HINDUSTAN
INSTITUTE OF TECHNOLOGY & SCIENCE
(DEEMED TO BE UNIVERSITY)

M.Sc. Computer Science

(Duration: 2 Years)

CURRICULUM

(Applicable for Students admitted from Academic Year 2023-24)

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

HINDUSTAN INSTITUTE OF TECHNOLOGY AND SCIENCE

HINDUSTAN INSTITUTE OF TECHNOLOGY AND SCIENCE

MOTTO

To Make Every Man a Success and No Man a Failure

VISION

To be an International Institute of Excellence, providing a conducive environment for education with a strong emphasis on innovation, quality, research, and strategic partnership blended with values and commitment to society.

MISSION

- To create an ecosystem that promotes learning and world-class research.
- To nurture creativity and innovation.
- To instill highest ethical standards and values with a sense of professionalism.
- To take up activities for the development of Society.
- To develop national and international collaborations and strategic partnerships with industry and institutes of excellence.
- To enable graduates to become future leaders and innovators.

VALUE STATEMENT

- Integrity, Innovation, and Internationalization.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

VISION

To excel in Computer Science and Engineering education, research, and project management by empowering the students with strong conceptual knowledge.

MISSION

M1: To educate the students with basic foundation blocks of core and allied disciplines of Computer Science.

M2: To provide practical skills in the advancements of the Computer Science field required for the growing dynamic IT and ITES industries.

M3: To sculpt strong personal, technical, research, entrepreneurial, and leadership skills.

M4: To inculcate knowledge in lifelong learning, professional ethics and contribution to the society.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

The Program Educational Objectives (PEOs) of B.Sc. Computer Science are listed below:

The graduate after 3 years of program completion will

PEO1: Excel in his/her professional career or pursue higher education including research by applying the knowledge of Computer Science

PEO2: Demonstrate the technical skills to analyze and design appropriate solutions for problems with social consciousness and ethical values.

PEO3: Adapt themselves to organizational needs by understanding the dynamically changing technologies.

PROGRAM OUTCOMES (ALIGNED WITH GRADUATE ATTRIBUTES) (PO)

(To be achieved by the student after every semester/year/and at the time of graduation)

At the end of this program, graduates will be able to

PO1: Computational knowledge: Apply the knowledge of mathematics, science, fundamentals, and an engineering specialization to the solution of complex problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex problems reaching substantiated conclusions using the first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including the design of experiments, analysis, and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling of complex engineering activities with an understanding of the limitations.

PO6. Professional Ethics: Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practice.

PO7. Life-long learning: Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.

PO8. Project management and finance: Demonstrate knowledge and understanding of the computing and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO9 Communication Efficacy: Communicate effectively with the computing community, and with society, about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.

PO10: Societal and Environmental Concern: Understand and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practice.

PO11: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO12: Innovation and Entrepreneurship: Identify a timely opportunity and use innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.

PROGRAMME- SPECIFIC OUTCOMES (PSO'S)

PSO 1: Understand and develop programming skills in the areas of full stack and web development**.**

PSO 2: Use appropriate AR / VR tools to provide working professionals with the essential Unity3D skills/tools needed to build VR/AR apps with a better understanding of emerging technologies.

PSO3: Ability to develop problem-solving skills through programming techniques for addressing real-life problems using appropriate principles and concepts of the Internet of Things**.**

M.Sc. Computer Science-Curriculum									
SEMESTER-I									
S.NO	**COURSE CATEGORY**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	BS	CMA02003	Mathematical Concepts for Computer Science	3	0	2	4	0	5
2	PC	CAD02003	Advanced Algorithms and Analysis	2	1	2	4	2	5
3	PC	ACS02001	Communication Networks	3	1	0	4	0	4
4	PC	ACS02002	Advanced Data Base Management Systems	3	0	0	3	1	3
5	PC	ACS02004	Advanced Computer Architecture	3	0	2	4	0	5
PRACTICAL									
6	PC	ACS02400	Advanced Data Base Management Systems Lab	0	0	2	1	0	2
			Total	14	2	8	20	3	24

L – Lecture; T – Tutorial; P – Practical; C – Credit; S- Self Study; TCH- Total Contact Hours

SEMESTER-II									
S.NO	**COURSE CATEGORY**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	PC	ACS02005	Software Engineering Methodologies	3	0	0	3	0	3
2	PC	ACS02006	Advanced Operating Systems	2	1	2	4	1	5
3	PC	ACS02007	Wireless Communications	3	0	0	3	0	3
4	PC	ACS02008	Advanced Network Security	3	0	2	4	0	5

5	DE	ACS025**	Elective-I	3	0	2	4	0	5
PRACTICAL									
6	PC	ACS02401	Mobile Communication LAB	0	0	4	2	0	4
			Total	**14**	**1**	**10**	**20**	**1**	**25**
L – Lecture; T – Tutorial; P – Practical; C – Credit; S- Self Study; TCH- Total Contact Hours									

SEMESTER-III									
S.NO	**COURSE CATEGORY**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	PC	ACS02009	Cognitive Computing	3	1	0	4	1	4
2	PC	ACS02010	Information Security	3	0	0	3	1	3
3	PC	ACS02003	Research Paper Reviews	3	0	0	3	2	3
4	PC	ACS02011	Cyber Forensics	3	0	2	4	1	5
5	DE	Elective-II	Elective-II	3	0	2	4	0	5
PRACTICAL									
6	PC	ACS02801	Internship*	*			2	*	
			Total	**15**	**1**	**4**	**20**	**5**	**20**
L – Lecture; T – Tutorial; P – Practical; C – Credit; S- Self Study; TCH- Total Contact Hours • **15 days Internship carried out in the end of SEM II and evaluated in the SEM III**									

SEMESTER-IV									
S.No	**Course Category**	**Course Code**	**Name of the course**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	PC	ACS02012	Virtualization and Cloud Computing	3	1	0	4	1	4
2	PC	ACS02013	Cyber Security Essentials	3	1	0	4	1	4
PRACTICAL									
3	PC	ACS02802	Project	0	0	24	12	2	24
			Total	0	0	24	20	0	32

TOTAL CREDITS: 80

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DEPARTMENT ELECTIVES								
SEM	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
FULL STACK DEVELOPMENT								
2	ACS02500	Typescript	3	0	2	4	0	5
2	ACS02501	Back End Development	3	0	2	4	0	5
3	ACS02502	Web Development	3	0	2	4	0	5
3	ACS02503	MEAN Stack development	3	0	2	4	0	5
AUGUMENTED REALITY/VIRTUAL REALITY								
2	ACS02504	AR/VR Tools and Techniques	3	0	2	4	0	5
2	ACS02505	Emerging trends in AR/VR	3	0	2	4	0	5
3	ACS02506	3D Texturing and Sculpting	3	0	2	4	0	5
3	ACS02507	Unity for AR/VR	3	0	2	4	0	5
IOT								
2	ACS02508	5G & IOT Technologies	3	0	2	4	0	5
2	ACS02509	Cognitive Iot	3	0	2	4	0	5
3	ACS02510	Wearable Computing	3	0	2	4	0	5
3	ACS02511	IOT Security	3	0	2	4	0	5

SEMESTER-I					
COURSE TITLE	**MATHEMATICAL CONCEPTS OF COMPUTER SCIENCE**		**CREDITS**	**4**	
COURSE CODE	**CMA02003**	**COURSE CATEGORY**	**BS**	**L-T-P-S**	**3-0-2-1**
VERSION	**1.0**	**APPROVAL DETAILS**	**38-ACM 13-05-2023**	**LEARNING LEVEL**	**BTL-3**

ASSESSMENT SCHEME					
CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ assignments/ Project**	**Surprise Test / Quiz**	**Attendance**	**ESE**
15%	15%	10%	5%	5%	50%

Course Description	The course focuses on the statistical modelling for computer science and the applications of statistics in the field of areas like artificial intelligence and Data Analytics. Formal languages and automata theory deals with the concepts of automata, formal languages, grammar, computability and decidability. The reasons to study Formal Languages and Automata Theory are Automata Theory provides a simple, elegant view of the complex machine that we call a computer. Automata Theory possesses a high degree of permanence and stability, in contrast with the ever-changing paradigms of the technology, development, and management of computer systems.
Course Objective	1. To understand the concepts of Statistics Methods and probability distribution. 1. To understand the sampling inference and testing of hypothesis. 2. To learn correlation and regression in nonparametric method 3. To understand curve fitting and decision theory 4. To Understand the analysis of variance in statistical problems.
Course Outcome	Upon completion of this course, the students will be able to 1. Apply the concepts of Statistics method and probability distribution. 2. Analyze Null and Alternative hypothesis in the statistical problems. 3. Elucidate the relation between two variables by using correlation andregression in not parametric method 4. Calculate the curve fitting equation based on the statistical data. 5. Analysis the significance difference between the classification of data.

Prerequisites: Maths

CO,PO,PSO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3	PSO4
CO 1	1	1	-	-	-	-							-	-	1	1
CO 2	-	-	-	-	-	-							-	-	-	-
CO 3	1	-	2	-	-	2							-	-	-	2
CO 4	1	-	2	-	-	2							-	-	-	2
CO 5	1	-	2	-	-	2							-	-	-	2

MODULE 1: STATISTICAL METHODS	**(9L+3P)**
Introduction – steps of statistical methods – Measures of central tendency – Measures of dispersion – coefficient of variation – skewness – kurtosis. Introduction – Definition of probability – addition and multiplication law of probability – conditional probability – Theorem	**CO-1 BTL-2**

of total probability – Bayes' theorem – RV – Discrete & continuous probability distributions – Binomial, Poisson, uniform & normal distribution.Practical Component: Implement calculation of simple statistical measures using MATLAB	
MODULE 2: SAMPLING INFERENCE AND TESTING OF HYPOTHESIS	**(9L+3P)**
Introduction – steps of statistical methods – Measures of central tendency – Measures of dispersion – coefficient of variation – skewness – kurtosis. Introduction – One sample test– Two sample tests – Small sample test – t-test – Ftest – Chi-square test.	**CO-2 BTL-2**
MODULE 3 CORRELATION AND REGRESSION	**(9L+3P)**
Simple, Multiple Regression and correlation – Nonparametric methods-Empirical laws and Curve Fitting – Decision Theory. Analysis of variance – one way & Two-way classification – Time series and forecasting. Implement analysis of variance and time series analysis.	**CO-3 BTL-2**
MODULE 4 FINITE MACHINE	**(9L+3P)**
Turing Machine : Introduction, The Turing Machine Model, Computable Languages and Functions , Techniques Turing Machine Construction, Modification of Turing Machines, Church's Hypothesis, Turing Machine As Enumerators, Restricted Turing Machine Equivalent to The Basic Model. Chomsky: Regular Grammars, Unrestricted Grammars, Context Sensitive Languages, Relation between Classes of Languages Tree Structures – Graph structures – graph representations – regular graph structures –random graphs – Connectivity – Cycles – Graph Coloring – Cliques, Vertex Covers, Independent sets – Spanning Trees – network flows – matching	**CO-4 BTL-2**
MODULE 5: FINITE AUTOMATA	**(9L+3P)**
Finite Automation and Regular Expression: Finite State Systems, Basic Definitions, Non - Deterministic Finite Automata, Finite Automata with Moves, Regular Expressions, Two Way Finite Automata, Finite Automata with Output, Application on Finite Automata. Properties of Regular Sets: The Pumping Lemma for Regular Sets, Close Properties of Regular Sets, Decision Algorithms for Regular Sets.	**CO-5 BTL-2**

1.	Dirk P.Kerose, Joshua C.C.Cla(2016), Statistical Modeling and Computation ,Publisher, Springer.
2.	Richard I. Levin, David S. Rubin (2017), Statistics for Management, Pearson Education Prentice -Hall 8th Edition.
REFERENCE BOOKS	
1.	Hopcroft, Ullman " Theory of Computation & Formal Languages", TMH.
2.	Anand Sharma, "Theory of Automata and Formal Languages", Laxmi Publisher.
3.	Formal Languages And Automata Theory, H S Behera, Janmenjoy Nayak , Hadibandhu Pattnayak, Vikash Publishing, New Delhi.
E-BOOKS	
1.	https://www.datasciencecentral.com/forum/topics/free-book-probabilistic-andstatistical-modeling-in-computerhttps://files.boazbarak.org/introtcs/lnotes_book.pdf
2.	https://machinelearningmastery.com/statistics-books-for-machine-learning/
MOOC	
1.	https://www.mooc-list.com/tags/statistical-modelinghttps://www.whitman.edu/mathematics/cgt_online/cgt.pdf
2.	https://www.edx.org/course/statistics-computation-and-applications

COURSE TITLE	ADVANCED ALGORITHMS AND ANALYSIS		CREDITS	4	
COURSE CODE	CAD02003	COURSE CATEGORY	PC	L-T-P-S	2-1-2-2
VERSION	1.0	APPROVAL DETAILS	38-ACM 13-05-2023	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

CIA					ESE
First Periodical Assessment	Second Periodical Assessment	Seminar/ assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	This course introduces advanced methods for the design and analysis of efficient algorithms emphasizing methods useful in practice.Different algorithms for a given computational task are presented and their relative merits evaluated based on performance measures
Course Objective	1. To analyze worst case and average case running times using asymptotic notation. 2. To identify limitation of algorithm. 3. To get awareness about various algorithmic techniques and real time applications. 4. To solve real world problems. 5. To identify efficient algorithm for NP hard problems
Course Outcome	Upon completion of this course, the students will be able to CO1. Apply the asymptotic notations to analyze worst-case and average case running times of algorithms. CO2. Identify the limitations of algorithms in problem solving. CO3. Describe the various algorithmic techniques and its real time applications. CO4. Solve the real-time problem using graphs. CO5. Determine an efficient algorithms NP hard problem.

Prerequisites: NIL

CO,PO, AND PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	1	-	-	-	-	-	-	-	-	1	1	1	1	1	1
CO2	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
CO3	1	-	2	-	-	2	1	-	-	-	2	-	-	2	-	2

MODULE 1 INTRODUCTION	(9L+6P)
Introduction – Algorithms – Analysing and Designing Algorithms - Growth of Functions – Asymptotic notation - Probabilistic Analysis and Randomized Algorithms - Indicator random variables - Randomized algorithms - Probabilistic analysis and further uses of indicator random variables **Practical component:** 1. Calculate complexity of algorithms using step count method. **Suggested Readings:** https://onlinecourses.nptel.ac.in/noc18_cs20	**CO-1 BTL-2**
MODULE 2 DIVIDE-AND-CONQUER	**(9L+6P)**

The maximum- Subarray problem - Strassen's algorithm for matrix multiplication - The substitution method for solving recurrences- The recursion-tree method for solving recurrences – Heapsort - Quicksort - Priority queues. **Practical component:** Solve problems using divide and conquer approach and analyze its complexity. **Suggested reading:** https://onlinecourses.nptel.ac.in/noc18_cs20Binary –	**CO-2 BTL-2**
MODULE 3 : DYNAMIC PROGRAMMING AND GREEDY ALGORITHMS	**(6L+6P)**
Dynamic Programming - Elements of dynamic programming - Optimal binary search trees - Greedy Algorithms - An activity-selection problem - Huffman codes **Practical component:** 1. Solve problem using Greedy approach and analyze its complexity 2. Solve problem using dynamic programming approach and analyze its complexity. **Suggested reading:** https://onlinecourses.nptel.ac.in/noc18_cs20	**CO-3 BTL-2**
MODULE 4 : ELEMENTARY GRAPH ALGORITHMS	**(6L+6P)**
Representations of graphs - Breadth-first search - Depth-first search - Minimum Spanning Trees - The algorithms of Kruskal and Prim – Single Source Shortest Paths - Single-source shortest paths in directed acyclic graphs - Dijkstra's algorithm - All-Pairs Shortest Paths - The Floyd Warshall algorithm **Practical component:** 1. Implement Single source shortest path algorithm and Analyze its complexity 2. Implement All source shortest path algorithm and Analyze its complexity 3. Implement Minimum spanning tree algorithm and analyze its complexity **Suggested reading** :https://onlinecourses.nptel.ac.in/noc18_cs20Dynamic Programming: Matrix-Chain Multiplication – Elements of Dynamic Programming – Longest Common Subsequence- Greedy Algorithms: An Activity-Selection Problem – Elements of the Greedy Strategy- Huffman Codes	**CO-4 BTL-2**
MODULE 5 LINEAR PROGRAMMING	**(6L+6P)**
Formulating problems as linear programs - The simplex algorithm - NP-CO-5 Completeness - NP-completeness and reducibility - Approximation Algorithms - The traveling-salesman problem - The set-covering problem **Practical component:** Implement Approximation algorithms for Traveling salesman problem and analyze its complexity **Suggested Readings:** https://www.edutechlearners.com/design-analysisalgorithms	**CO-5 BTL-2**

TEXTBOOKS	
1	Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, ―Data Structures and Algorithms‖, Pearson Education, Reprint 2006.

2	Robert Sedgewick and Kevin Wayne, ―ALGORITHMS, Fourth Edition, Pearson Education.
3	S.Sridhar,Design, and Analysis of Algorithms, First Edition, Oxford University Press. 2014
4	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, ―Introduction to Algorithms, Third Edition, Prentice-Hall, 2011.
REFERENCE BOOKS	
1	Data Structures – A Pseudocode Approach with C++ - Gilberg and Forouzan by Cengage Hill
2	Schaum's Outline of Data Structures with C++ - Hubbard John. R by Tata McGraw
3	Data Structures Using C and C++ - Langsam, Augenstein, Tanenbaum by Pearson Education
E-BOOKS	
1	https://dokumen.tips/documents/fundamentals-of-algorithmics-brassard-bratley.html?page=1
2	https://sd.blackball.lv/library/Introduction_to_Algorithms_Third_Edition_(2009).pdf
3	https://kishorekoduvayur.files.wordpress.com/2017/12/schaums-programming-with-c-434.pdf
MOOC	
1	http://www.coursera.org/learn/advanced-data-structures
2	http://ocw.mit.edu/6-851S12 (MITOPENCOURSEWARE, Massachusetts Institute of Technology)
3	http://freevideolectures.com/Course/2279/Data-Structures-And-Algorithm

COURSE TITLE	**COMMUNICATION NETWORKS**	**CREDITS**	**4**		
COURSE CODE	**ACS02001**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**3-1-0-1**
VERSION	**1.0**	**APPROVAL DETAILS**	**38-ACM 13-05-2023**	**LEARNING LEVEL**	**BTL - 3**

ASSESSMENT SCHEME

CIA			**ESE**		
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ assignments/ Project**	**Surprise Test / Quiz**	**Attendance**	**ESE**
15%	15%	10%	5%	5%	50%

Course Description	This module is the second level module of the curricula related to the computer network field that provides in-depth coverage of some basic topics taught such as layered communication architecture, routing algorithms, and congestion control algorithms.
Course Objective	This module aims to provide a broad coverage of some new advanced topics in the field of computer networks (wireless networks, mobile networks, VPN networks, Mobile IP, etc.)
Course Outcome	After the completion of the course, students will be able to CO1: Understand advanced concepts and next-generation networks CO2: Analyze TCP/IP variants, network Algorithm, Protocols, and their functionalities CO3: Comprehend features of SDN and its application to next-generation systems CO4: Analyze the performance of various server implementations CO5: Analyse the various routing algorithms

Prerequisites: NIL

CO,PO, AND PSO MAPPING

CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**

CO 1	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**1**	**1**	**1**	**1**
CO 2	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**
CO 3	**1**	**-**	**2**	**-**	**-**	**2**	**1**	**-**	**-**	**-**	**2**	**-**	**-**	**2**	**-**	**2**
CO 4	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**-**	**-**	**-**		**-**	**2**
CO 5	**-**	**-**	**-**	**-**	**1**	**2**	**1**	**-**	**-**	**-**	**1**	**2**	**1**	**1**	**-**	**2**

MODULE 1NETWORK LAYER	**9L CO1,BTL-2**

Network layer: Network Layer Services, Packet Switching, Performance, provided transport layers, implementation connectionless services, implementation connection oriented services, comparison ofvirtual – circuit and datagram subnets.IPV4 Address, Forwarding of IP Packets, Internet Protocol, ICMP v4, Mobile IP

MODULE 2 ROUTING ALGORITHMS	**9L CO2,BTL -3**

Routing Algorithms–Distance Vector routing, Link State Routing, Path Vector Routing, Unicast Routing Protocol-Internet Structure, Routing Information Protocol, Open Source Path First, Border Gateway Protocol V4, Broadcast routing, Multicasting routing, Multicasting Basics, Intradomain Multicast Protocols, IGMP.

