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UNION CHRISTIAN COLLEGE (AUTONOMOUS) ALUVA

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NAAC Accredited with A++ Grade in Vth cycle
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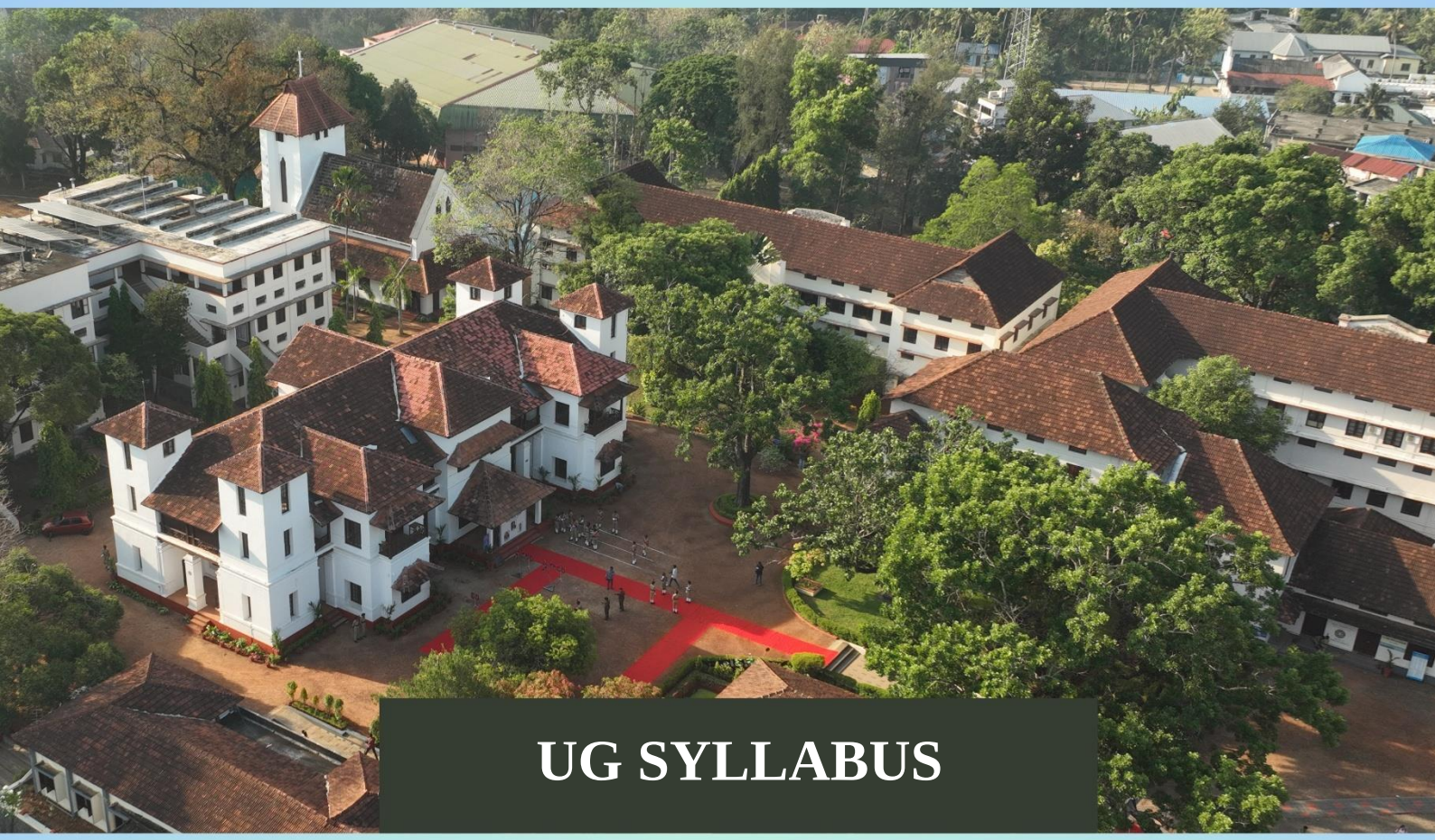
Department of Computer Science



UG SYLLABUS

UNDERGRADUATE (HONOURS) PROGRAMMES
{UCC UGP (HONOURS)}

Adopted from THE MAHATMA GANDHI UNIVERSITY
UNDER GRADUATE PROGRAMMES
(HONOURS) SYLLABUS
MGU-UGP (Honours)
(2024 Admission Onwards)

UNION CHRISTIAN COLLEGE ALUVA

(AUTONOMOUS)

UNDERGRADUATE PROGRAMMES (HONOURS)

SYLLABUS (2025 Admission Onwards)

Adopted from

THE MAHATMA GANDHI UNIVERSITY

MGU-UGP (Honours)

Faculty: Science

BoS: Computer Science(UG)

Programme: Bachelor of Science (Honours) Computer Science

Union Christian College Aluva

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Preface

Preface

The Outcome-Based Syllabus (OBS) presented herein is designed for the UGP Honours Programme in Computer Science. This syllabus is a result of comprehensive research, analysis, and collaboration among educators, industry professionals, and stakeholders to ensure alignment with the dynamic landscape of Computer Science education and industry demands.

The primary objective of this syllabus is to equip students with the knowledge, skills, and competencies necessary to excel in the field of computer science and its diverse applications. By focusing on outcomes, this syllabus aims to foster critical thinking, problem-solving abilities, creativity, and adaptability among students, preparing them for the challenges and opportunities of the digital era.

Key features of the Syllabus include:

- Alignment with Industry Needs: The syllabus is designed to reflect current industry trends, technologies, and best practices, ensuring that graduates are well-prepared for careers in various sectors including software development, cyber security, data science, artificial intelligence, and more.
- Emphasis on Core Concepts: Core principles and foundational concepts of computer science form the backbone of the syllabus, providing students with a strong theoretical understanding that underpins practical applications.
- Integration of Practical Experience: Hands-on experience, laboratory work, projects, and internships are integral components to develop practical skills.
- Interdisciplinary Approach: Recognizing the interdisciplinary nature of computer science, the syllabus incorporates elements from related fields such as mathematics, engineering, and cognitive science, fostering a holistic understanding of computational systems and their impact on society.
- Continuous Evaluation and Feedback: The syllabus emphasizes continuous assessment and feedback mechanisms to track student progress, identify areas for improvement, and adapt teaching methodologies accordingly, ensuring the effectiveness of the educational process.
- Flexibility and Adaptability: The syllabus is designed to be flexible and adaptable to accommodate advancements in technology ,changes in industry requirements, and feedback from stakeholders ,thereby ensuring its relevance and currency over time.

We believe that the Outcome-Based Syllabus presented here will serve as a guiding framework to empower students to become competent, ethical, and innovative professionals in the field of Computer Science and Computer Applications. It is our hope that this syllabus will inspire a lifelong passion for learning and exploration in the ever-evolving realm of technology.

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3	Dr Asha Das, Asst Professor Computer Science, Union Christian College, Aluva	Member
4	Ms Elizanbeth Thomas, Asst Professor Computer Science, Union Christian College, Aluva	Member
5	Ms Greeshma K, Asst Professor Computer Science , Union Christian College, Aluva	Member
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8	Dr. Julie M David Assistant Professor, MES College, Marampally	Nominee of University
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10	Mr Amal P Franglin, Soti ,Smart City Kakkanad	Alumnus

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5	Ms. Simi M, Associate Professor, Department of Computer Applications, SAS SNDP Yogam College, Konni
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7	Ms. Bindhu Prabha, Associate Professor, Department of Computer Applications, SAS SNDP Yogam College, Konni
8	Dr. Leena C Sekhar, Associate Professor, Department of Computer Applications, MES College, Marampally
9	Dr. Juby George, Assistant Professor, Department of Computer Applications, Marian College, Kuttikkanam
10	Dr. Sowmya M R, Assistant Professor, Department of Computer Science, Sree Sankara College, Kalady
11	Mr. Biju Kumar S P, Assistant Professor, Department of Computer Applications, NSS College Rajakumari, Idukki (Dist)

PREFACE

With great enthusiasm and a strong sense of responsibility, we, the Board of Studies in Computer Science at Union Christian College, Aluva (Autonomous), present this preface to the meticulously crafted curriculum and syllabus, adopted from the Board of Studies in Computer Science, Mahatma Gandhi University, for the Four-Year Undergraduate Program (FYUGP) in Computer Science at our institution. We sincerely acknowledge and thank the Board of Studies in Computer Application, Mahatma Gandhi University, for the excellent syllabus they have developed.

The introduction of the Four-Year Undergraduate Program marks a significant transformation in the landscape of higher education in Kerala. The Department of Higher Education, Government of Kerala, is leading this progressive initiative, which is set to be implemented from the academic year 2024–25. In alignment with this vision, Mahatma Gandhi University has undertaken a thorough and thoughtful curriculum design process, adhering closely to the directives laid down by the Department.

Computer Science, as a scientific discipline, offers an exciting and in-depth exploration of the plant world. It encompasses the study of plant origin, diversity, structure, physiology, and the intricate relationships plants share with other organisms and their environment. With its roots tracing back nearly 3.5 billion years to fossilized primitive cells, the field of Computer Science continues to unravel the wonders of the plant kingdom—from microscopic organisms to colossal trees—across levels ranging from the cellular to the ecosystem.

The core objective of this Four-Year Undergraduate Program is to impart a comprehensive and profound understanding of plant science. The curriculum aims to equip students with the knowledge and practical skills necessary to navigate and appreciate the complexities of plant life. Serving as a guiding framework, the syllabus offers a holistic journey—from the microscopic architecture of cells to the study of vast and dynamic ecosystems.

Throughout the four years, students will engage in a vibrant blend of theoretical instruction, hands-on experiences, field studies, and case-based learning. This integrated approach ensures students remain attuned to the latest advancements in plant science, while also encouraging exploration and the pursuit of research interests. The curriculum is intentionally structured to cultivate critical thinking, scientific curiosity, and a deep appreciation for the pivotal role of plants in sustaining life on Earth.

In conclusion, we look forward with great anticipation to accompanying students on this enriching journey through the diverse realms of Computer Science. We hope this syllabus serves as a gateway to a transformative academic experience—laying a solid foundation for lifelong learning and meaningful contributions to the scientific community.

Chairperson
UG Board of Studies in Computer Science

PREFACE

We are pleased to present the syllabus for the Postgraduate Program in Computer Science, designed to meet the evolving academic and research demands of advanced botanical sciences. This curriculum reflects our commitment to academic excellence, scientific innovation, and the holistic development of postgraduate students in the field of plant sciences. We sincerely acknowledge and thank the PG Board of Studies in Computer Science, Mahatma Gandhi University, for the excellent syllabus they have developed.

Computer Science, as a core discipline of biological sciences, plays a pivotal role in addressing many of the critical challenges of our time—including biodiversity conservation, sustainable agriculture, climate change adaptation, and medicinal plant research. The postgraduate curriculum is therefore carefully structured to deepen students' understanding of advanced plant biology, while also nurturing analytical skills, research aptitude, and scientific reasoning.

This program offers a balanced blend of core theoretical concepts, cutting-edge laboratory techniques, fieldwork, and independent research. Students will explore a wide array of topics ranging from molecular plant biology, plant physiology, taxonomy, ecology, biotechnology, and environmental science to interdisciplinary domains such as bioinformatics and global climate science. The inclusion of seminars, project work, and hands-on training ensures a dynamic and engaging academic experience that prepares students for careers in research, academia, industry, and beyond.

We believe that postgraduate education is not just about acquiring knowledge but about fostering a spirit of inquiry and a lifelong commitment to scientific pursuit. It is our sincere hope that this syllabus serves as a strong academic foundation for our students, inspiring them to contribute meaningfully to the scientific community and to the sustainable future of our planet.

Chairperson
UG Board of Studies in Computer Science

Syllabus Index

Name of the Major: Computer Science

Semester: 1

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution /week			
					L	T	P	O
UC1DSCCSC100	Art of Computing and Problem Solving	DSC A	4	5	3	0	2	0
UC1MDCCSC100	Cyber Laws and Online Safety	MDC	3	4	2	0	2	0
UC1MDCCSC101	Internet and Web Technologies							

L — Lecture, T — Tutorial, P — Practical/Practicum , O — Others

Semester: 2

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution /week			
					L	T	P	O
UC2DSCCSC100	Python Programming	DSC A	4	5	3	0	2	0
UC2MDCCSC100	Data Visualization using Python	MDC	3	4	2	0	2	0
UC2MDCCSC101	Mastering Spreadsheets							

Semester: 3

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution /week			
					L	T	P	O
UC3DSCCSC200	Database Management Systems	DSC A	4	5	3	0	2	0
UC3DSCCSC201	Data Structures using C	DSC A	4	5	3	0	2	0
UC3DSECSC200	Introduction to Data Science(Data Science and Analytics Specialization)	DSE	4	4	4	0	0	0
UC3DSECSC201	Introduction to Mobile and Web Technologies (Web and Mobile Technologies Specialization)							
UC3DSECSC202	Introduction to Embedded Systems (Embedded Systems and User Interface Design Specialization)							
UC3DSCCSC202	Python for Data Analytics (Minor for Others)	DSC B	4	5	3	0	2	0
UC3MDCCSC200	Cloud Computing Essentials	MDC	3	3	3	0	0	0
UC3VACCSC200	White Hat Hacking	VAC	3	3	3	0	0	0

Semester: 4

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution /week			
					L	T	P	O
UC4DSCCSC200	OOPs Concepts using JAVA	DSC A	4	5	3	0	2	0
UC4DSCCSC201	Computer Networks	DSC A	4	4	4	0	0	0
UC4DSECSC200	Data Mining (Data Science and Analytics Specialization)	DSE	4	5	3	0	2	0
UC4DSECSC201	Mobile App Development (Web and Mobile Technologies Specialization)							
UC4DSECSC202	System Programming (Embedded Systems and User Interface Design Specialization)							
UC4DSCCSC202	Introduction to Database Management Systems(Minor for Others)	DSC B	4	5	3	0	2	0
UC4SECCSC200	Foundations of Data Science	SEC	3	3	3	0	0	0
UC4SECCSC201	Computer Hardware Maintenance							

UC4SECCSC202	Visualization Tools for Data Analytics							
UC4VACCSC200	Green Computing Techniques	VAC	3	3	3	0	0	0

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution /week			
					L	T	P	O
UC4INTCSC200	Internship	INT	2					

Semester: 5

Course Code	Title of the Course		Type of the Course DSC, MDC, SEC etc.	Credit	Hours / week	Hour Distribution /week			
						L	T	P	O
UC5DSCCSC300	Software Engineering		DSC	4	4	4	0	0	0
UC5DSCCSC301	Operating Systems		DSC	4	4	4	0	0	0
UC5DSECSC300	Computer Security		DSE	4	4	4	0	0	0
UC5DSECSC301	Resource Optimization Techniques			4	4	4	0	0	0
UC5DSECSC302	Artificial Intelligence (Data Science and Analytics Specialization)	Any Two	DSE	4	4	4	0	0	0
UC5DSECSC303	Web Designing using PHP (Web and Mobile Technologies Specialization)								
UC5DSECSC304	Design Principles of User Computer Interaction (Embedded Systems and User Interface Design Specialization)								
UC5SECCSC300	Software Development Lab 1		SEC	3	5	1	0	4	0

Semester: 6

Course Code	Title of the Course		Type of the Course DSC, MDC, SEC etc.	Credit	Hours / week	Hour Distribution /week			
						L	T	P	O
UC6DSCCSC300	Cloud Computing		DSC	4	4	4	0	0	0
UC6DSCCSC301	Software Development Lab 2		DSC	4	7	1	0	6	0
UC6DSECSC300	Big Data Analytics (Data Science and Analytics Specialization)	Any Two	DSE	4	4	4	0	0	0
UC6DSECSC301	Internet of Things (Web and Mobile Technologies Specialization)								
UC6DSECSC302	Understanding MP and MC Architecture (Embedded Systems and User Interface Design Specialization)								
UC6SECCSC300	Machine Learning using Python		SEC	3	3	3	0	0	0
UC6SECCSC301	Natural Language Processing								
UC6VACCSC300	User Centric Computing and Software Standards		VAC	3	3	3	0	0	0

Semester: 7

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours/ week	Hour Distribution /week			
					L	T	P	O
UC7DCCCSC400	Advanced Java Programming	DCC	4	5	3	0	2	
UC7DCCCSC401	Advanced Database Management Systems	DCC	4	4	4	0	0	
UC7DCCCSC402	Advanced Data Structures	DCC	4	4	4	0	0	
UC7DCECSC400	Advanced Operating System Concepts	DCE	4	4	4	0	0	
UC7DCECSC401	Digital Image Computing	DCE	4	4	4	0	0	
UC7DCECSC402	Big Data Management Using R	DCE	4	4	4	0	0	

Semester: 8

Course Code	Title of the Course	Type of the Course DSC, MDC, SEC etc.	Credit	Hours / week	Hour Distribution /week			
					L	T	P	O
UC8DCCCSC400	Advanced Computer Networks	DCC	4	5	3	0	2	
UC8DCCCSC401	Computational Research Methodology	DCC	4	5	3	0	2	
UC8DCECSC400	Neural Networks and Deep Learning	DCE	4	5	3	0	2	
UC8DCECSC401	Pattern Recognition	DCE	4	5	3	0	2	
UC8DCECSC402	Generative AI	DCE	4	5	3	0	2	
UC8PRJCSC400	PROJECT/Dissertation	PRJ	12					

SEMESTER I

	Union Christian College, Aluva (Autonomous)					
Programme	BSc (Honours) Computer Science					
Course Name	Art of Computing and Problem Solving					
Type of Course	DSC A					
Course Code	UC1DSCCSC100					
Course Level	100					
Course Summary	This course covers fundamental concepts in computer programming, including algorithms, flowcharts, programming languages, control flow structures, arrays, and functions, emphasizing practical implementation through a series of hands-on exercises. Students will gain proficiency in solving problems using the C programming language.					
Semester	1	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	1	0	75
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe the fundamentals of computing and problem-solving tools and techniques.	U	1
2	Illustrate the basics of programming using C language.	U	1
3	Apply C data structures and control structures in programming.	A	2
4	Apply logic in designing solutions to various problems using C Language.	A	2
**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	Introduction to Computing and problem solving.		15Hrs	
	1.1	Basics of Computing- Bit, Byte, Data, and Information-Computer as a Data Processing machine-Computer Programs and Software-System and Application Software.	3	1
	1.2	Problem Solving Life Cycle (Software Development Method) – Specify the problem requirements - Analyze the problem- Design the algorithm - Implement the algorithm-Test and verify the completed program-Maintain and update the program.	3	1
	1.3	Understanding basic Problem-Solving Tools: Algorithms and Flowcharts- Examples.	4	1
	1.4	Problem solving approaches: Top-down approach, Bottom-up approach- Structured programming concepts.	2	1
	1.5	Computer Programming-Classification of Computer languages- Machine, Assembly and High-level languages, Language translators, Debugging, Types of errors- Syntax errors, Logical errors and Runtime errors.	3	1
2	Introduction to Programming		12Hrs	
	2.1	Introduction to C Programming: Character Set, Structure of a 'C' Program, Identifiers and keywords, Data Types, Variables, Constants, Operators, Expressions.	8	2
	2.2	Input and Output in C – Formatted functions, unformatted functions, commonly used library functions.	4	2
3	Control Flow Structures and Data Structures		18Hrs	

	3.1	Decision Statements- If, if-else, nested if-else, if-else-if ladder. Multi Branching Statement (Switch), Break and Continue, Unconditional Branching (Go to Statement).	6	3
	3.2	Loop control- for loops, nested for loops, while loops, do while loop. Nested Looping statements.	6	3
	3.3	Arrays: Declaration and Initialization of one and two-dimensional arrays, Strings.	3	3
	3.4	Functions: Definition-Declaration-Prototypes and Function call- actual and formal arguments.	3	3
4	Lab Practice		30Hrs	
	4.1	Simple C programs	5	4
	4.2	Program to illustrate control statements, Switch statement	5	4
	4.3	Program to illustrate looping statements	10	4
	4.4	Program to illustrate arrays	5	4
	4.5	Program to illustrate functions and user-defined functions	5	4
5		(Teacher specific content)		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** ● Use of ICT tools in conjunction with traditional classroom teaching methods ● Interactive sessions ● Class discussions ● Lab exercises

Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 25 Marks 1. Written test 2. Assignments CCA for Practical: 15 Marks 1. Practical assignments 2. Lab Record 3. Observation of practical skills 4. Viva
	B. Semester End Examination ESE for Theory: 50 Marks (1.5 Hrs) Written Test (50 Marks) Part A: Very Short Answer Questions (Answer all) - (10*1=10 Marks) Part B: Short Answer Questions (4 out of 6 Questions) - (4*5=20 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks) ESE for Practical: 35 Marks (1.5 Hrs) 1. Logic - 10 Marks 2. Successful Compilation - 5 Marks 3. Output - 5 Marks 4. Viva - 10 Marks 5. Record - 5 Mark

REFERENCES

1. Balagurusamy, E. (2019), "Programming in ANSI C" (8th ed.), Tata McGraw Hill.
2. Hanly J. R. and Koffman E. B. (2007), "Problem Solving and Program Design in C" (7th ed.), Pearson Education.

SUGGESTED READINGS

1. Gottfried, B. S. (2018). "Programming with C" (4th ed.). Schaum's Outline Series, TMH.
2. Pradeep K. Sinha and Priti Sinha (2004), "Computer Fundamentals -Concepts, Systems & Applications", 8th Edition, BPB Publications.

	Union Christian College, Aluva (Autonomous)					
Programme						
Course Name	Cyber Laws and Online Safety					
Type of Course	MDC					
Course Code	UC1MDCCSC100					
Course Level	100					
Course Summary	This comprehensive course on Cyber Laws, IT Act, and Online Security is designed to provide participants with a thorough understanding of the legal and security aspects in cyberspace. By the end of this course, participants will not only have a comprehensive understanding of cyber laws, cybercrimes, and online security but will also possess practical skills to navigate the digital realm safely and responsibly.					
Semester	1	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		2	0	1	0	60
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe cyber laws, IT Act, data protection, cybercrimes, cyber bullying, and harassment laws effectively.	U	1
2	Analyze internet security, passwords, browsing, social media, transactions.	An	1
3	Apply the acquired knowledge on cyber laws, IT security measures, and ethical considerations in real-world scenarios to safeguard digital information.	A	2
**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	Cyber Laws, IT Act and Cyber Crimes			
	1.1	Introduction to Cyber laws: Definition and Scope, Key legal concepts in cyber space.	2	1
	1.2	IT Act : Overview of the IT Act 2000, Offenses and penalties under the IT Act, Amendments and evolving landscape.	4	1
	1.3	Data Protection and Privacy Laws : Principles of Data Protection, Privacy laws and regulations.	3	1
	1.4	Cyber Crimes: Types of Cybercrimes, Hacking and unauthorized access, Identity theft and cyber fraud.	4	1
	1.5	Cyber Bullying and Harassment: Definition and Forms of Cyber Bullying, Legal Perspective on Cyber bullying.	4	1
	1.6	Harassment Laws and social media, Reporting and preventing cyber bullying.	3	1
2	Online Security			
	2.1	Introduction to Internet Security: Overview of Internet Security, Importance of Online Safety.	2	2
	2.2	Passwords and Authentication: Importance of Strong Password, Multi Factor Authentication (MFA).	2	2
	2.3	Secure Browsing Practices: Recognizing and Avoiding phishing Attacks, Identifying Secure Websites (HTTPS).	2	2
	2.4	Social Media Security: Privacy settings on Social media platforms, Secure sharing information.	2	2
	2.5	Online Transaction and Financial Security: Secure online shopping, Banking and Financial Security, Payment Card safety.	2	2

3	Practical Applications of Cyber Laws and Online Safety			
	3.1	Case Analysis: Assign students a cyber law case to analyze. They should present a summary of the case, identify key legal concepts involved, and discuss the offenses and penalties under the IT Act that are relevant to the case.	6	3
	3.2	Legislation Review: Ask students to review recent amendments to the IT Act and research how these changes impact the legal landscape. They should present their findings and discuss the evolving nature of cyber laws.	6	3
	3.3	Cybersecurity Incident Response Plan: Ask students to create a basic incident response plan for a hypothetical organization. This should include steps to take in case of hacking, unauthorized access, or a cybersecurity incident.	6	3
	3.4	Password Security Audit: Students should conduct a password security audit for their personal accounts. They should evaluate the strength of their passwords, implement multi-factor authentication where possible, and suggest improvements.	6	3
	3.5	Phishing Awareness Campaign: Task students with creating a phishing awareness campaign. Secure Online Transactions: Ask students to research and compile a guide on best practices for secure online transactions. This should cover topics such as secure online shopping, banking, and payment card safety.	6	3
4		Teacher Specific Content		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Lectures, Discussions, Case Analysis

Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 15 Marks 1. Written test 2. Assignments CCA for Practical: 15 Marks 1. Assignments 2. Record 3. Viva
	B. Semester End Examination ESE for Theory: 35 Marks (1 Hr) Written Test(35 Marks) Part A: Very Short Answer Questions (Answer all) - (10*1=10 Marks) Part B: Short Answer Questions(3 out of 5 Questions) - (3*5=15 Marks) Part C: Essay Questions(1 out of 2 Questions) - (1*10=10 Marks)
	ESE for Practical: 35 Marks 1. Report - 15 Marks 2. Viva - 20 Marks

REFERENCES:

1. Vakul Sharma, "Information Technology Law and Practice", 3rd ed. 2011, Universal Law Pub., New Delhi.
2. Adv. Prashant Mali, "Cyber Law & Cyber Crimes", Snow White Publications Pvt. Ltd, 2nd ed. 2015.
3. Michael Cross , "Social Media Security: Leveraging Social Networking While Mitigating Risk", Elsevier, 2014.
4. William Stallings & Lawrie Brown " Computer Security – Principles and Prctice" 3rd ed., Pearson Pub., 2017.

