufman, Fern Halper, Daniel Kirsch, " Hybrid Cloud for Dummies", 2nd Edition, John Wiley & Sons, (2010).
3. Manoj Hirway, "Hybrid Cloud for Developers", Packt,ISBN: 9781788830874, (2018).
4. Shreesh Dubey, Vijay Tandra Sistla, Shivam Garg, Aashish Ramdas, Mitch Tulloch, Series Editor, "Microsoft System Center: Data Protction for the Hybrid Cloud", First Edition, Microsoft Press, (2015).

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
CO1			2	1		2	3		3		1		3
CO2	2	1	3		1		1	3	2	1	3	3	2
CO3	3		1	3	2			2	1	3	2	1	
CO4		2		2	3	1		1		2		2	
CO5	1	3	1			3	2				1		1

Approved in the BOS Meeting held on 30.04.2021

Subject Code	Subject Title	Credit	Lecture	Tutorial	Practical	Type
	Core Project	8	0	0	15	**Practical**

GUIDELINES FOR PROJECT WORK

1. The aim of the Project work is to acquire practical knowledge on the implementation of the programming concepts studied.

2. Each student should carry out individually one Project Work and it may be a work using the software packages that they have learned or the implementation of Concepts from the papers studied or implementation of any innovative idea.

3. The Project work should be compulsorily done in the Industry only under the supervision of the Department staff concerned.

4. The work has to be done in five reviews during IV Semester.

5. External Exam will be conducted as follows. End Semester Viva Voce

- An End- semester Internal Viva-voce will be conducted at the end of IV semester for 200 marks.
- Both the Internal (Respective Guides) and External Examiners (100) + (100) Should Conduct the Viva-Voce Examination at the last day of the practical session.
- Along with the mark sheet an Annexure report containing the candidate's Register no and Title of the Project work should be sent to the Controller of Examinations by the Examiners and a copy of the same has to be retained in the Department.
- No candidate will be allowed to change the title of the Project work after the completion of End- semester Viva.
- For those absent on genuine grounds a common subliment End-Semester Viva-voce may be conducted at the COE for All degree by obtaining prior permission from the COE on the recommendations from the HODs of respective Department before the commencement of the next semester.

Mapping of Course Outcomes with Program Outcomes:

Course Outcomes	Program Outcomes												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	PS01	PS02	PS03	PS04
CO1	1	1	1			1	1			1	1		
CO2	2	3	3	2	1		3	2	1		3	2	1
CO3	3		2	1	3	3	2		3	3			3
CO4	2	2		3	2	2	3	3	1	2	2	3	2
CO5		2	3	1			3	1	2		3	1	

Approved in the BOS Meeting held on 30.04.2021