MODULE 3 IPV6 ADDRESSING	**9L CO3,BTL-3**

IPv6 Addressing, IPv6 Protocol, Transition from IPv4 to IPv6.Transport Layer Services, connectionless versus connection-oriented protocols. Transport Layer Protocols: Simple Protocol, Stop and Wait, Go-Back-N, Selective repeat, Piggy Backing. UDP: User datagram, Services, Applications: TCP services, TCP features, segement, A TCP connection, Flow control, error control, congestion control.

MODULE 4 ANALYSIS OF NETWORK CONGESTION	**9L CO4,BTL-4**

Analysis of Network congestion Mechanism, Routing algorithms, ARQ protocols Multimedia Networking; Implementation of multi-threaded Web Server/Web Proxy with Caching/Filtering features, Sliding Window protocol implementation, performance study of various TCP/IP variants.

MODULE 5 SCTP	**9L CO1,BTL-3**

SCTP: SCTP services SCTP features, packet format, An SCTP association, flow control, error control. QUALITY OF SERVICE: flow characteristics, flow control to improve QOS: scheduling, traffic shaping, resource reservation, admission control. Software Defined Network -Comparison between SDN and traditional networks -SDN controller, Switch design, SDN Controller-Switch Protocols, Open Flow Protocol, Control Overhead & Handoff algorithms. Network Function Virtualization -NFV Architecture, Use cases, NFV Orchestration and NFV for 5G.

TEXTBOOKS	
1	Computer Networks, Andrew S. Tanenbaum, David J. Wetherall, Pearson Education India; 5 editions, 2013.
2	Computer Networks: A Systems Approach, LL Peterson, BS Davie, Morgan-Kauffman , 5th Edition, 2011.
3	Computer Networking: A Top-Down Approach JF Kurose, KW Ross, Addison-Wesley , 5th Edition, 2009
4	Data Communication and Networking , Behrouz A. Forouzan, McGraw Hill, 5th Edition, 2012
REFERENCE BOOKS	
1	Douglas E Comer. Internet Working with TCP/IP Volume -1, Sixth Edition, Addison-Wesley Professional;2013.
2	Goransson P, Black C, Culver T. Software Defined Networks: a Comprehensive Approach. Morgan Kaufmann; 2014.

3	Chayapathi R, Hassan SF, Shah P. Network Functions Virtualization (NFV) with a Touch of SDN: Netw Fun Vir (NFV ePub_1. Addison-Wesley Professional; 2016 Nov 14.
4	Marschke D, Doyle J, Moyer P. Software Defined Networking (SDN): Anatomy of OpenFlow Volume 1. 2015.
E-BOOKS	
1	http://iotmumbai.bharatividyapeeth.edu/media/pdf/lab_manuals/Manual_CM5I_ACN_22520_031020.pdf
2	https://csc-knu.github.io/sys-prog/books/Andrew%20S.%20Tanenbaum%20-%20Computer%20Networks.pdf
3	https://eclass.teicrete.gr/modules/document/file.php/TP326/%CE%98%CE%B5%CF%89%CF%81%CE%AF%CE%B1%20(Lectures)/Computer_Networking_A_Top-Down_Approach.pdf
MOOC	
1	https://freevideolectures.com/course/2276/computer-networks
2	https://archive.nptel.ac.in/courses/106/106/106106243/
3	https://github.com/Developer-Y/cs-video-courses

COURSE TITLE	**ADVANCED DATABASE MANAGEMENT SYSTEMS**		**CREDITS**	**3**	
COURSE CODE	**ACS02002**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**3-0-0-0**
VERSION	**1.0**	**APPROVAL DETAILS**	**38-ACM, 13-05-2023**	**LEARNING LEVEL**	**BTL - 4**
ASSESSMENT SCHEME					
CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ assignments/ Project**	**Surprise Test / Quiz**	**Attendance**	**ESE**
15%	15%	10%	5%	5%	50%
Course Description	This module builds on the introductory module in databases. It intends to introduce more advanced topics in databases such as data mining and data warehousing, distributed databases, and client server architecture after introducing the DBMS implementation.				
Course Objective	This module aims to give students in-depth information about system implementation techniques, data storage, representing data elements, database system architecture, the system catalog, query processing and optimization, transaction processing concepts, concurrency control techniques, database recovery techniques, database security and authorization, and enhanced data models for advanced applications, temporal databases, deductive databases, database technology for decision support systems, distributed databases and client-server architecture, advanced database concepts, and emerging technologies and applications.				
Course Outcome	CO1 Master the basic concepts and appreciate the applications of database systems. CO2 Master the basics of SQL and construct queries using SQL. CO3 Be familiar with a commercial relational database system (Oracle) by writing SQL using the system. CO4 Understand the concepts of database technology for decision support systems,				

	distributed databases and client-server architecture. CO5 Understand the concept of emerging technologies and applications.

Prerequisites: NIL

CO,PO,AND PSO MAPPING															
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**1**	**1**	**1**
CO 2	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**
CO 3	**1**	**-**	**2**	**-**	**-**	**2**	**1**	**-**	**-**	**-**	**2**	**-**	**-**	**2**	**-**
CO 4	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**-**	**-**	**-**		**-**
CO 5	**-**	**-**	**-**	**-**	**1**	**2**	**1**	**-**	**-**	**-**	**1**	**2**	**1**	**1**	**-**

MODULE 1 OVERVIEW	**9L**
PL/SQL – Introduction to PL/SQL – Declare, begin statements, Variables, Control Structure, PL/SQL Transactions – Savepoint, Cursor, PL/SQL Database Objects – Procedures, Functions, Packages, Triggers. Programmatic SQL – Embedded SQL, Dynamic SQL, and ODBC Standard. Definition of Transaction and ACID properties. Transaction Processing – Transaction-processing monitors, transactional workflows, main-memory databases, real-time transaction systems, long-duration transactions, and transaction management in multi-databases. Concurrency Control – Locks, Optimistic Concurrency Control (Backward and Forward validations), Timestamping Concurrency Control.	**CO1,BTL - 3**
MODULE 2 OO DATABASE	**9L**
Object-based databases – Complex data types, structured types and inheritance in SQL, table inheritance, array and multiset types in SQL, object identity and reference types in SQL, implementing O-R features, Persistent programming languages, OO vs OR. XML – Structure of XML, Document Schema, Querying and Transformation, API in XML, XML applications.	**CO2,BTL - 3**
MODULE 3 OLAP	**9L**
On-line Analytical Processing – OLAP Benchmarks, applications, benefits, tools, categories, extensions to SQL, Data mining – introduction, techniques,predictivemodeling, tools. Data mining algorithms – Apriori, Decision tree,k-means, Bayesian classifier.	**CO3,BTL - 3**
MODULE 4 OTHER TYPES OF DATABASES	**9L**
More Recent Applications Mobile databases; Multimedia databases; Geographical Information Systems; Genome data management. Introduction to Data Warehousing – Concepts, Benefits and Problems, DW Architecture – Operational Data, load manager, meta data, DW Data flows – inflow, upflow, meta flow, DW tools and technologies – Extraction, cleansing, and transformation tools, DW DBMS, admin and management tools, data marts – reasons and issues, Data Warehousing using Oracle. Data Warehousing Design – Designing, Dimensionality modeling, Design methodology, DW design using Oracle.	**CO1,BTL - 4**
MODULE 5 SECURITY IN DATABASES	**9L**
Security and integrity threats, Defence mechanisms, Statistical database auditing & control. Security issue based on granting/revoking of privileges, Introduction to statistical database security. PL/SQL Security – Locks – Implicit locking, types and levels of locks, explicit locking, Oracles' named Exception Handlers.	**CO2,BTL - 4**
TEXTBOOKS	

1.	Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, 6th edition, Tata McGraw Hill, 2011
2.	RamezElmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, 4th Edition, Pearson/Addisionwesley, 2007
REFERENCE BOOKS	
1.	Hector Garcia-Molina, Jeff Ullman, and Jennifer Widom, “Database Systems: The Complete Book”, Pearson, 2011.
2.	Niall O’Higgins, “Mongo D B and Python”, O’reilly, 2011.
3	W. Lemahieu, S. vandenBroucke and B. Baesens Principles of Database Management: Practical Guide to Storing, Managing and Analyzing Big and Small Data Cambridge University Press ,2018 ISBN: 978-1107186125
4	T. M. Connolly and C. Begg,”Database Systems: Practical approach to design, implementation, and management “ Pearson Education Date: 2015 ISBN: 978-1292061184
E-BOOKS	
1	https://www.kopykitab.com/eBooks-for-MCA-master-of-computer-applications
2	https://www.oreilly.com/library/view/mongodb-and-python/9781449312817/
3	https://people.inf.elte.hu/miiqaai/elektroModulatorDva.pdf
MOOC	
1	https://cosmolearning.org/courses/database-design-417/video-lectures/
2	https://freevideolectures.com/course/2668/database-management-system
3	https://archive.nptel.ac.in/courses/106/105/106105175/

COURSE TITLE	**ADVANCED COMPUTER ARCHITECTURE**	**CREDITS**		**4**	
COURSE CODE	**ACS02003**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**3-0-2-1**
VERSION	**1.0**	**APPROVAL DETAILS**	**38-ACM 13-05-2023**	**LEARNING LEVEL**	**BTL - 3**

ASSESSMENT SCHEME

CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ assignments/ Project**	**Surprise Test / Quiz**	**Attendance**	**ESE**
15%	15%	10%	5%	5%	50%

Course Description	This module focuses on advanced computer architectures and low-level system software such as pipelined and Multiprocessor systems.
Course Objective	To make students know about the Parallelism concepts in Programming • To give the students an elaborate idea about the different memory systems and buses. • To introduce the advanced processor architectures to the students. • To make the students know about the importance of multiprocessor and multicomputers. • To study about data flow computer architectures
Course Outcome	CO1: Demonstrate concepts of parallelism in hardware/software. CO2 : Discuss memory organization and mapping techniques. CO3 : Describe architectural features of advanced processors.

	CO4 : Interpret performance of different pipelined processors. CO5: Explain data flow in arithmetic algorithms

Prerequisites:

CO,PO,AND PSO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO 11	PO12	PSO1	PSO2	PSO3
CO 1	1	1	-	-	-	-	-	-	-	-	1	1	1	1	1
CO 2	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
CO 3	1	-	2	-	-	2	1	-	-	-	2	-	-	2	-
CO 4	-	-	1	-	-	1	-	-	1	-	-	-	-		-
CO 5	-	-	-	-	1	2	1	-	-	-	1	2	1	1	-

MODULE 1 PIPELINE AND VECTOR PROCESSING	**(6L+6P)**
Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processors. **Practical Component:** 1. Implement a C program to convert a Hexadecimal, octal, and binary number to decimal number vice versa. 2. Implement a C program to perform Binary Addition & Subtraction.	**CO1,CO2 ,BTL - 3**
MODULE 2 COMPUTER ARITHMETIC	**(6L+6P)**
Addition and Subtraction, Hardware Implementation, Multiplication Algorithms and Hardware Implementation, Division Algorithms and Hardware Implementation, Floating Point Arithmetic Operations. **Practical Component:** 1. Implement a C program to perform Multiplication of two binary numbers 2. Implement a C program to perform Multiplication of two binary numbers (signed) using Booth's Algorithms. 3. Implement a C program to perform division of two binary numbers (Unsigned) using restoring division algorithm. 4. Implement a C program to perform division of two binary numbers (Unsigned) using non-restoring division algorithm.	**CO3,CO4 ,BTL - 3**
MODULE 3 PARALLEL COMPUTER MODELS	**(6L+6P)**
Evolution of Computer Architecture, System Attributes to Performance, Shared Memory Multiprocessors, Distributed Memory Multicomputer, Vector Super Computers, SIMD Super Computers. **Practical Component:** 1. SIMD 2. Vector Processor	**CO5,CO6 ,BTL - 3**
MODULE 4 PROCESSORS AND MEMORY HIERARCHY	**(6L+6P)**
Advanced Processor Technology: Design Space of Processors, Instruction-Set Architectures, CISC scalar Processors, RISC scalar Processors, Super Scalar and Vector Processors: Superscalar Processors **Practical Component:** 1. RISC	**CO1,CO2 ,BTL - 3**

2. CISC	
MODULE 5 PIPELINING AND SUPERSCALAR TECHNIQUES	**(6L+6P)**
Linear Pipeline Processors: Asynchronous and Synchronous models, Clocking and Timing Control, Speedup, Efficiency and Throughput, Pipeline Schedule Optimization, Instruction Pipeline Design: Instruction Execution Phases, Mechanisms for Instruction Pipelining, Dynamic Instruction Scheduling, Branch Handling Techniques **Practical Component:** 1. Pipeline 2. Scheduling 3. Clocking and timing	**CO2,CO4 ,BTL - 3**

TEXTBOOKS	
1.	Computer System Architecture, Morris M. Mano, 3rd edition, Pearson/Prentice Hall India
2	Kai Hwang and Naresh Jotwani, Advanced Computer Architecture (SIE): Parallelism, Scalability, Programmability, McGraw Hill Educastion 3/e. 2015
3	John L. Hennessy and David A. Patterson, Computer Architecture: A quantitative approach, 5th edition, Morgan Kaufmann Elseveir, 2013
REFERENCE BOOKS	
1	Computer Architecture, Fourth edition, J. L. Hennessy and D.A. Patterson. ELSEVIER.
2	Advanced Computer Architectures, S.G. Shiva, Special Indian edition, CRC, Taylor &Francis.
3	Introduction to High Performance Computing for Scientists and Engineers, G. Hager and G. Wellein, CRC Press, Taylor & Francis Group
4	Advanced Computer Architecture, D. Sima, T. Fountain, P. Kacsuk, Pearson education
E-BOOKS	
1	http://cs.baylor.edu/~maurer/aida/courses/archintro.pdf
2	https://ict.iitk.ac.in/wp-content/uploads/CS422-Computer-Architecture-patterson-5th-edition.pdf
3	https://www.cse.iitd.ac.in/~srsarangi/advbook/index.html
MOOC	
1	http://www.gcekjr.ac.in/pdf/lectures/2020/6292All_5th%20Semester_Computer%20Science%20And%20Engineering.pdf
2	https://abit.edu.in/wp-content/uploads/2019/11/ADVANCED-COMPUTER-ARCHITECTURE-1-1.pdf

COURSE TITLE	**ADVANCED DATABASE MANAGEMENT SYSTEMS LAB**		**CREDITS**	**1**	
COURSE CODE	**ACS02400**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**0-0-2-0**
VERSION	**1.0**	**APPROVAL DETAILS**	**38-ACM 13-05-2023**	**LEARNING LEVEL**	**BTL - 4**

ASSESSMENT SCHEME

CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ assignments/ Project**	**Surprise Test / Quiz**	**Attendance**	**ESE**
15%	15%	10%	5%	5%	50%

Course Description	This module builds on the introductory module in databases. It intends to introduce more advanced topics in databases such as data mining and data warehousing, distributed databases and client server architecture after introducing the DBMS implementation.
Course Objective	This module aims to give students in depth information about system implementation techniques, data storage, representing data elements, database system architecture, the system catalog, query processing and optimization, transaction processing concepts, concurrency control techniques, database recovery techniques, database security and authorization, and enhanced data models for advanced applications, temporal databases, deductive databases, database technology for decision support systems, distributed databases and client-server architecture, advanced database concepts, and emerging technologies and applications.
Course Outcome	CO1 Master the basic concepts and appreciate the applications of database systems. CO2 Master the basics of SQL and construct queries using SQL. CO3 Be familiar with a commercial relational database system (Oracle) by writing SQL using the system. CO4: Design concurrency control techniques, database recovery techniques. CO5: Design transaction processing concepts.

Prerequisites: NIL

CO,PO, AND PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**1**	**1**	**1**
CO2	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**
CO3	**1**	**-**	**2**	**-**	**-**	**2**	**1**	**-**	**-**	**-**	**2**	**-**	**-**	**2**	**-**
CO4	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**
CO5	**1**	**-**	**2**	**-**	**-**	**2**	**1**	**-**	**-**	**-**	**2**	**-**	**-**	**2**	**-**

LIST OF PROGRAMS	**(9L)**
1. DDL and DML Commands 2. Key Constrains-Normalization 3. Aggregate functions 4. Joins 5. Views 6. Index 7. PL/ SQL 8. Exception handling 9. Triggers 10. Cursors 11. Subprograms-procedure PL/ SQL 12. Functions of PL/ SQL	**CO1,2,3,4 ,5,BTL-4**

TEXTBOOKS

1.	Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", 6th edition, Tata McGraw Hill, 2011
2.	RamezElmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", 4th Edition, Pearson/Addisionwesley, 2007

REFERENCE BOOKS

1	Hector Garcia-Molina, Jeff Ullman, and Jennifer Widom, "Database Systems: The Complete Book", Pearson, 2011.
2	Niall O'Higgins, "Mongo D B and Python", O'reilly, 2011.

3	W. Lemahieu, S. vandenBroucke and B. Baesens Principles of Database Management: Practical Guide to Storing, Managing and Analyzing Big and Small Data Cambridge University Press ,2018 ISBN: 978-1107186125
4	T. M. Connolly and C. Begg,"Database Systems: Practical approach to design, implementation, and management " Pearson Education Date: 2015 ISBN: 978-1292061184
E-BOOKS	
1	https://www.kopykitab.com/eBooks-for-MCA-master-of-computer-applications
2	https://www.oreilly.com/library/view/mongodb-and-python/9781449312817/
3	https://people.inf.elte.hu/miiqaai/elektroModulatorDva.pdf
MOOC	
1	https://cosmolearning.org/courses/database-design-417/video-lectures/
2	https://freevideolectures.com/course/2668/database-management-system
3	https://archive.nptel.ac.in/courses/106/105/106105175/

SEMESTER II					
COURSE TITLE	**SOFTWARE ENGINEERING METHODOLOGIES**		**CREDITS**	**3**	
COURSE CODE	**ACS02004**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**3-0-0-0**
VERSION	**1.0**	**APPROVAL DETAILS**	**38-ACM 13-05-2023**	**LEARNING LEVEL**	**BTL-3**
ASSESSMENT SCHEME					
CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ assignments/ Project**	**Surprise Test / Quiz**	**Attendance**	**ESE**
15%	15%	10%	5%	5%	50%
Course Description	This course introduces students to the different software development lifecycle (SDLC) phases used in developing, delivering, and maintaining software products. Students will also acquire basic software development skills and understand common terminology used in the software engineering profession.				
Course Objective	To understand Software Engineering Lifecycle Models • To do project management and cost estimation • To gain knowledge of System Analysis and Design concepts. • To understand software testing approaches • To be familiar with DevOps practices				
Course Outcome	At the end of this course, the students will be able to: CO1 Understand the advantages of various Software Development Lifecycle Models CO2 Gain knowledge on project management approaches as well as cost and schedule estimation strategies CO3 Perform formal analysis of specifications CO4 Use UML diagrams for analysis and design CO5 Architect and design using architectural styles and design patterns				
Prerequisites: NIL					
CO,PO,AND PSO MAPPING					

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	1	1	-	-	-	-	-	-	-	-	1	1	1	1	1
CO 2	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
CO 3	1	-	2	-	-	2	1	-	-	-	2	-	-	2	-
CO 4	-	-	1	-	-	1	-	-	1	-	-	-	-		-
CO 5	-	-	-	-	1	2	1	-	-	-	1	2	1	1	-

MODULE 1INTRODUCTION	**(9L)**
Software engineering concepts – Development activities – Software lifecycle models - Classical waterfall - Iterative waterfall – Prototyping – Evolutionary - Spiral – Software project management – Project planning – Estimation – Scheduling – Risk management – Software configuration management	**C01,C02,BTL-3**
MODULE 2 SOFTWARE REQUIREMENT SPECIFICATION	**(9L)**
Requirement analysis and specification – Requirements gathering and analysis – Software Requirement Specification – Formal system specification – Finite State Machines – Petrinets – Object modelling using UML – Use case Model – Class diagrams – Interaction diagrams – Activity diagrams – State chart diagrams – Functional modelling – Data Flow Diagram	**C02,C03,BTL-3**
MODULE 3 ARCHITECTURE AND DESIGN	**(9L)**
Software design – Design process – Design concepts – Coupling – Cohesion – Functional independence – Design patterns – Model-view-controller – Publish-subscribe – Adapter – Command – Strategy – Observer – Proxy – Facade – Architectural styles – Layered - Client-server - Tiered - Pipe and filter.- User interface design	**C03,C04,BTL-3**
MODULE 4 TESTING	**(9L)**
Testing – Unit testing – Black box testing– White box testing – Integration and System testing– Regression testing – Debugging - Program analysis – Symbolic execution – Model Checking	**C05,C06,BTL-3**
MODULE 5 DevOps	**(9L)**
Motivation-Cloud as a platform-Operations- Deployment Pipeline: Overall Architecture Building and Testing-Deployment- Case study: Migrating to Microservices.	**C07,C02,BTL-3**

TEXTBOOKS	
1.	Bernd Bruegge, Alan H Dutoit, Object-Oriented Software Engineering, 2nd edition, Pearson Education, 2004.
2.	Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, Fundamentals of Software Engineering, 2nd edition, PHI Learning Pvt. Ltd., 2010.
3.	Craig Larman, Applying UML and Patterns, 3rd ed, Pearson Education, 2005.
4.	Len Bass, Ingo Weber and Liming Zhu, ―DevOps: A Software Architect‘s Perspective‖, Pearson Education, 2016
REFERENCE BOOKS	
1	Rajib Mall, Fundamentals of Software Engineering, 3rd edition, PHI Learning Pvt. Ltd., 2009.