SUGGESTED READINGS:

1. "Cyber Law in India" by Pavan Duggal
2. "Cyber Security: APractitioner's Guide" by Eric Cole
3. "Principles of Intellectual Property" by Stephen M McJohn
4. "The Indian Cyber Law" by Sandeep Agrawal

	Mahatma Gandhi University Kottayam					
Programme						
Course Name	Internet and Web Technologies					
Type of Course	MDC					
Course Code	UC1MDCCSC101					
Course Level	100					
Course Summary	The course covers the fundamentals of computer networks, including types, topologies, communication mediums, networking tools, security, and an introduction to the Internet, HTML, and webpage design.					
Semester	1	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		2	0	1	0	60
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe the fundamentals of computer networks and Internet.	U	1
2	Illustrate basic HTML tags for webpage designing.	U	1
3	Design websites using HTML tags.	A	2

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	Computer networks and Internet			
	1.1	Computer Networks –Types of Networks: WAN, MAN, LAN, PAN, CAN- Benefits of Networks.	2	1
	1.2	Network Topology –Bus, Ring, Star, Tree, Mesh, Hybrid- Communication Medium: Wired and Wireless.	4	1
	1.3	Networking Tools- MODEM, Repeater, Hub, Switches, Routers, Bridge, Gateway- Network Security –Firewalls.	3	1
	1.4	Internet - History, Benefits and Drawbacks, Internet Protocols: TCP/IP, FTP, HTTP, IP Address, Domain Name System (DNS), URL.	3	1
	1.5	Web Browsers, WWW, Search Engines – Types, Academic Search Techniques - Applications of Internet.	3	1
2	HTML and Webpage			
	2.1	Introduction to HTML – Essentials- Static & Dynamic Web Pages - Structure of a Web Page.	2	2
	2.2	Designing Web Pages- HTML Tags -Text Formats- Working with Text- Presenting and Arranging Text-Paragraphs- Animated Effects: Marquee – using White Space.	5	2
	2.3	Tables in HTML Working with Links.	4	2
	2.4	Lists, Images, Thumbnails, Audio & Video-Forms & Frames.	4	2
3	Lab Practice: Webpage designing			

	3.1	Text Formatting: Create a webpage demonstrating various text formatting options such as bold, italics, underline, strikethrough, and superscript/subscript using HTML tags.	6	3
	3.2	Lists: Develop a webpage showcasing different types of lists (unordered, ordered, and definition lists). Experiment with nested lists.	6	3
	3.3	Tabular Presentation: Build a webpage illustrating the use of HTML tables for organizing data. Explore table attributes for modifying cell spacing, padding, borders, and alignment. Incorporate colspan and rowspan attributes for complex table layouts.	6	3
	3.4	Form Creation: Construct a webpage containing a form with various input elements such as text fields, checkboxes, radio buttons, select dropdowns, and text areas.	6	3
	3.5	Frame Integration: Design a webpage with multiple frames using the <frame> and <frameset> tags. Experiment with different frame configurations such as rows, columns, and nested frames. Showcase the use of the <noframes> tag for browsers that do not support frames.	6	3
4		Teacher Specific Content		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Lecture, Practical, Demonstration through ICT tools
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 15 Marks 1. Written test 2. Assignments CCA for Practical: 15 Marks 1. Practical assignments 2. Lab Record 3. Observation of practical skills 4. Viva

	B. Semester End Examination ESE for Theory: 35 Marks (1 Hr) Written Test(35 Marks) Part A: Very Short Answer Questions (Answer all) - (10*1=10 Marks) Part B: Short Answer Questions(3 out of 5 Questions) - (3*5=15 Marks) Part C: Essay Questions(1 out of 2 Questions) - (1*10=10 Marks) ESE for Practical: 35 Marks (1.5 Hrs) 1. Design and Development - 20 Marks 2. Viva - 10 Marks 3. Record - 5 Marks

REFERENCES:

1. Raj Kamal, "Internet & Web Technologies", Tata McGraw Hill.

SUGGESTED READINGS:

1. Thomas. A. Powell, "HTML & CSS: The Complete Reference", 5th Edition, Tata McGraw Hill.
2. Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks", 5th Edition, Pearson.

SEMESTER II

	Union Christian College, Aluva (Autonomous)					
Programme	BSc (Honours) Computer Science					
Course Name	Python Programming					
Type of Course	DSC A					
Course Code	UC2DSCCSC100					
Course Level	100					
Course Summary	This course aims to provide students with a well-rounded understanding of Python programming, empowering them to tackle a variety of programming challenges and laying the groundwork for more advanced programming endeavours.					
Semester	2	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	1	0	75
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe fundamental concepts of Python programming language	U	1
2	Apply Python control structures in programming	A	2
3	Apply Python data structures in programming	A	2
4	Develop Python programs demonstrating control flow structures and data structures	A	2

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	Introduction to Python Programming		12	
	1.1	Python features, Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity	6	1
	1.2	Data types-Numbers, Boolean, Strings, None-Indentation, Comments, Reading Input, Print Output, Type Conversions	6	1
2	Python Control Structures		15	
	2.1	Decision Control Flow Statements – if, if-else, if-elif-else, nested if- Example python scripts	7	2
	2.2	Iterative statements - while, for, Nested loops, break and continue statements- Example python scripts	8	2
3	Python Data Structures		18	
	3.1	Lists: Creating Lists, Basic List Operations. list() function, Indexing and Slicing, Built-in-functions, List Methods, del statement.	3	3
	3.2	Tuples: Creating Tuples, Basic Tuple Operations, tuple() function, Indexing and Slicing, Built-in-functions on Tuples, Tuple methods, zip() Function.	3	3
	3.3	Dictionaries: Creating Dictionary, Accessing, and modifying, dict() function, Built-in-functions, Dictionary methods, del statement.	3	3
	3.4	Sets: Creating sets, Set methods	3	3

	3.5	Functions: Built-in-functions, User defined functions, Function Calls, The return Statement and void Function	3	3
	3.6	Files: Opening a file – Modes for opening a file and Attributes of file object, Closing a file, Writing to a file, Reading from a file, Renaming a file, Deleting a file	3	3
4		Lab Practice 1. Basic programs in Python: Display the use of variables and basic expressions, demonstrate arithmetic operators and data type conversions, create a Python script that involves working with numbers, floats, and string operations. 2. Programs Using Control structures: Logical operators and control flow using if- else statements, while and for loops in Python. 3. Programs Using Data structures: Manipulate lists, tuple, dictionary and sets- Programs demonstrating different data structure methods. 4. Programs using function: Python script incorporating basic in-built functions and demonstrating their usage. Implementation of user-defined functions, function calls, and parameterized function calls. 5. Programs using Files: Python scripts to open, read, and write to files, renaming and deleting files, illustrating file handling concepts in Python.	30	4
5		(Teacher specific content)		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) • Use of ICT tools in conjunction with traditional classroom teaching methods • Interactive sessions • Class discussions • Lab exercises
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 25 Marks 1. Written test 2. Assignments CCA for Practical: 15 Marks 1. Practical assignments 2. Lab Record 3. Observation of practical skills 4. Viva
	B. Semester End Examination ESE for Theory: 50 Marks (1.5 Hrs) Written Test(50 Marks) Part A: Very Short Answer Questions (Answer all) - (10*1=10 Marks) Part B: Short Answer Questions(4 out of 6 Questions) - (4*5=20 Marks) Part C: Essay Questions(2 out of 3 Questions) - (2*10=20 Marks) ESE for Practical: 35 Marks (1.5 Hrs) 1. Logic - 10 Marks 2. Successful Compilation - 5 Marks 3. Output - 5 Marks 4. Viva - 10 Marks 5. Record - 5 Marks

REFERENCES

1. Gowrishankar S, Veena A., “Introduction to Python Programming.”, CRC Press, Taylor & Francis Group, 2019.

SUGGESTED READINGS

1. David I. Schneider, “An Introduction to Programming Using Python”, Global Edition, Pearson Education Limited, 2015.
2. Eric Matthes, “Python Crash Course: A Hands-On, Project-Based Introduction to Programming”, 2nd Edition, No starch Press, 2019.
3. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist’’, 2nd edition, Updated for Python 3, Shroff/O’Reilly Publishers, 2016.

	Union Christian College, Aluva (Autonomous)

Programme						
Course Name	Data Visualization using Python					
Type of Course	MDC					
Course Code	UC2MDCCSC100					
Course Level	100					
Course Summary	This course offers a comprehensive introduction to data visualization principles and practices. Students will learn the importance and applications of data visualization, develop skills using popular libraries like Matplotlib, Seaborn, and Plotly, and explore best practices for effective visual representation. By the end of the course, students will apply these techniques to real-world datasets and create compelling data visualization projects.					
Semester	2	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		2	0	1	0	60
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Illustrate the fundamental principles of data visualization.	U	1
2	Use various plotting techniques for data visualization.	A	2
3	Apply data visualization techniques to real-world datasets using Python libraries.	A	2

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction to Data Visualization Overview of data visualization concepts, Importance and applications of data visualization.	5	1
	1.2	Introduction to Matplotlib: Basic plotting with Matplotlib, Customizing plots: labels, colors, styles.	5	1
	1.3	Plot types: line plots, scatter plots, bar plots, Subplots and layouts, Annotations and text, Plotting with pandas.	5	1
2	2.1	Introduction to Seaborn: Seaborn basics and advantages, Statistical plotting with Seaborn, Seaborn themes and aesthetics.	5	2
	2.2	Advanced Seaborn: Multi-plot grids, Categorical plots.	5	2
	2.3	Seaborn extensions: Swarm plots, Violin plots.	5	2
3	3.1	Introduction to Plotly, Overview of Plotly library, Interactive plotting basics, Creating interactive charts and dashboards, Customizing interactive plots, Plotly Express for rapid visualization, Plotly Dash for web-based applications.	10	3
	3.2	Data Visualization Best Practices: Principles of effective visualization, Choosing the right chart type, Color theory and accessibility.	5	3
	3.3	Case Studies and Real-world Applications • Visualizing real-world datasets • Apply learned techniques to a self-selected dataset • Create a comprehensive data visualization project	15	3
4		Teacher Specific Content		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** • Lecture • Demonstration • Lab Exercises

Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 15 Marks 1. Written test 2. Assignments CCA for Practical: 15 Marks 1. Practical assignments 2. Lab Record 3. Observation of practical skills 4. Viva
	B. Semester End Examination ESE for Theory: 35 Marks (1 Hr) Written Test(35 Marks) Part A: Very Short Answer Questions (Answer all) - (10*1=10 Marks) Part B: Short Answer Questions(3 out of 5 Questions) - (3*5=15 Marks) Part C: Essay Questions(1 out of 2 Questions) - (1*10=10 Marks) ESE for Practical: 35 Marks (1.5 Hrs) 1. Result - 20 Marks 2. Viva - 10 Marks 3. Record - 5 Marks

REFERENCES

1. Kalilur Rahman, “Python Data Visualization Essential Guide” , BPB Publications, 2021

SUGGESTED READINGS

1. Jake VanderPlas, “Python Data Science Handbook Essential Tools for Working with Data”, O'Reilly Media, 2016.
2. "Interactive Data Visualization for the Web" by Scott Murray
3. "Storytelling with Data: A Data Visualization Guide for Business Professionals" by Cole Nussbaumer Knaflic
4. Additional Resources: Online documentation and tutorials for Matplotlib, Seaborn, and Plotly.
5. Kaggle and GitHub repositories for code examples and projects.

	Union Christian College, Aluva (Autonomous)					
Programme						
Course Name	Mastering Spreadsheets					
Type of Course	MDC					
Course Code	UC2MDCCSC101					
Course Level	100					
Course Summary	This course covers fundamental spreadsheet skills, advanced formula application, data visualization techniques, pivot table analysis, and macro automation for effective data processing, analysis, and visualization.					
Semester	2	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		2	0	1	0	60
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Demonstrate the fundamental concepts of spreadsheet packages	U	1
2	Apply functions, formulas, charting techniques, and pivot tables for data representation and analysis	A	2
3	Utilize spreadsheet software to perform numerical computations and analyze data across various datasets	A	2

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Spreadsheet as a processing, analysis and visualisation tool, Layout of a worksheet- Title bar, Menu bar, Formula bar.	5	1
	1.2	Cell addressing, Data entry, Data Types, Data formatting, Data selection, Named ranges, Importing Data.	5	1
	1.3	Fill handle, Autofill, Autosum, Borders, Find and Replace, Sort, Filter, Advanced filter, Conditional formatting.	5	1
2	2.1	Formulas- Absolute addressing and relative addressing, IF statement, Functions- Categories, Exploring functions -Mathematical, Statistical, Text, Financial, and Date functions.	6	2
	2.2	Data representations and comparison using charts and pivot table- Different type of charts, Creation of charts, Setting Chart parameters, Customising charts, Creating and Manipulating Pivot table.	6	2
	2.3	Advanced features - Macros, Advantages of Macro, Creating and editing a macro, running a macro, Exporting Data, Printing data and result.	3	2
3	3.1	Basic Spreadsheet Skills: Create a simple spreadsheet including various types of data, format cells, use basic functions like autosum, and apply conditional formatting to highlight important information.	8	3
	3.2	Formula and Functions: Create a spreadsheet and apply formulas and functions for data computation (Mathematical, Statistical, Text, Financial, and Date functions).	6	3
	3.3	Data Visualization with Charts: Explore different types of charts to represent data by adjusting chart parameters and customizing visual elements for clarity and impact.	8	3

	3.4	Pivot Table Analysis: Create a pivot table to analyze data, explore different dimensions, and summarize information using calculated fields. Macro Automation: Automate repetitive tasks using macros.	8	3
4		Teacher Specific Content		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Lecture, Practical, Demonstration through ICT tools
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 15 Marks 1. Written test 2. Assignments CCA for Practical: 15 Marks 1. Practical assignments 2. Lab Record 3. Observation of practical skills 4. Viva
	B. Semester End Examination ESE for Theory: 35 Marks (1 Hr) Written Test(35 Marks) Part A: MCQ (15*1=15 Marks) Part B: Short Answer Questions (Answer all) - (10*2=20 Marks) ESE for Practical: 35 Marks (1.5 Hrs) 1. Procedure - 10 Marks 2. Output - 10 Marks
	2. Viva - 10 Marks 3. Record - 5 Marks

REFERENCES

1. Documentation Team, LibreOffice. LibreOffice 7.1 Calc Guide. N.p., Jean Hollis Weber, 2021.

SUGGESTED READINGS

1. Documentation Team, LibreOffice. “Getting Started with LibreOffice 6.0”. Friends of OpenDocument, INC, 2018.
2. https://documentation.libreoffice.org/assets/Uploads/Documentation/en/GS7.3/GS73-GettingStarted.pdf

SEMESTER III

	Union Christian College, Aluva (Autonomous)					
Programme	BSc (Honours) Computer Science					
Course Name	Database Management Systems					
Type of Course	DSC A					
Course Code	UC3DSCCSC200					
Course Level	200					
Course Summary	This course provides a comprehensive exploration of fundamental concepts in database management. The course delves into the Relational Model, Entity-Relationship Modeling, SQL, normalization. The course also covers transaction processing, desirable properties of transactions					
Semester	3	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	1	0	75
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand the fundamental concepts of database systems.	U	1
2	Analyse Relational database model	An	1
3	Apply SQL queries to create and manipulate relational databases.	A	1,2
4	Apply DDL Commands to manage Database operations.	A	2

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction to database, database management systems, functions of DBMS, characteristics of database approach	2	1
	1.2	Database users- database administrator, database designers, end users. Advantages of using DBMS approach.	2	1
	1.3	Database system Concepts and Architecture - Data model, schema, instance, categories of data model, data independence- physical and logical data independence, three-schema architecture.	2	1
	1.4	Database system environment- DBMS component modules	2	1
	1.5	Conceptual data modeling using Entity Relationship model- main phases of database design.	2	1
	1.6	Entity type, entity set, attributes, types of attributes, domain of attributes, keys- super key, candidate key, primary key	2	1
	1.7	Relationship Types ,Relationship Sets, Roles , and Structural Constraints – Weak Entity Types – Notation for ER diagrams – Sample ER diagrams.	3	1
2	2.1	Relational Data Model- Domains, Attributes, Tuples and Relations-Characteristics of Relations –Relational Model Constraints and Relational Database Schemas : Domain Constraints, Key Constraints, Relational Database Schemas, Entity Integrity, Referential Integrity, and Foreign Keys.	7	2

	2.2	Normalization: Informal Design Guidelines for Relational Schemas –Functional Dependencies – Normal forms : First Normal Form, Second Normal Form, Third Normal Form – General Definitions of Second and Third Normal Forms –Boyce-Codd Normal Form.	8	2
3	3.1	Structured Query Language-DDL,DML,DCL commands	1	3
	3.2	Basic data types in SQL, Data Definition commands : CREATE, ALTER,DROP - Adding constraints in SQL	2	3
	3.3	Basic SQL Queries : INSERT ,SELECT ,DELETE, UPDATE, Substring comparison using LIKE operator, BETWEEN operator	3	3
	3.4	Ordering of rows – SQL set operations :UNION, EXCEPT, INTERSECT	2	3
	3.5	,Nested queries , EXISTS and UNIQUE functions, Renaming of attributes	2	3
	3.6	Joining of tables, Aggregate functions ,GROUP BY, Managing Views	2	3
	3.7	Transaction-state, desirable properties of transaction	3	3
4	4.1	• Creating and altering the structure of a table in the database using DDL commands • Inserting rows to the table using INSERT command • Modifying data in the table using UPDATE and DELETE • Basic querying using SELECT	30	4
5		(Teacher specific content)		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) • Use of ICT tools in conjunction with traditional classroom teaching methods • Interactive sessions • Class discussions • Lab exercises

Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 25 Marks 1. Written test 2. Assignments CCA for Practical: 15 Marks 1. Practical assignments 2. Lab Record 3. Observation of practical skills 4. Viva
	B. Semester End Examination ESE for Theory: 50 Marks (1.5 Hrs) Written Test(50 Marks) Part A: Very Short Answer Questions (Answer all) - (10*1=10 Marks) Part B: Short Answer Questions(4 out of 6 Questions) - (4*5=20 Marks) Part C: Essay Questions(2 out of 3 Questions) - (2*10=20 Marks) ESE for Practical: 35 Marks (1.5 Hrs) 1. Coding and Output - 20 Marks 2. Viva - 10 Marks 3. Record - 5 Marks

REFERENCES

1. Ramez Elmasri and Shamkant B. Navathe (2010). Database Systems (6th Edition). Pearson Education.

SUGGESTED READINGS

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, 7th Edition, McGraw Hill
2. C.J Date- An Introduction to Database Systems, Eighth edition,Pearson Education,2003.
3. Reghu Ramakrishnan and Johannes Gehrke- Database Management Systems, Third edition, Mc Graw Hill International Edition.
4. Dipin Desai, An Introduction to Database Systems, First Edition, Galgotia Publications.

	Union Christian College, Aluva (Autonomous)

Programme	BSc (Honours) Computer Science					
Course Name	Data Structures using C					
Type of Course	DSC A					
Course Code	UC3DSCCSC201					
Course Level	200					
Course Summary	This course provides the concepts of fundamental data structures and their implementations in C. Starting with an introduction to structured data, students delve into arrays, stacks, queues, linked lists and trees. The course covers memory allocation, operations, applications and emphasizes practical examples and hands-on programming.					
Semester	3	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	1	0	75
Pre- requisites, if any	Basic knowledge of programming in C and an understanding of fundamental computer science concepts.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe functions, the fundamental concepts of static and dynamic data structures and Compare and Contrast different searching and sorting techniques.	U	1
2	Apply linear data structures such as stacks and queues.	A	2
3	Implement operations on linked lists and trees.	An	2
4	Devise programs for implementing Fundamental Data Structures.	A	1,2

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Function Calls , Parametrized function calls , Function returns , Recursive functions, types , Scope concepts - local, global	3	1
	1.2	Introduction to Data Structures, Definition, classification of data structures, Primitive and Non- primitive	2	1
	1.3	Operations on data structures, Arrays, Representation of array in memory,	3	1
	1.4	Linear array operations, Search-Searching techniques- Linear search, Binary Search, Sort - Sorting Techniques, Bubble sort, Merge sort, Recursion.	4	1
2	2.1	Stack, Definition, Array representation of stack, Operations on stack	3	2
	2.2	Infix, prefix and postfix notations, Conversion of an arithmetic expression from infix to postfix, Postfix evaluation, Applications of stack	5	2
	2.3	Queue- Definition, Array representation of queue, Simple queue operations, Circular queues, Double ended queue, Priority queue..	5	2
3	3.1	Dynamic memory allocation and pointers, Linked list- definition, Components of linked list, Representation of linked list, Advantages and disadvantages of linked lists	5	3
	3.2	Types of linked list, Singly linked list - Operations on singly linked list	5	3
	3.3	Trees - Concept of recursion, trees, tree terminology, binary trees, representation of binary trees, Types of binary tree. creation and operations on binary tree,	5	3
	3.4	binary search trees, Creation of binary search tree, tree traversing methods – examples	5	3
4		Practicals	30Hrs	
	4.1	Implement array insertion, Deletion	5	4

	4.2	Implement Linear Search, Binary Search, Bubbl Sort, Selection Sort, Merge Sort	6	4
	4.3	Implement stack and Queue operations using arrays	6	4
	4.4	Implement Circular Queue operations.	6	4
	4.5	Implement operations on a linked list.	7	4
5		(Teacher specific content)		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) • Use of ICT tools in conjunction with traditional classroom teaching methods • Interactive sessions • Class discussions • Lab exercises
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 25 Marks 1. Written test 2. Assignments CCA for Practical: 15 Marks 1. Practical assignments 2. Lab Record 3. Observation of practical skills 4. Viva
	B. Semester End Examination ESE for Theory: 50 Marks (1.5 Hrs) Written Test(50 Marks) Part A: Very Short Answer Questions (Answer all) - (10*1=10 Marks) Part B: Short Answer Questions(4 out of 6 Questions) - (4*5=20 Marks)

	Part C: Essay Questions(2 out of 3 Questions) - (2*10=20 Marks) ESE for Practical: 35 Marks (1.5 Hrs) 1. Logic - 10 Marks 2. Successful Compilation - 5 Marks 3. Output - 5 Marks 4. Viva - 10 Marks 5. Record - 5 Marks

REFERENCES

1. G.S Baluja (2004). Data Structures Through C (A Practical Approach) (2nd Edition). Danapat Rai & Co.
2. Ellis Horowitz and Sartaj Sahni. Fundamentals of Data Structures (2nd Edition). Galgotia Publications.