2	Stephen Schach, Software Engineering 7th ed, McGraw-Hill, 2007.
E-BOOKS	
1	https://engineering.futureuniversity.com/BOOKS%20FOR%20IT/Software-Engineering-9th-Edition-by-Ian-Sommerville.pdf
2	http://infolab.stanford.edu/~burback/watersluice/watersluice.pdf
3	https://davcollegetitilagarh.org/wp-content/uploads/2020/09/fundamentals-of-software-engineering-fourth-edition-rajib-mall.pdf
MOOC	
1	https://www.edx.org/learn/software-engineering
2	https://www.upgrad.com/software-engineering-course/

COURSE TITLE	**ADVANCED OPERATING SYSTEMS**		**CREDITS**	**4**	
COURSE CODE	**ACS02005**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**2-1-2-1**
VERSION	**1.0**	**APPROVAL DETAILS**	**38-ACM 13-05-2023**	**LEARNING LEVEL**	**BTL -3**

ASSESSMENT SCHEME

CIA		**ESE**			
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ assignments/ Project**	**Surprise Test / Quiz**	**Attendance**	**ESE**
15%	15%	10%	5%	5%	50%

Course Description	This course is a journey to understanding the role played by the Operating System in providing the rich user experience afforded to modern applications by today's computers. Along the way, we highlight the symbiotic relationship between hardware and software that makes it possible for the computer and OS to provide a pleasing user experience.
Course Objective	The main objectives of this course are to: Enable the students to learn the different types of operating systems and their functioning. Gain knowledge of Distributed Operating Systems Gain insight into the components and management aspects of real-time and mobile operating systems. Learn case studies in Linux Operating Systems
Course Outcome	On the successful completion of the course, students will be able to: CO1 Understand the design issues associated with operating systems CO2 Master various process management concepts including scheduling, deadlocks, and distributed file systems CO3 Prepare Real-Time Task Scheduling CO4 Analyze Operating Systems for Handheld Systems CO5 Analyze Operating Systems like LINUX and iOS

Prerequisites: NIL

CO,PO, AND PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**1**	**1**	**1**
CO2	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**
CO3	**1**	**-**	**2**	**-**	**-**	**2**	**1**	**-**	**-**	**-**	**2**	**-**	**-**	**2**	**-**
CO4	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**-**	**-**	**-**		**-**
CO5	**-**	**-**	**-**	**-**	**1**	**2**	**1**	**-**	**-**	**-**	**1**	**2**	**1**	**1**	**-**

MODULE 1 BASICS OF OPERATING SYSTEMS (6L+6P)

What is an Operating System? – Main frame Systems –Desktop Systems – Multiprocessor Systems – Distributed Systems – Clustered Systems –Real-Time Systems – Handheld Systems – Feature Migration – Computing Environments -Process Scheduling – Cooperating Processes – Inter Process Communication- Deadlocks –Prevention –Avoidance – Detection – Recovery. **Practical Component:** 1. Implementation of CPU scheduling. a) Round Robin b) SJF c) FCFS d) Priority 2. Implement all file allocation strategies 3. Implement the all page replacement algorithms a) FIFO b) LRU c) LFU 4. 10. Implement Threading & Synchronization Applications	**C01,C02,BTL-3**
MODULE 2 DISTRIBUTED OPERATING SYSTEMS	**(6L+6P)**
Issues – Communication Primitives – Lamport‟s Logical Clocks – Deadlock handling strategies – Issues in deadlock detection and resolution-distributed file systems –design issues – Case studies – The Sun Network File System-Coda. **Practical Component:** 1. Implement all file allocation strategies 2. Implement Semaphores 3. Implement ll File Organization Techniques a 4. Implement the all page replacement algorithms a) FIFO b) LRU c) LFU 5. Implement Paging Technique f memory management.	**C01,C02,BTL-3**
MODULE 3 REALTIME OPERATING SYSTEMS	**(6L+6P)**
Introduction – Applications of Real Time Systems – Basic Model of Real Time System – Characteristics – Safety and Reliability - Real Time Task Scheduling. **Practical Component:** 1. Implementation of CPU scheduling. a) Round Robin b) SJF c) FCFS d) Priority 2. Implement all file allocation strategies 3. Implement Semaphores 4. Implementation of File Organization Techniques	**C01,C02,BTL-3**
MODULE 4 OPERATING SYSTEMS FOR HANDHELD SYSTEMS	**(6L+6P)**
Requirements – Technology Overview –Handheld Operating Systems – PalmOS-Symbian Operating System- Android –Architecture of android – Securing handheld systems **Practical Component:** 1. Implement Bankers algorithm for Dead Lock Avoidance 2. Implement an Algorithm for Dead Lock Detection	C01,C02,BTL-3
MODULE 5 CASE STUDIES	**(6L+6P)**
Case Studies: Linux System: Introduction – Memory Management – Process Scheduling – Scheduling Policy - Managing I/O devices – Accessing Files- iOS : Architecture and SDK Framework - Media Layer - Services Layer - Core OS Layer - File System **Practical Component:** 1. Implementation of CPU scheduling. a) Round Robin b) SJF c) FCFS d) Priority 3. Implement all file allocation strategies 4. Implement Semaphores	**C01,C02,BTL-3**

5. Implement ll File Organization Techniques a 6. Implement the all page replacement algorithms a) FIFO b) LRU c) LFU 2. Implement Shared memory and IPC 3. Implement Paging Technique f memory management. 4. Implement Threading & Synchronization Applications	

TEXTBOOKS	
1	Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, "Operating System Concepts", Seventh Edition, John Wiley & Sons, 2004.
2	MukeshSinghal and Niranjan G. Shivaratri, "Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems", Tata McGraw-Hill, 2001.
REFERENCE BOOKS	
1	Rajib Mall, "Real-Time Systems: Theory and Practice", Pearson Education India, 2006.
2	Pramod Chandra P.Bhatt, An introduction to operating systems, concept and practice, PHI, Third edition, 2010.
3	Daniel.P.Bovet& Marco Cesati,"Understanding the Linux kernel",3rdedition,O"Reilly, 2005
4	Neil Smyth, "iPhone iOS 4 Development Essentials – Xcode", Fourth Edition, Payload media, 2011.
E-BOOKS	
1	https://minnie.tuhs.org/CompArch/Resources/os-notes.pdf
2	https://www.phindia.com/Books/BookDetail/9789387472877/introduction-to-operating-systems-bhatt
MOOC	
1	https://onlinecourses.nptel.ac.in/noc20_cs04/preview 2

COURSE TITLE	**WIRELESS COMMUNICATIONS**		**CREDITS**	**3**	
COURSE CODE	**ACS02006**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**3-0-0-0**
VERSION	**1.0**	**APPROVAL DETAILS**	**38-ACM 13-05-2023**	**LEARNING LEVEL**	**BTL - 3**

ASSESSMENT SCHEME					
CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ assignments/ Project**	**Surprise Test / Quiz**	**Attendance**	**ESE**
15%	15%	10%	5%	5%	50%

Course Description	To introduce the concepts of wireless / mobile communication using cellular environment. To make the students to know about the various modulation techniques, propagation methods, coding and multi access techniques used in the mobile communication. Various wireless network systems and standards are to be introduced.
Course Objective	The student should be made to: • Understand the basic concepts of mobile computing • Understand Wireless LAN, Bluetooth and WiFi Technologies • Be familiar with the network protocol stack • Learn the basics of mobile telecommunication system • Be exposed to Ad-Hoc networks

Course Outcome	On the successful completion of the course, students will be able to: CO1 Explain the basics of mobile telecommunication system CO2 Illustrate the generations of telecommunication systems in wireless network CO3 Understand the architecture of Wireless LAN technologies CO4 Determine the functionality of network layer and Identify a routing protocol for a given Ad hoc networks CO5 Explain the functionality of Transport and Application layer

Prerequisites: NIL

CO,PO, AND PSO MAPPING															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**1**	**1**	**1**
CO2	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**
CO3	**1**	**-**	**2**	**-**	**-**	**2**	**1**	**-**	**-**	**-**	**2**	**-**	**-**	**2**	**-**
CO4	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**-**	**-**	**-**		**-**
CO5	**-**	**-**	**-**	**-**	**1**	**2**	**1**	**-**	**-**	**-**	**1**	**2**	**1**	**1**	**-**

MODULE I CELLULAR CONCEPT AND SYSTEM DESIGN FUNDAMENTALS	**9**
Introduction to wireless communication: Evolution of mobile communications, mobile radio systems- Examples, trends in cellular radio and personal communications. Cellular Concept: Frequency reuse, channel assignment, hand off, Interference and system capacity, tracking and grade of service, Improving Coverage and capacity in Cellular systems.	**CO1, BTL-3**
MODULE II MOBILE RADIO PROPAGATION	**9**
Free space propagation model, reflection, diffraction, scattering, link budget design, Outdoor Propagation models, Indoor propagation models, Small scale Multipath propagation, Impulse model, Small scale Multipath measurements, parameters of Mobile multipath channels, types of small scale fading, statistical models for multipath fading channels.	**CO2, BTL-3**
UNIT III MODULATION TECHNIQUES AND EQUALIZATION	**9**
Modulation Techniques: Minimum Shift Keying, Gauss ion MSK, M-ary QAM, M-ary FSK, Orthogonal Frequency Division Multiplexing, Performance of Digital Modulation in Slow-Flat Fading Channels and Frequency Selective Mobile Channels. Equalization: Survey of Equalization Techniques, Linear Equalization, Non-linear Equalization, Algorithms for Adaptive Equalization. Diversity Techniques, RAKE receiver.	**CO3, BTL-3**
UNIT IV CODING AND MULTIPLE ACCESS TECHNIQUES	**9**
Coding: Vocoders, Linear Predictive Coders, Selection of Speech Coders for Mobile Communication, GSM Codec, RS codes for CDPD. Multiple Access Techniques: FDMA, TDMA, CDMA, SDMA, Capacity of Cellular CDMA and SDMA.	**CO4, BTL-3**
UNIT V WIRELESS SYSTEMS AND STANDARDS	**9**
Second Generation and Third Generation Wireless Networks and Standards, WLL, Blue tooth. AMPS, GSM, IS-95 and DECT	**CO5, BTL-3**

TEXTBOOKS	
1	T.S.Rappaport, “Wireless Communications: Principles and Practice, Second Edition, Pearson Education/ Prentice Hall of India, Third Indian Reprint 2003.
REFERENCE BOOKS	
1	W.C.Y.Lee, "Mobile Communications Engineering: Theory and applications, Second Edition, McGraw-Hill International, 1998.
2	R. Blake, “ Wireless Communication Technology”, Thomson Delmar, 2003.
E-BOOKS	
1	https://minnie.tuhs.org/CompArch/Resources/os-notes.pdf
MOOC	
1	https://www.coursera.org/courses?query=mobile%20cloud%20computing
2	https://www.mooc-list.com/tags/mobile-computing

COURSE TITLE	**ADVANCED NETWORK SECURITY**	**CREDITS**		**4**	
COURSE CODE	**ACS02007**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**3-0-2-1**
VERSION	**1.0**	**APPROVAL DETAILS**	**38-ACM 13-05-2023**	**LEARNING LEVEL**	**BTL - 3**

ASSESSMENT SCHEME

CIA					**ESE**	
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ assignments/ Project**	**Surprise Test / Quiz**		**Attendance**	**ESE**
15%	15%	10%	5%	5%		50%

Course Description	To highlight the features of different technologies involved in Network Security
Course Objective	Explain the objectives of information security Explain the importance and application of each of confidentiality, integrity, authentication and availability Understand various cryptographic algorithms. Understand the basic categories of threats to computers and networks Describe public-key cryptosystem. Describe the enhancements made to IPv4 by IPSec. Discuss the fundamental ideas of public-key cryptography. Generate and distribute a PGP key pair and use the PGP package to send an encrypted e-mail message. Discuss Web Security and Firewalls
Course Outcome	After successful completion of the course, the learners would be able to CO1. Provide security of the data over the network. CO2. Do research in the emerging areas of cryptography and network security. CO3. Implement various networking protocols. CO4. Protect any network from the threats in the world CO5: Understand Intrusions and intrusion detection

Prerequisites: NIL

CO,PO,AND PSO MAPPING															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**1**	**1**	**1**
CO2	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**
CO3	**1**	**-**	**2**	**-**	**-**	**2**	**1**	**-**	**-**	**-**	**2**	**-**	**-**	**2**	**-**
CO4	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**-**	**-**	**-**		**-**

MODULE 1 SECURITY TRENDS	**(6L+6P)**
Security trends - Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies - Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography).- Foundations of modern cryptography: perfect security – information theory – product cryptosystem – cryptanalysis. **Practical Component:** 1. Classical encryption technique 2. Substitution technique 3. Transposition technique	**C01,C02,BTL-3**
MODULE 2 SYMMETRIC KEY CRYPTOGRAPHY	**(6L+6P)**
Algebraic structures - Modular arithmetic-Euclid‘s algorithm- Congruence and matrices - Groups, Rings, Fields- Finite fields-DES– Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis - Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard - RC4 – Key distribution. **Practical Component:** 1. DES 2. SDS 3. AES 4. RC4 5. Block cipher	**C01,C02,BTL-3**
MODULE 3 ASYMMETRIC KEY CRYPTOGRAPHY	**(6L+6P)**
Primes – Primality Testing – Factorization – Euler‘s totient function, Fermat‘s and Euler‘s Theorem - Chinese Remainder Theorem – Exponentiation and logarithm - ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange - ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography. **Practical Component:** 1. Asymmetric Key Ciphers 2. RSA 3. Diffie Hellman key exchange 4. ElGamal cryptosystem	**C01,C02,BTL-3**
MODULE 4 MESSAGE AUTHENTICATION AND INTEGRITY	**(6L+6P)**

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA –Digital signature and authentication protocols – DSS-Entity Authentication: Biometrics, Passwords, Challenge Response protocols-Authentication applications - Kerberos, X.509 **Practical Component:** 1. Digital signature 2. Biometrics 3. Password response protocols 4. Kerberos	**C01,C02,BTL-3**
MODULE 5 EMAIL SECURITY	**(6L+6P)**
E-Mail Security: Pretty Good Privacy, S/MIME IP Security: IP Security overview, IP Security architecture, Authentication Header, encapsulating security payload, Combining security associations, Internet Key Exchange Case Studies on Cryptography and security: Secure Multiparty Calculation, Virtual Elections, Single sign On, Secure Inter-branch Payment Transactions, Cross site Scripting Vulnerability. **Practical Component:** 1. S/MIME IP Security 2. Cross site scripting	**C01,C02,BTL-3**

TEXTBOOKS	
1.	Cryptography and Network Security - Principles and Practice: William Stallings, Pearson Education, 6th Edition
2.	Cryptography and Network Security: Atul Kahate, Mc Graw Hill, 3rd Edition
REFERENCE BOOKS	
1.	C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt.Ltd
2.	BehrouzA.Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007.
3.	Charlie Kaufman, Radia Perlman, and Mike Speciner, Network Security: PRIVATE Communication in a PUBLIC World, Prentice Hall, ISBN 0-13-046019-2
EBOOKS	
1.	https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.800-12r1.pdf
2.	https://www.vssut.ac.in/lecture_notes/lecture1423183198.pdf
3.	https://www.iare.ac.in/sites/default/files/lecture_notes/IARE_IS_LECTURE_NOTES_0.pdf
MOOC	
1.	http://nptel.ac.in/courses/106105031/lecture by Dr.DebdeepMukhopadhyayIIT Kharagpur
2.	https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-033-computer-system-engineering-spring-2009/video-lectures/

COURSE TITLE	**MOBILE COMMUNICATION LAB**		**CREDITS**	**2**	
COURSE CODE	**ACS02401**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**0-0-4-0**
VERSION	**1.0**	**APPROVAL DETAILS**	**38-ACM 13-05-2023**	**LEARNING LEVEL**	**BTL - 4**
ASSESSMENT SCHEME					
CIA					**ESE**

First Periodical Assessment	Second Periodical Assessment	Seminar/ assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	This course contains a comprehensive material about MATLAB as a powerful simulation tool for communications. The aim of this course is to introduce MATLAB not only as a general programming language, rather, the role of the extremely powerful MATLAB capabilities as a simulation tool is emphasized. The examples given to illustrate the material of the course is not just a direct use of MATLAB commands, instead they often represent real problems.
Course Objective	The objective of the lab is to introduce a basic digital communication system through MATLAB simulations. The students will be familiar with the following items: • Waveform generation. • Signal detection. • Evaluating various plots to quantify the performance of basic digital communication systems: Bit-error-rate versus signal-to-noise-ratio, power spectrum, power versus time, constellation plot, polar plot, and eye diagram.
Course Outcome	On the successful completion of the course, students will be able to: CO1. Use simulation tools to demonstrate various aspects of the communication process. CO2. Demonstrate the modulation/demodulation based on BPSK/QPSK-OFDM, GMSK, TDM. CO3. Analyze the properties/performance of CDMA-based codes. CO4. Model the T1 Carrier bitstream. CO5. Develop codes to characterize and compute the parameters of different channel models of wireless networks.

Prerequisites: NIL

CO,PO, AND PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	-	-	-	-	-	-	-	-	1	1	1	1	1
CO2	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
CO3	1	-	2	-	-	2	1	-	-	-	2	-	-	2	-
CO4	-	-	1	-	-	1	-	-	1	-	-	-	-		-
CO5	-	-	-	-	1	2	1	-	-	-	1	2	1	1	-

LIST OF PROGRAMMS **(9P)**

Study of wireless Communications using Communication Trainer Kits 1.a Baseband Communication 1.b. Adaptive Linear Equalizer 1. c. Code Division Multiple Access (CDMA) - Multipath 1. d Code Division Multiple Access (CDMA) – Multiuser	**CO1,2,3,4,5 ,BTL-4**

1. e Global System for Mobile Communication (GSM) (Using WiCOMM-T - Wireless Digital Communication Training system – SDR Platform) 1.f. Spread Spectrum – DSSS Modulation & Demodulation (Using Emona 101 Tranier Kit) Wireless Path loss Computations - Study of Propagation Path loss Models : Indoor & Outdoor(Using Matlab Programming) 2.a Free Space Propagation – Path Loss Model 2.b Link Budget Equation for Satellite Communication 2.c Carrier to Noise Ratio in Satellite Communication 2.d Outdoor Propagation – Okumura Model 2.e Outdoor Propagation – Hata Model Antenna Design Concept (using 4NEC2) 3.a Dipole Antennas 3.b Yagi – Uda Antenna – 3 element 3.c Yagi – Uda Antenna – 5 element 3.d Yagi – Uda Antenna – 7 element	

TEXTBOOKS	
1	Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, “Operating System Concepts”, Seventh Edition, John Wiley & Sons, 2004.
2	Mukesh Singhal and Niranjan G. Shivaratri, “Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems”, Tata McGraw-Hill, 2001.
REFERENCE BOOKS	
1	Rajib Mall, “Real-Time Systems: Theory and Practice”, Pearson Education India, 2006.
2	Pramod Chandra P.Bhatt, An introduction to operating systems, concept and practice, PHI, Third edition, 2010.
3	Daniel.P.Bovet& Marco Cesati,“Understanding the Linux kernel”,3rdedition,O‟Reilly, 2005
4	Neil Smyth, “iPhone iOS 4 Development Essentials – Xcode”, Fourth Edition, Payload media, 2011.
E-BOOKS	
1	https://minnie.tuhs.org/CompArch/Resources/os-notes.pdf
MOOC	
1	https://www.coursera.org/courses?query=mobile%20cloud%20computing
2	https://www.mooc-list.com/tags/mobile-computing

SEMESTER-III					
COURSE TITLE	**COGNITIVE COMPUTING**	**CREDITS**		**4**	
COURSE CODE	**ACS02008**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**3-1-0-0**
VERSION	**1.0**	**APPROVAL DETAILS**	**38-ACM 13-05-2023**	**LEARNING LEVEL**	**BTL-3**
ASSESSMENT SCHEME					
CIA					**ESE**

First Periodical Assessment	Second Periodical Assessment	Seminar/ assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	This course deals with various algorithms to enable computers to learn data without being explicitly programmed. An insight into various types of machine learning algorithms, strategies for model generation and evaluation are given in this course. The fundamental machine learning algorithms required in industries are covered together with their concrete implementations.
Course Objective	• To understand the concepts of Machine Learning. • To appreciate supervised learning and their applications. • To appreciate the concepts and algorithms of unsupervised learning. • To understand the theoretical and practical aspects of Probabilistic Graphical Models. • To appreciate the concepts and algorithms of advanced learning.
Course Outcome	Design a learning model appropriate to the application. CO1 Design a Neural Network for an application of your choice. CO2 Implement Probabilistic Discriminative and Generative algorithms for an application. CO3 Use a tool to implement typical Clustering algorithms for different types of applications. CO4 Design and implement an HMM for a Sequence Model type of application. CO5 Identify applications suitable for different types of Machine Learning with suitable justification.

Prerequisites: NIL

CO,PO, AND PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	-	-	-	-	-	-	-	-	1	1	1	1	1
CO2	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
CO3	1	-	2	-	-	2	1	-	-	-	2	-	-	2	-
CO4	-	-	1	-	-	1	-	-	1	-	-	-	-		-
CO5	-	-	-	-	1	2	1	-	-	-	1	2	1	1	-

MODULE 1 INTRODUCTION	**(9L)**
Machine Learning–Types of Machine Learning –Machine Learning process- preliminaries, testing Machine Learning algorithms, turning data into Probabilities, and Statistics for Machine Learning Probability theory – Probability Distributions – Decision Theory Solving Regression Classification using Decision Trees. Root Node Attribute Selection for Decision Trees using Information Gain Bayesian Inference in Gene Expression Analysis	**CO1,BTL -3**
MODULE 2 SUPERVISED LEARNING	**(9L)**

Linear Models for Regression – Linear Models for Classification- Discriminant Functions, Probabilistic Generative Models, Probabilistic Discriminative Models – Decision Tree Learning – Bayesian Learning, Naïve Bayes – Ensemble Methods, Bagging, Boosting, Neural Networks, Multi-layer Perceptron, Feed- forward Network, Error Back propagation - Support Vector Machines. Pattern Recognition Application using Bayesian Inference Bagging in Classification Bagging, boosting applications using Regression Trees	**CO2,BTL -3**
MODULE 3 UNSUPERVISED LEARNING	**(9L)**
Clustering- K-means – EM Algorithm- Mixtures of Gaussians –Dimensionality Reduction, Linear Discriminant Analysis, Factor Analysis, Principal Components Analysis, Independent Components Analysis. Data & Text Classification using Neural Networks Using Weka tool for SVM classification for chosen domain application	**CO3,BTL -3**
MODULE 4 PROBABILISTIC GRAPHICAL MODELS	**(9L)**
Graphical Models – Undirected Graphical Models – Markov Random Fields – Directed Graphical Models–Bayesian Networks – Conditional Independence properties – Markov Random Fields Hidden Markov Models– Conditional Random Fields (CRFs). Data Text Clustering using K-means algorithm Data Text Clustering using Gaussian Mixture Models	**CO4,BTL -3**
MODULE 5 ADVANCED LEARNING	**(9L)**
Sampling-Basic Sampling methods, Monte Carlo, Gibbs Sampling – Computational Learning Theory – Mistake Bound Analysis – Reinforcement learning – Markov Decision processes, Deterministic and Non-deterministic Rewards and Actions, Temporal Difference Learning Exploration. Dimensionality Reduction Algorithms in Image Processing applications Application of CRFs in Natural Language Processing	**CO5,BTL -3**

TEXTBOOKS	
1.	Christopher Bishop, “Pattern Recognition and Machine Learning” Springer, 2007
2.	Stephen Marsland, “Machine Learning – An Algorithmic Perspective”, Chapman andHall, CRC Press,Second Edition, 2014
REFERENCE BOOKS	
1.	Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.
2.	Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press, Third Edition, 2014.
3.	Tom Mitchell, “Machine Learning”, McGraw-Hill, 1997.
E-BOOKS	
1.	https://www.microsoft.com/en-us/research/uploads/prod/2006/01/Bishop-Pattern-Recognition-and-Machine-Learning-2006.pdf
2.	https://doc.lagout.org/science/Artificial%20Intelligence/Machine%20learning/Machine%20Learning _%20An%20Algorithmic%20Perspective%20%282nd%20ed.%29%20%5BMarsland%202014-10-08%5D.pdf
MOOC	
1.	https://nptel.ac.in/courses/106106139
2.	https://www.coursera.org/specializations/machine-learning-introduction

COURSE TITLE	INFORMATION SECURITY		CREDITS	3	
COURSE CODE	ACS02009	COURSE CATEGORY	PC	L-T-P-S	3-0-0-1
VERSION	1.0	APPROVAL DETAILS	38-ACM 13-05-2023	LEARNING LEVEL	BTL - 3

ASSESSMENT SCHEME

CIA					ESE
First Periodical Assessment	Second Periodical Assessment	Seminar/ assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	In this course students learn basics of information security, in both management aspect and technical aspect. Students understand of various types of security incidents and attacks, and learn methods to prevent, detect and react incidents and attacks. Students will also learn basics of application of cryptography which are one of the key technology to implement security functions. At the last session, teams of students will make presentation of their study project fora topic related to information security.
Course Objective	• Aware and Understand the Challenges and Scope of Information Security. • Gain Knowledge of Basic Security Concepts. • Learn and Understand the Importance of Cryptographic Algorithms and Their Uses. • Learn and Understand Access Control Mechanism Used for User Authentication and Authorization. • Understand and Practice the Sockets Layer (SSL). • Aware and Learn the Usages of Secure Internet Protocol (IP) and HTTP
Course Outcome	On the successful completion of the course, students will be able to: CO1 Understand and explain the risks faced by computer systems and networks. CO2 Identify and analyze security problems in computer systems and networks. CO3 Explain how standard security mechanisms work. CO4 Develop security mechanisms to protect computer systems and networks. CO5 Use cryptography algorithms and protocols to achieve computer security.

Prerequisites: NIL

CO,PO, AND PSO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	1	-	-	-	-	-	-	-	-	1	1	1	1	1
CO 2	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
CO 3	1	-	2	-	-	2	1	-	-	-	2	-	-	2	-
CO 4	-	-	1	-	-	1	-	-	1	-	-	-	-		-
CO 5	-	-	1	-	-	1	-	-	1	-	-	-	-		-
CO 6	-	-	-	-	1	2	1	-	-	-	1	2	1	1	-

MODULE 1INTRODUCTION &SECURITY INVESTIGATION	(9L)
History, what is Information Security? Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLCNeed for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues - An Overview of Computer Security - Access Control Matrix, Policy-Security policies, Confidentiality policies, Integrity policies and Hybrid policies	**C01,C02,B TL-3**
MODULE 2 LOGICALDESIGN & PHYSICAL DESIGN	**(9L)**
Blueprint for Security, Information Security Policy, Standards and Practices, ISO 17799/BS 7799, NIST Models, VISA International Security Model, Design of Security Architecture, Planning for Continuity Security Technology, IDS, Scanning and Analysis Tools, Cryptography, Access Control Devices, Physical Security, Security and Personnel	**C02,C03,B TL-3**
MODULE 3 SECURITY ANALYSIS	**(9L)**
Risk Management: Identifying and Assessing Risk, Assessing and Controlling Risk - Systems: Access Control Mechanisms, Information Flow and Confinement Problem	C03,C04,B TL-3
MODULE 4 ASSET SECURITY	**(9L)**
IP Security: IP security overview-IP Security Architecture-Authentication Header-Encapsulating Security Pay load-Combing Security Associations-Key Management. Web Security: Web Security Requirements-SSL and Transport Layer Security-SET Network Management Security. System Security: Intruders-viruses-related threats-Fire Design principles-Trusted Systems Asset Security (Protecting Security of Assets): Information and asset classification -Ownership (e.g. data owners, system owners) - Protect privacy - Appropriate retention - Data security controls - Handling requirements (e.g. markings, labels, storage)	C05,C06,B TL-3
MODULE 5 TYPES OF SECURITY IN NETWORK	**(9L)**
Program Security : Nonmalicious Program errors – Buffer overflow, Incomplete mediation, Time-of-check to Time-of- use Errors, Viruses, Trapdoors, Salami attacks, Man-in-the-middle attacks, Covert channels, Threats in networks, Network Security Controls – Architecture, Encryption, Content Integrity, Strong Authentication, Access Controls, Wireless Security, Honeypots, Traffic flow security, Firewalls – Design and Types of Firewalls, Personal Firewalls, IDS, Email Security – PGP,S/MIME	C01,C02,B TL-3

TEXTBOOKS	
1.	Michael E Whitman and Herbert J Mattord, ―Principles of Information Security‖, Vikas Publishing House, New Delhi, 2003
2.	Security in Computing, Fourth Edition, by Charles P. Pfleeger, Pearson Education
3.	Cryptography And Network Security Principles And Practice, Fourth or Fifth Edition, William Stallings, Pearson
4.	Modern Cryptography: Theory and Practice, by Wenbo Mao, Prentice Hall.

REFERENCE BOOKS	
1.	Network Security Essentials: Applications and Standards, by William Stallings. Prentice Hall.
2.	Micki Krause, Harold F. Tipton, ― Handbook of Information Security Management, Vol 1-3 CRCPress LLC, 2004.
3.	Stuart McClure, Joel Scrambray, George Kurtz, ―Hacking Exposed‖, Tata McGraw- Hill, 2003
4.	Matt Bishop, ― Computer Security Art and Science‖, Pearson/PHI, 2002.

E-BOOKS	
1.	https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.800-12r1.pdf
2.	https://www.vssut.ac.in/lecture_notes/lecture1423183198.pdf
3.	https://www.iare.ac.in/sites/default/files/lecture_notes/IARE_IS_LECTURE_NOTES_0.pdf

MOOC	
1.	http://nptel.ac.in/courses/106105031/lecture by Dr.DebdeepMukhopadhyayIIT Kharagpur
2.	https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-033-computer-system-engineering-spring-2009/video-lectures/

COURSE TITLE	RESEARCH PAPER FINDINGS			CREDITS	3
COURSE CODE	ACS02010	COURSE CATEGORY	PC	L-T-P-S	3-0-0-2
Version	1.0	APPROVAL DETAILS	38th, 13-05-2023	LEARNING LEVEL	BTL – 4

ASSESSMENT SCHEME

CIA	ESE
50%	50%

Course Description	The course provides students the opportunity to acquire and train skills and knowledge on how to independently assess the state of knowledge within a given narrow field of research. This course provides new insights or interpretation of a subject through thorough and systematic evaluation. In this project-based course, the students will outline a complete scientific paper based on Descriptive, Predictive or Prescriptive Modelling
Course Objective	1.To write briefly the research and theories 2. To understand the basics of the research 3. To integrate and evaluate the research and theories 4. To provide a justification for the research proposed based on the previous research.
Course Outcome	Upon completion of this course, the students will be able to 1. Identify theories and empirical results within a field of research 2. Evaluate research findings and implicit assumptions within a field of research 3. Present the theories and empirical results in a way that combines precision with readability 4. Design and write a literature review within the specified time limit 5. Organise and present the research findings for various audiences

PREREQUSITE Research Methodology

CO,PO, AND PSO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO 10	PO 11	PO 12	PSO1	PSO 2	PSO3
CO-1	3	3	3	3	1	-	-	1	-		-	1	1	1	2
CO-2	3	3	3	3	-	-	1	-	1	2	-	-	1	2	-
CO-3	3	3	3	3	-	1	-	-	-	-	-	-	1	1	2

CO-4	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**2**	**-**	**1**	**-**	**1**	**1**	**-**
CO-5	**3**	**3**	**3**	**3**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**2**

RESEARCH PAPER REVIEW

1. Find review articles and other basic information to use for background (outside of what is provided in textbook)
2. Find 3 empirical articles (papers have method/results sections)
3. Write the paper:-

a. Background information to topic; research question/hypotheses
b. Describe/summarize empirical articles
c. Critically analyse topic; synthesize findings from articles
d. Propose future directions/research (be specific)

4. The paper must be written in APA format. There are 2 primary ways you will use APA formatting: referencing and use of section headers.

a. Referencing must be in APA style. Any ideas or conclusions that are not your own (information that you have learned), you must cite – give credit to the person that had that idea!
b. Section headers are required in your paper. These should be descriptive of the paragraph(s) in that section (e.g. "Overview of false memories and children" then "Theories for false memories" then "Examination of familiarity", etc.). The headers should be italicized and on their own line.

5. There is not a page requirement or limit, but typical papers are approximately 10 pages, double-spaced, 12-pt font, with additional, separate title page and reference page. Please include page numbers. Other APA style formatting, such as running heads or abstract, are not required but welcomed.
6. Reference page: Only include references of papers
7. Finally Proofread, revise, check for plagiarism, and publish in indexed journals

Remarks	**Allocation of Marks**
Tentative Area, Topic selection	10%
Abstract, Introduction, Literature Review, Gap Identification, Objectives	10%
Methodology, (Materials and Methods, Design/Modelling/Analysis/Fabrication/Testing)	20%
Results and Discussion, Conclusion, Future Scope, References and Draft Project Report submission	20%
Project Report submission, PPT Preparation	20%
Internal and External Examiners Evaluation	20%
Total	**100%**

TEXT BOOKS

1.	Chris A. Mack(2018), How to Write a Good Scientific Paper, SPIE publications

REFERENCE BOOKS

1.	James D. Lester Jr.(2001), Writing Research Papers: A Complete Guide, Pearson Education

EBOOKS

1.	http://thuvienso.bvu.edu.vn/bitstream/TVDHBRVT/15289/1/How-to-Write-a-Research-Paper.pdf

COURSE TITLE	CYBER FORENSICS		CREDITS	4	
COURSE CODE	ACS02011	COURSE CATEGORY	PC	L-T-P-S	3-0-2-1
VERSION	1.0	APPROVAL DETAILS	38-ACM,13-05-2023	LEARNING LEVEL	BTL -3

ASSESSMENT SCHEME

CIA					ESE
First Periodical Assessment	Second Periodical Assessment	Seminar/ assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	Introduces the principles and practices of digital forensics including digital investigations, data and file recovery methods, and digital forensics analysis and invalidation. Topics include data acquisition, digital forensics tools, virtual machines, network, mobile devices and cloud forensics.
Course Objective	• To correctly define and cite appropriate instances for the application of computer forensics Correctly collect and analyze computer forensic evidence • Identify the essential and up-to-date concepts, algorithms, protocols, tools, and methodology of Computer Forensics
Course Outcome	Upon completion of this course, the students will be able to CO1 Explain how to prepare a digital forensics investigation by taking a systematic approach CO2 Analyze how the advent of computer technologies changes the nature of cybercrime. CO3 Determine what data to collect and analyze CO4 Explain standard procedures for conducting forensic analysis CO5 Apply different computer forensic tools to a given cybercrime scene

Prerequisites: NIL

CO,PO,AND PSO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3
CO1	3	3	3	3	1	-	-	1	-	-	-	1	1	1	1
CO2	3	3	3	3	-	-	1	-	1	2	-	-	1	2	-
CO3	3	3	3	3	-	1	-	-	-	-	2	-	1	1	-
CO4	3	3	3	3	-	-	-	-	1	-	-	1	1	1	-
CO5	3	3	3	3	-	-	-	-	-	-	-	-	1	1	-

MODULE 1: CYBER CRIME AND COMPUTER CRIME **(9L)**

Introduction to Digital Forensics, Definition and types of cybercrimes, electronic evidence and handling, electronic media, collection, searching and storage of electronic media, introduction to internet crimes, hacking and cracking, credit card and ATM frauds, web technology, cryptography, emerging digital crimes and modules.	**CO1,BTL-3**
MODULE 2: BASICS OF COMPUTER	**(9L)**
Computer organisation, components of computer- input and output devices, CPU, Memory hierarchy, types of memory, storage devices, system softwares, application softwares, basics of computer languages.	**CO2,BTL-3**
MODULE 3: COMPUTER FORENSICS	**(9L)**
Definition and Cardinal Rules, Data Acquisition and Authentication Process, Windows Systems-FAT12, FAT16, FAT32 and NTFS, UNIX file Systems, mac file systems, computer artifacts, Internet Artifacts, OS Artifacts and their forensic applications	**CO3,BTL-3**
MODULE 4 FORENSIC TOOLS AND PROCESSING OF ELECTRONIC EVIDENCE	**(9L)**
Introduction to Forensic Tools, Usage of Slack space, tools for Disk Imaging, Data Recovery, Vulnerability Assessment Tools, Encase and FTK tools, Anti Forensics and probable counters, retrieving information, process of computer forensics and digital investigations, processing of digital evidence, digital images, damaged SIM and data recovery, multimedia evidence, retrieving deleted data: desktops, laptops and mobiles, retrieving data from slack space, renamed file, ghosting, compressed files.	**CO4,BTL-3**
MODULE 5 COMPUTER FORENSIC ANALYSIS	**(9L)**
Computer forensic analysis: Discover of Electronic EvidencEIdentification of Data – Reconstructing Past Events – Fighting against Macro Threats – Information Warfare Arsenal – Tactics of the Military – Tactics of Terrorist and Rogues – Tactics of Private Companies	**C01,C02,BTL -3**

TEXTBOOK	
1	John R. Vacca, "Computer Forensics: Computer Crime Scene Investigation", Cengage Learning, 2nd Edition, 2005. (CHAPTERS 1 – 18). (UNIT I – IV)
2	Marjie T Britz, "Computer Forensics and Cyber Crime: An Introduction", Pearson Education, 2nd Edition, 2008. (CHAPTERS 3 – 13). (UNIT IV – V)
REFERENCE BOOKS	
1.	MariE-Helen Maras, "Computer Forensics: Cybercriminals, Laws, and Evidence", Jones & Bartlett Learning; 2nd Edition, 2014.
2.	Chad Steel, "Windows Forensics", Wiley, 1st Edition, 2006.
3.	Majid Yar, "Cybercrime and Society", SAGE Publications Ltd, Hardcover, 2nd Edition, 2013.
4.	Robert M Slade, "Software Forensics: Collecting Evidence from the Scene of a Digital Crime", Tata McGraw Hill, Paperback, 1st Edition, 2004.
E-BOOKS	
1.	https://www.gettextbooks.com/author/Bill_Nelson_Amelia_Phillips_Christopher_Steuart
2.	https://baou.edu.in/assets/pdf/PGDCL_104_slm.pdf
3.	https://www.nitm.ac.in/nitmeghalaya/ckfinder/userfiles/files/CS%20420%20-%20Cyber%20Forensics%20and%20Analysis.pdf
MOOC	
1.	https://www.mygreatlearning.com/academy/learn-for-free/courses/cyber-forensics
2.	https://www.edx.org/learn/computer-forensics

COURSE TITLE	INTERNSHIP*			CREDITS	2
COURSE CODE	ACS02801	COURSE CATEGORY	PC	L-T-P-S	0-0-0-0
VERSION	1.0	APPROVAL DETAILS	38-ACM 13-05-2023	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME	
CIA	ESE
50%	50%

Course Description	The internship is guided by learning goals and reflective assignments. It is supervised academically by a faculty member and professionally by aninternship supervisor. All academic internships must be approved in advance, and students must be concurrently enrolled in academic internship units
Course Objective	1. Gain an understanding of workplace dynamics, professionalexpectations, and the influence of culture on both. 2. Build proficiency in a range of industry skills appropriate to the fieldof the internship 3. Refine and clarify professional and career goals through criticalanalysis of the internship experience or research project
Course Outcome	Upon completion of the course the students will be able to 1. Describe main issues and challenges to be faced in the industry,both internally andon the market 2. Accomplish to unfamiliar work place , working culture and style 3. Draw skills from experience and process challenges 4. Develop an awareness of their skills and aspirations 5. Recognize more thoroughly on their company and sector as well as on their own experience, perceptions, and career goals

Prerequisites: Basics of database

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO1	PSO2	PSO3
CO-1	3	3	3	3	1	-	-	1	-	-	-	1	1	1	-
CO-2	3	3	3	3	-	-	1	-	1	2	-	-	1	1	-
CO-3	3	3	3	3	-	1	-	-	-	-	-	-	1	1	-
CO-4	3	3	3	3	-	-	-	-	2	-	2	1	1	1	-
CO-5	3	3	3	3	-	-	-	-	-	-	-	-	1	1	-

1: Weakly related, 2: Moderately related and 3: Strongly related

INTERNSHIP

The internship is guided by learning goals and reflective assignments. It is supervised academically by a faculty member and professionally by an internship supervisor. All academic internships must be approved in advance, and students must be concurrently enrolled in academic internship units. Students evaluate the work site and supervisors evaluate the student's performance at the internship.