SUGGESTED READINGS

1. Seymour Lipschutz, Theory and Problems of Data Structures, Schaums Outline Series,2006, McGraw Hill
2. Yedidyah Langsam, Moshe Augustein, Aaron M Tenenbaum- Data structures using C and C++, Second Edition, Prentice Hall

	Union Christian College, Aluva (Autonomous)					
Programme	BSc (Honours) Computer Science					
Course Name	Introduction to Data Science					
Type of Course	DSE					
Course Code	UC3DSECSC200					
Course Level	200					
Course Summary	This course covers key concepts from data collection to modeling, emphasizing practical skills in preprocessing, exploratory analysis, and linear regression. With real-world applications and security considerations, learners gain essential knowledge for success in data science.					
Semester	3	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
Pre- requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand the need, evolution, roles, life cycle, applications, prerequisites, tools, and security issues in data science.	U	1
2	Understand data types, sources, collection methods, statistical descriptions, and pre-processing techniques.	A	2
3	Analyse the importance, types, techniques, steps, and tools for performing exploratory data analysis	An	2
4	Analyze the steps in data science modeling, including linear regression, model selection, diagnostics, evaluation metrics, and cross-validation techniques.	U,An	1,2

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction to Data Science - Need of data Science - Evolution of Data Science – Data Science Roles	5	1
	1.2	Data Science Life Cycle - Applications of Data Science in various fields – Prerequisites & Tools for Data Science - Data Security Issues.	7	1
2	2.1	Introduction to Data - Types of data - Sources of data – Data Collection methods - Basic Statistical Descriptions of Data	7	2
	2.2	Data Pre-Processing Overview: Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization.	5	2
3	3.1	Exploratory Data Analytics – Importance of EDA – Types of EDA	5	3
	3.2	Univariate Analysis, Bivariate Analysis, Multivariate Analysis	5	3
	3.3	Specialized EDA Techniques - Steps for performing EDA - Tools for Performing EDA.	7	3
4	4.1	Data Science Modelling – Steps in Data Scienc Modelling - Simple Linear Regression - Multiple Linea Regression	6	4
	4.2	Linear Model Selection and Diagnostics. - Mod Evaluation and Metrics in Data Science - Comm Evaluation Metrics: Confusion matrix - Mean Absolu Error (MAE) - Mean Squared Error (MSE) - Root Mean Squared Error (RMSE)	10	4
	4.3	Cross Validation: K-fold cross-validation - stratified cross-validation.	3	4
5		(Teacher specific content)		

	Classroom Procedure (Mode of transaction)

Teaching and Learning Approach	• Use of ICT tools in conjunction with traditional classroom teaching methods • Interactive sessions
	• Class discussions
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 30 Marks 1. Written tests 2. Assignments
	B. Semester End Examination ESE for Theory: 70 Marks (2 Hrs) Written Test (70 Marks) Part A: Very Short Answer Questions (Answer all) - (10*2=20 Marks) Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks)

REFERENCES

1. Jojo Moolayil, “Smarter Decisions : The Intersection of IoT and Data Science”, PACKT, 2016.

2. Cathy O’Neil and Rachel Schutt , “Doing Data Science”, O'Reilly, 2015.

3. David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big data Analytics”, EMC 2013

SUGGESTED READINGS

1. Raj, Pethuru, “Handbook of Research on Cloud Infrastructures for Big Data Analytics”, IGI Global
2. Tilman M. Davies “ The Book of R” 2016, No Starch Press
3. T. M. Mitchell, “Machine Learning”, McGraw Hill, 2017

<table>
<tr><td>  </td><td colspan="6">Union Christian College, Aluva

(Autonomous)</td></tr>
<tr><td>Programme</td><td colspan="6">BSc (Honours) Computer Science</td></tr>
<tr><td>Course Name</td><td colspan="6">Introduction to Mobile and Web Technologies</td></tr>
<tr><td>Type of Course</td><td colspan="6">DSE</td></tr>
<tr><td>Course Code</td><td colspan="6">UC3DSECSC201</td></tr>
<tr><td>Course Level</td><td colspan="6">200</td></tr>
<tr><td>Course Summary</td><td colspan="6">This course provides a comprehensive overview of mobile and web technologies, covering their history, core technologies, web and mobile architecture, responsive design principles, and security practices, while also exploring emerging trends like Progressive Web Apps (PWAs) and the role of AI and ML in modern applications.</td></tr>
<tr><td>Semester</td><td>3</td><td colspan="3">Credits</td><td>4</td><td rowspan="2">Total Hours</td></tr>
<tr><td rowspan="2">Course Details</td><td>Learning Approach</td><td>Lecture</td><td>Tutorial</td><td>Practical</td><td>Others</td></tr>
<tr><td></td><td>4</td><td>0</td><td>0</td><td>0</td><td>60</td></tr>
<tr><td>Pre-requisites, if any</td><td colspan="6"></td></tr>
</table>

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand the history and Current Landscape of Mobile and Web Technologies	U	1
2	Understand web architecture basics, core technologies, popular frameworks, server-side tech, and responsive design principles for improved cross-device experiences	U	1
3	Demonstrate the mobile architecture, explores core technologies and emphasizes principles of user experience design for intuitive mobile interfaces.	U,An	1,2
4	Apply security measures against common vulnerabilities, secure mobile apps through encryption and coding practices, develop Progressive Web Apps, and explore AI and ML in mobile and web technologies.	U,A	1,2
**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
	Introduction to Mobile and Web Technologies			
1	1.1	History and Evolution-Early web and mobile technologies, Milestones in the development of the internet and mobile devices.	5	1
	1.2	Current Landscape-Overview of modern mobile and web technologies, Key players in the industry (Apple, Google, Microsoft, etc.)	5	1
	Web Technologies			

2	2.1	Web Architecture-Client-server model, Front-end vs. back-end, Web protocols (HTTP/HTTPS).	5	2
	2.2	Core Web Technologies-HTML, CSS, and JavaScript, Web development frameworks (React, Angular, Vue.js), Server-side technologies (Node.js, Django, Ruby on Rails).	7	2
	2.3	Responsive Web Design-Principles of responsive design, Media queries and flexible grid layouts.	5	2
	Mobile Technologies			
3	3.1	Mobile Architecture- Mobile operating systems (iOS, Android), Mobile app lifecycle	5	3
	3.2	Core Mobile Technologies- Native vs. hybrid vs. web apps, Mobile development frameworks (React Native, Flutter, Xamarin).	5	3
	3.3	User Experience in Mobile Apps- Principles of mobile UI/UX design, Human Interface Guidelines (HIG) and Material Design.	5	3
	Security and Trends in Mobile and Web Applications			
4	4.1	Web Application Security- Common vulnerabilities (XSS, SQL Injection), Security best practices.	5	4
	4.2	Mobile Application Security - Data encryption, Secure coding practices.	5	4
	4.3	Progressive Web Apps (PWAs)-Features and benefits, Development considerations. Artificial Intelligence and Machine Learning in Mobile and Web- Current applications and future possibilities.	8	4
5		Teacher Specific Content		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) • Use of ICT tools in conjunction with traditional classroom teaching methods • Interactive sessions • Class discussions
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 30 Marks 1. Written tests 2. Assignments
	B. Semester End Examination ESE for Theory: 70 Marks (2 Hrs) Written Test (70 Marks) Part A: Very Short Answer Questions (Answer all) - (10*2=20 Marks) Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks)

REFERENCES

1. "Mobile Application Development: A Practical Approach" by Jeff McWherter and Scott Gowell
2. "Web Security for Developers: Real Threats, Practical Defense" by Malcolm McDonald

SUGGESTED READINGS

1. "HTML and CSS: Design and Build Websites" by Jon Duckett
2. "JavaScript and JQuery: Interactive Front-End Web Development" by Jon Duckett
3. "Responsive Web Design with HTML5 and CSS" by Ben Frain

	Union Christian College, Aluva (Autonomous)					
Programme	BSc (Honours) Computer Science					
Course Name	Introduction to Embedded Systems					
Type of Course	DSE					
Course Code	UC3DSECSC202					
Course Level	200					
Course Summary	This course covers the basics of computer architecture and embedded systems, including memory concepts, program execution, and the differences between microprocessors and microcontrollers, as well as their applications in various fields such as automotive electronics, robotics, and biomedical applications.					
Semester	3	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
Pre-requisites, if any	Basic knowledge in Computer Fundamentals.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand the fundamentals of computer architecture	U	1
2	Understand the embedded systems, their applications, features, and components.	U	1
3	Analyze embedded systems, focusing on MCUs, especially 8-bit MCUs, memory, low power design, interfacing techniques, real-world sensors and control of displays and relays.	An	2
4	Apply embedded system knowledge to real-world applications like mobile phones, RFID, sensor networks, robots, and medical devices.	U,A	1,2

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
	Computer architecture			
1	1.1	Binary System – Memory concept – Memory capacity- Program execution logic.	5	1
	1.2	Instruction Pointer – Execution logic of programs stored in ROM and RAM – BIOS program .	7	1
	Introduction to embedded systems			
2	2.1	Embedded systems- Application areas- features and characteristics , model of an embedded system.	5	2
	2.2	Microprocessor Vs microcontroller, concept of interfacing ports, example of a simple embedded system, MCUs: 4/8/16/32 bits	7	2
	Embedded systems			
3	3.1	Microcontroller unit(MCU), a popular 8-bit MCU, memory for embedded systems.	5	3
	3.2	Low power design, pull up and pull down resistors, Interfacing ADC and DAC	5	3
	3.3	Real world sensors- Temperature Sensor, Light Sensor, Proximity/range Sensor; Display and Relays control.	10	3
	Examples of embedded systems			
4	4.1	Mobile phone, automotive electronics, radi frequency identification (RFID), wireless sensor networks(WISENET).	6	4
	4.2	Robotics, biomedical applications, brain machin interface, Concept of embedded programming	10	4
5		(Teacher specific content)		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) • ICT enabled Lecture • Interactive sessions • Class discussions
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 30 Marks 1. Written tests 2. Assignments
	B. Semester End Examination ESE for Theory: 70 Marks (2 Hrs) Written Test (70 Marks) Part A: Very Short Answer Questions (Answer all) - (10*2=20 Marks) Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks)

REFERENCES

1. Lyla B Das, Embedded systems: An Integrated Approach, 1st Ed., Pearson, 2013

SUGGESTED READINGS

1. Shibu, K.V., Introduction to Embedded Systems, 1st Ed., TMH, 2009
2. Kanta Rao B, Embedded Systems, 1st Ed., PHI
3. Frank Vahid & Tony Givargis, Embedded System Design, 2nd Edition, John Wiley.

	Union Christian College, Aluva (Autonomous)

Programme						
Course Name	Python for Data Analytics					
Type of Course	DSC B					
Course Code	UC3DSCCSC202					
Course Level	200					
Course Summary	This course is designed to teach students how to analyze different types of data using Python. Students will learn how to prepare data for analysis, perform simple statistical analysis, create meaningful data visualizations and predict future trends from data.					
Semester	3	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	1	0	75
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
Upon completion of this course, the students will be able to:			
1	Describe data, its type and the data analysis process.	U	1
2	Illustrate the numerical computation of data using NumPy library.	U	1
3	Analyse data manipulation and visualization using Pandas and Matplotlib library respectively.	An	1
4	Implement various Python libraries to perform data analysis tasks.	A	2

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	Introduction to Data analysis:		10 hrs	
	1.1	Understanding structured and unstructured data	2	1
	1.2	Data Analysis process -Defining objectives, Data collection, Data cleaning, Data analysis, Data interpretation and visualization, Types of data analysis	8	1
2	Numerical Computation with NumPy Library		15 hrs	
	2.1	Ndarray, Creating Ndarrays, Data types for Ndarrays, Arithmetic with NumPy Arrays	5	2
	2.2	Basic Indexing and Slicing, Boolean Indexing and Fancy indexing.	5	2
	2.3	Universal functions, Mathematical and statistical functions, Sorting.	5	2
3	Data Manipulation and Visualization		20 hrs	
	3.1	Data Manipulation with Pandas Library: Introduction to Pandas Object, Pandas data structures- Series, DataFrame, Index object.	6	3
	3.2	Functionalities- Reindexing, Indexing, Selection, Filtering, Sorting, Ranking, Summarizing and Computing Descriptive Statistics, Handling missing data, Hierarchical indexing.	8	3

	3.3	Introduction to Data visualization: Matplotlib Library, pyplot, Data visualization using matplotlib - bar plot, line plot, histogram, pie chart, box plots, density plots and scatter plot.	6	3
4	Lab Practice		30 hrs	
	4.1	Implementation of Ndarray Basic Operations - Indexing, Slicing and Iterating, Conditions and Boolean Arrays, Shape Manipulation, Array Manipulation	10	4
	4.2	Implementation of DataFrames, Reading from csv files, Python programs to use data cleaning, loc() function, iloc() function, Descriptive Statistics – count(), sum(), mean(), median(), mode(), std(), min(), max() and cumsum(). Reading from csv files, Data cleaning, Inserting columns into DataFrames, Deleting columns from DataFrame, Concatenating DataFrame, Writing back to csv files.	10	4
	4.3	Data Visualization using bar plot, line plot, histogram, pie chart, box plots, density plots, and scatter plot.	10	4
5		Teacher Specific Content		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Lecture, Practical
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 25 Marks 1. Written test 2. Assignments CCA for Practical: 15 Marks 1. Practical assignments 2. Lab Record 3. Observation of practical skills 4. Viva
	B. Semester End Examination ESE for Theory: 50 Marks (1.5 Hrs) Written Test(50 Marks) Part A: Very Short Answer Questions (Answer all) - (10*1=10 Marks) Part B: Short Answer Questions(4 out of 6 Questions) - (4*5=20 Marks) Part C: Essay Questions(2 out of 3 Questions) - (2*10=20 Marks) ESE for Practical: 35 Marks (1.5 Hrs) 1. Coding and Output - 20 Marks 2. Viva - 10 Marks 3. Record - 5 Marks

REFERENCES

1. Wes Mckinney, “Python for Data Analysis: Data Wrangling with pandas, NumPy, and Jupyter” 3rd Edition, O'Reilly, 2022. Free online access: https:// wesmckinney.com/book/

SUGGESTED READINGS

1. Fabio Nelli, "Python Data Analytics Data Analysis and Science Using Pandas, Matplotlib, and the Python Programming Language", Edition 1, 2015, Apress.
2. William McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Ipython", Edition 2, 2017, Shroff/O'Reilly.

	Union Christian College, Aluva (Autonomous)

Programme						
Course Name	Cloud Computing Essentials					
Type of Course	MDC					
Course Code	UC3MDCCSC200					
Course Level	200					
Course Summary	This course provides a comprehensive overview of cloud computing, covering its definition, models, architecture, services, applications, virtualization technologies, and a comparative analysis of leading cloud service providers, with a case study on Amazon Web Services.					
Semester	3	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	0	0	45
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe the concept, types, pros and cons of Cloud Computing.	U	1
2	Demonstrate the Cloud architecture and compare and contrast various Cloud service models.	An	1
3	Analyse Abstraction and Virtualization technologies and Compare the features of leading Cloud Service Providers.	An	1

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	Introduction to Cloud Computing			
	1.1	Defining Cloud Computing, Cloud types- The NIST model, The Cloud Cube model, Deployment models, Service models.	10	1
	1.2	Desired Features of a Cloud, Benefits and Disadvantages of Cloud Computing.	5	1
2	Cloud Architecture, Services and Applications			
	2.1	Exploring the Cloud Computing Stack, connecting to the Cloud.	5	2
	2.2	Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS).	6	2
	2.3	Identity as a Service (IDaaS), Compliance as a Service (CaaS).	4	2
3	Abstraction and Virtualization			
	3.1	Introduction to Virtualization Technologies, Load Balancing and Virtualization.	4	3
	3.2	Understanding Hyper visors, Understanding Machine Imaging, Porting Applications.	4	3
	3.3	Leading Cloud Service Providers – Amazon Web Services (AWS), Microsoft Azure, Google Cloud Platform (GCP)- Comparative analysis of features and services.	4	,3
	3.4	Case study: Using AWS	3	3
4		Teacher Specific Content		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Lecture, Demonstration through ICT tools
Assessment Types	MODE OF ASSESSMENT A. continuous Comprehensive Assessment (CCA) CCA for Theory: 25 Marks 1. Written test 2. Assignments
	B. Semester End Examination ESE for Theory: 50 Marks (1.5 Hrs) Written Test(50 Marks) Part A: Very Short Answer Questions (Answer all) - (10*1=10 Marks) Part B: Short Answer Questions(4 out of 6 Questions) - (4*5=20 Marks) Part C: Essay Questions(2 out of 3 Questions) - (2*10=20 Marks)

REFERENCES

1. Buyya R., Broberg J., Goscinski A., "Cloud Computing: Principles and Paradigm", First Edition, John Wiley& Sons, 2011.

SUGGESTED READINGS

1. Sosinsky B., "Cloud Computing Bible", First Edition, Wiley Edition, 2011.
2. Rittinghouse, John W., and James F. Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2017.

	Union Christian College, Aluva (Autonomous)					
Programme						
Course Name	White Hat Hacking					
Type of Course	VAC					
Course Code	UC3VACCSC200					
Course Level	200					
Course Summary	This course delivers the basic idea about ethical hacking					
Semester	3	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	0	0	45
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe the concept of Ethical Hacking	U	1
2	Describe the Information Gathering Methodology and Tools used by Hackers	U	1
3	Summarize various methods of System Hacking	U	1

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Understanding the importance of security-Concept of ethical hacking and essential Terminologies: Threat, Attack – Vulnerabilities- Target of Evaluation– Exploit- Phases involved in hacking.	15	1
2	2.1	Footprinting - Introduction to foot printing- Understanding the information gathering methodology of the hackers- Tools used for the reconnaissance phase -Port Scanning – Introduction- using port scanning tools- Ping sweeps- Scripting Enumeration.	15	2
3	3.1	Aspect of remote password guessing- Role of eavesdropping -Various methods of password cracking- Keystroke Loggers- Understanding Sniffers - Comprehending Active and Passive Sniffing- ARP Spoofing and Redirection DNS and IP Sniffing- HTTPS Sniffing.	15	3
4		(Teacher specific content)		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Lecture, Demonstration through ICT tools
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 25 Marks 1. Written test 2. Assignments
	B. Semester End Examination ESE for Theory: 50 Marks (1.5 Hrs)

	Written Test (50 Marks) Part A: Very Short Answer Questions (Answer all) - (10*1=10 Marks) Part B: Short Answer Questions(4 out of 6 Questions) - (4*5=20 Marks) Part C: Essay Questions(2 out of 3 Questions) - (2*10=20 Marks)

REFERENCES

1. Kimberly Graves (2010). Certified Ethical Hacker. Wiley India Pvt Ltd.
2. Michael T. Simpson (2010). Hands-on Ethical Hacking & Network Defence. Course Technology.

SUGGESTED READINGS

1. Patrick Engebretson, “The Basics of Hacking and Penetration Testing” Ethical Hacking and Penetration Testing Made Easy, Syngress Media, Second Revised Edition, 2013.
2. RajatKhare, "Network Security and Ethical Hacking", Luniver Press, 2006.
3. Ramachandran V, “Wireless Penetration Testing Beginner’s Guide “ 3rd edition Packt Publishing, 2011.
4. Thomas Mathew, "Ethical Hacking", OSB publishers, 2003.

SEMESTER IV

	Union Christian College, Aluva (Autonomous)					
Programme	BSc (Honours) Computer Science					
Course Name	OOPs Concepts using JAVA					
Type of Course	DSC A					
Course Code	UC4DSCCSC200					
Course Level	200					
Course Summary	Programming concepts of JAVA language					
Semester	4	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Other s	
		3	0	1	0	75
Pre-requisites, if any	Knowledge about program logic					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Apply OOP concepts and Java fundamentals to develop robust programs.	A	1,2
2	Analyze class structure, inheritance, method implementation, and array handling in Java.	An	1,3
3	Demonstrate Java packages, exception handling, multithreading, Swing components, and event handling.	A	1,2
4	Demonstrate proficiency in Java programming through practical implementation and problem- solving.	A	2

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Concepts of Object Oriented Programming, Benefits of OOP,	1	1
	1.2	Features of Java, Java Environment, Java tokens. Constants, variables, data types, operators.	2	1
	1.3	Control statements-branching, looping and jump statements, labelled loops.	7	1
2	2.1	Defining a class, fields declaration, method declaration , creating object, accessing class members	4	2
	2.2	Method overloading, constructors, constructor overloading,	4	2
	2.3	Command line arguments, super keyword, static members,	4	2
	2.4	Inheritance, overriding methods, dynamic method despatch, final(variables, methods and classes), abstract methods and classes, interfaces, visibility control.	4	2
	2.5	Arrays-one dimensional arrays, declaration, creation, initialization of arrays, two dimensional arrays. String class.	4	2
3	3.1	Packages:- Java API packages overview(lang, util, io, swing, applet), user defined packages-creating packages, using packages.	3	3
	3.2	Exception handling techniques, Multithreading-creation of multithreaded program-Thread class – Runnable interface-thread life cycle.	4	3

	3.3	Swing components-ImageIcon, JLabel, JTextField, JTextArea, JButton, JCheckBox, JRadioButton, JList, JComboBox, JTable, JTabbedPane, JScrollPane,	4	3
	3.4	Event handling –Delegation Event Model-event classes-sources of events-event listeners.	4	3
4		• Implement basic OOP concepts through hands-on exercises. • Develop Java applications demonstrating inheritance and polymorphism • Utilize arrays and strings in practical coding tasks. • Create and use custom packages • Implement exception handling techniques • Build multithreaded Java programs to handle concurrent tasks efficiently. • Design and develop graphical user interfaces using Swing components. • Implement event handling mechanisms to respond to user interactions effectively.	30	4
5		(Teacher Specific content)		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) • Use of ICT tools in conjunction with traditional classroom teaching methods • Interactive sessions • Class discussions • Lab exercises
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 25 Marks 1. Written test 2. Assignments CCA for Practical: 15 Marks 1. Practical assignments 2. Lab Record 3. Observation of practical skills 4. Viva
	B. Semester End Examination ESE for Theory: 50 Marks (1.5 Hrs) Written Test (50 Marks) Part A: Very Short Answer Questions (Answer all) - (10*1=10 Marks) Part B: Short Answer Questions (4 out of 6 Questions) - (4*5=20 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks) ESE for Practical: 35 Marks (1.5 Hrs) 1. Logic - 10 Marks 2. Successful Compilation - 5 Marks 3. Output - 5 Marks 4. Viva - 10 Marks 5. Record - 5 Marks

REFERENCES

1. E. Balagurusamy (2014). Programming with Java (3rd Edition). McGraw Hill Education. (Module 1, 2 and 3)
2. Patrick Naughton (2002). Java 2 The Complete Reference (7th Edition). Osborne/McGraw-Hill.(Module 4 and 5)

SUGGESTED READINGS

1. Cay S. Horstmann & Gary Cornell – Core Java Volume 1 – Fundamentals, Eighth edition.
2. K. Somasundaram – Programming in Java 2 , First edition, Jaico Publishing House.

	Union Christian College, Aluva (Autonomous)

Programme	BSc (Honours) Computer Science					
Course Name	Computer Networks					
Type of Course	DSC A					
Course Code	UC4DSCCSC201					
Course Level	200					
Course Summary	This course provides a concise overview of key networking concepts and protocols, covering network topologies, layered architecture, circuit- switched and packet-switched networks, error detection, routing algorithms, and transport protocols like UDP and TCP, as well as internet protocols such as FTP, SMTP, Telnet, HTTP, and DNS.					
Semester	4	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
Pre-requisites, if any	Basic Knowledge of Computers					

COURSE OUTCOMES (CO):

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Demonstrate a solid understanding of fundamental networking concepts	K	1
2	Illustrate the concepts of circuit-switched and packet-switched networks.	U	1,2
3	Explore techniques for detecting and correcting errors in transmitted data	A	2
4	Describe the functionality of various layers of network model	U	1

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	Introduction to Computer Networks , Network Architecture Models		15 hrs	
	1.1	Network definition; network topologies; types of network, types of connections, protocols and standards.	7	1
	1.2	Layered architecture approach, OSI Reference Model, TCP/IP Reference Model.	8	1
2	Switching		15 hrs	
	2.1	Circuit Switched Network, Three Phases, Packet Switching, Datagram Networks	7	2
	2.2	Virtual Circuit Networks, Three Phases, Connection Oriented and Connectionless Services.	8	2
3	Data Link Layer Functions and Protocol, Network Layer Functions and Protocols		15 hrs	
	3.1	Error detection and error correction techniques error recovery protocols	5	3
	3.2	Framing, Flow control and Error control Noisy and Noiseless channel protocols-stop and wait ARQ, go-back-n ARQ; Point to Point Protocol on Internet.	5	3
	3.3	Routing; routing algorithms network layer protocol of Internet- IPV4, IPV6.	5	3
4	Transport Layer Functions and Protocols, Overview of Application layer protocol		15 hrs	
	4.1	Elements of Transport Protocols, Internet Transport protocols: UDP, TCP	7	4
	4.2	FTP (File Transfer protocol), SMTP (Simple, Mail Transfer Protocol), Telnet and remote login protocol, WWW (World Wide Web), HTTP (Hyper Text Transfer protocol), DNS, Uniform Resource Locator	8	4
5		(Teacher specific content)		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) • Use of ICT tools in conjunction with traditional class room teaching methods • Interactive sessions • Class discussions
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) - 30 Marks CCA for Theory: 30 Marks 1. Written tests 2. Assignments
	B. Semester End Examination ESE for Theory: 70 Marks (2 Hrs) Written Test (70 Marks) Part A: Very Short Answer Questions (Answer all) - (10*2=20 Marks) Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks)

REFERENCES

1. B. A. Forouzan, Data Communications and Networking (Fourth edition). THM, 2007

SUGGESTED READINGS

1. A. S. Tanenbaum: Computer Networks, Fourth edition, PHI , 2002
2. Stallings, W. (2013). *Data and Computer Communications*. Pearson Education India.
3. Kurose, J. F., & Ross, K. W. (2017). *Computer Networking: A Top-Down Approach*. Pearson Education India.