Procedure for applying for internships

For internship, look for the companies and organisations of the industry the students are interested in and search for training, internships or any links that allow to enteryour details and upload professional resume with the website. If direct application is
allowed, apply for the internship.

SEMESTER -IV					
COURSE TITLE	**VIRTUALIZATION AND CLOUD COMPUTING**	**CREDITS**		**4**	
COURSE CODE	**ACS02012**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**3-1-0-0**
VERSION	**1.0**	**APPROVAL DETAILS**	**36-ACM 13-05-2023**	**LEARNING LEVEL**	**BTL-4**
ASSESSMENT SCHEME					
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ assignments/ Project**	**Surprise Test / Quiz**	**Attendance**	**ESE**
15%	15%	10%	5%	5%	50%
Course Description	The course presents a top-down view of cloud computing, from applications and administration to programming and infrastructure. Its main focus is on parallel programming techniques for cloud computing and large scale distributed systems which form the cloud infrastructure.				

Course Objective	To introduce the concept of Cloud Computing, Parallel and Distributed Computing. To enable students to learn about Virtualization and the Cloud Architecture. To give a detailed overview on Resource Pooling, Scaling, Capacity Planning and Load Balancing in the Cloud To familiarize concepts on Cloud Security, Service Oriented Architecture (SOA) and Cloud-based Storage.
Course Outcome	Upon successful completion of the course, the student will be able to: CO1:Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing. CO2: Apply fundamental concepts in cloud infrastructures to understand the tradeoffs in power, efficiency, and cost, and then study how to leverage and manage single and multiple data centers to build and deploy cloud applications that are resilient, elastic and cost-efficient. CO3: Discuss system, network and storage virtualization and outline their role in enabling the cloud computing system model. CO4: Illustrate the fundamental concepts of cloud storage and demonstrate their use in storage systems such as Amazon S3 and HDFS. CO5: Analyze various cloud programming models and apply them to solve problems on the cloud.

Prerequisites: NIL

CO, PO AND PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	1	-	-	1	-	-	-	1	1	1	1
CO2	3	3	3	3	-	-	1	-	1	2	-	-	1	2	-
CO3	3	3	3	3	-	1	-	-	-	-	2	-	1	1	-
CO4	3	3	3	3	-	-	-	-	1	-	-	1	1	1	-
CO5	3	3	3	3	-	-	-	-	-	-	-	-	1	1	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1 CLOUD COMPUTING OVERVIEW	**(9L)**
Origins of Cloud computing – Cloud components - Essential characteristics – On-demand selfservice, Broad network access, Location independent resource pooling ,Rapid elasticity , Measured service, Comparing cloud providers with traditional IT service providers, Roots of cloud computing	**CO1 BTL-4**
MODULE 2 CLOUD INSIGHTS	**9L**
Architectural influences – High-performance computing, Utility and Enterprise grid computing, Cloud scenarios – Benefits: scalability ,simplicity ,vendors ,security, Limitations – Sensitive information - Application development- security level of third party - security benefits, Regularity issues: Government policies	**CO2 BTL-4**
MODULE 3 CLOUD ARCHITECTURE- LAYERS AND MODELS	**9L**
Layers in cloud architecture, Software as a Service (SaaS), features of SaaS and benefits, Platform as a Service (PaaS), features of PaaS and benefits, Infrastructure as a Service (IaaS), features of	**CO3 BTL-4**

IaaS and benefits, Service providers, challenges and risks in cloud adoption. Cloud deployment model: Public clouds – Private clouds – Community clouds - Hybrid clouds - Advantages of Cloud computing.	
MODULE 4 CLOUD SIMULATORS- CLOUDSIM AND GREENCLOUD	**9L**
Introduction to Simulator, understanding CloudSim simulator, CloudSim Architecture(User code, CloudSim, GridSim, SimJava) Understanding Working platform for CloudSim, Introduction to GreenCloud	**CO4 BTL-4**
MODULE 5 INTRODUCTION TO VMWARE SIMULATOR	**9L**
Basics of VMWare, advantages of VMware virtualization, using Vmware workstation, creating virtual machines-understanding virtual machines, create a new virtual machine on local host, cloning virtual machines, virtualize a physical machine, starting and stopping a virtual machine.	**CO5 BTL-4**

TEXTBOOKS	
1.	Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter, TATA McGraw- Hill , New Delhi – 2010
2.	Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online - Michael Miller - Que 2008
REFERENCE BOOKS	
1.	Cloud computing for dummies- Judith Hurwitz , Robin Bloor , Marcia Kaufman ,Fern Halper, Wiley Publishing, Inc, 2010
2.	Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley & Sons, Inc. 2011
E-BOOKS	
1.	https://www.iare.ac.in/sites/default/files/lecture_notes/CC%20LECTURE%20NOTES.pdf
2.	https://aws.amazon.com/what-is-cloud-computing/
3.	https://azure.microsoft.com/en-in/overview/what-is-cloud-computing/
MOOC	
1.	https://aws.amazon.com/what-is-cloud-computing/
2.	https://azure.microsoft.com/en-in/overview/what-is-cloud-computing/
3.	https://www.salesforce.com/what-is-cloud-computing/
4.	https://cloud.google.com/docs/

COURSE TITLE	**CYBER SECURITY ESSENTIALS**		**CREDITS**	**4**	
COURSE CODE	**ACS02013**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**3-1-0-0**
VERSION	**1.0**	**APPROVAL DETAILS**	**38-ACM 13-05-2023**	**LEARNING LEVEL**	**BTL-4**
ASSESSMENT SCHEME					
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ assignments/ Project**	**Surprise Test / Quiz**	**Attendance**	**ESE**

15%	15%	10%	5%	5%	50%

Course Description	Learn the foundations of Cyber security and the threat landscape. To equip students with the technical knowledge and skills needed to protect and defend against cyber threats. To develop skills in students that can help them plan, implement, and monitor cyber security mechanisms to ensure the protection of information technology assets. To expose students to governance, regulatory, legal, economic, environmental, social, and ethical contexts of cyber security. To expose students to the responsible use of online social media networks. To systematically educate the necessity to understand the impact of cybercrimes and threats with solutions in a global and societal context. To select suitable ethical principles and commit to professional responsibilities and human values and contribute value and wealth for the benefit of the society
Course Objective	• Analyse and evaluate the importance of personal data and its privacy and security. • Analyse and evaluate the security aspects of social media platforms and ethical aspects associated with the use of social media. • Analyse and evaluate the cyber security risks. • Based on the Risk assessment, plan suitable security controls, audit, and compliance. • Evaluate and communicate the human role in security systems with an emphasis on ethics, social engineering vulnerabilities, and training. • Increase awareness about cyber-attack vectors and safety against cyberfrauds. • Take measures for self-cyber-protection as well as societal cyber-protection.
Course Outcome	Upon successful completion of the course, the student will be able to: CO1: Understand the cyber security threat landscape. CO2: Develop a deeper understanding and familiarity with various types of cyberattacks, cybercrimes, vulnerabilities and remedies thereto. CO3: Analyse and evaluate existing legal framework and laws on cyber security. CO4: Analyse and evaluate the digital payment system security and remedial measures against digital payment frauds. CO5: Evaluate and communicate the human role in security systems with an emphasis on ethics, social engineering vulnerabilities, and training.

Prerequisites: NIL

CO, PO AND PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	1	-	-	1	-	-	-	1	1	1	1
CO2	3	3	3	3	-	-	1	-	1	2	-	-	1	2	-
CO3	3	3	3	3	-	1	-	-	-	-	2	-	1	1	-
CO4	3	3	3	3	-	-	-	-	1	-	-	1	1	1	-
CO5	3	3	3	3	-	-	-	-	-	-	-	-	1	1	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1 INTRODUCTION TO CYBER SECURITY	**(9L)**

Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security.	**CO1, BTL-4**
MODULE 2 CYBER CRIME AND CYBER LAW	**9L**
Classification of cyber crimes, Common cyber crimes- cyber crime targeting computers and mobiles, cyber crime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Cybercriminals modus-operand , Reporting of cyber crimes, Remedial and mitigation measures, Legal perspective of cyber crime, IT Act 2000 and its amendments, Cyber crime and offences, Organisations dealing with Cyber crime and Cyber security in India, Case studies.	**CO1, BTL-4**
MODULE 3 SOCIAL MEDIA OVERVIEW AND SECURITY	**9L**
Introduction to Social networks. Types of social media, Social media platforms, Social media monitoring, Hashtag, Viral content, Social media marketing, Social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Flagging and reporting of inappropriate content, Laws regarding posting of inappropriate content, Best practices for the use of Social media, Case studies.	**CO1, BTL-4**
MODULE 4 E - C O M M E R C E AND DIGITAL PAYMENTS	**9L**
Definition of E- Commerce, Main components of E-Commerce, Elements of E-Commerce security, E-Commerce threats, E-Commerce security best practices, Introduction to digital payments, Components of digital payment and stake holders, Modes of digital payments- Banking Cards, Unified Payment Interface (UPI), e-Wallets, Unstructured Supplementary Service Data (USSD), Aadhar enabled payments, Digital payments related common frauds and preventive measures. RBI guidelines on digital payments and customer protection in unauthorised banking transactions. Relevant provisions of Payment Settlement Act,2007,	**CO1, BTL-4**
MODULE 5 DIGITAL DEVICES S E C U R I T Y, TOOLS AND TECHNOLOGIES FOR CYBER SECURITY	**9L**
End Point device and Mobile phone security, Password policy, Security patch management, Data backup, Downloading and management of third-party software, Device security policy, Cyber Security best practices, Significance of host firewall and Ant-virus, Management of host firewall andAnti-virus, Wi-Fi security, Configuration of basic security policy and permissions.	**CO1, BTL-4**

TEXTBOOKS	
1.	Cyber Crime Impact in the New Millennium, by R. C Mishra , Auther Press. Edition 2010.
2.	Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011)
REFERENCE BOOKS	
1.	Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform. (Pearson , 13th November, 2001)
2.	Electronic Commerce by Elias M. Awad, Prentice Hall of India Pvt Ltd.
3.	Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers.
4.	Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition, Wiley India Pvt. Ltd.
E-BOOKS	
1.	https://mrcet.com/downloads/digital_notes/EEE/CyberSecurity.pdf
2.	https://www.vssut.ac.in/lecture_notes/lecture1423183198.pdf

3.	https://www.uou.ac.in/sites/default/files/slm/Introduction-cyber-security.pdf
MOOC	
1.	https://www.simplilearn.com/learn-cyber-security-basics-skillup
2.	https://www.coursera.org/learn/cyber-security-fundamentals

COURSE TITLE	**PROJECT**		**CREDITS**	**12**	
COURSE CODE	**ACS02802**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**0-0-24-0**
VERSION	**1.0**	**APPROVAL DETAILS**	**38-ACM 13-05-2023**	**LEARNING LEVEL**	**BTL-4**

ASSESSMENT SCHEME

First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ assignments/ Project**	**Surprise Test / Quiz**	**Attendance**	**ESE**
15%	15%	10%	5%	5%	50%

Course Description	In the project work students are supposed to develop quality software solutions by applying theoretical and practical knowledge of various courses learnt. The Project work constitutes a major component in the course it needs to be carried out with due care and should be executed with seriousness by the students with essential foundation principles and practices to develop effective ways to solve computing problems.
Course Objective	1. To function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, 2. To identify, formulate, and solve complex engineering problems by applying principles 3. To apply engineering design to produce solutions that meet specified needs 4. To develop and conduct appropriate experimentation, analyze and interpret data. 5. To acquire and apply new knowledge as needed, using appropriate learning strategies.
Course Outcome	On successful completion of the project students will be able to: CO1. Identify a real time work helpful for the society. CO2. Analyze and solve the solution for the problem. CO3. Create an application by using relevant computer application concepts. CO4. Conduct appropriate experiment in different software design methods. CO5. Create Real time scenario-based software project design.

Prerequisites: Software Engineering concepts and Programming Skills

SOFTWARE DESIGN PROJECT

- Identify a real time work helpful for the society.
- Develop a solution for the problem
- Develop an application by using relevant computer application concepts

Tools used

Any Application Software in the specific domain for solving the problem

Rubrics for Grading the Software Design Project

Component	**Grading Criteria**	**Total**

	Exemplary (20)	Competent (15)	Partially correct – Needs to work (10)	Unsatisfactory (5)		
FIRST PERIODICAL ASSESSMENT						
Project objective formulation	All major objectives are identified and methodology clearly identified based on the existing system	Most of the objectives were identified but one or two were not identified	Only few objectives were identified	Objectives are not identified		15%
Methodology to be followed	Methodology clearly identified based on the existing system	Methodology chosen and some are not adequately addressed	Partially identified	Not identified		
SECOND PERIODICAL ASSESSMENT						
Use of Software Engineering	techniques Employ appropriate tools and software engineering techniques	Employ appropriate tools and software engineering techniques in his course of study	Employ some tools and software engineering techniques	Not used		15%
Implementation /Demonstration	Implemented and demonstrated the project with all the details	Implemented and demonstrated the project	Partial implementation	Not implemented		
Assignment/ Observation/lab records/Quiz						**15 %**
Attendance						**5%**
END SEMESTER EXAMINATION						
Project	Report is well organized and clearly written Diagrams are consistent Sentences are grammatical and free from	Report is well organized and clearly written some of the parts Sentences are mostly grammatical and only a few spelling	Report is organized Some diagrams are not well explained. Grammar errors that impede the flow of communication	Report lacks an overall organization. Diagrams are not drawn , grammatical spelling errors etc		**10 %**

	spelling errors	errors are present			
Presentation	Presentation, demonstration with all the project details &viva voce	Presentation well organized with demonstration	The presentation is not organized and partial demonstration	Presentation lacks content and not demonstrate d	40%
				Total	**100%**

LIST OF DEPARTMENT ELECTIVE COURSES FOR SPECILIZATION IN FULL STACK DEVELOPMENT										
S.NO	**SEM**	**COURSE CATEGORY**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
DEPARTMENT ELECTIVE-1(SEMESTER-II)										
1	2	DE	ACS02500	Typescript	3	0	2	4	0	5
2	2	DE	ACS02501	Backend development	3	0	2	4	0	5
DEPARTMENT ELECTIVE-II(SEMESTER-III)										
2	3	DE	ACS02502	Web Development	3	0	2	4	0	5
3	3	DE	ACS02503	MEAN Stack development	3	0	2	4	0	5

ELECTIVE- I

COURSE TITLE	**TYPESCRIPT**	**CREDITS**		**4**	
COURSE CODE	**ACS02500**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**3-0-2-0**
VERSION	**1.0**	**APPROVAL DETAILS**	**38 ACM 13-05-2023**	**LEARNING LEVEL**	**BTL-4**
ASSESSMENT SCHEME					
CIA		**ESE**			
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ assignments/ Project**	**Surprise Test / Quiz**	**Attendance**	**ESE**
15%	15%	10%	5%	5%	50%
Course Description	AngularJS is a structural framework for creating dynamic web applications. HTML is a great declarative language for static pages. It does not contain much for creating a dynamic application. So Angular will be filling that gap. Angular's data binding and dependency injection eliminate much of the code than we would actually write. The best part is that it all happens in the browser by making it an ideal partner with any server technology				
Course Objective	• Reduce the amount of code you write to build rich user interface applications. • Increase the reliability and maintainability of UI by using data binding. • Retrieve data from back-end server, manipulate it and display it with ease. • Modularise your code with the custom services and directives. • Providing two way binding of data. • Create Single Page Applications (SPA).				
Course Outcome	Upon successful completion of the course, the student will be able to: CO1. Build native mobile apps for Android, iOS and using Angular 1.x CO2. Understand the fundamentals of Angular Forms and its architecture CO3. Present data in beautiful, interactive lists CO4. Build forms and setting pages CO5. Implement Single page application(SPA)				

Prerequisites: NIL

CO, PO AND PSO MAPPING															
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO 1	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**1**	**1**
CO 2	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**1**
CO 3	**1**	**-**	**2**	**-**	**-**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**-**
CO 4	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**-**	**1**	**3**	**1**	**1**
CO 5	**-**	**-**	**-**	**-**	**1**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**1**	**1**
1: Weakly related, 2: Moderately related, and 3: Strongly related															

MODULE 1 INTRODUCTION	**(6L+6P)**
Introduction to AngularJS, MVC Architecture, Conceptual Overview, Setting up the Environment, First Application, Understanding ng attributes, Expressions and Data Biding, Number and String Expressions, Object Binding and Expressions, Working with Arrays, Forgiving Behavior, Understanding Data binding, Working with Directives, Conditional Directives, Styles Directives, Mouse and Keyboard Events Directives 1. Jumping Into JavaScript 2. Getting Started with AngularJS 3. Understanding AngularJS Application Dynamics	CO1-BTL-4
MODULE 2 CONTROLLERS	**(6L+6P)**
Understanding Controllers, Programming Controllers & $scope object, Adding Behaviour to a Scope Object, Passing Parameters to the Methods, Having Array as members in Controller Scope, Nested Controllers and Scope Inheritance, Multiple Controllers and their scopes, Built-In Filters, Uppercase and Lowercase Filters, Currency and Number Formatting Filters, OrderBy Filter, Filter Filter, Creating Custom Filter **Practical Components:** 1. Implementing the Scope as a Data Model 2. Using AngularJS Templates to Create Views Implementing Directives in AngularJS Views	**CO2-BTL-4**
MODULE 3 FORMS	**(6L+6P)**
Using Simple Form, Working with Select and Options, Input Validations, Using CSS classes, Form Events, Custom Model update triggers, Why Module?, Module Loading and Dependencies, Recommended Setup of Application, Creation vs Retrieval., Understanding Services, Developing Creating Services, Using a Service Injecting Dependencies in a Service, http Service, $q Service, Ajax Impl using $http and $q Service, Routing Introduction to SPA, Creating HTML Templates, Configuring Route Provider. **Practical Components:** 1. The Model View Controller (MVC) 2. Data binding in AngularJS 3. Directives	**CO3-BTL-4**

The role of $routeProvider in AngularJS.	
MODULE 4 DIRECTIVES	**(6L+6P)**
Introduction – objects in HTML, event handling, window object, document object, browser object, object methods, built-in objects, user defined objects, cookies. Suggested Readings: Built-in objects **Practical Components:** 1. Creating Your Own Custom Directives to Extend HTML 2. Using Events to Interact with Data in the Model Implementing AngularJS Services in Web Applications	**CO4-BTL-4**
MODULE 5 DATA BINDING	**(6L+6P)**
Expressions and Data Binding, Number and String Expressions, Object Binding and Expressions, Working with Arrays, forgiving Behaviour, Understanding Data binding. **Practical Components:** Creating Your Own Custom AngularJS Services	**CO5-BTL-4**

TEXTBOOKS	
1.	Learning AngularJS by Ken Williamson Published by O'Reilly Media 2015
2.	Laura Lemay, Jennifer Kymin(2016) Mastering HTML,CSS & JavaScript, Web Publishing ,
REFERENCE BOOKS	
1.	AngularJS Essentials by Rodrigo Branas published by Packt Publishing 2014
E-BOOKS	
1.	https://gist.github.com/chrisnicola/9673040
MOOC	
1.	https://www.coursera.org/specializations/web-design

COURSE TITLE	**BACK END DEVELOPMENT**		**CREDITS**	**4**	
COURSE CODE	**ACS02501**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**3-0-2-0**
VERSION	**1.0**	**APPROVAL DETAILS**	**38 ACM 13-05-2023**	**LEARNING LEVEL**	**BTL-4**
ASSESSMENT SCHEME					
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ assignments/ Project**	**Surprise Test / Quiz**	**Attendance**	**ESE**
15%	15%	10%	5%	5%	50%
Course Description	This course provides hands-on experience and exposure to developing web application using HTTP. This course builds strong foundation of HTTP based request and response scenarios which will help developer to build efficient web applications				
Course Objective	Building strong expertise in WebSocket's. Implement frontend and backend scenarios using WebSocket's. Developing single page application using Express Framework				

Course Outcome	Upon successful completion of the course, the student will be able to: Conduct ethnographic research to produce user profiles. CO1 Create a functional, interactive prototype. CO2 Apply the basics of test design, including user consent, safety, ethics, and privacy concerns. CO3 Conduct effective usability and user experience test sessions. CO4 Generate usability and user experience assessment reports Conduct the express for framework

CO, PO, AND PSO MAPPING														
CO	**PO 1**	**PO2**	**PO3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO 1	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**1**	**1**
CO 2	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO 3	**1**	**-**	**2**	**-**	**-**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**2**
CO 4	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**1**	**-**	**3**	**-**	**-**
CO 5	**-**	**-**	**-**	**-**	**1**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**1**	**1**

Prerequisites: NIL

MODULE 1 INTRODUCTION	**(6L+6P)**
OOPs-Design Patterns-Object Oriented Design-JSON-DOM-AJAX	**CO1-BTL-4**
MODULE 2 HTTP	**(6L+6P)**
Introduction to HTTP,HTTP Parameters, HTTP Messages HTTP Request,HTTP Response,HTTP Methods,HTTP Status Code,HTTP Header Fields,Registration,HTTP Authentication,HTTP Caching,HTTP URL Encoding,HTTP Security	**CO2-BTL-4**
MODULE 3 WEB SOCKETS	**(6L+6P)**
Introduction to Web sockets,Web socket URIs,Web socket APIs,Opening Handshake ,Data Framing, Sending and Receiving Data,Closing the Connections,Error Handling,Web socket Security,Deployment Considerations,Project	**CO3-BTL-4**
MODULE 4: MICROSERVICESINTRODUCTION	**(6L+6P)**
Microservices Architecture, Microservices Project Structure, Microservices Frameworks,Spring Boot with Microservices Basics,. Spring Boot with Microservices Coding Standards, Spring Boot with Microservices Builder Design Pattern,Spring Boot with Microservices QR Code Generator	**CO3-BTL-4**
MODULE 5 FRAME WORK	**(6L+6P)**
Hibernate Introduction,Hibernate Basics,Hibernate Architecture, Hibernate Session Hibernate SessionFactory, Hibernate Configuration,Hibernate Configuration Offline Hibernate with HBM,Hibernate with Annotation	**CO3-BTL-4**

TEXTBOOKS	
1.	JAVA SPRING– A unified hardware and software introduction: F. Vahid John Wiley
REFERENCE BOOKS	

1.	Spring boot, Rajkamal, TataMcGraw-Hill
2.	Hibernate: Shibu K. V. (TMH)
E-BOOKS	
1.	https://docs.spring.io/spring-boot/docs/current/reference/pdf/spring-boot-reference.pdf
2.	https://docs.spring.io/spring-boot/docs/1.5.4.RELEASE/reference/pdf/spring-boot-reference.pdf
MOOC	
1.	https://onlineitguru.com/spring-boot-training.html

ELECTIVE-II

COURSE TITLE	**WEB DEVELOPMENT**		**CREDITS**	**4**	
COURSE CODE	**ACS02502**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**3-0-2-0**
VERSION	**1.0**	**APPROVAL DETAILS**	**38-ACM 13-05-2023**	**LEARNING LEVEL**	**BTL-4**

ASSESSMENT SCHEME

CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ assignments/ Project**	**Surprise Test / Quiz**	**Attendance**	**ESE**
15%	15%	10%	5%	5%	50%

Course Description	This course is intended to teach students the fundamentals of web development in a project-based learning environment. Students are taught the basic elements of web development, such as web hosting, file organization, and incorporating Javascript into HTML files.
Course Objective	1. To understand the graphic design principles that relate to web design and learn how to implement theories into practice. 2. To develop skills in analyzing the usability of a web site. 3. To develop how to plan and conduct user research related to web usability. 4. To learn the language of the web: HTML and CSS. 5. To develop skills in DHTML.
Course Outcome	Upon successful completion of the course, the student will be able to: CO1. Develop a web page using HTML simple tags. CO2. Implement the various use of cascading style sheet CO3. Analyze and write the functions using scripting language CO4. Evaluate the website using event handling mechanism CO5. Analyze the use of DHTML

Prerequisites: NIL

CO, PO, AND PSO MAPPING

CO	**PO 1**	**PO 2**	**PO3**	**PO4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO3**
CO 1	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**1**	**3**	**-**

CO 2	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**
CO 3	**3**	**3**	**2**	**-**	**-**	**2**	**1**	**-**	**-**	**-**	**-**	**2**	**1**	**3**	**2**
CO 4	**3**	**3**	**1**	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**3**	**1**
CO 5	**3**	**3**	**-**	**-**	**1**	**2**	**1**	**-**	**-**	**-**	**1**	**1**	**-**	**3**	**-**
1: Weakly related, 2: Moderately related and 3: Strongly related															

MODULE 1 HTML	**(6L+6P)**
Internet basics, introduction to HTML, list, creating tables, linking documents, frames, graphics to HTML documents, style sheet basics, adding styles to documents. Suggested Readings: Introduction to HTML **Practical Components:** 1. Basic HTML Tags,Table Tags,List Tags,Image Tags, Forms . 2. Implement forms using HTML,FRAMES,CSS.	**CO1-BTL-4**
MODULE 2 CSS	**(6L+6P)**
Creating style sheet tools, style sheet properties, font, text, list, color and background color, box, display properties. Suggested Readings: CSS Tools **Practical Components:** 1. CSS Selectors 2. CSS Padding and Margin 3. CSS Positions 4. CSS animation	**CO2-BTL-4**
MODULE 3 JAVA SCRIPT	(6L+6P)
Introduction to JavaScript, Advantages of JavaScript, JavaScript Syntax, data types, variables, arrays. Operators and Expressions, Looping constructors, functions, dialog box, JavaScript, document object model. **Practical Components:** Suggested Readings: Introduction to JavaScript 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 10and 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 5p	CO3-BTL-4
MODULE 4 DOM	**(6L+6P)**
Introduction – objects in HTML, event handling, window object, document object, browser object, object methods, built-in objects, user defined objects, cookies. Suggested Readings: Built-in objects **Practical Components:** 1. How to Access Elements in the DOM 2. How to Traverse the DOM 3. How to Make Changes to the DOM 4. How to Modify Attributes, Classes, and Styles in the DOM	**CO4-BTL-4**

5. Understanding Events in JavaScript	
MODULE 5 DHTML	(6L+6P)
DHTML, cascading style sheets, class, external style sheets, working with JavaScript style sheet. Suggested Readings: DHTML **Practical Components:** 1. Create login form and validate it username/password stored in database. 2. Create student record and perform following operations: Add record, delete, and edit, search record, navigation between records. 3. A web application display product names and price in tabular formats. Each row containing product detail should display Know More button. When the button is clicked the description for the selected item should be displayed	CO5-BTL-4

TEXTBOOKS	
1.	Thomas Powell(2017), HTML & CSS: The complete Reference, Fifth Edition McGraw Hill Education
2.	Laura Lemay, Jennifer Kymin(2016) Mastering HTML,CSS & JavaScript, Web Publishing ,
REFERENCE BOOKS	
1	Joshua Johaman, Richard Zea, Talha Khan(2016), Web Developers Reference Guide, Packet Publishing.
E-BOOKS	
1.	https://www.creativebloq.com/web-design/free-ebooks-web-designers-5132836
MOOC	
1.	https://www.coursera.org/specializations/web-design

COURSE TITLE	**MEAN STACK DEVELOPMENT**	**CREDITS**	**4**		
COURSE CODE	**ACS02503**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**3-0-2-0**
VERSION	**1.0**	**APPROVAL DETAILS**	**38-ACM 13-05-2023**	**LEARNING LEVEL**	**BTL-4**
ASSESSMENT SCHEME					
CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ assignments/ Project**	**Surprise Test / Quiz**	**Attendance**	**ESE**
15%	15%	10%	5%	5%	50%
Course Description	This course is intended to teach students the fundamentals of web development in a project- based learning environment. Students are taught the basic elements of web development, such as web hosting, file organization, and incorporating Javascript into HTML files.				

Course Objective	1. To understand the graphic design principles that relate to web design and learn how to implement theories into practice. 2. To develop skills in analyzing the usability of a web site. 3. To develop how to plan and conduct user research related to web usability. 4. To learn the language of the web: HTML and CSS. 5. To develop skills in DHTML.
Course Outcome	Upon successful completion of the course, the student will be able to: CO1. Develop a web page using HTML simple tags. CO2. Implement the various use of cascading style sheet CO3. Analyze and write the functions using scripting language CO4. Evaluate the website using event handling mechanism CO5. Analyze the use of DHTML

Prerequisites: NIL

			CO, PO, AND PSO MAPPING													
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**1**	**3**	**-**	**-**
CO2	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**
CO3	**3**	**3**	**2**	**-**	**-**	**2**	**1**	**-**	**-**	**-**	**-**	**2**	**1**	**3**	**2**	**-**
CO4	**3**	**3**	**1**	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**3**	**1**	**-**
CO5	**3**	**3**	**-**	**-**	**1**	**2**	**1**	**-**	**-**	**-**	**1**	**1**	**-**	**3**	**-**	**-**
1: Weakly related, 2: Moderately related and 3: Strongly related																

MODULE1: MONGO DB	**(6L+6P)**
Overview, Understand what is NOSQL, Describe CRUD, State the types of NOSQL, Explain what is Aggregation, Describe Replication & Sharding,CRUD Operations, Understand what are Crud Operations, Explain what is Upsert, Describe Query Interface, List the Comparison Operators and Logical Operators, State what are Wrapped Queries and Query Operators, Basic Operations Crud Operations, Data Model, JSON, BSON, Aggregations, Indexing. **Practical Components:** 1. Create database, 2. Create collection, 3. insert data, find, find one, sort, limit, skip, distinct, projection.	**CO1-BTL-4**
MODULE 2 EXPRESS.JS	**(6L+6P)**
Introduction of ExpressJs, What is ExpressJS, How Express.js works, Installation of Express.js, Basic Example, Templating Engines, Working with Express.js, Request/Response in Express.js Request-params,body,files,route,header,get, Response-render,locals,status,json,redirect, Using middleware, Types of middleware, Application level middleware,Express-json,session,logger,compress, Router level middleware, Built-in middleware ,Third party middleware, Express 4. Router. **Practical Components:**	**CO2-BTL-4**

1. Install Express.jsExpress.js RequestExpress.js ResponseExpress.js GetExpress.js PostExpress.js 2. RoutingExpress.js CookiesExpress.js 3. File UploadExpress.js 4. MiddlewareExpress.js ScaffoldingExpress.js Template	
MODULE 3 ANGULAR.JS	**(6L+6P)**
Introduction to AngularJS, MVC Architecture, Conceptual Overview, Setting up the Environment, First Application, Understanding ng attributes, Expressions and Data Biding, Number and String Expressions, Object Binding and Expressions, Working with Arrays, Forgiving Behavior, Understanding Data binding, Working with Directives, Conditional Directives, Styles Directives, Mouse and Keyboard Events Directives. **Practical Components:** 1. AngularJS First AppAngularJS Data 2. BindingAngularJS ExpressionsAngularJS DirectivesAngularJS ControllersAngularJS ModulesAngularJS 3. ScopesAngularJS DependencyAngularJS FiltersAngularJS TablesAngularJS SelectAngularJS 4. DOMAngularJS FormsAngularJS 5. ValidationAngularJS AJAXAngularJS Animation	**CO3-BTL-4**
MODULE 4 NODE.JS	**(6L+6P)**
Introduction to Node JS Introduction, What is Node JS? Advantages of Node JS,Traditional Web Server Model, Node.js Process Model, Callback Concept,Global Objects,Streams,Buffers,Utility Modules, Node JS Modules, Functions Buffer, Module,Module Types Core Modules,Local Modules, Module.Exports, Creating Web server, Debugging Node JS Application, Core Node JS debugger Debugging with Visual Studio,Events, EventEmitter class, Returning event emitter, Inhering events. **Practical Components:** 1. Setting up Node.js and Other Essentials 2. Using Express.js 4 to Create Node.js Web Apps 3. TDD and BDD for Node.js with Mocha 4. Template Engines: Jade and Handlebars 5. Building Node.js REST API Servers with Express.js and Hapi 6. Real-Time Apps with WebSocket, Socket.IO, and DerbyJS	**CO4-BTL-4**
MODULE 5 DHTML	**(6L+6P)**
DHTML, cascading style sheets, class, external style sheets, working with JavaScript style sheet. Suggested Readings: DHTML. **Practical Components:** 1. About Me Page 2. Style Your Page with CSS 3. Validate Your Page 4. Upload Your Page to the Web 5. Advanced Style Techniques 6. Favorite Movie	**CO5-BTL-4**
TEXTBOOKS	
1.	Thomas Powell(2017), HTML & CSS: The complete Reference, Fifth Edition McGraw Hill Education

2.	Laura Lemay, Jennifer Kymin(2016) Mastering HTML,CSS & JavaScript, Web Publishing ,
REFERENCE BOOKS	
1.	Joshua Johaman, Richard Zea, Talha Khan(2016), Web Developers Reference Guide, Packet Publishing.
E-BOOKS	
1.	https://www.creativebloq.com/web-design/free-ebooks-web-designers-5132836
MOOC	
1.	https://www.coursera.org/specializations/web-design

LIST OF DEPARTMENT ELECTIVE COURSES FOR SPECILIZATION IN AUGUMENTED REALITY/VIRTUAL REALITY										
S.NO	**SEM**	**COURSE CATEGORY**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
DEPARTMENT ELECTIVE-1(SEMESTER-II)										
1	2	DE	ACS02504	AR/VR Tool and techniques	3	0	2	4	0	5
2	2	DE	ACS02505	Emerging trends in AR/VR	3	0	2	4	0	5
DEPARTMENT ELECTIVE-II(SEMESTER-III)										
3	3	DE	ACS02506	3d Texturing and Sculpting	3	0	2	4	0	5
4	3	DE	ACS02507	Unity For AR/VR	3	0	2	4	0	5

ELECTIVE -I

COURSE TITLE	**AR & VR TOOLS AND TECHNIQUES**		**CREDITS**	**4**	
COURSE CODE	**ACS02504**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**3-0-2-0**
VERSION	**1.0**	**APPROVAL DETAILS**	**38-ACM 13-05-2023**	**LEARNING LEVEL**	**BTL-4**
ASSESSMENT SCHEME					
CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ assignments/ Project**	**Surprise Test / Quiz**	**Attendance**	**ESE**
15%	15%	10%	5%	5%	50%
Course Description	This course provides you with end-to-end training in Dimensional Content for Augmented and Virtual Reality.				

Course Objective	The objective of this course is to provide a foundation to the fast-growing field of AR and make the students aware of the various AR devices. It is designed to give historical and modern overviews and perspectives on virtual reality. It describes the fundamentals of sensation, perception, technical and engineering aspects of virtual reality systems.
Course Outcome	Upon successful completion of the course, the student will be able to: CO1: Compare and Contrast VR and AR experiences CO2: Demonstrate and develop VR apps in Unity CO3: Demonstrate and develop AR apps in Unity CO4: Acquire knowledge in VR and AR technologies in terms of used devices, building of the virtual environment and modalities of interaction and modelling. CO5: Acquire knowledge about the application of VR and AR technologies in medicine, education, cultural heritage and games.

CO, PO, AND PSO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	1	-	-	-	-	-	-	-	-			1		1
CO 2	-	-	-	-	-	-	-	-	-	-			-		-
CO 3	1	-	2	-	-	2	1	-	-	-			-		2
CO 4	-	-	1	-	-	1	-	-	1	-			-		
CO 5	-	-	-	-	1	2	1	-	-	-			1		1

Prerequisites: NIL

MODULE 1 INTRODUCTION	**(6L+6P)**
What Is Augmented Reality - Defining augmented reality, history of augmented reality, The Relationship Between Augmented Reality and Other Technologies-Media, Technologies, Other Ideas Related to the Spectrum Between Real and Virtual Worlds, applications of augmented reality Augmented Reality Concepts- How Does Augmented Reality Work? Concepts Related to Augmented Reality, Ingredients of an Augmented Reality Experience. **Practical Components:** 1. Timeline of evolution of AR from VR	**CO1-BTL-4**
MODULE 2: VIRTUAL REALITY	**(6L+6P)**
Defining Virtual Reality, History of VR, Human Physiology and Perception, Key Elements of Virtual Reality Experience, Virtual Reality System, Interface to the Virtual World-Input & output- Visual, Aural & Haptic Displays, Applications of Virtual Reality. **Practical Components:** 1. Study the use of Virtual Reality at NASA 2. Creating 3D objects using Blender.	**CO2-BTL-4**
MODULE 3 GEOMETRY OF VIRTUAL WORLDS &THE PHYSIOLOGY OF HUMAN VISION	**(6L+6P)**

Representation of the Virtual World, Visual Representation in VR, Aural Representation in VR and Haptic Representation in VR Case Studies GHOST (General Haptics Open Software Toolkit) software development toolkit.Geometric Models, Changing Position and Orientation, Axis-Angle Representations of Rotation, Viewing Transformations, Chaining the Transformations, Human Eye, eye movements & implications for VR. **Practical Components:** 1. Sweeping coverage of eye movements 2. Use of OpenCV for AR App Development	**CO3-BTL-4**
MODULE 4: VISUAL PERCEPTION & RENDERING	**(6L+6P)**
Visual Perception - Perception of Depth, perception of Motion, Perception of Color, Combining Sources of Information Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions ,Improving Latency and Frame Rates Case studies: Automatic stitching of panoramas in Virtual Reality .Motion in Real and Virtual Worlds- Velocities and Accelerations, The Vestibular System, Physics in the Virtual World, Mismatched Motion and Vection Tracking- Tracking 2D & 3D Orientation, Tracking Position and Orientation, Tracking Attached Bodies Case Studies A virtual Study Use Case- NICE, An Educational Experience Interaction - Motor Programs and Remapping, Locomotion, Manipulation, Social Interaction. Audio -The Physics of Sound, The Physiology of Human Hearing, Auditory Perception, Auditory Rendering **Practical Components:** 1. Google Daydream 2. Create a C# script which plays a video when an image is scanned using AR App (use 3. ARCore & Unity).	**CO4-BTL-4**
MODULE 5 WORKING WITH VR & AR DEVICES	**(6L+6P)**
VR Devices – Structure and working of HTC Vive, Google Cardboard, Samsung gear VR, Oculus Quest, Samsung Odyssey, Oculus Rift. AR Components – Scene Generator, Tracking system, monitoring system, display, Game scene AR Devices – Optical See-Through HMD, Virtual retinal systems, Monitor based systems, Projection displays, Video see-through systems. Advantages and Disadvantages of AR and VR technologies. Case Studies Google Daydream Trending Application Areas - Gaming and Entertainment, Architecture and Construction, Science and Engineering, Health and Medicine, Aerospace and Defence, Education, Tele robotics and Telepresence Human Factors, Legal and Social Considerations - Human Factors Considerations, Legal and Social Considerations, The Future. **Practical Components:** 1. Case Studies: What is Google Maps AR navigation and how it is used	**CO5-BTL-4**

TEXTBOOKS	
1.	Steve Aukstakalnis- Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR, Addison-Wesley Professional, September 2016, ISBN: 9780134094328
2.	Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016
3.	Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer Graphics)". Morgan KaufmannPublishers, San Francisco, CA, 2002
REFERENCE BOOKS	

1.	Jesse Glover, Jonathan Linowes – Complete Virtual Reality and Augmented Reality Development with Unity: Leverage the power of Unity and become a pro at creating mixed reality applications. Packt publishing, 17th April 2019. ISBN -13 : 978-1838648183
2.	Jonathan Linowes, Krystian Babilinski – Augmented Reality for Developers: Build practical augmented reality applications with Unity, ARCore, ARKit, and Vuforia. Packt publishing, 9th October 2017. ISBN-13: 978-1787286436
E-BOOKS	
1.	https://www.amazon.in/Soft-Computing-Fundamentals-Applications-Pratihar/dp/8184873387
MOOC	
2.	https://www.coursera.org/learn/augmented-reality
3.	https://www.coursera.org/specializations/unity-xr

COURSE TITLE	**EMERGING TRENDS IN AR/VR**		**CREDITS**	**4**	
COURSE CODE	**ACS02505**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**3-0-2-0**
VERSION	**1.0**	**APPROVAL DETAILS**	**38-ACM 13-05-2023**	**LEARNING LEVEL**	**BTL-4**
ASSESSMENT SCHEME					
CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ assignments/ Project**	**Surprise Test / Quiz**	**Attendance**	**ESE**
15%	15%	10%	5%	5%	50%
Course Description	This course provides you with end-to-end training in Dimensional Content for Augmented and Virtual Reality.				
Course Objective	The objective of this course is to provide a foundation to the fast-growing field of AR and make the students aware of the various AR devices. It is designed to give historical and modern overviews and perspectives on virtual reality. It describes the fundamentals of sensation, perception, technical and engineering aspects of virtual reality systems.				
Course Outcome	Upon successful completion of the course, the student will be able to: CO1: Compare and Contrast VR and AR experiences CO2: Demonstrate and develop VR apps in Unity CO3: Demonstrate and develop AR apps in Unity CO4: Acquire knowledge in VR and AR technologies in terms of used devices, building of the virtual environment and modalities of interaction and modelling. CO5: Acquire knowledge about the application of VR and AR technologies in medicine, education, cultural heritage and games.				