	Union Christian College, Aluva (Autonomous)

Programme	BSc (Honours) Computer Science					
Course Name	Data Mining					
Type of Course	DSE					
Course Code	UC4DSECSC200					
Course Level	200					
Course Summary	This Course provides the concept of Data Mining techniques and its implementation. Introducing the basic concept of Data Mining and Data warehouse, Association Rule Mining and Supervised and Unsupervised classification techniques. Implementation of the above Data Mining techniques using some open databases explores hands-on programming to analyse different real world problems.					
Semester	4	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	1	0	75
Pre-requisites, if any	Basic knowledge of any programming language like Python, C++,java etc. and an understanding of Basic database concepts.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Illustrate understanding of data mining techniques and methodologies effectively.	U	1
2	Apply concepts of data warehousing, OLAP, and association rule mining.	A	2
3	Analyse Supervised and Unsupervised Classification	An	2
4	Apply Association Rule mining ,Supervised and Unsupervised Classification techniques.	A	1,2

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction Data Mining, Data Ware House, Transactional Databases	3	1
	1.2	Data Mining Functionalities Characterization and Discrimination, Mining frequent patterns, Association and correlation, Classification and Prediction, Cluster Analysis, Classification of Data Mining Systems,	3	1
	1.3	Data Mining Task Primitive, Integration of Data Mining systems, Major issues in Data Mining, Data integration and transformation, Data reduction, Data discretization. Data Preprocessing.	4	1
2	2.1	Data Warehouse and OLAP technology ,Comparitive study of OLTP and OLAP	3	2
	2.2	Data Warehouse, Multidimensional data Model, Data warehouse architecture, Data Warehouse implementation,	4	2
	2.3	OLAP, Data Warehouse and data mining.	4	2
	2.4	Association Rules and Classification Concepts , Support and Confidence	3	2
	2.5	Efficient and Scalable Frequent item set Mining methods, Mining various kind of association rules,	3	2
	2.6	Apriori Algorithm From association mining to Co-relation analysis,	3	2
3	3.1	Classification and prediction, Issues, Classificati on by Decision tree induction	4	3
	3.2	Bayesian Classification, Rule-based classification, Support Vector Machine,K-nearest neighbor (KNN), Prediction.	4	3
	3.3	Cluster Analysis Definition, Types of data in cluster analysis,	3	3
	3.4	Clustering methods-Partitioning methods, K-means and k-medoids, from k-medoids to CLARANS, Hierarchical methods	4	3

4	Practicals		30Hr	
	4.1	Load and Analyse Database, Identify Noise and Missing Values.	7	4
	4.2	Implement Apriori algorithm for identifying frequent pattern.	7	4
	4.3	Implement Supervised classification techniques	8	4
	4.4	Implement Unsupervised Classification techniques	8	4
5		(Teacher specific content)		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) • Use of ICT tools in conjunction with traditional classroom teaching methods • Interactive sessions • Class discussions • Lab exercises
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 25 Marks 1. Written test 2. Assignments CCA for Practical: 15 Marks 1. Practical assignments 2. Lab Record 3. Observation of practical skills 4. Viva
	B. Semester End Examination ESE for Theory: 50 Marks (1.5 Hrs) Written Test(50 Marks) Part A: Very Short Answer Questions (Answer all) - (10*1=10 Marks)

	Part B: Short Answer Questions(4 out of 6 Questions) - (4*5=20 Marks) Part C: Essay Questions(2 out of 3 Questions) - (2*10=20 Marks) ESE for Practical: 35 Marks(1.5 Hrs) 1. Design and Development - 20 Marks 2. Viva - 10 Marks 3. Record - 5 Marks

REFERENCES

1. Jiawei Han and Micheline Kamber(2006), *Data Mining :Concepts and Techniques(2*nd ed.).Elsevier

SUGGESTED READINGS

1. Witten and Frank, *Data Mining Practical Machine Learning Tools and Techniques*,2nd ed. Elsevier,2005
2. Soman, Divakar and Ajay, *Data Mining Theory and Practice*, PHI, 2006
3. Margaret H Dunham, *Data Mining:Introductory and Advanced Topics*, Person

	Union Christian College, Aluva (Autonomous)

Programme	BSc (Honours) Computer Science					
Course Name	Mobile App Development					
Type of Course	DSE					
Course Code	UC4DSECSC201					
Course Level	200					
Course Summary	Introduction to mobile application development, user interface designing, data management and core functionalities of mobile applications and web services and Develop mobile applications using GUI and Layouts.					
Semester	4	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	1	0	75
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe the process of developing mobile applications and explore Android development	U	1
2	Apply Android components for UI development, data persistence, and user interaction.	A	1
3	Apply Android content providers for data sharing, SMS messaging, email sending, and location-based services and Utilize HTTP and JSON for consuming web services.	A	1,2
4	Apply essential Android Programming concepts and Develop various Android applications related to layouts	A	1,2

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	Introduction to Mobile apps		10hrs	
	1.1	Mobile Application Development - Mobile Applications and Device Platforms - Alternatives for Building Mobile Apps -Comparing Native vs. Hybrid Applications -The Mobile Application Development Lifecycle-The Mobile Application Front-End-The Mobile Application Back-End	5	1
	1.2	Key Mobile Application Services-What is Android-Android version history-Obtaining the Required Tools- Launching Your First Android Application-Exploring the IDE-Debugging Your Application-Publishing Your Application	5	1
2	Android Activities , User Interface, Basic Views, Fragments, and Data Persistence		20 hrs	
	2.1	Understanding Activities-Linking Activities Using Intents-Fragments-Displaying Notifications	3	2
	2.2	Understanding the Components of a Screen-Adapting to Display Orientation-Managing Changes to Screen Orientation	2	2
	2.3	Utilizing the Action Bar-Creating the User Interface Programmatically Listening for UI Notifications	5	2
	2.4	Using Basic Views-Using Picker Views -Using List Views to Display Long Lists	3	2
	2.5	Understanding Specialized Fragments - Using Image Views to Display Pictures -Using Menus with ViewsUsing WebView- Saving and Loading User Preferences-Persisting Data to Files-Creating and Using Databases.	7	2
3	Sharing Data and Advanced Functionality, Web Services		15 hrs	
	3.1	Sharing Data in Android-Creating Your Own Content Providers -Using the Content Provider	5	3

	3.2	SMS Messaging -Sending Email-Displaying Maps-Getting Location Data- Monitoring a Location.	5	3
	3.3	Consuming Web Services Using HTTP-Consuming JSON Services	5	3
4	Lab Experiments 1 .Develop an application that uses GUI components, Font and Colours 2. Develop an application that uses Layout Managers and event listeners. 3. Develop a native calculator application. 4. Writean application that draws basic graphical primitives on the screen. 5. Develop an application that makes use of RSS Feed. 6. Implement an application that implements Multi threading 7. Develop a native application that uses GPS location information. 8. Implement an application that writes data to the SD card. 9.Implement an application that creates an alert upon receiving a message.		30 Hrs	4
5	(Teacher specific content)			

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) • Use of ICT tools in conjunction with traditional classroom teaching methods • Interactive sessions • Class discussions • Lab exercises
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 25 Marks 1. Written test 2. Assignments CCA for Practical: 15 Marks 1. Practical assignments 2. Lab Record 3. Observation of practical skills 4. Viva
	B. Semester End Examination ESE for Theory: 50 Marks Written Test(50 Marks) (1.5 Hrs) Part A: Very Short Answer Questions (Answer all) - (10*1=10 Marks) Part B: Short Answer Questions(4 out of 6 Questions) - (4*5=20 Marks) Part C: Essay Questions(2 out of 3 Questions) - (2*10=20 Marks) ESE for Practical: 35 Marks(1.5 Hrs) 1. Design and Development - 20 Marks 2. Viva - 10 Marks 3. Record - 5 Marks

REFERENCES

1. Jerome DiMarzio. “Beginning Android Programming with Android Studio”(4thEdition). -Module 1,2
2. Anubhav Pradhan and Anil V Deshpande, Wiley Publications(2014). Composing Mobile Apps : Learn, Explore and Apply using Android. ISBN: 978-81-265-4660-2. - Module 2,3,4
3. Bill Phillips and Chris Stewart, Big Nerd Ranch Guides. Android Programming: The Big Nerd Ranch Guide - Module 5

SUGGESTED READINGS

1. Dawn Griffiths, David Griffiths, “Head First Android Development: A Brain-Friendly Guide”, 2017.
2. Neil Smyth , “Android Studio 3.0 Development Essentials: Android”, 8th Edition.
3. Pradeep Kothari, “Android Application Development (With Kitkat Support)”, Black Book 2014.

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https://en.wikipedia.org/wiki/Android_10 Develop App for Free
https://flutter.dev/
http://ai2.appinventor.mit.edu
https://en.wikipedia.org/wiki/Android_version_history
https://aws.amazon.co m/mobile/mobile-application-development/
(Unit1) https://en.wikipedia.org/wiki/Mobile_app_development

	Union Christian College, Aluva (Autonomous)

Programme	BSc (Honours) Computer Science					
Course Name	System Programming					
Type of Course	DSE					
Course Code	UC4DSECSC202					
Course Level	200					
Course Summary	This course equips students with a solid foundation in system software, language processors, and the tools used in program development. Through theoretical learning, students will gain the knowledge and skills necessary for effective software development in various computing environments.					
Semester	4	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	1	0	75
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe system software, language processing and Assemblers fundamentals.	*U*	1
2	Identify Macro processors, interpreters, compilers, and software tools for program development.	*A*	1
3	Analyze the functions and concepts of linkers and loaders.	*An*	1
4	Apply language processing techniques using LEX and YACC.	*A*	2

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Overview of system software and its role	2	1
	1.2	Language Processing Activities: Fundamentals of Language Processing & Language Specification.	4	1
	1.3	Scanning and Parsing,	4	1
	1.4	Elements of Assembly Language Programming	2	1
	1.5	A Simple Assembly Scheme	2	1
	1.6	Pass Structure of Assemblers, Design of a Two Pass Assembler	3	1
2	2.1	Introduction to Macros, Macro Definition and Call, Macro Expansion Different types of parameters	3	2
	2. 2	Design of a Macro Preprocessor	3	2
	2.3	Interpreters: Use and overview of interpreters Compilers: Phases of the Compiler , Aspects of compilation	5	2
	2.4	Compilation of Expressions, Control Structures, Code Optimization Software Tools: Software Tools for Program Development ,Editors ,Debug Monitors	7	2
	3.1	Introduction to linkers , Relocation and Linking Concepts	3	3
3	3.2	Design of a Linker	2	3

	3.3	Loaders and its types, Relocatability of Programs , Linking for Overlays and Loaders.	5	3
4	4.1	1. Write a program to implement the Lexical Analyzer. 2. Write a lexical analyzer (using lex utility for unix). 3. Write a Program to count the number of characters, words, spaces and lines in a given input file using LEX. 4. Write a Program to count the numbers of comment lines in a given C program using LEX 5. Write a Program to recognize a valid arithmetic expression and to recognize the identifiers and operators present. Print them separately using LEX 6. Write a Program to recognize and count the number of identifiers in a given input file using LEX 7. Write a Program to recognize a valid arithmetic expression that uses operators +, – , * and / using YACC. 8. Write a Program to recognize a valid variable, which starts with a letter, followed by any number of letters or digits using YACC 9. Use macro features of C language	30	4
5		(Teacher Specific Content)		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) • Use of ICT tools in conjunction with traditional classroom teaching methods • Interactive sessions • Class discussions • Lab exercises

Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 25 Marks 1. Written test 2. Assignments CCA for Practical: 15 Marks 1. Practical assignments 2. Lab Record 3. Observation of practical skills 4. Viva
	B. Semester End Examination ESE for Theory: 50 Marks (1.5 Hrs) Written Test(50 Marks) Part A: Very Short Answer Questions (Answer all) - (10*1=10 Marks) Part B: Short Answer Questions(4 out of 6 Questions) - (4*5=20 Marks) Part C: Essay Questions(2 out of 3 Questions) - (2*10=20 Marks) ESE for Practical: 35 Marks(1.5 Hrs) 1. Result - 15 Marks 2. Viva - 10 Marks 3. Record - 10 Marks

REFERENCE

1. D M Dhamdhere - System programming and operating Systems , Tata McGraw Hill

SUGGESTED READING

1. John J Donovan - System Programming, First edition, Tata McGraw Hill 2009.

	Union Christian College, Aluva (Autonomous)					
Programme						
Course Name	Introduction to Database Management Systems					
Type of Course	DSC B					
Course Code	UC4DSCCSC202					
Course Level	200					
Course Summary	This course provides a comprehensive understanding of database concepts, relational database design, and practical experiences on MySQL database systems.					
Semester	4	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	1	0	75
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
Upon completion of this course, the students will be able to:			
1	Demonstrate the basic concepts of database and database management systems.	U	1
2	Describe the fundamental concepts of Relational Database Management Systems, Data Normalization and its application in database design.	U	1
3	Design SQL queries for data definition and data manipulation.	A	2
4	Apply MYSQL to implement DDL and DML commands.	A	2
**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction Data vs Information, File oriented approach-Disadvantages.	3	1
	1.2	Database Concepts: Character- Field-Record-File- Types of Databases-examples– DBMS – Advantages-Disadvantages, Applications.	6	1
	1.3	DBMS architecture-Database users- Database administrator (DBA), Database designers, End users, Application programmers- Database Languages- DDL-DML-DCL.	3	1
2	2.1	Relational database management system (RDBMS) Data models, Entity Relationship model-Features-Concepts-Entity sets, Relationship sets, Attributes-ER diagram- Conversion of ER-Diagram to Relational Database.	6	2
	2.2	Relational data model-Domain, Attribute, Tuple, Relations. RDBMS – Relationships - Types of Relationships - One to One - One to Many - Many to Many.	4	2
	2.3	Functional Dependency - Normalization (1NF, 2NF, 3NF).	5	2
	2.4	Defining Relationships -Referential Integrity, Key: Candidate key, Primary key, and Foreign Key.	3	2
3	3.1	MYSQL Introduction- Features- advantages, Datatypes-numeric-string-date /time-boolean, Variables, MYSQL database-table-view.	5	3

	3.2	MYSQL Commands- DDL-Create-Alter, Drop, DML-Insert, Select, Update, Delete DCL-Grant, Revoke, Command clauses- where, order by, group by, having, like, between, MYSQL functions- aggregate functions.	10	3
4	4.1	MYSQL Lab practice Implementation of Database commands- Viewing existing databases, Creating databases, Accessing databases, Deleting databases, Viewing tables in databases.	15	4
	4.2	Implementation of DDL and DML commands- Creating table, inserting data in to table, retrieving data from table-select- selecting all data, selecting particular rows/ columns, selecting based on condition/pattern matching, working with null values, sorting data in table, modifying data in table, deleting data from table, implementing aggregate and group functions, dropping table, altering table such as adding/ modifying/ deleting columns of tables.	15	4
5		Teacher Specific Content		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Lecture, Practical
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 25 Marks 1. Written test 2. Assignments CCA for Practical: 15 Marks 1. Practical assignments 2. Lab Record 3. Observation of practical skills 4. Viva

	B. Semester End Examination ESE for Theory: 50 Marks (1.5 Hrs) Written Test(50 Marks) Part A: Very Short Answer Questions (Answer all) - (10*1=10 Marks) Part B: Short Answer Questions(4 out of 6 Questions) - (4*5=20 Marks) Part C: Essay Questions(2 out of 3 Questions) - (2*10=20 Marks) ESE for Practical: 35 Marks (1.5 Hrs) 1. Coding and Output - 20 Marks 2. Viva - 10 Marks 3. Record - 5 Marks

REFERENCES

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", Sixth Edition, Tata McGraw-Hill 2006 (Module 1 & 2).

2. Vikram Vaswani, "MySQL: The Complete Reference", 1st Edition, McGraw Hill Education, 2004 (Module 3 & 4).

SUGGESTED READINGS

1. C.J.Date, Introduction to Database Systems, 8th Ed. , Pearson Publications
2. Elvis C. Foster, Shripad Godbole, "Database Systems-A Pragmatic Approach", Apress, 2014.
3. Elmasri and Navathe, "Fundamentals of Database Systems" 6th Ed., Pearson, 2010
4. Seyed, M. M. et.al, "Learning MySQL: Get a handle on your data", O'Reilly, 2006.
5. Ian Gilfillan, "Mastering MySQL 4", Wiley, 2003

	Union Christian College, Aluva (Autonomous)					
Programme						
Course Name	Foundations of Data Science					
Type of Course	SEC					
Course Code	UC4SECCSC200					
Course Level	200					
Course Summary	This course covers the fundamentals of data analysis, including the collection and presentation of data, measures of central tendency, and measures of dispersion. Students will learn various statistical techniques and methods, providing a comprehensive understanding of statistical concepts and their applications.					
Semester	4	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	0	0	45
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Demonstrate understanding of data collection methods and types of data.	U	1
2	Analyze various measures of central tendency and their applications in statistics.	U	1
3	Apply probability concepts to solve real-world problems and analyze data.	A	1,2

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1		Collection of Data, Classification of Data Frequency Distribution		1
	1.1	Introduction to Collection of Data, Primary and Secondary Data,	3	1
	1.2	Methods of Collecting Primary Data, Methods of Secondary Data, Statistical Errors, Rounding off Data (Approximation).	3	1
	1.3	Introduction Classification of Data - Objectives, Methods, Ways to Classify Numerical Data or Raw Data.	3	1
	1.4	Tabular, Diagrammatic and Graphical Presentation of Data: Introduction and Objectives of Tabulation, Components of a Statistical Table, General Rules for the Construction of a Table, Types of Tables	3	1
	1.5	Introduction to Diagrammatic Presentation of Data, Advantage and Disadvantage of Diagrammatic Presentation, Types of Diagrams, Introduction to Graphic Presentation of Data, Advantage and Disadvantage of Graphic Presentation, Types of Graphs.	3	1
2	2.1	Introduction to Central Tendency, Purpose and Functions of Average, Characteristics of a Good Average, Types of Averages, Meaning of Arithmetic Mean, Calculation of Arithmetic Mean, Merit and Demerits of Arithmetic Mean.	7	2
	2.2	Meaning of Median, Calculation of Median, Merit and Demerits of Median, Meaning of Mode, Calculation of Mode, Merit and Demerits of Mode, Harmonic Mean-Properties Merit and Demerits.	8	
3	3.1	Random experiment, union and intersection of events and their meaning. Mutually exclusive, equally likely and independent events.	5	3
	3.2	Classical, Frequency and Axiomatic approaches to probability. Monotone property, Addition theorem(up to 3 events).	5	3

	3.3	Conditional probability. Multiplication theorem(up to 3 events).Independence of events. Bayers theorem.	5	3
4		(Teacher specific content)		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) • ICT enabled Lecture • Interactive sessions • Class discussions
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 25 Marks 1. Written test 2. Assignments
	B. Semester End Examination ESE for Theory: 50 Marks (1.5 Hrs) Written Test(50 Marks) Part A: Very Short Answer Questions (Answer all) - (10*1=10 Marks) Part B: Short Answer Questions(4 out of 6 Questions) - (4*5=20 Marks) Part C: Essay Questions(2 out of 3 Questions) - (2*10=20 Marks)

REFERENCES

1. A.Abebe, J. Daniels, J.W.Mckean(2000). Statistics and Data Analysis.(Module 1)
2. David M. Lane. Introduction to Statistics. Rice University (Module 1, Module 2)
3. Gupta S.C and Kapoor V K (2002).Fundamentals of Mathematical Statistics (11th edition). (Module 3)

SUGGESTED READINGS

1. Banfield J.(1999), Rweb: Web-based Statistical Analysis, Journal of Statistical Software.
2. Bhattacharya,G.K. and Johnson, R.A.(19977), Statistical Concepts and Methods, New York, John Wiley & Sons.
3. Statistics, Tmt. S. EzhilarasiThiru, 2005, Government of Tamilnadu.
4. Weiss, N.A., Introductory Statistics. Addison Wesley, 1999.

E-Books/ Online learning material

1. http://onlinestatbook.com/Online_Statistics_Education.pdf
2. https://textbookcorp.tn.gov.in/Books/12/Std12-Stat-EM.pdf

3. https://3lihandam69.files.wordpress.com/2015/10/introductorystatistics.pdf

	Union Christian College, Aluva (Autonomous)

Programme						
Course Name	Computer Hardware Maintenance					
Type of Course	SEC					
Course Code	UC4SECCSC201					
Course Level	200					
Course Summary	This course provides a detailed understanding of computer components, system assembly, troubleshooting methodologies, preventive maintenance, and security measures, empowering participants with the skills needed for effective computer hardware management and support.					
Semester	4	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	0	0	45
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Summarize computer hardware, system assembly, and maintenance.	U	1
2	Demonstrate troubleshooting methodologies, identify common hardware issues using error codes, diagnostic tools and software.	An	1
3	Illustrate preventive maintenance and security measures for computer hardware.	U	1

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction to Computer Hardware & System Assembly: Overview of Computer Hardware Components, Understanding the Motherboard, CPU, and Memory, Input and Output Devices.	4	1
	1.2	Storage Devices: HDDs, SSDs, and External Drives, Introduction to Peripheral Devices. Tools and Equipment for Hardware Maintenance.	4	1
	1.3	Building a Computer System: Step-by-Step Assembly, Disassembly and Troubleshooting Procedures, Cable Management Best Practices, Basic BIOS/UEFI Configuration.	7	1
2	2.1	Hardware Troubleshooting and Diagnostics Introduction to Troubleshooting Methodologies, Common Hardware Issues and Error Codes.	5	2
	2.2	Diagnostic Tools and Software, System Recovery and Backup Strategies, Remote Troubleshooting Techniques.	5	2
	2.3	Connecting and Configuring External Devices, Troubleshooting Common External Device Issues.	5	2
3	3.1	Preventive Maintenance and Security Importance of Preventive Maintenance, Cleaning and Cooling Systems, Security Measures for Hardware.	5	3
	3.2	Understanding Anti-virus and Anti-malware Software.	2	3
	3.3	Overview of External Devices: Peripherals and Expansion Cards, Types of External Devices: Input (e.g., keyboards, mice), Output (e.g., monitors, printers), Storage (e.g., external hard drives, USB drives).	8	3
4		Teacher Specific Content		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Lecture, Demonstration through Animations/Video
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 25 Marks 1. Written test 2. MCQ 3. Quiz 4. Assignments
	B. Semester End Examination ESE for Theory: 50 Marks (1.5 Hrs) Written Test(50 Marks) Part A: MCQ (Answer all) - (20*1=20 Marks) Part B: Short Answer Questions(10 out of 12 Questions) - (10*3=30 Marks)

REFERENCES

1. David A. Patterson and John L. Hennessy, "Computer Organization and Design", Elsevier
2. Scott Mueller, "Upgrading and Repairing PCs", 4th Ed.

SUGGESTED READINGS

1. IT Essentials- PC Hardware and Software Companion Guide, 4th Ed., CISCO Networking Academy.

	Union Christian College, Aluva (Autonomous)					
Programme						
Course Name	Visualization Tools for Data Analytics					
Type of Course	SEC					
Course Code	UC4SECCSC202					
Course Level	200					
Course Summary	This course provides a comprehensive introduction to data visualization tools, covering popular platforms such as Tableau and Power BI, and enabling students to create interactive dashboards and visualizations.					
Semester	4	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	0	0	45
Pre- requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Summarize the concepts of data visualization, kinds of data analytics, different tools for visualization, features of data visualization.	U	1
2	Demonstrate how to create interactive data visualization using Tableau.	U	1
3	Demonstrate how to create an interactive dashboard using Power BI.	U	1

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	Introduction to Data Visualization			
	1.1	Benefits of Data Visualization Tools-Kinds of Data Analytics – Descriptive, Diagnostic, Predictive and Data Mining.	5	1
	1.2	Data Visualization Tools - Google Data Studio, Qlikview, Tableau, Power BI.	5	1
	1.3	Features- Common features of Data Visualization Tool, Salient features of popular data visualization tools.	5	1
2	Tableau - An Interactive Analytics platform			
	2.1	Tableau Product Suite. How to connect to a data source using Tableau interface. Tableau interface and basic terminologies.	4	2
	2.2	Create – Time series chart, Bullet chart, Area chart, Symbol map, Score cards.	3	2
	2.3	Heat Map – Introduction, Uses of Heat Map, Procedure to create heat map in Tableau.	3	
	2.4	Building interactive dashboards using Tableau.	5	2
3	Power BI - Unleash the power of business analytics			
	3.1	Introduction to Power BI, Preparing data with Power BI.	4	3
	3.2	Data visualization using Power BI- Creating simple visualization, Map Visualization, Combination Charts.	5	3
	3.3	Dashboard in Power BI - creating, sharing, Tiles in Dashboard.	6	3
4		Teacher Specific Content		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Lecture, Demonstration through ICT tools and video
Assessment Types	MODE OF ASSESSMENT A. continuous Comprehensive Assessment (CCA) CCA for Theory: 25 Marks 1. Written test 2. MCQ 3. Quiz 4. Assignments
	B. Semester End Examination ESE for Theory: 50 Marks (1.5 Hrs) Written Test(50 Marks) Part A: MCQ (Answer all) - (20*1=20 Marks) Part B: Short Answer Questions(10 out of 12 Questions) - (10*3=30 Marks)

REFERENCES

1. Dr. S. Karpagavalli , "Introduction to Data Visualization Tools", Blue Hill Publishers, 2020.
2. https://www.tutorialspoint.com/tableau/index.htm
3. https://www.tutorialspoint.com/power_bi/power_bi_visualization_options.ht m

SUGGESTED READINGS

1. Alexander Loth, "Visual Analytics with Tableau", Wiley, 2019.
2. Alberto Ferrari and Marco Russo, "Introducing Microsoft Power BI", Microsoft Press, 2016.

	Union Christian College, Aluva (Autonomous)					
Programme						
Course Name	Green Computing Techniques					
Type of Course	VAC					
Course Code	UC4VACCSC200					
Course Level	200					
Course Summary	This course offers basic concepts of soft and Green Computing.					
Semester	4	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	0	0	45
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand the basic ideas of green computing	U	1,8, 10
2	Understand the idea of green architecture and framework	A	1, 2, 9
3	Analyse the idea of protocols and standards related with the environment and sustainability	An	2, 5, 10

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction to Green computing: carbon foot print, scoop on power - Green IT Strategies: Drivers, Dimensions, and Goals – Environmentally Responsible Business: Policies, Practices, and Metrics.	8	1
	1.2	Paperless : Paper problems, Environment issues, Cost: Paper and office, Storage, Practicality, Going paperless, Organizational realities, Changing Over, Paperless billing, Handheld Computers vs. the Clipboard, Unified Communications, Intranets, What to Include, Building an Intranet, Electronic Data Interchange (EDI), Value Added Networks, Advantages & Disadvantages	7	1
2	2.1	Green Assets: Buildings, Data Centers, Networks and Devices - Green Information Systems: Design and Development Models - Green Enterprise Architecture – Environmental Intelligence – Green Supply Chains	7	2
	2.2	Socio cultural aspects of Green IT – Green Enterprise Transformation Roadmap –Materials recycling – Best ways for Green PC – Green Data center – Green Grid framework.	8	2
3	3.1	Hardware Considerations: – Restriction of Hazardous Substances (RoHS) in IT, EPEAT, Energy Star, Computers, Servers, Consolidation, Products, Hardware Considerations, Planned Obsolescence, Packaging, Toxins, Other Factors	9	3
	3.2	Green Compliance: Protocols, Standards, UNFCCC, Copenhagen summit, Kyoto Protocol, ISO 14000:2004 Family of Standards, Government Initiatives.	6	3
5		(Teacher specific content)		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Lecture, Demonstration through ICT tools

Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 25 Marks 1. Written test 2. MCQ 3. Quiz 4. Assignments
	B. Semester End Examination ESE for Theory: 50 Marks (1.5 Hrs) Written Test(50 Marks) Part A: MCQ (Answer all) - (20*1=20 Marks) Part B: Short Answer Questions(10 out of 12 Questions) - (10*3=30 Marks)

REFERENCES

1. Bhuvan Unhelkar, ―Green IT Strategies and Applications-Using Environmental Intelligence, CRC Press, June 2014.

SUGGESTED READINGS

1. Woody Leonhard, Katherine Murray, ―Green Home computing for dummies‖, August 2012.
2. Alin Gales, Michael Schaefer, Mike Ebbers, ―Green Data Center: steps for the Journey‖, Shroff/IBM rebook, 2011. ason Harris, ―Green Computing and Green IT- Best Practices on regulations & industry‖, Lulu.com, 2008
3. John Lamb, ―The Greening of IT‖, Pearson Education, 2009.
4. Carl speshocky, ―Empowering Green Initiatives with IT‖, John Wiley & Sons, 2010.
5. Wu Chun Feng (editor), ―Green computing: Large Scale energy efficiency‖, CRC Press.

	Union Christian College, Aluva (Autonomous)					
Programme	BSc (Honours) Computer Science					
Course Name	Internship					
Type of Course	INT					
Course Code	UC4INTCSC200					
Course Level	200					
Course Summary	A key aspect of the new UCU UGP programme is induction into actual work situations. All Students will undergo internships in a firm, industry, or organization or training in labs with faculty and researchers in their own or other institutions during the summer vacation.					
Semester		Credits			2	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
Pre-requisites, if any	Basic knowledge of programming and understanding of computer science concepts.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Apply technical knowledge effectively to assigned tasks and projects	An, A, S	1
2	Demonstrate critical thinking and problem-solving skills in various situations	C, S, E	1
3	Communicates clearly and effectively, both verbally and in writing	An, A, Ap	2

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	All Students will undergo internships in a firm, industry, or organization or training in labs with faculty and researchers in their own or other institutions during the summer vacation.		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** · No class room activity. Done During Vacation · Discussions · Self-learning and Development

Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA)- 15 marks **1.** Review 1 **2.** Review 2
	B. Semester End Examination - 35 marks **1.** Project Presentation -15 **2.** Viva - 10 **3.** Report - 10

SEMESTER V

	Union Christian College, Aluva (Autonomous)

Programme	BSc (Honours) Computer Science					
Course Name	Software Engineering					
Type of Course	DSC					
Course Code	UC5DSCCSC300					
Course Level	300					
Course Summary	This course is designed to equip students with the knowledge and skills needed to design, build, and maintain high-quality software systems in a professional environment.					
Semester	5	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
Pre-requisites, if any	Familiarisation with Computer Fundamentals.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe software engineering and the different software process models used in industry.	U	1
2	Explain software requirement analysis and requirement elicitation methods.	U	1
3	Analyse and compare various software design and testing methods.	An	2
4	Develop software project management skills.	A	2

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction to Software Engineering - Definition, Program Vs Software. Software Characteristics, brief introduction to product and process. Software Development Life Cycle (SDLC). Role of a Software Engineer, Ethics in Software Engineering.	3	1
	1.2	Overview of different life cycle models -Waterfall model, Increment process models- Iterative, RAD, and Evolutionary process models-Prototyping, Spiral, and Agile. Selection of a life cycle model.	9	1
2	2.1	Requirements Engineering - Software Requirement Analysis and Specification Requirements Engineering, Type of requirements, Feasibility Studies,	6	2
	2.2	Requirement Elicitation – Use Case, DFD, Data Dictionaries , Various steps for requirement analysis,	6	2
	2.3	Requirement documentation, SRS, Requirement validation.	6	2
3	3.1	Software Design & Testing - Definition, Various types, Objectives and importance of Design phase, Modularity, IEEE recommended practice for software design descriptions .SDD.	8	3
	3.2	Software Testing - Development testing, Test-driven development, Release testing, User testing.	10	3
4	4.1	Managing Software Projects Introduction, Risk Management- Risk identification, Risk analysis, Risk planning, Risk monitoring.	3	4
	4.2	Project planning- Software pricing, Plan-driven development, Project scheduling, Agile planning, Estimation Techniques-COCOMO.	3	4

	4.3	Quality Management - Software Reliability Definition, McCall software quality model, Capability Maturity Model.	3	4
	4.4	Configuration Management- Change Management, Version Management.	3	4
5		(Teacher specific content)		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Lecture, Classroom Discussions, Case study
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 30 Marks 1. Written tests 2. Assignments
	B. Semester End Examination ESE for Theory: 70 Marks (2 hrs) Written Test(70 Marks) Part A: Very short Answer Questions (Answer all) - (10*2=20 Marks) Part B: Short Answer Questions(6 out of 8 Questions) - (6*5=30 Marks) Part C: Essay Questions(2 out of 3 Questions) - (2*10=20 Marks)

REFERENCES:

1. K K Aggarwal, Yogesh Singh - Software Engineering, Third Edition, New Age International Publications.
2. Ian Somerville - Software Engineering, Ninth Edition, Pearson Education.

SUGGESTED READINGS

1. Roger S Pressman - Software Engineering: A Practitioner's Approach, Sixth Edition, McGraw-Hill Higher Education.
2. Pankaj Jalote - An Integrated Approach to Software Engineering, Second Edition, Narosa Publishing Company.

	Union Christian College, Aluva (Autonomous)					
Programme	BSc (Honours) Computer Science					
Course Name	Operating Systems					
Type of Course	DSC					
Course Code	UC5DSCCSC301					
Course Level	300					
Course Summary	Operating Systems (OS) courses cover the essential concepts and functionalities of computer operating systems. Key topics include process management, memory management and file systems. Students learn about synchronization and communication between processes.					
Semester	5	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
Pre-requisites, if any	Basic understanding of Computer Fundamentals					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe essential aspects of operating systems	U	1,2
2	Compare various process scheduling algorithms	U, A, An	1,2
3	Describe the techniques for detecting, preventing deadlocks and deadlock management techniques.	U, A, An	1
4	Illustrate memory and storage management techniques.	U, A, An	1,2

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction: OS Definition, Functions, Types of OS	2	1
	1.2	User Operating System Interface	3	1
	1.3	System Calls, Types of System Calls.	5	1
2	2.1	Process: Basic Concepts.	2	2
	2.2	Types of schedulers, Operations on Processes	2	2
	2.3	Inter process communication	4	2
	2.4	Scheduling Criteria, Scheduling Algorithms.	7	2
3	3.1	Process Coordination: Synchronization, The Critical Section problem,. Deadlocks: Deadlock definition, Deadlock Characterization, Methods of handling Deadlocks- Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.	2	3
	3.2	Semaphores, Classic Problems of Synchronization	5	3
	3.3	Deadlocks: Deadlock definition, Deadlock Characterization	2	3
	3.4	Methods of handling Deadlocks- Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.	9	3
4	4.1	Memory Management: Memory Management Strategies - Swapping, Contiguous memory allocation, Paging, Segmentation.	7	4
	4.2	Virtual Memory Management- Demand paging,	2	4
	4.3	Page Replacement algorithms	3	4

	4.4	Storage Management: File System: - File Concept, Access Methods, Directory Structure	2	4
	4.5	File System Structure, Allocation Methods, Free Space Management.	3	4
5		(Teacher specific content)		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Lecture, Presentations Classroom Discussions Assignments
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 30 Marks 1. Written tests 2. Assignments
	B. Semester End Examination ESE for Theory: 70 Marks (2 Hrs) Written Test (70 Marks) Part A: Very Short Answer Questions (Answer all) - (10*2=20 Marks) Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks)

REFERENCES

1. Abraham Silberschatz, Peter B. Galvin, and Greg Gagne (2006). Operating System Principles (7th Edition). John Wiley & Sons.

SUGGESTED READINGS

1. William Stallings - Operating Systems, Sixth Edition, Prentice Hall of India, Pearson
2. Milan Kovic – Operating Systems, 2ndEdition, (TMH)

	Union Christian College, Aluva (Autonomous)					
Programme	BSc (Honours) Computer Science					
Course Name	Computer Security					
Type of Course	DSE					
Course Code	UC5DSECSC300					
Course Level	300					
Course Summary	This course provides a comprehensive introduction to computer security, covering fundamental concepts, cryptographic techniques, system security measures, user authentication mechanisms, and basics of network security. Students will develop analytical and practical skills necessary for critical thinking in security, fostering problem-solving abilities crucial for scientific reasoning in cybersecurity.					
Semester	5	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
Pre requisites, if any	A basic understanding of computer systems, networks, and introductory programming concepts is recommended as a prerequisite for this course.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Explain security basics, approaches, principles, and types of attacks.	U	1

2	Apply cryptographic techniques and algorithms effectively.	A	2
3	Demonstrate proficiency in system security practices	U	1
4	Develop understanding of user authentication and network security mechanisms	U,A	1, 2
**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Concepts of security, Need for Security, Security Approaches, Security services and Mechanisms, Principles of Security, Types of Attacks, Sniffing and spoofing, Phishing, Pharming.	15	1
2	2.1	Cryptography Techniques: Cipher Methods: Caesar cipher, One time pad. Mono alphabetic Cipher, Play fair cipher. Poly alphabetic cipher, Vigenère Cipher, Transposition ciphers, Cryptographic Algorithms: Symmetric & Asymmetric- Basic idea of Cryptographic tools: PKI- Digital Signatures.	15	2
3	3.1	System Security: Intrusion Detection and Prevention Systems, Need of IDPS. Types of IDPS, Password Management, Counter measures, Access Controls and Authentication, Malware and Antivirus Techniques, Security Patching and Update.	15	3
4	4.1	User Authentication Mechanisms User Authentication Mechanisms -Authentication Basics, Passwords, Authentication tokens, Authentication token types, Biometric Authentication, Kerberos, Key distribution Center. Basics of Network Security: Introduction to TCP/IP, Firewalls, Types, IP Security, Virtual Private Network, VPN architecture.	15	4
5		(Teacher specific content)		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) ICT enabled classroom lectures Discussions
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 30 Marks 1. Written tests 2. Assignments
	B. Semester End Examination ESE for Theory: 70 Marks (2 Hrs) Written Test (70 Marks) Part A: Very Short Answer Questions (Answer all) - (10*2=20 Marks) Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks)

REFERENCES

1.Michael E. Whitman, Herbert J. Mattord, “Principles of Information Security”, Course Technology
2.William Stallings, “Cryptography and Network Security – Principles and Practices”, ,Pearson Education.

SUGGESTED READINGS

1.Behrouz A. Forouzan, Dedeep Mukhopadhyay “Cryptography & Network Security”, ,Tata McGraw Hill, New Delhi, 2010.
2. Atul Kahate, “Cryptography and Network Security”, Second Edition, Tata McGraw Hill

	Union Christian College, Aluva (Autonomous)					
Programme	BSc (Honours) Computer Science					
Course Name	Resource Optimization Techniques					
Type of Course	DSE					
Course Code	UC5DSECSC301					
Course Level	300					
Course Summary	This course covers fundamental concepts in decision-making and optimization techniques. This enables the students to explore models, methods, and applications, understanding their advantages, limitations, and the interplay between operations research techniques and decision- making processes across industries.					
Semester	5	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	60
		4	0	0	0	
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Solve linear programming problems effectively	U	1
2	Utilize simplex and dual methods proficiently	A	1
3	Implement transportation and assignment problem-solving methods.	An	2
4	Solve sequencing and network routing problems effectively	S	2,3

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	OR: Introduction, origin and development, nature and features, scientific methods, modeling, Advantages and limitations of models, methodology, OR and decision making, applications, opportunities and shortcomings	8	1
	1.2	Linear Programming Problem: Mathematical formulation of LPP, Graphical solution method and exceptional cases, General LPP, Canonical and standard form of LPP	7	1
2	2.1	Simplex method-Introduction, properties, computational procedure of simplex method, Artificial variables	6	2
	2.2	Duality in Linear Programming: Introduction, general Primal-Dual pair, Formulation of dual problem, Dual Simplex Method.	9	2
3	3.1	Transportation Problem: Introduction, North West Corner method, Least Cost Method and Vogel's Approximation Method.	5	3
	3.2	Assignment Problems: Introduction, Solution using Hungarian Method, Prohibited Assignment Problems	10	3
4	4.1	Sequencing Problems: Introduction, Basic Terms, Processing n job through 2 machines, Processing n job through k machines, Processing 2 job through k machines and Maintenance Crew Scheduling	5	4
	4.2	Network Routing Problem: Introduction, Basic components, Logical sequencing, Rules, concurrent activities, Critical Path Analysis-CPM,PERT method, Distinction between PERT and CPM, Advantages and Limitations	10	4
5		(Teacher specific content)		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Lecture, Presentations, Demonstrations
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 30 Marks 1. Written tests 2. Assignments
	B. Semester End Examination ESE for Theory: 70 Marks (2 Hrs) Written Test (70 Marks) Part A: Very Short Answer Questions (Answer all) - (10*2=20 Marks) Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks)

REFERENCES

1. Kanthi Swarup,P.K Gupta,Man Mohan,Operations Research,16th edition, Sultan Chand & sons.

SUGGESTED READINGS

1. Hamdy A Taha,Operations Research:An Introduction,9th edition,Pearson
2. Prem Kumar Gupta and D.S Hira,Problems in OPerations Research,Sultan Chand & Sons
3. K.V Mital and C.Mohan,Optimization methods in Operations Research and system Analysis,Third Edition,New Age International.

	Union Christian College, Aluva (Autonomous)

Programme	BSc (Honours) Computer Science					
Course Name	Artificial Intelligence					
Type of Course	DSE					
Course Code	UC5DSECSC302					
Course Level	300					
Course Summary	The course introduces the concept of artificial intelligence. The various knowledge representation and Knowledge Inference methods are introduced. The course introduces the application of AI in various fields.					
Semester	5	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
Pre- requisites, if any	Awareness of algorithmic approaches in Computer Science.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains*	PO No
1	Describe the fundamental concepts, applications and informed searching techniques in AI.	U	1,2

2	Analyze informed and uninformed search techniques for problem-solving.	A	1,2,3
3	Illustrate the knowledge representation in AI.	An	1,2
4	Appraise the application of the fuzzy logic and statistical machine learning in AI systems.	An	1,2
**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction: Basics of Artificial Intelligence- What is AI, Definition of AI through Problems, History of AI	2	1
	1.2	AI problems and techniques, Problem solving methods in AI- State space search, Production system, Problem Characteristics, Control Strategies	4	1
	1.3	Search Strategies- Uninformed Search Category- Depth First Search, Breadth First Search.	4	1
	1.4	Applications of AI in daily life including Health care, Education, Agriculture, Banking,	2	1
	1.5	Expert Systems- Examples of Expert systems. Problem Solving Examples-Expert system in Agriculture, Expert system in Environmental Management.	3	1

2	2.1	Uninformed Search Strategies- Generate and Test, Depth First Search, Breadth First Search	5	2
	2.2	Informed Searches:Hill Climbing, Best First Search and A* Search, Problem Reduction,	5	2
	2.3	Constraint Satisfaction with Inference.	5	2
3	3.1	Ontologies, Objects, Events, Representations and Mappings. Approaches to Knowledge Representation, Forward and Backward Chaining,	7	3
	3.2	Logic in Artificial Intelligence- Propositional Logic, First Order Predicate Logic.	7	3
4	4.1	Basics of Fuzzy Logic and Applications- Introduction, Set Theory, Fuzzy set theory- Fuzzy sets and Crisp set	5	4
	4.2	Membership Functions, Linguistic Variable, Fuzzification and Defuzzification	6	4
	4.3	Statistical Machine Learning -Statistical Reasoning, Probability Axioms, Bayes Rules, Bayesian Network.	5	4
5		Teacher specific content		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Lecturing Problem Solving Presentations

Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 30 Marks 1. Written tests 2. Assignments
	B. Semester End Examination ESE for Theory: 70 Marks (2 Hrs) Written Test (70 Marks) Part A: Very Short Answer Questions (Answer all) - (10*2=20 Marks) Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks)

References

1. Artificial Intelligence A Modern Approach, Third Edition, Stuart Russell and Peter Norvig, Pearson Education
2. S.N.SivanandamS.N.Deepa ,"Principles of soft computing " second edition, Wiley India Pvt. Ltd

SUGGESTED READINGS

1. Artificial Intelligence, Shivani Goel, Pearson Education. Ryan, D. Artificial Intelligence, 3rd Edn., Patrick Henny Winston, Pearson Education

	Union Christian College, Aluva (Autonomous)					
Programme	BSc (Honours) Computer Science					
Course Name	Web Designing using PHP					
Type of Course	DSE					
Course Code	UC5DSECSC303					
Course Level	300					
Course Summary	This course introduces students to the principles and practices of web development using PHP. The focus is on building dynamic and interactive web applications with database. Students will gain the skills and knowledge to install and use an integrated PHP/MySQL environment.					
Semester	5	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	g Others	
		4	0	0	0	60
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe the fundamental concepts and components of web development.	U	1
2	Apply intermediate-level web development techniques	A	1,2
3	Design interactive web forms with data exchange between pages	A	1,2
4	Integrate database to web application using PHP-MYSQL database connection	An	1,2

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction to web, WWW architecture,	1	1
	1.2	Fundamentals of HTML, text formatting tags- text formatting tag, FONT tag, header tags.	4	1
	1.3	Inserting images, links, lists, marquee,	3	1
	1.4	Creating tables, working with form elements.	4	1
2	2.1	CSS introduction, <link> and <style> elements, CSS properties, Controlling Fonts, Text formatting, Text-pseudo classes, Selectors, Links, Backgrounds, lists.	7	2
	2.2	Introduction to PHP, server-side scripting, XAmPP, role of web server software, php comments,variables, echo and print, PHP operators, data types.	5	2
3	3.1	PHP branching statements and looping statements,	5	3
	3.2	arrays in PHP-numeric array, associative array, multidimensional array,	5	3
	3.3	array functions in PHP- push, pop, shift, unshift, array_search, in_array, sort(), rsort, asort, arsort, ksort, krsort	5	3
	3.4	PHP form:$_GET,$_POST,$_SERVER, $_REQUEST, $_GLOBALS, include and require function	4	3
4	4.1	Basic MYSQL commands CRUD	5	4
	4.2	PHP- MYSQL database connectivity using procedure-oriented methods-mysqli_connect, mysqli_close.	6	4
	4.3	mysqli_query, mysqli_fetch_row, mysqli_fetch_assoc, mysqli_fetch_array	6	4
5		(Teacher specific content)		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Lecture, Demonstration through ICT tools
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 30 Marks 1. Written tests 2. Assignments
	B. Semester End Examination ESE for Theory: 70 Marks (2 Hrs) Written Test (70 Marks) Part A: Very Short Answer Questions (Answer all) - (10*2=20 Marks) Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks)

REFERENCES

1. Ivan Bayross - "HTML, DHTML, JavaScript, Pearl & CGI ", BPB Publication. (Module 1,2)
2. Dave W Mercer, Allan Kent, Steven D Nowicki, David Mercer, Dan Squier, Wankyu Choi- "Beginning PHP5", Wiley Publishing, Inc (Module 3)
3. Adrian W. West, Steve Prettyman, Practical PHP 7, MySQL 8, and MariaDB Website Databases, A Simplified Approach to Developing Database-Driven Websites, Second Edition, Apress (Module 4)

SUGGESTED READINGS

1. Thomas A. Powell- "HTML & CSS: The Complete Reference", 5th Edition, McGraw Hill
2. Mike O'Kane, Essential Algorithms, Syntax, and Control Structures Using PHP, HTML, and MariaDB/MySQL, Carolina Academic Press, Fourth Edition.
3. Julie C. Meloni, Teach Yourself PHP, MySQL® and Apache All in One, Fifth Edition.