CO, PO, AND PSO MAPPING												
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**
CO1	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**
CO2	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	**1**	**-**	**2**	**-**	**-**	**2**	**1**	**-**	**-**	**-**	**-**	**2**
CO4	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**-**	
CO5	**-**	**-**	**-**	**-**	**1**	**2**	**1**	**-**	**-**	**-**	**1**	**1**

Prerequisites: NIL

MODULE 1 INTRODUCTION	**(6L+6P)**
What Is Augmented Reality - Defining augmented reality, history of augmented reality, The Relationship Between Augmented Reality and Other Technologies-Media, Technologies, Other Ideas Related to the Spectrum Between Real and Virtual Worlds, applications of augmented reality Augmented Reality Concepts- How Does Augmented Reality Work? Concepts Related to Augmented Reality, Ingredients of an Augmented Reality Experience. **Practical Components:** 1. Timeline of evolution of AR from VR	**CO1-BTL-4**
MODULE 2: VIRTUAL REALITY	**(6L+6P)**
Defining Virtual Reality, History of VR, Human Physiology and Perception, Key Elements of Virtual Reality Experience, Virtual Reality System, Interface to the Virtual World-Input & output- Visual, Aural & Haptic Displays, Applications of Virtual Reality. **Practical Components:** 1. Study the use of Virtual Reality at NASA 2. Creating 3D objects using Blender.	**CO2-BTL-4**
MODULE 3 GEOMETRY OF VIRTUAL WORLDS &THE PHYSIOLOGY OF HUMAN VISION	**(6L+6P)**
VR Hardware and Software- Sensory hardware; Limitations and interactions; AR and VR together; Introduction to AR headset and smart glasses; Various AR software available; Introduction to Spark AR; Create a face detection app; Introduction: What is Unity; Introduction: Why Unity; Introduction: Unity installation; Introduction: What is Software Development Kit (SDK); Introduction to AR foundation; Installing AR foundation SDK; SDK setup,3D computer graphics basics; Creating 3D objects C-Sharp basics; Unity classes; Vectors in Unity Basics of creating a virtual environment for AR; Applying physics Interactions in AR Types of interaction in AR; How to test your project **Practical Components:** 1. Sweeping coverage of eye movements 2. Use of OpenCV for AR App Development	**CO3-BTL-4**
MODULE 4: VISUAL PERCEPTION & RENDERING	**(6L+6P)**
Visual Perception - Perception of Depth, perception of Motion, Perception of Color, Combining Sources of Information Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions ,Improving Latency and Frame Rates Case studies: Automatic stitching of panoramas in Virtual Reality .Motion in Real and Virtual Worlds- Velocities and Accelerations, The Vestibular System, Physics in the Virtual	CO4-BTL-4

World, Mismatched Motion and Vection Tracking- Tracking 2D & 3D Orientation, Tracking Position and Orientation, Tracking Attached Bodies Case Studies A virtual Study Use Case- NICE, An Educational Experience Interaction - Motor Programs and Remapping, Locomotion, Manipulation, Social Interaction. Audio -The Physics of Sound, The Physiology of Human Hearing, Auditory Perception, Auditory Rendering **Practical Components:** 1. Google Daydream 2. Create a C# script which plays a video when an image is scanned using AR App (use ARCore & Unity).	
MODULE 5 WORKING WITH VR & AR DEVICES	**(6L+6P)**
VR Devices – Structure and working of HTC Vive, Google Cardboard, Samsung gear VR, Oculus Quest, Samsung Odyssey, Oculus Rift. AR Components – Scene Generator, Tracking system, monitoring system, display, Game scene AR Devices – Optical See-Through HMD, Virtual retinal systems, Monitor based systems, Projection displays, Video see-through systems. Advantages and Disadvantages of AR and VR technologies. Case Studies Google Daydream Trending Application Areas - Gaming and Entertainment, Architecture and Construction, Science and Engineering, Health and Medicine, Aerospace and Defence, Education, Tele robotics and Telepresence Human Factors, Legal and Social Considerations - Human Factors Considerations, Legal and Social Considerations, The Future. **Practical Components:** 1. Case Studies: What is Google Maps AR navigation and how it is used	**CO5-BTL-4**

TEXTBOOKS	
1.	Steve Aukstakalnis- Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR, Addison-Wesley Professional, September 2016, ISBN: 9780134094328
2.	Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016
3.	Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer Graphics)". Morgan KaufmannPublishers, San Francisco, CA, 2002
REFERENCE BOOKS	
1.	Jesse Glover, Jonathan Linowes – Complete Virtual Reality and Augmented Reality Development with Unity: Leverage the power of Unity and become a pro at creating mixed reality applications. Packt publishing, 17th April 2019. ISBN -13 : 978-1838648183
2.	Jonathan Linowes, Krystian Babilinski – Augmented Reality for Developers: Build practical augmented reality applications with Unity, ARCore, ARKit, and Vuforia. Packt publishing, 9th October 2017. ISBN-13: 978-1787286436
E-BOOKS	
1.	https://www.amazon.in/Soft-Computing-Fundamentals-Applications-Pratihar/dp/8184873387
MOOC	
1.	https://www.coursera.org/learn/augmented-reality
2.	https://www.coursera.org/specializations/unity-xr

ELECTIVE-II

COURSE TITLE	3D TEXTURING AND SCULPTING		CREDITS	4	
COURSE CODE	ACS02506	COURSE CATEGORY	DE	L-T-P-S	3-0-2-0
VERSION	1.0	APPROVAL DETAILS	38 ACM 13-05-2023	LEARNING LEVEL	BTL-4

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	Provides an introduction to creating, editing, and analyzing 3D models. Develops foundational skills to work with, and navigate the digital 3D modelling workspace to create 3D objects. Examines basic elements of the 3D development of modeling, texturing, lighting, animating, and rendering.
Course Objective	This course enables the students: • To understand the concepts of 3D- Three Dimension. • To gain Theoretical knowledge of how to create Three-dimensional (3D) Environment. • Demonstrate the ability to map detailed textures to 3D objects in theoretical way. • To gain Theoretical knowledge on Lighting and Rendering for the 3D objects and 3D environment. • To Understand the Basics of Animation.
Course Outcome	On the successful completion of the course, students will: CO1 Understand the concept of 3D Three Dimension in General. CO2 Understand the 3D Industrial Pipeline process and ability to apply the pipeline in their 3D projects. CO3 Be able to Start working on 3D related software and learned the tools and Techniques. CO4 Have a brief knowledge about Modeling, Texturing, Lighting and Rendering, Rigging and animation. CO5 Examines basic elements of the 3D development.

CO, PO, AND PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	1	1	-	-	-	-	-	-	-	-			1	1	
CO2	-	-	-	-	-	-	-	-	-	-			-	-	
CO3	1	-	2	-	-	2	1	-	-	-			-	2	

CO4	-	-	**1**	-	-	**1**	-	-	**1**	-			-		
CO4	-	-	**1**	-	-	**1**	-	-	**1**	-			-		

Prerequisites: NIL

MODULE 1 INTRODUCTION	**(6L+6P)**
3D Modelling - Types of 3D Modelling - Digital Sculpting - Procedural Modelling - Image Based Modelling - Tool-Box - Navigate the Camera -Show or Hide - Change the Display of Objects - Display Scene Information - Level of Detail (LOD) - Walk Through The Scene - Create and Edit Objects - Types of Objects - Create Basic 3D Objects and Curves- Duplicate - Cut, Copy, Paste - Delete, Undo, Redo & Repeat - Edit Components Numeric Values Directly - Component Editor - Transform Objects and Components - Change The Pivot Point - Align and Snap - Matching object attribute values. **Practical Component:** 1. Create 3D model Surface of mud pot set using the given reference. 2. Create A Model of Dining Table set using basic polygon modelling tools. 3. Make a model of soda can and apply the given texture using UV Unwraping techniques.	**CO1-BTL-4**
MODULE 2 MODELLING	**(6L+6P)**
Polygonal Modelling - Editing Polygons - Transforming Polygonal Components - Combining, Separating, and Splitting - Smoothing polygons - Colouring Polygons - Retopology - Polygonal Modelling Reference - Modelling Menu Set - Polygonal Modelling Tools - Nurbs Modelling - Creating NURBS Surfaces - Editing NURBS - UV's - Mapping UV's - Editing UV's - Sculpt a mesh - Sculpt using symmetry. **Practical Component:** 1. Create 3D model of Wine Bottle and Glass, Render it using Maya mental ray Glass Materials. 2. Create 3D model of Reading Table and props required on it and set up the Lighting for the same and render it. 3. Set up a 3-point light setup for Given product model and take Render Images for product modeling.	**CO2-BTL-4**
MODULE 3 SHADING AND TEXTURING	**(6L+6P)**
Surface material Attributes - Surface Material Specular Shading Attributes Surface Materials- Displacement Materials - Volumetric Materials - Shading - Assign Materials To The Surface - Create Layer -Shaders - Reflect Or Refract Light - Overview of texture nodes - 2D textures - Environment Texture - Layered Texture - File Textures - Procedural Textures - Shading Editor – Hypershade. **Practical Component:** 1. Create Simple Cartoon Character and Give appropriate Texture and Render it. 2. Make Realistic Ball Bounce Animations For Different Balls using Keyframe Animation. 3. Set up Interior and Exterior Lighting For The Given 3D Building model	**CO3-BTL-4**
MODULE 4: ANIMATION	**(6L+6P)**
Animation Basics - Animated rotation - Create Time Warping Effects -Edit animation preferences - Playback Animation - Keyframe Animation- Edit Curves - Driven Keys - Breakdowns – In Between - Time Editor -Character Animation - Skeletons - Skeleton	**CO4-BTL-4**

components - Skinning - IK handles overview - HumanIK - Constraints - Graph Editor - Animation Layers And Animation File Formats - Base Animation - Animation Layer Editor **Practical Component:** 1. Using Background Shader and Surface Shaders. 2. Make a 3D model of ROBO, Set up Rig and Controls for it and make Walk cycle Animation.	
MODULE 5 MAYA	**(6L+6P)**
Hardware, software, and vector rendering - Maya Software Renderer -Maya Hardware 2.0 Renderer - Maya Vector Renderer - ARNOLD FOR MAYA RENDERER - Camera Setup - Depth of field - Focus and Blur -Using A Stereoscopic Camera - Create A Multi-Camera Rig - Working in Viewport 2.0 - Viewport 2.0 Limitations- Linear Workflows AndColor Management - Limitations of color management. **Practical Component:** 1. Kicking a ball 2. Character thinking 3. Variations for face expressions 4. Change a character emotion (Happy to sad, sad to angry etc.,) 5. Object falling into a body of water	**CO5-BTL-4**

TEXTBOOKS	
1.	Preston J. Blair, “Animation 1: Learn to Animate Cartoons Step by Step” (Cartooning, Book 1) Paperback – 2003
2.	Russell Chun “Adobe Animate CC Classroom in a Book” 1st Edition, 2018
REFERENCE BOOKS	
1.	The Animator's Survival Kit: A Manual of Methods, Principles and Formulas for Classical, Computer, Games, Stop Motion and Internet Animators 4th Edition – 2009
2.	Jean Ann Wright, “Animation Writing and Development: From Script Development to Pitch (Focal Press Visual Effects and Animation) 1st Edition”
E-BOOKS	
1.	https://pdfcoffee.com/3d-modeling-for-beginners-danan-thilakanathanpdf-pdf-free.html
2.	https://itbook.store/books/9781593279264
MOOC	
1.	https://in.coursera.org/courses?query=3d%20modeling
2.	https://www.udacity.com/course/interactive-3d-graphics--cs291

COURSE TITLE	**UNITY FOR AR/VR**		**CREDITS**	**4**	
COURSE CODE	**ACS02507**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**3-0-2-0**
VERSION	**1.0**	**APPROVAL DETAILS**	**38 ACM 13-05-2023**	**LEARNING LEVEL**	**BTL-4**
ASSESSMENT SCHEME					

First Periodical Assessment	Second Periodical Assessment	Seminar/ assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	Unity VR lets you target virtual reality devices directly from Unity, without any external plugins in projects. It provides a base API and feature set with compatibility for multiple devices. It has been designed to provide forward compatibility for future devices and software.
Course Objective	The objective of this course is to explain how Unity supports the many components of a VR app, including tracking, teleporting, interacting with virtual objects. At the same time to see how Unity's AR Foundation supports building AR apps.
Course Outcome	On the successful completion of the course, students will: CO1 Compare and Contrast VR and AR experiences CO2 Demonstrate and develop VR apps in Unity CO3 Demonstrate and develop AR apps in Unity CO4 Acquire knowledge in VR and AR technologies in terms of used devices, building of the virtual environment and modalities of interaction and modelling. CO5 Acquire knowledge about the application of VR and AR technologies in medicine, education, cultural heritage and games

CO, PO, AND PSO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO
CO1	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**3**
CO2	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**
CO3	**1**	**-**	**2**	**-**	**-**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**
CO4	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**1**	**-**	**-**		**3**
CO4	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**1**	**-**	**-**		**3**

1: Weakly related, 2: Moderately related and 3: Strongly related

Prerequisites: NIL

MODULE I : INTRODUCTION	**(6L+6P)**
Categorizing the realities – Virtual Reality, Augmented Reality & Mixed Reality, Introduction, features and application areas of Virtual Reality, Augmented Reality & Mixed Reality. All you need to know about VR – Integration of VR techniques, Contents objects and scale, GazeBased Control, Handy Interactables, IDE setup with package files, concepts and features of VR, VR project example All you need to know about AR - Working with AR techniques, compatibility with the environment, system architecture, AR terminology, application areas of AR, Integration of AR toolkits with existing IDE's (Unity-Vuforia, Visual Studio, Netbeans, intellij IDEA, Android, iOS), connectivity of smart devices with AR. **Practical Component:** 1. Case study of a single application using both VR and AR technologies	**CO1-BTL-4**
MODULE II VR APP DEVELOPMENT WITH UNITY	**(6L+6P)**

VR SDK's – VR SDK'S and Frameworks – OpenVR SDK, StreamVR SDK, VRTK, Oculus SDK, Google VR SDK. VR Concept Integration- Motion Tracking, Controllers, Camera , Hardware and Software requirements Setting up Unity with VR- Framework/SDK Integration with Unity, Debugging VR projects, Unity XR API's, Mobile VR Controller Tracking, Object Manipulation, Text optimizing and UI for VR **Practical Component:** 1. Creating 3D objects using Blender.	**CO2-BTL-4**
MODULE 3 AR APP DEVELOPMENT WITH UNITY	**(6L+6P)**
AR Foundation – Detection of surfaces, identifying feature points, track virtual objects in real world, face and object tracking. AR Algorithms – Briefing on SLAM Algorithm (Simultaneous Localization and Mapping), understanding uncertain spatial relationship, Anatomy of SLAM, Loop detection and Loop closing Unity AR concepts- Pose tracking, Environmental detection, Raycasting and physics for AR, Light estimation, Occlusion, working with ARCore and ARKit Working with AR Tools– ARCore, ARToolkitx ARCore - Features of ARCore, integration with Unity/Unreal/iOS/Android Studio, augmented reality applications with ARCore. ARToolkit – Features of ARToolkit, setting up the environment for application development. Vuforia- Features of Vuforia, setting up the environment for application development **Practical Component:** 1. Use of OpenCV for AR App Development	**CO3-BTL-4**
MODULE 4: PROGRAMMING LANGUAGES FOR AR & VR APPLICATIONS	**(6L+6P)**
C# with Unity – OOL concepts, classes in C#, setting up visual studio or code editor for C#, 3D models compatibility with C#, C# for AR and VR C++ with Unreal Engine – Building and compiling C++ programs with unreal engine, variables and memory, looping and if else structures with unreal engine, functions and macros, adding actors to the scene, dynamic memory allocations, spell book **Practical Component:** 1. Create a C# script which plays a video when an image is scanned using AR App (use ARCore & Unity)	**CO4-BTL-4**
MODULE 5 MAYA	**(6L+6P)**
VR Devices – Structure and working of HTC Vive, Google Cardboard, Samsung gear VR, Oculus Quest, Samsung Odyssey+, Oculus Rift. AR Components – Scene Generator, Tracking system, monitoring system, display, Game scene AR Devices – Optical See- Through HMD, Virtual retinal systems, Monitor based systems, Projection displays, Video see-through systems.Advantages and Disadvantages of AR and VR technologies. **Practical Component:** 1. Google Daydream	**CO5-BTL-4**
TEXTBOOKS	
1.	Steve Aukstakalnis- Practical Augmented Reality: A Guide to the Technologies, Applications, and Human Factors for AR and VR, Addison-Wesley Professional, September 2016, ISBN: 9780134094328
2.	Allan Fowler- Beginning iOS AR Game Development Developing Augmented Reality Apps with Unity and C#, 1st Edition, Apress Publications, 2018, ISBN 978-1484236178
3.	William Sherif- Learning C++ by Creating Games with UE4 ||, Packt Publishing, 2015, ISBN 978-1-78439-657-2
REFERENCE BOOKS	

1.	Jesse Glover, Jonathan Linowes – Complete Virtual Reality and Augmented Reality Development with Unity: Leverage the power of Unity and become a pro at creating mixed reality applications. Packt publishing, 17th April 2019. ISBN -13 : 978-1838648183
2.	Jonathan Linowes, Krystian Babilinski – Augmented Reality for Developers: Build practical augmented reality applications with Unity, ARCore, ARKit, and Vuforia. Packt publishing, 9th ctober 2017. ISBN-13: 978-1787286436
E-BOOKS	
1.	https://www.oreilly.com/library/view/practical-augmented-reality/9780134094328/
2.	https://www.scholarvox.com/catalog/book/docid/88852781
MOOC	
1.	https://www.coursera.org/googlearvr
2.	https://www.freecodecamp.org/news/augmented-reality-full-course/

LIST OF DEPARTMENT ELECTIVE COURSES FOR SPECIALIZATION IN IOT										
S.NO	**SEM**	**COURSE CATEGORY**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
DEPARTMENT ELECTIVE-1(SEMESTER-II)										
1	2	DE	ACS02508	5G & IOT Technologies	3	0	2	4	0	5
2	2	DE	ACS02509	Cognitive Iot	3	0	2	4	0	5
DEPARTMENT ELECTIVE-II(SEMESTER-III)										
3	3	DE	ACS02510	Wearable Computing	3	0	2	4	0	5
4	3	DE	ACS02511	IOT Security	3	0	2	4	0	5

ELECTIVE-I

COURSE TITLE	5G AND IOT TECHNOLOGIES		CREDITS	4	
COURSE CODE	ACS02508	COURSE CATEGORY	DE	L-T-P-S	3-0-2-0
VERSION	1.0	APPROVAL DETAILS	38 ACM 13-05-2023	LEARNING LEVEL	BTL - 4

ASSESSMENT SCHEME

CIA			ESE		
First Periodical Assessment	Second Periodical Assessment	Seminar/ assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	The course explains in great details the trade-offs between cellular IoT and emerging low power wider area networking technologies. it explains the advantages of cellular and gives technical of NB-IoT, LTE-M and EC-GSM. Also, the course provides some of the untold and behind-the-scene facts on IoT.
Course Objective	This course is organized in a way to help students to grasp the basic concepts of Internet of Things. It describes the IoT communication, it's building block and operating system requirements. The course also includes Industrial Internet of Things (IoT) which is an application of IoT in industries to modify the various existing industrial systems by linking the automation system with enterprise, planning and product lifecycle. Lastly it covers IoT applications, security and legal considerations.
Course Outcome	Upon successful completion of the course, the student will be able to: CO1: Identify and describe the need and evolution of Internet of Things. CO2: Describe working principle IOT sensors and actuators. CO3: Explain working principle of on-board peripherals. CO4: Explain the different networking concepts used in IoT networks. CO5: Understand the types of technologies that are available in industry and in use today and can be utilized to implement Industrial IoT solutions. CO6: Explain various IoT related used cases and applications