	Union Christian College, Aluva (Autonomous)					
Programme	BSc (Honours) Computer Science					
Course Name	Design Principles of User Computer Interaction					
Type of Course	DSE					
Course Code	UC5DSECSC304					
Course Level	300					
Course Summary	This course provides comprehensive coverage of Human-Computer Interaction (HCI) fundamentals, design principles, and evaluation methods, integrating psychological insights, interaction models, usability testing, and advanced topics such as augmented reality and security considerations to create user-centric applications across various domains.					
Semester	5	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
Pre-requisites, if any						

COURSE OUTCOMES (CO):

After the completion of course student should be able to

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe the basic concepts of human, computer interactions and create the processes of human computer interaction life cycle	K	1
2	Analyze and design the various interaction design models	An	2
3	Apply the interface design standards/guidelines for evaluating the developed interactions	A	2
4	Apply product usability evaluations and testing methods and demonstrate the principles of human computer interactions	A	2

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	HCI Foundations, Designing Interaction		15hrs	
	1.1	Input–output channels, Human memory and cognition, Emotional aspects in design, Individual differences in user behaviour	5	1
	1.2	Psychological principles in interactive system design, Various input devices: keyboards, touchscreens, etc., Display technologies and interfaces	5	1
	1.3	Applications: Designing mobile interfaces for elderly users. Use Case: Developing a navigation app for visually impaired individuals	5	1
2	Interaction Design Models and Evaluation Methods		10hrs	
	2.1	Model Human Processor and GOMS models, State transition networks and Fitts' Law, Heuristic evaluation and usability testing, Contextual evaluation techniques.	5	2
	2.2	Applications: Designing a social media platform interface. Use Case: Usability testing of a task management application.	5	2
3	Guidelines in HCI and Communication		15hrs	
	3.1	Shneideman's eight golden rules, Norman's model of interaction, Nielsen's ten heuristics,	5	3
	3.2	Dialog design notations and semantics, Face-to-face and Text-based Communication in HCI.	5	3
	3.3	Applications: Designing an e-commerce website interface. Use Case: Analyzing user feedback for a video conferencing tool.	5	3
4	Human Factors and Security, Validation and Advanced Concepts		20 hrs	
	4.1	Human Factors in Interaction Design, Security Considerations in HCI, Groupware and Collaboration, Frameworks for groupware Implementation,	10	4
	4.2	Augmented and Virtual Reality. Application: Designing a Health Monitoring Wearable Device. Use Case: Evaluating User Privacy Concerns in a Social Networking Site	10	4
5		(Teacher specific content)		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) • ICT enabled Class room Lectures • Interactive sessions • Discussions
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 30 Marks 1. Written tests 2. Assignments
	B. Semester End Examination ESE for Theory: 70 Marks (2 Hrs) Written Test (70 Marks) Part A: Very Short Answer Questions (Answer all) - (10*2=20 Marks) Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks)

REFERENCES

1. DA Dix, Janet Finlay, G D Abowd, R Beale.(2008). Human-Computer Interaction(3rd Edition).Pearson Publishers.

SUGGESTED READINGS

1. Shneiderman, Plaisant, Cohen and Jacobs, Designing the User Interface: Strategies for Effective Human Computer Interaction, 5th Edition, Pearson Publishers, 2010.
2. Hans-Jorg Bullinger, ”Human-Computer Interaction”, Lawrence Erlbaum Associates, Publishers
3. Jakob Nielsen,”Advances in Human-computer Interaction”,Ablex Publishing Corporation
4. Thomas S. Huang,” Real-Time Vision for Human-Computer Interaction”, Springer
5. Preece et al, Human-Computer Interaction, Addison-Wesley, 1994

	Union Christian College, Aluva **(Autonomous)**

Programme	BSc (Honours) Computer Science					
Course Name	Software Development Lab 1					
Type of Course	SEC					
Course Code	UC5SECCSC300					
Course Level	300					
Course Summary	This course has been introduced to make students capable of developing software applying the concepts and techniques learned. This course provides a platform for developing their communication and presentation skills.					
Semester	5	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		1	0	2	0	75
Pre-requisites, if any	Must have learnt any one of Python, Java, PHP or C, Require knowledge in Software Engineering Techniques					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
Upon completion of this course, the students will be able to:			
1	Apply Software Engineering concepts in project development.	A	1, 2
2	Plan, analyse, design a project using any selected technique.	C, Ap	3, 2,8

3	Demonstrate independent and group learning through project implementation.	A, S	4
4	Demonstrate and document software product.	A, S	5,9
**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Discussion on Software Development life cycle, Design principles and techniques, Documentation	15	1,2,3,4
2	2.1	Develop a complete Software using Python/ Java/PHP/C. Apply software engineering concepts in the development. Projects can be individual or group wise. Maximum number of students allowed in a group is two. The internal and external evaluation include project demonstration and viva. A project report should be submitted at the end of the semester. Project must be done in the college lab under the guidance of a faculty from the department. • *Students opting for the 'Web and Mobile Technologies' track are required to utilize PHP programming language for software development purposes.*	60	1,2,3,4

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Discussions Presentations Project Development
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 15 Marks

	1. Viva 2. Review CCA for Practical: 15 Marks 1. Review 2. Demonstration 3. Report 4. Viva
	B. Semester End examination ESE for Theory: 35 Marks 1. Viva - 25 Marks 2. Report - 10 Marks ESE for Practical: 35 Marks 1. Project demonstration and Presentation - 25 marks 2. Report - 10 marks

SEMESTER VI

<table>
<tr><td>  </td><td colspan="5">Union Christian College, Aluva

(Autonomous)</td></tr>
<tr><td>Programme</td><td colspan="5">BSc (Honours) Computer science</td></tr>
<tr><td>Course Name</td><td colspan="5">Cloud Computing</td></tr>
<tr><td>Type of Course</td><td colspan="5">DSC</td></tr>
<tr><td>Course Code</td><td colspan="5">UC6DSCCSC300</td></tr>
<tr><td>Course Level</td><td colspan="5">300</td></tr>
<tr><td>Course Summary</td><td colspan="5">Analyse the fundamentals of Cloud Computing and Virtualization Technologies, exploring their evolution, characteristics, and implementation levels. Investigate Cloud Architecture, Services, and Deployment Models, including Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS). Examine leading Cloud Service Providers and their applications in various industries, such as Amazon Web Services, Google AppEngine, and Microsoft Azure.</td></tr>
<tr><td>Semester</td><td>6</td><td colspan="2">Credits</td><td>4</td><td rowspan="2">Total Hours</td></tr>
<tr><td rowspan="2">Course Details</td><td rowspan="2">Learning Approach</td><td>Lecture</td><td>Tutorial</td><td>Practical</td><td>Others</td></tr>
<tr><td>4</td><td>0</td><td>0</td><td>0</td><td>60</td></tr>
<tr><td>Pre-requisites, if any</td><td colspan="5">Understanding of computer science fundamentals, networking principles.</td></tr>
</table>

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe Cloud Computing fundamentals, including characteristics and on-demand provisioning.	U	1
2	Analyze Virtualization: Types, Implementation Levels, Structures, Tools, and Mechanisms.	An	2

3	Describe Cloud Architecture, NIST reference, and various service models.	U	1
4	Analyze different cloud service providers and cloud applications	An	2
**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction to Cloud Computing –Definition of Cloud – Evolution of Cloud Computing	7	1
	1.2	Cloud Characteristics –Advantages and Challenges	8	1
2	2.1	Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization	7	2
	2.2	Virtualization Structures – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices	8	2
3	3.1	Layered Cloud Architecture Design – cloud services- Software as a Service Platform as a Service.	8	3
	3.2	Infrastructure as a Service. Cloud deployment models- public private, community, hybrid	7	3
4	4.1	Cloud Platforms in Industry: Amazon Web Services, Google AppEngine, Microsoft Azure	8	4
	4.2	Cloud Applications: Scientific Applications, Business and Consumer Applications	7	4
5		Teacher specific content		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Lecturing and Discussion

Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 30 Marks 1. Written tests
	2. Assignments
	B. Semester End Examination ESE for Theory: 70 Marks (2 Hrs) Written Test (70 Marks) Part A: Very Short Answer Questions (Answer all) - (10*2=20 Marks) Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks)

REFERENCES

1. Toby Velte, Anthony Velte, Robert Elsenpeter(2009). "Cloud Computing -A Practical Approach".Tata Mcgraw Hill.

SUGGESTED READINGS

1. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice)", O'Reilly, 2009
2. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012
3. .Rittinghouse, JohnW., and James F. Ransome, "Cloud Computing: Implementation, Management and Security", CRC Press, 2017.
4. .Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, "Mastering Cloud Computing", Tata Mcgraw Hill, 2013.

	Union Christian College, Aluva **(Autonomous)**					
Programme	BSc (Honours) Computer Science					
Course Name	Software Development Lab 2					
Type of Course	DSC					
Course Code	UC6DSCCSC301					
Course Level	300					
Course Summary	This course has been introduced to make students capable of developing a software applying the concepts and techniques learned. This course provide a platform for developing their communication and presentation skills.					
Semester	6	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		1	0	3	0	105
Pre-requisites, if any	Must have learnt programming, Require knowledge in Software Engineering Techniques.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
Upon completion of this course, the students will be able to:			
1	Conduct research to acquire a thorough understanding of current industry requirements.	A	1, 2

2	Build a software product by applying Software Engineering methods.	C, Ap	3, 2,8
3	Demonstrate the skills to communicate effectively and to present ideas clearly and coherently to in both the written and oral forms	A, S	4
4	Demonstrate independent learning skills.	A, S	5,9
**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Discussion on Software Development life cycle, Design principles and techniques, Documentation	15	1,2,3,4
2	2.1	Develop a complete Software choosing any areas of current industry requirement, using latest packages / languages running on appropriate platforms (Except the tools used in Software Development Lab 1), so that the student becomes industry ready. A hard bound project report should be submitted that is complete in all aspects. For internal evaluation, the progress of the student shall be systematically assessed through various stages of evaluation at periodic intervals. Projects should be individual.	90	1,2,3,4

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) Discussions Presentations Project Development

Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 15 Marks 1. Viva 2. Review CCA for Practical: 25 Marks 1. Review 2. Demonstration 3. Report 4. Viva
	B. Semester End examination ESE for Theory: 35 Marks 1. Viva - 25 Marks 2. Report - 10 Marks ESE for Practical: 50 Marks 1. Project Presentation and Demonstration - 30 Marks 2. Viva Voce - 10 3. Report - 10 marks

	Union Christian College, Aluva **(Autonomous)**					
Programme	BSc (Honours) Computer Science					
Course Name	Big Data Analytics					
Type of Course	DSE					
Course Code	UC6DSECSC300					
Course Level	300					
Course Summary	This course introduces Big Data concepts and the Hadoop ecosystem, covering data classification, Hadoop features, HDFS, MapReduce, and frameworks like Pig and Hive for Big Data applications. Students will gain practical experience with Hadoop tools and techniques for processing and analyzing large datasets.					
Semester	6	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
Pre-requisites, if any	Basic knowledge in Data Base Management Systems.					

COURSE OUTCOMES (CO):

After the completion of course student should be able to

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand the fundamental characteristics of big data, and differentiate between structured, semi-structured, and unstructured data.	U	1
2	Explain the advantages and features of Hadoop technology.	A	1,2
3	Understand and implement MapReduce programming, including job execution, handling failures, and optimizing performance.	U,A	1,2
4	Compare and contrast Pig and Hive for big data processing	A	2

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
	Introduction to Big Data			
1	1.1	Classification of digital data - structured, semistructures, unstructured data-Characteristics of data- Definition of big data-evolution, challenges with big data	8	1
	1.2	Three Vs of big data- Other characteristics.-Business Intelligence versus Big Data-Hadoop Environment-why big data.	7	1
	Introduction to Hadoop			
2	2.1	Features of Hadoop-Key Advantages of Hadoop-Versions of Hadoop-Overview of Hadoop Ecosystems-Hadoop Distributions-Hadoop versus SQL-RDBMS versus-Hadoop	7	2
	2.2	Hadoop Overview-Hadoop Use case-Managing Resources with YARN. Hadoop Distributed File System(HDFS)-HDFS Daemons- Anatomy of File Read and Write-Working with HDFS Commands-Special Features of HDFS	8	2
	Processing Data with Hadoop			
3	3.1	MapReduce, Daemons-Working-Example.MapReduce Programming-Mapper,Reducer, Combiner, Partitioner	8	3
	3.2	Anatomy of a Map Reduce Job runFailures-Job Scheduling-Shuffle and Sort – Task execution - Map Reduce Input-Output Types and Formats- Map Reduce Features.	7	3
	Frameworks			
3	3.1	Applications on Big Data Using Pig- Pig Latin Overview-Operators-Data Types- Pig Latin Running Modes- Relational Operators-AVG, MAX, COUNT- Complex Data Types-Word Count example using Pig.	8	4
	3.2	Introduction to Hive-Architecture- Data Types- File Formats- HiveQL. Difference between RDBMS and Hadoop, MapReduce versus Pig, Pig versus Hive	7	4
5		(Teacher specific content)		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) • ICT enabled Lecture • Interactive sessions • Class discussions
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 30 Marks 1. Written tests 2. Assignments
	B. Semester End Examination ESE for Theory: 70 Marks (2 Hrs) Written Test (70 Marks) Part A: Very Short Answer Questions (Answer all) - (10*2=20 Marks) Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks)

REFERENCES

1. Seema Acharya, Subhasini Chellappan(2015). "Big Data Analytics". Wiley. (Module I,2,3,4).
2. Tom White(2012). " Hadoop: The Definitive Guide"(Third Edition). O'reilly Media. (Module 3)

SUGGESTED READINGS:

1. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
2. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", John Wiley & sons, 2012.
3. Glenn J. Myatt, "Making Sense of Data", John Wiley & Sons, 2007.
4. Pete Warden, "Big Data Glossary", O'Reilly, 2011.

	Union Christian College, Aluva **(Autonomous)**

Programme	BSc (Honours) Computer Science					
Course Name	Internet of Things					
Type of Course	DSE					
Course Code	UC6DSECSC301					
Course Level	300					
Course Summary	This course provides a comprehensive understanding of the fundamentals of the Internet of Things (IoT), covering key concepts, technologies, and applications. The syllabus is organized into four units, each addressing crucial aspects of IoT.					
Semester	6	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
Pre-requisites, if any	Basic knowledge of Computer Networks.					

COURSE OUTCOMES (CO):

After the completion of course student should be able to

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Demonstrate Knowledge of IoT Fundamentals	U	1
2	Understand and implement sensor networks and IoT development boards, including Arduino, Raspberry Pi, and RFID systems.	U,A	1,2
3	Understand and apply wireless sensor networks and IoT wireless technologies	U,A	1,2
4	Analyze and evaluate IP-based IoT protocols , edge connectivity, IoT applications	An,E	2,3

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Fundamentals of IoT: Introduction, Definitions & Characteristics of IoT	3	1
	1.2	IoT Architectures, Physical & Logical Design of IoT	4	1
	1.3	Enabling Technologies in IoT, History of IoT, The Identifiers in IoT	4	1
	1.4	About the Internet in IoT, IoT frameworks, IoT and M2M.	4	1
2	2 .1	Sensors Networks : Definition, Types of Sensors, Types of Actuators, Examples and Working	8	2
	2.2	IoT Development Boards: Arduino IDE and Board Types, RaspberriPi Development Kit,RFIDPrinciples and components,	7	2
3	3.1	Wireless Sensor Networks: History and Context, The node, Connecting nodes, Networking Nodes, WSN and IoT.	7	3
	3.2	Wireless Technologies for IoT: WPAN Technologies for IoT: IEEE 802.15.4, Zigbee, HART,NFC, Z-Wave, BLE, Bacnet, Modbus.	8	3
4	4.1	IP Based Protocols for IoT IPv6, 6LowPAN, RPL, REST, AMPQ, CoAP, MQTT.	3	4
	4.2	Edge connectivity and protocols	2	4
	4.3	Applications of IoT: Home Automation, Smart Cities, Energy Logistics, Agriculture, Health and Lifestyle, Industrial IoT Retail Management, Legal challenges IoT design Ethics, IoT in Environmental Protection	10	4
5		Teacher Specific Content		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) • ICT enabled Lectures • Interactive sessions • Class discussions
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 30 Marks 1. Written tests 2. Assignments
	B. Semester End Examination ESE for Theory: 70 Marks (2 Hrs) Written Test (70 Marks) Part A: Very Short Answer Questions (Answer all) - (10*2=20 Marks) Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks)

REFERENCES

1. Vijay Madisetti and Arshdeep Bahga (2014). “Internet of Things (A Hands-on-Approach)”(1st Edition). VPT.

SUGGESTED READINGS

1. Daniel Minoli, — “Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications”, ISBN: 978-1-118-47347-4, Willy Publications
2. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies,Platforms, and Use Cases", CRC Press
3. Hakima Chaouchi, — “The Internet of Things Connecting Objects to the Web” ISBN : 978-1-84821-140-7, Wiley Publications
4. Olivier Hersent, David Boswarthick, and Omar Elloumi, — “The Internet of Things: Key Applications and Protocols”, WileyPublications
5. J. Biron and J. Follett, "Foundational Elements of an IoT Solution", O'Reilly Media, 2016.Keysight Technologies, “The Internet of Things: Enabling Technologies and Solutions for Design and Test”, Application Note, 2016.

Web links:

1. https://onlinecourses.nptel.ac.in/noc17_cs22/course
2. http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.html

	Union Christian College, Aluva **(Autonomous)**					
Programme	BSc (Honours) Computer Science					
Course Name	Understanding MP and MC Architecture					
Type of Course	DSE					
Course Code	UC6DSECSC302					
Course Level	300					
Course Summary	Understanding the operating concepts and programming of 8086 microprocessor					
Semester	6	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
Pre-requisites, if any	Knowledge about digital fundamentals.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe the fundamental concepts of microprocessor architecture	U	1
2	Develop assembly language programs for the 8086 microprocessor.	A	1,2
3	Demonstrate proficiency in assembly language programming, integrating strings, procedures, and macros for efficient optimization and recursion.	U	1
4	Demonstrate proficiency in programming and understanding microcontrollers, including 8031 and PIC.	U	1

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Microprocessor architecture and its operations – concept of clock pulse-basic operations of microprocessor – read ,write operations. Opcode and operands - accumulator and flags- . 8086 Internal architecture.	5	1
	1.2	Basic 8086 microcomputer system - 8086 bus, Read machine cycle,Write machine cycle. .Operating modes- Register organization ,.	5	1
	1.3	Memory segmentation, Instruction sequencing. 8086 interrupts	5	1
2	2.1	Assembly language programming – program development steps, 8086 instructions – data transfer instructions, arithmetic instructions, bit manipulation instructions, string instructions,	8	2
	2.2	Program development steps- program execution, Sample programs	7	2
3	3.1	Strings , Procedures and Macros – 8086 string instructions,	5	3
	3.2	Writing and using procedures, CALL and RET instructions, stack, using PUSH and POP to save register contents, passing parameters, reentrant and recursive procedures,	5	3
	3.3	Writing and using macros.	4	3
4	3.1	Microcontrollers - – 8031 –Basic architecture and components of a typical microcontroller -CPU, memory, input/output ports, timers, and serial communication modules	8	4
	3.2	Programming basics -Writing assembly and C-language programs for the microcontroller -Architecture diagram- pins- instructions. Comparison with microprocessors. New micro controllers.- PIC - other examples.	8	4
5		Teacher specific content		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) • ICT enabled Lectures • Interactive sessions • Class discussions
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 30 Marks 1. Written tests 2. Assignments
	B. Semester End Examination ESE for Theory: 70 Marks (2 Hrs) Written Test (70 Marks) Part A: Very Short Answer Questions (Answer all) - (10*2=20 Marks) Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks)

REFERENCES

1. A.Nagoor Kani - Microprocessor 8086 programming and interfacing,Second edition, Tata McGraw Hill Education.

SUGGESTED READING

1. Microprocessors and Interfacing , Programming and Hardware, Douglas V- Hall. Tata McGraw-Hill,1990.

	Union Christian College, Aluva **(Autonomous)**

Programme	BSc (Honours) Computer Science					
Course Name	Machine Learning using Python					
Type of Course	SEC					
Course Code	UC6SECCSC300					
Course Level	300					
Course Summary	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.					
Semester	6	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	0	0	45
Pre-requisites, if any	Basic knowledge of Python Programming					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe the basics, applications, types, and techniques of machine learning..	U	1, 2
2	Describe and evaluate regression and classification techniques in machine learning.	U,E	1, 2
3	Illustrating an understanding of neural networks, classifier metrics, overfitting, and ensemble learning is the aim.	U,An	1, 2

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction to Machine Learning, Examples of Machine Learning applications, Types of learning: supervised, unsupervised, semi-supervised learning, learning associations	8	1
	1.2	Regression, Classification, Training versus testing. Model Selection and Generalization, Data Preprocessing, Feature Selection, Feature Extraction	7	
2	2.1	Regression: Simple Linear Regression, Multiple Linear Regression, Ridge Regression, Lasso Regression, Metrics for evaluating regression problems – MAE, MSE, RMSE, MAPE, R^2	8	2
	2.2	Classification- Logistic Regression, KNN, Decision Trees- Entropy, Information Gain, Tree construction, Issues in Decision Tree learning	7	
3	3.1	Neural Networks- The Perceptron, Activation Functions, Feed Forward Networks, Multi layer neural networks, Back Propagation.	7	3
	3.2	Measuring classifier performance- Accuracy, Precision, recall, F1 score, ROC curves Problem of Overfitting, Regularization, Cross validation hyperparameter tuning. Introduction to Ensemble Learning, Introduction to Deep Learning.	8	
4		(Teacher specific content)		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) • ICT enabled Lectures • Interactive sessions • Class discussions
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 25 Marks 1. Written test

	2. Assignments
	B. Semester End Examination ESE for Theory: 50 Marks (1.5 Hrs) Written Test(50 Marks) Part A: Very Short Answer Questions (Answer all) - (10*1=10 Marks) Part B: Short Answer Questions(4 out of 6 Questions) - (4*5=20 Marks) Part C: Essay Questions(2 out of 3 Questions) - (2*10=20 Marks)

REFERENCES

1. Ethem Alpaydın(2004). Introduction to Machine Learning (Adaptive Computation and Machine Learning). MIT Press.
2. Jake VanderPlas(2016).Python Data Science Handbook.O'Reilly Media.