Prerequisites: NIL

CO, PO AND PSO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO 3
CO 1	1	1	-	-	-	-	-	-	-	-	2	-	1	1	3
CO 2	-	-	-	-	-	-	-	-	-	-	-	1	-	-	3

CO 3	**1**	**-**	**2**	**-**	**-**	**2**	**1**	**-**	**-**	**-**	**-**	**1**	**-**	**2**	**3**
CO 4	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**-**	**1**	**-**	**-**	**1**	**-**		**3**
CO 5	**-**	**-**	**-**	**-**	**1**	**2**	**1**	**-**	**-**	**-**	**-**	**1**	**1**	**1**	**3**

MODULE 1 BASICS OF IOT	**(6L+6P)**
Definition of "Internet of Things", Technological trends which have led to IoT, impact of IoT on society, History of IOT, How IOT works, IOT Applications, Characteristics of IoT, Challenges of IoT, Advantages of IoT, Disadvantages IOT, evolution of IOT **Practical components:** 1. To write a program to sense the available networks using Arduino. 2. To write a program to measure the distance using ultrasonic sensor and make LED blink using Arduino. 3. To write a program to detects the vibration of an object with sensor using Arduino.	**CO1-BTL-4**
MODULE 2 IOT SENSORS AND ACTUATORS	**(6L+6P)**
Various IOT Sensors and actuators and technologies, Temperature sensors, Moisture sensors, Light sensors, Acoustic and noise sensors, Water level sensors, Proximity sensors, motion sensors, Gyroscope, Chemical sensors, Image sensors, Light actuators, motors, relays, solenoids etc, Data sheet reading of sensors, actuators **Practical components:** 1. To write a program to connect with the available Wi-Fi using Arduino 2. To write a program to sense a finger when it is placed on the board Arduino. 3. To write a program to get temperature notification using Arduino.	**CO2-BTL-4**
MODULE 3 ON-BOARD PERIPHERALS	**(6L+6P)**
Disk controllers, Integrated graphic controller, integrated sound card, fast ethernet network controller, USB 2.0, IRDA controller, temperature, PS/2 port, VGA port, DVI port, HDMI port, Ethernet port, audio card, voltage and fan speed controller to monitor health of computer components, Multiplexers, Power devices, Displays and glue logic for I/Os, Data sheet reading of on board peripherals **Practical components:**	**CO3-BTL-4**

1. To write a program to install MySQL database in Raspberry pi. 2. To write a program to work with basic MySQL queries by fetching data from database in Raspberry pi.	
MODULE 4 SOFTWARE DEFINED NETWORKS	**(6L+6P)**
SDN, Cloud, Fog and MIST networking for IoT communications, Principles of Edge/P2P networking, M2M and peer networking concepts, Protocols to support IoT communications, security and privacy in fog. **Practical components:** 1. To write a program to switch light on when the input is 1 and switch the light off when the input is 0 using Raspberry pi. 2. Design of digital DC voltmeter and ammeter. 3. Design of digital frequency meter.	CO4-BTL-4
MODULE 5 INDUSTRY IOT	**(6L+6P)**
Basics of Industrial IoT, Industrial Processes, Industrial Sensing & Actuation, Industrial Internet Systems, Business Model and Reference Architecture Applications of IoT: Connected cars IoT Transportation, Smart Grid and Healthcare sectors using IoT, Security and legal considerations, IT Act 2000 and scope for IoT legislation, Smart cities and IoT revolution. **Practical components:** 1. Traffic signal control 2. Railway gate control by stepper motors 3. Direction and Speed control of DC motor	CO5-BTL-4

TEXTBOOKS	
1	Designing the Internet of Things Adrian McEwen, Hakim Cassimally Paperback 1st edition
2	Internet of things Samuel Greenguard MIT Press - 2015
3	Analytics for the Internet of Things (IoT)Andrew Minteer Kindle Edition 1st edition
4	IoT Fundamentals Networking Technologies, Protocols and Use Cases for Internet of Things David Hanes, Gonzalo salgueiro Cisco Press Kindle Edition 2017

REFERENCE BOOKS	
1	D.W. Patterson, “Introduction to AI & Expert Systems”, PHI, 1992.
2	Peter Jackson, “Introduction to Expert Systems”, AWP, M.A., 1992.
3	R.J. Schalkoff, “Artificial Intelligence - An Engineering Approach”, McGraw Hill International Edition, Singapore, 1992.

E-BOOKS	
1	https://www.vssut.ac.in/lecture_notes/lecture1530018613.pdf

2	https://www.cet.edu.in/noticefiles/271_AI%20Lect%20Notes.pdf
MOOC	
1	https://youtu.be/WUYAjxnwjU4?list=PLaxu2gn9WXMf_ln5pMvxjf043jzof4-i&t=13
2	www.iitk.ac.in https://youtu.be/p7kYStiASLo?list=PLbRMhDVUMngdcLdH4-YF1uJI4IuhcDZPR&t=
3	www.nptel.ac.in https://nptel.ac.in/courses/108108098/
4	www.edureka.com https://youtu.be/LlhmzVL5bm8?list=PL9ooVrP1hQOGccfBbP5tJWZ1hv5sIUWJl&t=120

COURSE TITLE	**COGNITIVE IOT**		**CREDITS**	**4**	
COURSE CODE	**ACS02509**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**3-0-2-0**
VERSION	**1.0**	**APPROVAL DETAILS**	**38 ACM 13-05-2023**	**LEARNING LEVEL**	**BTL - 4**
ASSESSMENT SCHEME					
CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ assignments/ Project**	**Surprise Test / Quiz**	**Attendance**	**ESE**
15%	15%	10%	5%	5%	50%
Course Description	By combining AI and machine learning capabilities with IoT devices, cognitive IoT enables real-time decision-making and automation that can revolutionise various industries, from healthcare and manufacturing to agriculture and energy.				
Course Objective	1. To emphasis the students from shifting their mindset from theoretical to practical multidisciplinary skills through installing the know-how of actual practice in industry field 2. Impart the knowledge to log the sensor data and to perform further data analytics 3. Make the students to apply Internet of Things (IoT) data for business solution in various domain in secured manner				
Course Outcome	At the end of course, the student will be able to: CO1 Integrate the aspects of human cognitive processes in the system design CO2 Comprehend the underlying cognitive process can have many abstractions of a cognitive cycle such as ‘Sense’, ‘Understand’, ‘Decide’ and ‘Act’. CO3 Detect any failures of system components and re-configure itself which provides a graceful degradation through self-healing. CO4 Accomplish knowledge about the application, system architecture, resources, system state and behaviour				

	CO5	Incorporate recent advancements in the machine learning including deep learning in IOT

Prerequisites: NIL

CO, PO, AND PSO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	1	1	-	-	-	-	-	-	-	-	1	1	1	1
CO 2	-	-	-	-	-	-	-	-	-	-	1	2	-	-
CO 3	1	-	2	-	-	2	1	-	-	-	1	1	-	2
CO 4	1	2	-	-	1	2	1	-	-	-	1	1	-	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1 INTRODUCTION	**(6L+6P)**
Cognitive IoT, Need for Cognitive IoT, Current and Future trends of IoT, Cognitive computing and applications. Data Analytics for IoT Regression, Data Analytics for IoT ANN Classification, Data Analytics for IoT Modern DNN's.	CO1-BTL-4
MODULE 2 CLOUD AND EDGE COMPUTING IN IOT	**(6L+6P)**
Decentralized Computing, Cloud computing, Cloudlets and fog computing, Cloud and edge computing for large scale IoT applications. **Practical Component:** 1. Connect with the Available Wi-Fi Using Arduino 2. Sense a Finger When it is Placed on Board Using Arduino 3. Temperature Notification Using Arduino	CO2-BTL-4
MODULE 3 INTRODUCTION TO GPU	**(6L+6P)**
Introduction to GPU's Parallel programming for GPU, Parallel Programming in CUDA, CNN Inference in GPU, CNN Training in GPU. **Practical Components:** 1. LDR to Vary the Light Intensity of LED Using Arduino 2. MySQL Database Installation in Raspberry Pi 3. SQL Queries by Fetching Data from Database in Raspberry Pi	CO3-BTL-4
MODULE 4: FPGA FOR INTERNET OF THINGS	**(6L+6P)**
Benefits of FPGA, Interfacing FPGAs with IoT-based edge devices, IoT-FPGA based applications, Microsemi's SmartFusion2 SoC FPGA.Big data, Digital twin, Cloud Computing, Sensors, Communications, Analytical software, Edge Devices **Practical Components:** 1. Switch Light on and Off Based on the Input of 2. User Using Raspberry Pi	CO4-BTL-4
MODULE 5 SECURITY IN COGNITIVE IOT	**(6L+6P)**
Cloud services and IoT – offerings related to IoT from cloud service providers – Cloud IoT security controls – An enterprise IoT cloud security architecture – New directions in cloud enabled IoT computing Security in Cognitive IoT, Security Issues in IoT, A hardware assisted approach for security, Architectural level overview for providing security, Security threats.	CO5-BTL-4

Practical Components: 1. Home automation using the BOLT IoT module. 2. Introduction to Arduino microcontroller and its programming. 3. Interfacing of the sensors and actuators with Arduino. 4. Real Time Projects Based on IoT.	
TEXTBOOKS	
1.	Alessandro Bassi, Martin Bauer, Martin Fiedler, Thorsten Kramp, Rob van Kranenburg, Sebastian Lange and Stefan Meissner, enabling things to talk – Designing IoT solutions with the IoT Architecture Reference Model, 1 st edition, Springer Open, 2016
2.	Matin, Mohammad Abdul, ed. Towards Cognitive IoT Networks, 1st edition ,Springer International Publishing, 2020.
REFERENCE BOOKS	
1.	Arshdeep Bahga and Vijay Madisetti, Cloud Computing: A Hands-on Approach, 1st edition, CreateSpace Independent Publishing Platform, 2013.
2.	John Mutumba Bilay, Peter Gutsche, Mandy Krimmel and Volker Stiehl, SAP Cloud Platform Integration: The Comprehensive Guide, 2nd edition, Rheinwerg publishing.2019.
E-BOOKS	
1.	https://link.springer.com/book/10.1007/978-3-642-40403-0
2.	http://www.forbes.com/sites/jacobmorgan/2014/05/13/simple-explanation-internet-things-that-anyone-can-understand/
MOOC	
1.	https://www.cybrary.it/course/iot-security/

ELECTIVE-II

COURSE TITLE	**WEARABLE COMPUTING**		**CREDITS**	**4**	
COURSE CODE	**ACS02510**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**3-0-2-0**
VERSION	**1.0**	**APPROVAL DETAILS**	**38 ACM 13-05-2023**	**LEARNING LEVEL**	**BTL - 4**
ASSESSMENT SCHEME					
CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ assignments / Project**	**Surprise Test / Quiz**	**Attendance**	**ESE**
15%	15%	10%	5%	5%	50%
Course Description	The course covers general-purpose graphics systems and their use. It gives an in-depth knowledge of computer graphics and graphical user interfaces. This course				

	introduces students to the concepts of graphical representation on computers and teach students the design of good graphical user interfaces.
Course Objective	• To provide a basic understanding of evolution of IoT and its functional modules. • To develop skillset to implement IoT systems for wearable applications.
Course Outcome	Upon successful completion of the course, the student will be able to: CO1: Design and develop IoT end points for wearable applications. CO2: To identify the real-world problem and give IoT solutions. CO3: To analyse and select appropriate protocols, wireless techniques for the problem. CO4: Examine, select and implement appropriate design patterns and frameworks for a chosen wearable platform. CO5: Appraise and apply general / platform-specific HCI and design and development guidelines and techniques for developing highly usable and intuitive wearable applications, making use of creative and problem solving skills.

Prerequisites: NIL

	CO, PO, AND PSO MAPPING													
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PS 2**
CO 1	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**1**	**1**	**1**
CO 2	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**
CO 3	**1**	**-**	**2**	**-**	**-**	**2**	**1**	**-**	**-**	**-**	**-**	**1**	**-**	**2**

MODULE 1 ROLE OF IOT IN WEARABLE DEVICES	**(6L+6P)**
Fundamentals of Wearable Technologies - History of wearable Technologies -User Experience Design for Internet of Things - Social Aspects of Wearability - Internet of Things – Applications - Wearable Chemical and Biochemical Sensors - Technology of Connected Devices – Device Types, Sensors, Actuators. **Practical Components:** 1. IntelliVue MX40 2. BlueLibris	CO1-BTL-4
MODULE 2 WEARABLE COMPUTING APPLICATIONS	**(6L+6P)**
Medical Applications of Wearable Technologies - Wearable Technologies - Energy Expenditure and Energy Harvesting - Technology of Connected Devices – Energy Considerations - Flexible Electronics and Textiles for Wearable Technologies. **Practical Components:** 1. BioHarness BT 2. Avery Dennison Medical Solutions	CO2-BTL-4
MODULE 3 WEARABLE COMPUTING ARCHITECHTURE	**(6L+6P)**

Wearable Algorithms - Web of Things – Architecture Standardization- Data Mining for Body Sensor Network - Internet of Things – Embedded Device UX Design. **Practical Components:** 1. Zoll Life Vest 2. Basis B1 Basis 3. Fuel Band Nike	CO3-BTL-4
MODULE 4 COMMUNICATION TECHNOLOGIES	**(6L+6P)**
Physical Activity Modelling and Behaviour Change - Internet of Things – Interface and Interaction Design - Human Body Communication for a Data Rate Sensor Network. Internet of Things – Networking. - Wireless Body Area Networks - Wearable Computing as a form of urban design **Practical Components:** 1. Fit bit Ultra fit bit 2. Body Media Link	CO4-BTL-4
MODULE 5 IOT APPLICATION DEVELOPMENT	**(6L+6P)**
Wearable Sensors for Monitoring of Physical and Physiological Changes and for Early Detection of Diseases - Wearable and Non-Invasive Assistive Technologies. **Practical Components:** 1. Smart Eye Glasses 2. Ring scanner 3. iGlove	CO5-BTL-4

TEXTBOOKS	
1.	Alessandro Bassi, Martin Bauer, Martin Fiedler, Thorsten Kramp, Rob van Kranenburg, Sebastian Lange, Stefan Meissner, "Enabling things to talk – Designing IoT solutions with theIoT Architecture Reference Model", Springer Open, 2013
2.	The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World 1st Edition
REFERENCE BOOKS	
1.	Jan Holler, VlasiosTsiatsis, Catherine Mulligan, StamatisKarnouskos, Stefan Avesand, David Boyle, "From Machine to Machine to Internet of Things", Elsevier Publications, 2014.
2.	IEEE Standards Association Working Group for an Architectural Framework for the Internet of Things (IoT) (P2413) - http://grouper.ieee.org/groups/2413/
3.	Internet of Things – Architecture – Final Architectural Reference Model for the IoT v3.0,
E-BOOKS	
1.	https://www.csa.iisc.ac.in/~vijayn/courses/Graphics/index.html
2.	http://www.svecw.edu.in/Docs%5ACSECGLNotes2013.pdf
3.	https://www.cs.umd.edu/~mount/427/Lects/427lects.pdf
MOOC	
1.	https://in.coursera.org/learn/wearable-technologies
2.	https://codereality.net/wearable-computing/
3.	https://www.udemy.com/course/wearable-technology-a-complete-primer-on-wearables/
4.	https://www.mooc-list.com/tags/wearable-technology

COURSE TITLE	IOT SECURITY		CREDITS	4	
COURSE CODE	ACS02511	COURSE CATEGORY	DE	L-T-P-S	3-0-2-0
VERSION	1.0	APPROVAL DETAILS	38 ACM 13-05-2023	LEARNING LEVEL	BTL - 4

ASSESSMENT SCHEME

CIA					ESE
First Periodical Assessment	Second Periodical Assessment	Seminar/ assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	The course will introduce the advanced topics of IoT security and privacy challenges. With IoT being deployed in various applications, IoT security and privacy issues become major concerns. Upon this request, the course will systematically analyze IoT security from hardware, communication, and system perspectives.
Course Objective	This course is designed to have students become acquainted with IoT security. Students will be able to understand or master IoT security related to hardware, system and networking.
Course Outcome	At the end of course, the student will be able to: CO1 Ability to understand the Security requirements in IoT CO2 Understand the cryptographic fundamentals for IoT CO3 Ability to understand the authentication credentials and access control CO4 Understand the various types trust models and Cloud Security. CO5 Understand the security from hardware, communication, and system perspectives

Prerequisites: NIL

CO, PO, AND PSO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	1	-	-	-	-	-	-	-	-	2	1	1	1	3
CO 2	-	-	-	-	-	-	-	-	-	-	1	1	-	-	3
CO 3	1	-	2	-	-	2	1	-	-	-	1	2	-	2	3
CO 4	1	2	-	-	1	2	1	-	-	-	1	3	-	-	3
CO 5	1	1	2	1	0	0	1	2	1	3	1				3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1 INTRODUCTION: SECURING THE INTERNET OF THINGS	(6L+6P)
Security Requirements in IoT,Architecture - Security in Enabling Technologies -Security Concerns in IoT Applications. Security Architecture in the Internet of Things -Security Requirements in IoT – Insufficient Authentication/Authorization – Insecure Access Control - Threats to Access Control, Privacy, and Availability - Attacks Specific to IoT. Vulnerabilities – Secrecy and Secret-Key Capacity -Authentication/Authorization for Smart Devices – Transport Encryption – Attack & Fault trees **Practical Components:** 1. Sense the Available Networks Using Arduino 2. Measure the Distance Using Ultrasonic Sensor and Make Led Blink Using Arduino 3. Detect the Vibration of an Object Using Arduino	CO1-BTL-4
MODULE 2 CRYPTOGRAPHIC FUNDAMENTALS FOR IOT	**(6L+6P)**
Cryptographic primitives and its role in IoT – Encryption and Decryption – Hashes –Digital Signatures – Random number generation –Cipher suites – key management fundamentals – cryptographic controls built into IoT messaging and communication protocols – IoT Node Authentication **Practical Components:** 1. Connect with the Available Wi-Fi Using Arduino 2. Sense a Finger When it is Placed on Board Using Arduino 3. Temperature Notification Using Arduino	CO2-BTL-4
MODULE 3 IDENTITY & ACCESS MANAGEMENT SOLUTIONS FOR IOT	**(6L+6P)**
Identity lifecycle – authentication credentials – IoT IAM infrastructure – Authorization with Publish / Subscribe schemes – access control. **Practical Components:** 1. LDR to Vary the Light Intensity of LED Using Arduino 2. MySQL Database Installation in Raspberry Pi 3. SQL Queries by Fetching Data from Database in Raspberry Pi	CO3-BTL-4
MODULE 4: PRIVACY PRESERVATION AND TRUST MODELS FOR IOT	**(6L+6P)**
Concerns in data dissemination – Lightweight and robust schemes for Privacy protection – Trust and Trust models for IoT – self-organizing Things - Preventing unauthorized access. **Practical Components:** 1. Switch Light On and Off Based on the Input of 2. User Using Raspberry Pi	CO4-BTL-4
MODULE 5 CLOUD SECURITY FOR IOT	**(6L+6P)**
Cloud services and IoT – offerings related to IoT from cloud service providers – Cloud IoT security controls – An enterprise IoT cloud security architecture – New directions in cloud enabled IoT computing **Practical Components:** 1. Home automation using the BOLT IoT module. 2. Introduction to Arduino microcontroller and its programming. 3. Interfacing of the sensors and actuators with Arduino. 4. Real Time Projects Based on IoT.	CO5-BTL-4

TEXTBOOKS	
3.	Practical Internet of Things Security (Kindle Edition) by Brian Russell, Drew Van Duren

REFERENCE BOOKS	
3.	Securing the Internet of Things Elsevier
4.	Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementation
E-BOOKS	
3.	ttp://searchsecurity.techtarget.com/feature/Secure-all-the-things
4.	http://www.forbes.com/sites/jacobmorgan/2014/05/13/simple-explanation-internet-things-that-anyone-can-understand/
MOOC	
2.	https://www.cybrary.it/course/iot-security/