SUGGESTED READINGS

1. Han, Jiawei, Jian Pei, and Micheline Kamber, “Data mining: concepts and techniques”, 3 rd Edition, Elsevier, 2011.

<table>
<tr><td>  </td><td colspan="6">Union Christian College, Aluva

(Autonomous)</td></tr>
<tr><td>Programme</td><td colspan="6">BSc (Honours) Computer Science</td></tr>
<tr><td>Course Name</td><td colspan="6">Natural Language Processing</td></tr>
<tr><td>Type of Course</td><td colspan="6">SEC</td></tr>
<tr><td>Course Code</td><td colspan="6">UC6SECCSC301</td></tr>
<tr><td>Course Level</td><td colspan="6">300</td></tr>
<tr><td>Course Summary</td><td colspan="6">This course provides a comprehensive foundation for understanding and applying natural language processing techniques. It covers language fundamentals, linguistics resources, and advanced NLP topics, including part-of-speech tagging, parsing, semantics, word sense disambiguation, information retrieval, and practical applications like machine translation and automatic speech recognition.</td></tr>
<tr><td>Semester</td><td>6</td><td colspan="3">Credits</td><td>3</td><td rowspan="2">Total Hours</td></tr>
<tr><td rowspan="2">Course Details</td><td rowspan="2">Learning Approach</td><td>Lecture</td><td>Tutorial</td><td>Practical</td><td>Others</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>0</td><td>45</td></tr>
<tr><td>Pre-requisites, if any</td><td colspan="6"></td></tr>
</table>

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe the various levels of linguistic analysis.	U	2
2	Distinguish between various NLP techniques for managing and analyzing linguistic data.	U	1
3	Compare and contrast various aspects of natural language structure and analysis.	An	2
**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction- Human languages, models, ambiguity, processing paradigms. Levels of language analysis- Syntax, Semantics, Pragmatics.	5	1
	1.2	Phonetics- Speech Sounds and Phonetic, Articulatory Phonetics, Prosody. Text representation in computers, encoding schemes.	4	1
	1.3	Linguistics resources- Introduction to corpus, elements in balanced corpus, TreeBank, PropBank, WordNet, VerbNet etc. Resource management with XML	5	2
	2.1	Management of linguistic data with the help of GATE, NLTK. Regular expressions, Finite State Automata, word recognition, lexicon.	5	2

2	2.2	Morphology, acquisition models, Finite State Transducer. N-grams, smoothing, entropy, HMM, ME, SVM, CRF.	6	2
	2.3	Part of Speech tagging- Stochastic POS tagging, HMM, Transformation based tagging (TBL), Handling of unknown words, named entities, multi word expressions.	6	3
3	3.1	A survey on natural language grammars, lexeme, phonemes, phrases and idioms, word order, agreement, tense, aspect and mood and agreement, Context Free Grammar, spoken language syntax	7	3
	3.2	Parsing-Unification, probabilistic parsing, TreeBank. Semantics- Meaning representation, semantic analysis, lexical semantics, WordNet.	5	3
	3.3	Word Sense Disambiguation- Selectional restriction, machine learning approaches, dictionary-based approaches. Discourse-Reference resolution, constraints on co-reference, algorithm for pronoun resolution, text coherence, discourse structure	10	4
	3.4	Applications of NLP-Machine Translation, Information Retrieval and Extraction, Text Categorization and Summarization, Automatic Speech Recognition, Text to Speech.	7	4

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) • ICT enabled Lectures • Interactive sessions • Class discussions
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA)
	CCA for Theory: 25 Marks **1.** Written test **2.** Assignments

	B. Semester End Examination ESE for Theory: 50 Marks (1.5 Hrs) Written Test(50 Marks) Part A: Very Short Answer Questions (Answer all) - (10*1=10 Marks) Part B: Short Answer Questions(4 out of 6 Questions) - (4*5=20 Marks) Part C: Essay Questions(2 out of 3 Questions) - (2*10=20 Marks)

REFERENCES

1. Daniel Jurafsky and James H Martin. Speech and Language Processing, 2e, Pearson Education, 2009

SUGGESTED READINGS

1. James Allen, Natural Language Understanding, 2e, The Benjamin/Cummings Publishing Company Inc., Redwood City, CA.

2. U. S. Tiwary and Tanveer Siddiqui. Natural language processing and Information retrieval, OUP, 2008

	Union Christian College, Aluva **(Autonomous)**

Programme	BSc (Honours) Computer Science					
Course Name	User Centric Computing and Software Standards					
Type of Course	VAC					
Course Code	UC6VACCSC300					
Course Level	300					
Course Summary	This course is designed for user centric tools and software standards in computer industry					
Semester	6	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	0	0	45
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe the historical evolution, challenges, and evaluation techniques of user-centric design.	U	1,8, 10
2	Apply knowledge of assistive technologies and ICT to address various disabilities and enhance accessibility.	A	1, 2, 9
3	Illustrate software quality concepts and quality management frameworks,	An, S	2, 5, 10

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction to user centric design: historical evolution, issues and challenges and current trend – User centric computing	5	1
	1.2	User centric design evaluation: overview of evaluation techniques, expert evaluation, user evaluation, model- based evaluation with case studies	6	1
	1.3	Introduction to alternative augmentative communication(AAC) – Team based approach	4	1
2	2.1	Introduction to Assistive technologies - Assistive Devices - Information and Communication technology (ICT) - History of assistive technologies	5	2
	2.2	Benefits of ICT - ICT Used at institution level: Online education, Teleconferencing, Mobilephone based education, E-resources	3	2
	2.3	ICT for different disabilities: Intellectual disability, locomotor impairment and cerebral palsy, hearing impairment, Visual impairment, and autism - Comparison of present and future of ICT	7	2
3	3.1	Software Quality Concepts: Quality, Quality Control, Quality Assurance; Cost of Quality	5	3
	3.2	Software Reliability and Quality Management: ISO 9000, ISO 9001 Certification - SEI Capability Maturity Model - ISO 9000 certification vs SEI/CMM	7	3
	3.3	Applicability of SEI CMM to organization - Personal software process - Levels of PSP.	3	3
4		(Teacher specific content)		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) ICT enabled Lecture, Discussions
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 25 Marks 1. Written tests 2. Assignments
	B. Semester End Examination ESE for Theory: 50 Marks (1.5 Hrs) Written Test(50 Marks) Part A: Very Short Answer Questions (Answer all) - (10*1=10 Marks) Part B: Short Answer Questions(4 out of 6 Questions) - (4*5=20 Marks) Part C: Essay Questions(2 out of 3 Questions) - (2*10=20 Marks)

References

1. Dr.Samit Bhattacharya, Human Computer Interaction
2. Narsimhan N, E. Accessibility Policy handbook for persons with disabilities. Hemkunt Publishers

SUGGESTED READINGS

1. Singh J P, Technology for the blind concept and context, Kanishka Publishers
2. Dr. Hemlata, Technology for inclusion of persons with disabilities, Kanishka Publishers.
3. Software Engineering: A Practitioner's Approach, 9th edition – Roger S Pressman, Bruce R Maxim; McGraw Hill

SEMESTER VII

	Union Christian College, Aluva **(Autonomous)**					
Programme	BSc (Honours) Computer Science					
Course Name	Advanced Java Programming					
Type of Course	DCC					
Course Code	UC7DCCCSC400					
Course Level	400					
Course Summary	Understanding the advanced features of JAVA					
Semester	7	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	1	0	75
Pre-requisites, if any	Knowledge about basic JAVA					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Apply JDBC architecture, drivers, SQL, and Result Set interfaces effectively.	A	2,3
2	Develop robust servlets and Java Server Pages (JSP) for dynamic web applications.	A	2,8
3	Apply networking concepts in application programs	A	1.2
4	Implement database connectivity, networking, RMI and web applications	A	`1.2

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	JDBC – Components of JDBC, JDBC architecture, various kinds of JDBC drivers,	5	1
	1.2	The Structured Query Language, The Connection Interface, The Statement Interface, The Prepared Statement Interface,	5	1
	1.3	Scrollable and Updatable ResultSets, RowSets, Transactions.	5	1
2	2.1	Servlets-The life cycle of a servlet, creation of a simple servlet.	4	2
	2.2	The servlet API-javax.servlet package and javax.servlet.http package,	4	2
	2.3	reading servlet parameters. Handling HTTP GET and HTTP POST requests.	4	2
	2.4	Java Server Pages(JSP)-overview, syntax and semantics, expressions and scriptlets, implicit objects, declarations, directives-include directive, page directive, tag lib directive. Session and cookies concept	4	2
	2.5	Java collections, JMS, Java beans, Java server Faces, JDBC	4	2
3	3.2	Networking basics-Networking classes and interfaces, Inet Address class-TCP/IP Client Sockets, URL Connection, TCP/IP Server Sockets.	5	3
	3.2	RMI-basic concepts-A simple client/server application using RMI.	5	3
4		1. Implementing JDBC Connectivity: Develop a Java application that connects to a relational database using JDBC. Perform basic CRUD operations (Create, Read, Update, Delete) on database tables. 2. Creating Servlets: Build a simple web application using servlets to handle HTTP requests and responses. Implement servlets for user authentication, data retrieval, and form submission. 3. Java Server Pages (JSP) Development: Create dynamic web pages using JSP to interact with servlets and display data retrieved from a database. Implement features like user authentication, session management, and form validation. 4. Networking Basics: Develop a Java application to demonstrate network programming concepts such as TCP/IP client-server communication using sockets. Implement a chat application or a file transfer program. 5. Remote Method Invocation (RMI): Create a distributed application using RMI to allow communication between Java	30	4

		objects running on different JVMs. Implement a simple client-server application to perform remote method calls.		
5		(Teacher specific content)		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) • ICT enabled Lectures • Interactive sessions • Class discussions • Lab exercises
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 25 Marks 1. Written test 2. Assignments CCA for Practical: 15 Marks 1. Practical assignments 2. Lab Record 3. Observation of practical skills 4. Viva
	B. Semester End Examination ESE for Theory: 50 Marks (1.5 Hrs) Written Test (50 Marks) Part A: Very Short Answer Questions (Answer all) - (10*1=10 Marks) Part B: Short Answer Questions (4 out of 6 Questions) - (4*5=20 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks) ESE for Practical: 35 Marks (1.5 Hrs) 1. Logic - 10 Marks 2. Successful Compilation - 5 Marks 3. Output - 5 Marks 4. Viva - 10 Marks 5. Record - 5 Marks

REFERENCES

1. Uttam K Roy . ADVANCED JAVA PROGRAMMING. Oxford University Press; UK edition

SUGGESTED READINGS

1. Bernard Van Haecke, JDBC: Java Database Connectivity, , IDG Books India (2000)

2. C Thomas Wu, An introduction to Object Oriented Programming with Java, , Tata McGraw Hill, (2006)

3. DT Editorial Services, Java 8 Programming Black Book, Dreamtech Press.

4. Herbert Schildt Java 2 The Complete Reference, Tata McGraw Hill (5th Edn.)

5. James. P. Cohoon, Programming java 5.0, Jack. W. Davison (Tata McGraw Hill)

6. Wigglesworth and McMillan, Java Programming: Advanced Topics, , Cengage Learning India, 3rd Edn.

	**Union Christian College, Aluva** **(Autonomous)**

Programme	BSc (Honours) Computer Science					
Course Name	Advanced Database Management Systems					
Type of Course	DCC					
Course Code	UC7DCCCSC401					
Course Level	400					
Course Summary	This course builds upon the foundational concepts of database management systems and SQL. It covers advanced topics, including Object-Oriented Database Management Systems (OODBMS), NoSQL databases, and MongoDB. Students will gain a deep understanding of advanced database concepts and technologies.					
Semester	7	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
Pre-requisites, if any	Basic understanding of relational database and SQL					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Illustrate transaction processing, Concurrency Control and Object oriented Concepts in database management systems	U	1,2
2	Apply XML in Database Systems.	A	1,2,3
3	Analyse distributed and NoSQL databases	An	1,2
4	Apply shell operations and querying on MongoDB databases.	A	2,3

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction to Transaction Processing: Transaction and System Concepts, Characterizing Schedules based on Recoverability and Seriability,	3	1
	1.2	Two-Phase Locking Technique for Concurrency Control, Recovery Concepts	4	1
	1.3	Overview of Object-Oriented Database Concepts, Object-Oriented Data Modeling, Object Definition Language(ODL), Object Query Language	4	1
	1.4	Object-Relational Mapping (ORM)	2	1
	1.5	Case Studies and Applications of OODBMS	2	1
2	2.1	XML: Extensible Markup Language-Structured, Semistructured, and Unstructured Data, XML Hierarchical (Tree) Data Model	5	2
	2.2	XML Schema Definition, Storing and Extracting XML Documents from Databases	5	2
	2.3	Querying XML Data (XPath and XQuery)	5	2
3	3.1	Distributed Databases and NoSQL Databases: Distributed Database Concepts, Data Fragmentation	4	3
	3.2	Replication and Allocation Technique for Distributed Database Design, Overview of Transaction Management in Distributed Databases	4	3
	3.3	Introduction to NoSQL databases, Characteristics of NoSQL Systems	4	3
	3.4	Categories of NoSQL Systems, Consistency and CAP Theorem.	3	3
4	4.1	Introduction to MongoDB-advantages, features, documents, collections, dynamic schemas, naming, databases	4	4
	4.2	MongoDB Shell, MongoDB client, create, read, update, delete	2	4
	4.3	Data types, arrays, embedded documents, objectids	2	4
	4.4	insert method, remove, updating documents	3	4

	4.5	Basic querying	4	4
5		Teacher Specific Module		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) • Lecture • Problem Solving • Presentation • Discussions • Case Studies
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 30 Marks 1. Written tests 2. Assignments
	B. Semester End Examination ESE for Theory: 70 Marks (2 Hrs) Written Test (70 Marks) Part A: Very Short Answer Questions (Answer all) - (10*2=20 Marks) Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks)

REFERENCE

1. Ramez Elmasri and Shamkant B. Navathe. DATABASE SYSTEMS(Sixth Edition). Pearson Education. (Module 1,2,3)
2. Kristina Chodorow. MongoDB: The Definitive Guide(Second Edition). O'Reilly Media. (Module 4)

SUGGESTED READINGS

1. Reghu Ramakrishnan and Johannes Gehrke- Database Management Systems, Third edition, Mc Graw Hill International Edition.
2. Andreas Meier, Michael Kaufmann, - SQL & NoSQL Databases-Models, Languages, Consistency, Options and Architectures for Big Data Management.
3. https://www.mongodb.com/docs/manual/MongoDB-manual.pdf

	Union Christian College, Aluva (Autonomous)

Programme	BSc (Honours) Computer Science					
Course Name	Advanced Data Structures					
Type of Course	DCC					
Course Code	UC7DCCCSC402					
Course Level	400					
Course Summary	This course offers a thorough understanding of data structures and algorithms, covering algorithmic analysis, array implementation, sorting, searching, linked lists, trees, graphs, and hashing for effective data management and retrieval.					
Semester	7	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
Pre-requisites, if any	Basic knowledge of Data Structure Concepts					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Demonstrate a comprehensive understanding of advanced sorting and searching algorithms	U	1
2	Analyze and compare AVL trees, Red-Black trees, and B-Trees.	A	2
3	Describe and analyze graph representations and traversal algorithms.	An	1,2
4	Describe the implementation and applications of Minimum Spanning Trees and Network Flow Algorithms.	U	2,3

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Advanced Sorting Algorithms: Merge sort, quicksort, heap sort, radix sort, external sorting techniques.	5	1
	1.2	Searching Algorithms: Binary search trees, balanced search trees (such as AVL trees), hash tables, bloom filters.	5	1
	1.3	Advanced Search Techniques: Binary search on sorted arrays, interpolation search, exponential search, Fibonacci search.	5	1
2	2.1	AVL Trees: Introduction, balancing operations, rotations, insertion, and deletion algorithms.	5	2
	2.2	Red-Black Trees: Properties, insertion, and deletion algorithms, balancing operations.	8	2
	2.3	B-Trees and B+ Trees: Structure, insertion, and deletion operations, applications in databases and file systems.	9	2
3	3.1	Graph Representation: Adjacency matrix, adjacency list, and adjacency set representations.	3	3
	3.2	Graph Traversal: Depth-First Search (DFS), Breadth-First Search (BFS), applications in graph connectivity and cycle detection.	3	3
	3.3	Shortest Path Algorithms: Dijkstra's algorithm, Bellman-Ford algorithm, Floyd-Warshall algorithm.	7	3
4	4.1	Minimum Spanning Trees: Prim's algorithm, Kruskal's algorithm, applications in network design and clustering	5	4
	4.2	Network Flow Algorithms: Ford-Fulkerson algorithm, Edmonds-Karp algorithm, applications in network optimization and flow analysis.	5	4
5		(Teacher specific content)		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) • ICT enabled Lectures • Interactive sessions • Class discussions

Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 30 Marks 1. Written tests 2. Assignments
	B. Semester End Examination ESE for Theory: 70 Marks (2 Hrs) Written Test (70 Marks) Part A: Very Short Answer Questions (Answer all) - (10*2=20 Marks) Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks)

References

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein . "Introduction to Algorithms" (Third Edition). The MIT Press, Cambridge, Massachusetts London, England.

Suggested Readings

1. "Advanced Data Structures" by Peter Brass, 1st Edition, Cambridge University Press
2. "Algorithm Design" by Jon Kleinberg and Éva Tardos, 1st Edition, Pearson Education
3. "Approximation Algorithms" by Vijay V. Vazirani, 1st Edition, Springer
4. "Algorithms" by Robert Sedgewick and Kevin Wayne, 4th Edition,Addison-Wesley Professional

	Union Christian College, Aluva **(Autonomous)**

Programme	BSc (Honours) Computer Science					
Course Name	Advanced Operating System Concepts					
Type of Course	DCE					
Course Code	UC7DCECSC400					
Course Level	400					
Course Summary	To provide a comprehensive understanding of advanced topics and prepare students for research, development, or advanced system administration roles and to introduce students to the Mobile application development ecosystem.					
Semester	7	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
Pre-requisites, if any	Basic knowledge in Operating System concepts.					

COURSE OUTCOMES (CO):

After the completion of course student should be able to

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Analyze distributed, database, and multiprocessor operating systems intricacies	An	1,2
2	Evaluate real-time systems applications and justify design choices.	E	1,2,3
3	Compare and contrast Linux and Windows operating systems	U	1
4	Develop proficiency in Android operating system	A	1

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	Distributed, Database & Multiprocessor operating systems		20 hrs	
	1.1	Distributed Operating Systems: System Architectures Design issues – Communication models – clock synchronization – mutual exclusion – election algorithms Distributed Deadlock detection.	6	1
	1.2	Database Operating Systems: Requirements of Databa se OS – Transaction process model –Synchronization primitives Concurrency control algorithms.	7	1
	1.3	Multiprocessor Operating Systems: System Architectures Structures of OS – OS design issues – Process synchronization – Process Scheduling and Allocation memory management.	7	1
2	Real Time & Mobile Operating Systems		15 hrs	
	2.1	Basic Model of Real Time Systems – Characteristics Applications of Real Time Systems – Real Time Task Scheduling Handling Resource Sharing	7	2
	2.2	Mobile Operating Systems –Microkernel Design Client Server Resource Access – Processes and Threads Memory Management File system.	8	2
3	Case study on Linux OS and Windows OS		15 hrs	
	3.1	Case Study on Linux: History of Unix and Linux, Linux Overview, Processes in Linux, Memory management in Linux, I/O in Linux, Linux file system, security in Linux.	8	3
	3.2	Case Study on Windows: History of windows through Windows 10, programming windows, system structure, processes and threads in windows, memory management, caching in windows, I/O in windows, Windows NT file system, Windows power management, Security in windows.	7	3
4	Android OS		10hrs	
	4.1	History of Android, Introduction to Android Operating Systems, Android Development Tools, Android Architecture	5	4

	4.2	Installing and using Eclipse with ADT plug-in, Installing Virtual machine for Android sandwich/Jelly bean (Emulator), configuring the installed tools, creating a android project – Hello Word, run on emulator, Deploy it on USB-connected Android device.	5	4
5		(Teacher specific content)		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) • ICT enabled Lectures • Interactive sessions • Class discussions
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 30 Marks 1. Written tests 2. Assignments
	B. Semester End Examination ESE for Theory: 70 Marks (2 Hrs) Written Test (70 Marks) Part A:Very Short Answer Questions (Answer all) - (10*2=20 Marks) Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks)

REFERENCES

1. Mukesh Singhal, Niranjan G.(2001). Shivaratri Advanced Concepts In Operating Systems: Distributed Database And Multiprocessor Operating Systems. Tata McGrawHill Edition,. (Module 1)

2. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne(2018). Operating System Concepts(10th Edition). John Wiley & Sons. ISBN: 9781118063330.(Module 2)

3. Sheusi, J. C. (2013). *Android Application Development for Java Programmers*. Cengage Learning. - Module-4

4. Stevens, W. R., & Rago, S. A. (2013). *Advanced Programming in the UNIX® Environment* (3rd ed.). Addison-Wesley. - Module 3

5. John A.(2020).Understanding Windows Operating Systems". TechPress. - Module 3

SUGGESTED READINGS

1. Dhamdhere, Dhananjay M. Operating systems: a concept-based approach, 2E. Tata McGraw-Hill Education, 2006.
2. Tanenbaum, Andrew S., and Albert S. Woodhull. Operating systems: design and implementation. Vol. 68. Englewood Cliffs: Prentice Hall, 1997.
3. W. Stallings, Operating Systems, Internals & Design Principles , 5th Edition, Prentice Hall of India. 2008.
4. Pradhan, A., & Deshpande, A. V. (2014). *Composing Mobile Apps: Learn, Explore and Apply using Android*. Wiley Publications. ISBN: 978-81-265-4660-2. Pradhan, A., & Deshpande, A. V. (2014). *Composing Mobile Apps: Learn, Explore and Apply using Android*. Wiley Publications. ISBN: 978-81-265-4660-2.

	Union Christian College, Aluva **(Autonomous)**

Programme	BSc (Honours) Computer Science					
Course Name	Digital Image Computing					
Type of Course	DCE					
Course Code	UC7DCECSC401					
Course Level	400					
Course Summary	The course imparts a comprehensive knowledge about the digital image processing techniques					
Semester	7	Credits			4	Total Hours
Course Details\	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Analyze digital images, processing steps, acquisition, sampling, quantization, color models.	An	1,2
2	Apply spatial domain techniques for image enhancement effectively	A	2
3	Analyze and utilize frequency domain transformations for image enhancement.	An	2
4	Implement image restoration and segmentation techniques proficiently.	A	2

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	Introduction to Digital Image Processing			
	1.1	Digital Image and Digital Image Processing	2	1
	1.2	Fundamental steps in Digital Image Processing	1	1
	1.3	Components of Image Processing system	2	1
	1.4	Image sensing and acquisition	2	1
	1.5	Image sampling and quantization	2	1
	1.6	Relationships between pixels	2	1
	1.7	Color image fundamentals	2	1
	1.8	Color Models-RGB, CMY, HSI	2	1
	Image Enhancement in spatial domain			
2	2.1	Basic Intensity transformation functions - Image Negatives, Log Transformations, Power Law Transformations, Piecewise Linear Transformations,	3	2
	2.2	Histogram processing	3	2
	2.3	Spatial filtering – Spatial correlation and convolution	3	2
	2.4	Smoothing Spatial Filters	3	2
	2.5	Sharpening Spatial Filters - Laplacian Filter - Unsharp masking - High Boost Filter. Gradient operators	3	2
	Image Enhancement in Frequency domain			
3	3.1	Introduction to Fourier transform: 1- DFT, 2 –D DFT and its Inverse Transform,	3	3
	3.2	Properties of 2-D DFT	3	3

	3.3	2-D Convolution theorem	3	3
	3.4	Filtering in the frequency domain	3	3
	3.5	Image Smoothing and Sharpening using Frequency Domain Filters- Ideal, Butterworth and Gaussian filters	3	3
	Image Restoration and segmentation			
4	4.1	Noise models-Gaussian Noise, Rayleigh Noise, Gamma Noise, Exponential Noise, Impulse Noise	2	4
	4.2	Restoration using Mean Filters, Order Statistics filters, Adaptive filters	2	4
	4.3	Edge models	2	4
	4.4	Edge Detection - Gradient operator, canny edge detector	3	4
	4.5	Thresholding- Global Thresholding using otsu's method	3	4
	4.6	Region based segmentation – Region growing, Region splitting and merging, watershed segmentation	3	4
5		(Teacher specific content)		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) • Lecturing • Collaborative learning • Self-directed learning • ICT enabled Lectures
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 30 Marks 1. Written tests 2. Assignments
	B. Semester End Examination ESE for Theory: 70 Marks (2 Hrs) Written Test (70 Marks)

	Part A: Very Short Answer Questions (Answer all) - (10*2=20 Marks) Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks)

REFERENCES

1. Rafael C. Gonzalez, Richard E. Woods.(2010). Digital Image Processing(Third Edition).Pearson.

SUGGESTED READINGS

1. Anil K. Jain, Fundamentals of Digital Image Processing, Pearson, 2002.

2. Kenneth R. Castleman, Digital Image Processing Pearson, 2006.
3. William K. Pratt, Digital Image Processing, John Wiley, Fourth Edition, New York, 2002.
4. Milan Sonka et al, Image processing, analysis and machine vision Brookes/Cole, Vikas Publishing House, Fourth edition, 2007.
5. AzrielRosenfield, Avinash C. Kak, "Digital Picture Processing", Morgan Kaufmann, 2nd Ed., 1982.
6. Bernd Jahne, “Digital Image Processing”, Springer, 6th Ed., 2005.

	Union Christian College, Aluva **(Autonomous)**

Programme	BSc (Honours) Computer Science					
Course Name	Big Data Management using R					
Type of Course	DCE					
Course Code	UC7DCECSC402					
Course Level	400					
Course Summary	The course provides a comprehensive exploration of big data analytics, covering fundamental concepts, the data analytics lifecycle, advanced tools, and practical skills in R programming for data analysis and visualization. Students will gain a deep understanding of the analytics process, from discovery to project operationalization, and develop proficiency in utilizing key technologies and methodologies in the field.					
Semester	7	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand big data analytics fundamentals, ecosystems, and key roles for successful analytics projects.	U	1
2	Navigate through the data analytics lifecycle, from discovery to operationalizing projects.	A	1,2
3	Describe the fundamental concepts and functionalities in R programming	U	2
4	Illustrate various data visualization techniques in R	U	2

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction to Big Data Analytics: Big Data Overview – Data Structures - Analyst Perspective on Data Repositories - State of the Practice in Analytics	5	1
	1.2	BI versus Data Science - Current analytical architecture - Emerging big data Ecosystem - Key Roles for the New Big Data Ecosystem.	5	1
2	2.1	Data Analytics Lifecycle: Data Analytics Lifecycle Overview – Key roles for a successful Analytics project	5	2
	2.2	Background and overview of data analytics life cycle. Phase 1: Discovery, Phase 2: Data Preparation, Phase 3: Model Planning, Phase 4: Model Building, Phase 5: Communicate Results, Phase 6: Operationalize. (Phases in detail by including all sub topics.)	10	2
3	3.1	Introduction to R – Basics - RStudio - R Data Types - Operators - Basic Read and Write functions	5	3
	3.2	R Objects: Vector, Matrix, Array, Data Frame, Factor, List ()– Decision Making Statements – Control Structures	5	3
	3.3	Functions - Import and export Data into and from R: CSV, Text file, Excel file	5	3
	3.4	Exception Handling – Progress and Timing	5	3
4	4.1	Data Visualization in R: Scatter Plot, Boxplot, Bar Chart, Histogram, Box and Whiskers plot	5	4
	4.2	Using plots with Coordinate vector – Graphical Parameters – Adding Points, Lines and Text to an existing plot	5	4
	4.3	The ggplt2 package - R dplyr package - Data Manipulation commands: select, filter, arrange.	5	4
5		(Teacher specific content)		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) • Lecturing • Collaborative learning • Self-directed learning
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 30 Marks 1. Written tests 2. Assignments
	B. Semester End Examination ESE for Theory: 70 Marks(2 Hrs) Written Test (70 Marks) Part A: Very Short Answer Questions (Answer all) - (10*2=20 Marks) Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks)

REFERENCES

1. EMC Education Services. “Data Science and Big Data Analytics”, WILEY
2. Tilman M. Davies.(2016). “ The Book of R”. No Starch Press
3. Seema Acharya.(2018). “Data Analytics Using R”. McGraw Hill Education
4. "R for Data Science" by Hadley Wickham and Garrett Grolemund.

SUGGESTED READINGS

1. "Big Data: A Revolution That Will Transform How We Live, Work, and Think" by Viktor Mayer-Schönberger and Kenneth Cukier.
2. "Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking" by Foster Provost and Tom Fawcett.
3. "Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die" by Eric Siegel.
4. "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data" by EMC Education Services.
5. "Hands-On Programming with R: Write Your Own Functions and Simulations" by Garrett Grolemund

SEMESTER VIII

	Union Christian College, Aluva **(Autonomous)**

Programme	BSc (Honours) Computer Science					
Course Name	Advanced Computer Networks					
Type of Course	DCC					
Course Code	UC8DCCCSC400					
Course Level	400					
Course Summary	This advanced course focuses on the theoretical foundations and practical applications of networking algorithms and real-world network administration strategies. Students will delve into the complexities of network routing, congestion control, traffic management, and network security. They will gain hands-on experience in configuring and managing network devices using CCNA and CompTIA standards.					
Semester	8	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	1		75
Pre-requisites, if any	Preferably completed course on Networking Fundamentals					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe the principles and importance of high-performance switching and routing in network architectures.	U	1
2	Apply Software-Defined Networking (SDN) and Network Function Virtualization (NFV) concepts in practical scenarios.	A	2
3	Evaluate the effectiveness and challenges of Information-Centric Networking (ICN) architectures in modern networks..	E	3
4	Create and design simulated network configurations integrating SDN, NFV, and Data Center Networking concepts.	S	3

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	High Performance Switching and Routing ,Introduction to High Performance Switching and Routing, Performance considerations and IP address lookup. Algorithms and Optimization	7	1
	1.2	Hardware implementation of address lookup and optimization techniques. Packet Classification and QoS , Packet Classification Fundamentals , Methods and importance of packet classification. Quality of Service (QoS), Traffic shaping, differentiation, and QoS implementations.	8	1
2	2.1	Network Softwarization , Introduction to Network Softwarization, Overview of SDN, NFV, and programmable networks. Deep Dive into SDN and NFV, Software Defined Networking (SDN), Northbound and Southbound interfaces, SDN controllers, Mininet lab exercises	7	2
	2.2	Network Function Virtualization (NFV) , Architecture, concepts, and practical applications. Data Center Networking (DCN), Introduction to DCN. Understanding DCN and various network topologies. DCN Deep Dive , Container Network Interfaces (CNIs) and advanced DCN concepts.	8	2
3	3.1	Information-Centric Networking (ICN), Content Distribution and Architectures for ICN Principles and architectures of ICN.	7	3
	3.2	Advanced ICN Topics. Content Naming, Routing, Caching. In-depth study of content naming, routing, caching in ICN. Security in ICN Security aspects and challenges in ICN.	8	3
4		Practical Exercises in Switching, Routing, SDN, NFV, DCN, and ICN Hands-on implementation, simulations, and lab exercises covering the course topics.	30	4
5		(Teacher specific content)		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) • Collaborative learning • Self-directed learning • ICT enabled Lectures
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 25 Marks 1. Written test 2. Assignments CCA for Practical: 15 Marks 1. Practical assignments 2. Lab Record 3. Observation of practical skills 4. Viva
	B. Semester End Examination ESE for Theory: 50 Marks (1.5 Hrs) Written Test (50 Marks) Part A: Very Short Answer Questions (Answer all) - (10*1=10 Marks) Part B: Short Answer Questions (4 out of 6 Questions) - (4*5=20 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks) ESE for Practical: 35 Marks 1.Demonstration - 20 Marks 2.Viva - 10 Marks 3.Record - 5 Mark

REFERENCES

1. H. Jonathan Chao, Bin Liu, (2007). High Performance Switches and Routers. John Wiley & Sons, Inc. ISBN-10: 0-470-05367-4(Module 1)
2. Gabriel M. de Brito, Pedro B. Velloso, Igor M. Moraes, Wiley-ISTE.(2013). Information-Centric Networks: A New Paradigm for the Internet (Focus Series in Networks and Telecommunications).(1st edition).ISBN: 9781848214491(Module 2)
3. B. Wissingh, C. Wood, A. Afanasyev, L. Zhang, D. Oran and C. Tschudin, RFC 8793.(2020). Information-Centric Networking (ICN): Content Centric Networking (CCNx) and Named Data Networking (NDN) Terminology. (Module 3)

SUGGESTED READINGS

1. Software-Defined Networks: A Systems Approach, Peterson, Cascone, O'Connor, Vachuska, and Davie, Online Free Reference Book available at https://sdn.systemsapproach.org/index.html
2. Cloud Networking: Understanding Cloud-based Data Centre Networks, Gary Lee (Author), Morgan Kaufmann (Publisher), 2014,ISBN-139780128007280

Union Christian College, Aluva

(Autonomous)

Programme	BSc (Honours) Computer Science					
Course Name	Computational Research Methodology					
Type of Course	DCC					
Course Code	UC8DCCCSC401					
Course Level	400					
Course Summary	The course in Research Methodology and Ethics for Computer Science provides a comprehensive understanding of fundamental research concepts, data analysis methods, and historical developments in computing research. Students will acquire analytical skills through hands-on applications of parametric tests and interdisciplinary research approaches. The curriculum emphasizes ethical considerations in research, addressing issues such as plagiarism, data misuse, and intellectual property rights. By the end of the course, students will be equipped with the knowledge and skills necessary to conduct ethical and rigorous research in the field of computer science.					
Semester	8	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	1	0	75
Pre-requisites, if any	Basic understanding of computer science concepts and familiarity with academic writing and research principles.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe research methodology, including objectives, types, approaches, and significance.	U,A	1,2
2	Explain the comprehensive framework of research methodology and scientific method.	U	2
3	Describe the historical evolution of computing ideas, explore research methods, and analyze the application of computers in research.	U,An	3,6
4	Apply computer science research methodology to prepare a research paper	A	2

Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Meaning, Objectives, Motivation, Types, Approaches and Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process,	5	1
	1.2	Reading and Reviewing-Research literature, Finding Research Papers, Critical Reading, Developing a literature Review,	5	1
	1.3	Guidelines for Research Skills and Awareness, Validity of Research, Criteria of Good Research.	5	1
2	2.1	Data analysis in Research: Introduction, Need for Data Collection, Methods of Data Collection	2	2
	2.2	Principles for Accessing Research Data, Data Processing, Data Analysis, Presentation of Data,	2	2
	2.3	Error Analysis, Scientific Models. Scientific Methodology - Introduction Rules and Principles of Scientific Method.	3	2
	2.4	Hypothesis, Testing of Hypothesis, Basic concepts, Procedure, Important parametric tests: z-test ,t-test, $\chi 2$ - square test, F test	4	2
	2.5	Ethics in Research, Technical Reports-Bibliography referencing and footnotes.	4	2
	2.6	Research in Practice- Literature Review, Journals, Conference Proceedings, journal Impact Factor, citation Index, h Index.	4	2
3	3.1	History of ideas in computing, Evolution of Computing Research	2	3
	3.2	Overview of Research Methods: Measurements based research methods - Deductive Methods - Inductive Methods.	3	3
	3.3	The significance of Interdisciplinary research for Computer Science.	3	3

	3.4	Application of Computer in Research --MS office and its application in Research, Use of Internet in Research – Websites, search Engines, E-journal and E-Library.	3	3
4	4.1	Prepare a research paper by applying the principles of literature review, hypothesis formulation, data collection, analysis, and ethical considerations in the context of computer science.	30	4
5		(Teacher specific content)		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) • Lecture • Presentations • Interactive sessions • Class discussions
Assessment Types	MODE OF ASSESSMENT **A.** Continuous Comprehensive Assessment (CCA) CCA for Theory: 25 Marks 1. Written tests 2. Assignments CCA for Practical: 15 Marks 1. Literature Review 2. Review Report 3. Viva
	B. Semester End Examination ESE for Theory: 50 Marks (1.5 Hrs) Written Test (50 Marks) Part A: Very Short Answer Questions (Answer all) - (10*1=10 Marks) Part B: Short Answer Questions (4 out of 6 Questions) - (4*5=20 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks) ESE for Practical: 35 Marks 1. Paper publication - 25 marks 2. Viva - 10 marks

REFERENCES

1.Kothari, C.R.(1990). Research Methodology: Methods and Techniques. New Age International. Publishers(Second revised edition)

SUGGESTED READINGS

1. Krishnan Nallaperumal, "Engineering Research Methodology : A Computer Science and Engineering and Information and Communication Technologies Perspective. " (First Edition)
2. Justin Zobel,Writing For Computer Science, Springer (Third Edition)
3. K Prathapan,Research Methodology for Scientific Writing ,I.K International Publishing House Pvt.Ltd
4. S.P Satarkar, S.V., 2000. Intellectual Property Rights and Copy right. Ess Publication

	Union Christian College, Aluva **(Autonomous)**

Programme	BSc (Honours) Computer Science					
Course Name	Neural Networks and Deep Learning					
Type of Course	DCE					
Course Code	UC8DCECSC400					
Course Level	400					
Course Summary	Neural Networks and deep learning course covers fundamental concepts and practical skills in neural networks, CNNs, RNNs, GANs, and reinforcement learning using TensorFlow and PyTorch. Participants will gain hands-on experience in image processing, NLP, generative models, and unsupervised learning, fostering the ability to apply deep learning to real-world problems.					
Semester	8	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	1	0	75
Pre-requisites, if any	Programming Knowledge, Basic Understanding of Artificial Intelligence and machine Learning					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand neural networks, activation functions, and backpropagation.	U	2,3
2	Design and implement CNN and RNN, apply transfer learning techniques, and utilize reinforcement learning algorithms for complex tasks.	A, An	1,2,3

3	Understand and apply GANs, including DCGAN and WGAN, as well as clustering and dimensionality reduction techniques.	U,A	1,2,3
4	Design and implement neural networks, CNNs, GANs, reinforcement learning algorithms, clustering algorithms, and dimensionality reduction techniques.	A	2,3
**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Basics of Neural Networks:-Neurons and their mathematical representation.	2	1
	1.2	Activation functions (e.g., sigmoid, ReLU). Feedforward process and the role of weights and biases.	2	1
	1.3	Backpropagation algorithm for training neural networks.	2	1
	1.4	Deep Learning Frameworks:-Introduction to TensorFlow and PyTorch.	2	1
	1.5	Setting up the development environment, Overview of basic operations and syntax.	2	1
2	2.1	Convolution and Pooling Layers:-Understanding convolutional and pooling operations. Stride, padding, and filter design. CNN Architectures:- In-depth study of popular architectures (LeNet, AlexNet, VGG, ResNet). Parameters and design choices.	7	2
	2.2	Transfer Learning:-Leveraging pre-trained models for specific tasks. Fine-tuning models for custom datasets.	6	2
	2.3	Basics of Recurrent Neural Networks:-Concept of sequential data processing. Vanishing gradient problem and solutions.		

		LSTM and GRU:- In-depth study of advanced RNN architectures, Handling long-term dependencies.	6	2
	2.4	Basics of Reinforcement Learning:-Markov Decision Processes (MDPs), Exploration-exploitation trade-off. Q-Learning and DQN:-Core algorithms for reinforcement learning, Deep Q Networks for handling complex state spaces.	6	2
3	3.1	Introduction to GANs:-Generative models and their applications, Understanding adversarial training. GAN.	5	3
	3.2	Architectures:- DCGAN (Deep Convolutional GAN), WGAN (Wasserstein GAN). Exploring variations and improvements. Unsupervised Learning:-Clustering algorithms (e.g., K-Means).Dimensionality reduction techniques (e.g., PCA).	5	3
4	4.1	Practical: 1. Implementing a basic neural network using TensorFlow or PyTorch. 2. Image Classification using CNNs, Generating Synthetic Images with GANs, Implementing RL algorithms on simple environments. 3. Implementing k-mean Clustering Algorithm, Apply PCA for a sample dataset and classify.	30	4
5		(Teacher specific content)		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) • Lecture • Presentations • Demonstration • Discussions

Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 25 Marks 1. Written test 2. Assignments 3. Quiz 4. Viva CCA for Practical: 15 Marks 1. Practical assignments 2. Lab Record 3. Observation of practical skills 4. Viva
	B. Semester End Examination ESE for Theory: 50 Marks (1.5 Hrs) Written Test (50 Marks) Part A: Very Short Answer Questions (Answer all) - (10*1=10 Marks) Part B: Short Answer Questions (4 out of 6 Questions) - (4*5=20 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks) ESE for Practical: 35 Marks 1. Coding and Output - 20 Marks 2. Viva - 10 Marks 3. Record - 5 Marks

REFERENCES

1. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville;[Module1]
2. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron.[Module 1]
3. "Deep Learning for Computer Vision" by Rajalingappaa Shanmugamani;[Module2]
4. "Deep Reinforcement Learning" by Pieter Abbeel and John Schulman.[Module 3]
5. "Generative Deep Learning" by David Foster; [Module4]
6. "Unsupervised Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville.[Module 4]

SUGGESTED READINGS

1. “Deep Learning with Python" by François Chollet.
2. "Reinforcement Learning: An Introduction" by Richard S. Sutton and Andrew G. Barto;

<table>
<tr><td>  </td><td colspan="6">Union Christian College, Aluva

(Autonomous)</td></tr>
<tr><td>Programme</td><td colspan="6">BSc (Honours) Computer Science</td></tr>
<tr><td>Course Name</td><td colspan="6">Pattern Recognition</td></tr>
<tr><td>Type of Course</td><td colspan="6">DCE</td></tr>
<tr><td>Course Code</td><td colspan="6">UC8DCECSC401</td></tr>
<tr><td>Course Level</td><td colspan="6">400</td></tr>
<tr><td>Course Summary</td><td colspan="6">Pattern recognition course provides a comprehensive exploration of fundamental concepts, including Bayesian Decision Theory, linear discriminant functions, and nonparametric techniques. Students will develop practical skills in applying these principles to real-world problems, mastering Bayesian parameter estimation, support vector machines, and stochastic/nonmetric methods for effective pattern recognition.</td></tr>
<tr><td>Semester</td><td>8</td><td colspan="3">Credits</td><td>4</td><td rowspan="2">Total Hours</td></tr>
<tr><td rowspan="2">Course Details</td><td rowspan="2">Learning Approach</td><td>Lecture</td><td>Tutorial</td><td>Practical</td><td>Others</td></tr>
<tr><td>3</td><td>0</td><td>1</td><td>0</td><td>75</td></tr>
<tr><td>Pre-requisites, if any</td><td colspan="6">Must know programming, Basic Mathematics, fundamental knowledge of machine learning</td></tr>
</table>

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand Pattern Recognition Fundamentals and the principles of Bayesian Decision Theory.	U	2,3
2	Analyse Bayesian Parameter Estimation and Nonparametric techniques.	An	1,2,3

3	Implement and analyze linear discriminant functions, support vector machines, multilayer neural networks, and various stochastic and nonmetric methods for classification and inference.	A,An	1,2,3
4	Implement Pattern Recognition techniques for solving Real World Problem.	C	2,3
**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Pattern recognition systems: – The design cycle, Learning and Adaptation.	2	1
	1.2	Bayesian Decision theory:- two-category classification ,Minimum error rate classification.	2	1
	1.3	Classifiers, Discriminant functions and Decision Surfaces , The normal density.	2	1
	1.4	Discriminant Functions for the Normal Density, Error probabilities and Integrals, Discrete Features, Missing and Noisy Features.	3	1
2	2.1	Bayesian Parameter estimation and Nonparametric Techniques:- Maximum likelihood estimation, Bayesian estimation,	3	2
	2.2	Bayesian Parameter Estimation: Gaussian case and general theory.	3	2
	2.3	Nonparametric techniques: – Density estimation, Parzen Windows,	3	2
	2.5	k_n-Nearest Neighbour Estimation, Nearest-Neighbour Rule, Fuzzy Classification.	4	2
	3.1	Linear Discriminant Functions: - Linear discriminant functions and decision surfaces.	2	3

3	3.2	Generalized linear discriminant functions, Two-category linearly separable case. Non-separable behavior, Linear programming algorithms, Support vector machines.	5	3
	3.3	Multilayer neural networks :– Feed forward operation and classification. Back propagation algorithm, Error surfaces, Back propagation as feature mapping.	7	3
	3.4	Stochastic methods and Nonmetric methods: – Stochastic search, Boltzmann learning.	4	3
	3.5	Nonmetric methods: - Decision trees ,CART, Other tree methods(ID3,C4.5) - Grammatical methods, Grammatical inference.	5	3
4	4.1	Practical Implement following Pattern Recognition Methods 1. Bayesian Decision Theory 2. Bayesian Parameter Estimation 3. Nearest Neighbour Rule 4. Fuzzy Classification 5. Support Vector Machine 6. Multilayer Neural Networks 7. Boltzmann Learning 8. Decision Trees 9. CART 10. ID3,C4.5	30	4
5		(Teacher specific content)		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) • Lecture • Demonstration • Presentation • discussions
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 25 Marks 1. Written test

	2. Assignments 3. Quiz 4. Viva CCA for Practical: 15 Marks 1. Practical assignments 2. Lab Record 3. Observation of practical skills 4. Viva
	B. Semester End Examination ESE for Theory: 50 Marks (1.5 Hrs) Written Test (50 Marks) Part A: Very Short Answer Questions (Answer all) - (10*1=10 Marks) Part B: Short Answer Questions (4 out of 6 Questions) - (4*5=20 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks) ESE for Practical: 35 Marks (1.5 Hrs) 1. Coding and Output - 20 Marks 2. Viva - 10 Marks 3. Record - 5 Mark

REFERENCES

1. R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, Second edition, John Wiley, 2006

SUGGESTED READINGS

1. S Thodoridis,K Koutroumbas, Pattern Recognition,Fourth Edition, ELSEVIER Publication.

2. Gonzalez R.C. & Thomson M.G., Syntactic Pattern Recognition - An Introduction, Addison Wesley.

3. Fu K.S., Syntactic Pattern Recognition And Applications, Prentice Hall

4. RajanShinghal, Pattern Recognition: Techniques and Applications, Oxford University Press, 2008.

<table>
<tr><td>  </td><td colspan="6">Union Christian College, Aluva

(Autonomous)</td></tr>
<tr><td>Programme</td><td colspan="6">BSc (Honours) Computer Science</td></tr>
<tr><td>Course Name</td><td colspan="6">Generative AI</td></tr>
<tr><td>Type of Course</td><td colspan="6">DCE</td></tr>
<tr><td>Course Code</td><td colspan="6">UC8DCECSC402</td></tr>
<tr><td>Course Level</td><td colspan="6">400</td></tr>
<tr><td>Course Summary</td><td colspan="6">This course introduces students to the dynamic field of Generative Artificial Intelligence (Generative AI), covering foundational concepts, model architectures, and practical applications. The curriculum is structured into four modules, each addressing key aspects of Generative AI.</td></tr>
<tr><td>Semester</td><td>8</td><td colspan="3">Credits</td><td>4</td><td rowspan="2">Total Hours</td></tr>
<tr><td rowspan="2">Course Details</td><td rowspan="2">Learning Approach</td><td>Lecture</td><td>Tutorial</td><td>Practical</td><td>Others</td></tr>
<tr><td>3</td><td>0</td><td>1</td><td></td><td>75</td></tr>
<tr><td>Pre-requisites, if any</td><td colspan="6">Basic knowledge of machine learning.</td></tr>
</table>

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe generative models' ethical usage, including bias and fairness.	U	1
2	Apply GANs and VAEs: Implementing architectures, training models, and exploring applications.	A	2
3	Explore recent advances in generative AI:	An	2
5	Apply generative models (GANs, VAEs) using Python/TensorFlow.	A	2

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Overview of Generative Models, Introduction to generative models and their role in artificial intelligence. Understanding the difference between generative and discriminative models	4	1
	1.2	Types of Generative Models, Probabilistic models: Gaussian Mixture Models (GMM), Hidden Markov Models (HMM).Variational Autoencoders (VAEs) and their applications.	3	1
	1.3	Introduction to Generative Adversarial Networks (GANs). Applications, Ethical Considerations and Privacy concerns related to generative models. Understanding bias and fairness in generative AI. Responsible use of generative models in various domains.	3	1
2	2.1	Introduction to GANs Core concepts of GANs: generator, discriminator, adversarial training. Historical development and key milestones in GAN research.	2	2
	2.2	Architectures and Variants of GANs, DCGAN, WGAN, and other variants. Conditional GANs and their applications.	3	2
	2.3	Training and Stability Issues: Techniques for stable GAN training. Dealing with mode collapse and other common issues.	3	
	2.4	Applications of GANs:Image-to-image translation using GANs. Super-resolution and style transfer.	3	2
	2.5	Introduction to VAEs:Understanding the encoder-decoder architecture. The role of variational inference in VAEs.	3	2
	2.6	Training VAEs:The reparameterization trick and backpropagation. Comparing VAEs to traditional autoencoders.	3	2
	2.7	Applications of VAEs:Image generation and reconstruction.Latent space exploration and manipulation.VAEs in semi-supervised learning.	3	2
3	3.1	Advanced Topics and Future Directions:Recent Advances in Generative AI Attention mechanisms in generative models. Self-supervised learning and its application in generative tasks.	4	3

	3.2	Generative AI in Industry, Use cases and applications in various industries. Challenges and opportunities in deploying generative models.	4	3
	3.3	Research Trends and Future Directions, Cutting-edge research in generative AI. Potential breakthroughs and challenges on the horizon.	4	3
	3.4	Final Project and Capstone, Students work on a generative AI project of their choice. Presentation and discussion of project outcomes.	3	3
4		1: Introduction to Python and TensorFlow: Setting up TensorFlow environment, Basic operations in TensorFlow. 2: Fundamentals of Generative Models: Implementing basic probabilistic models (Gaussian Mixture Models, Hidden Markov Models) using Python. Hands-on exercise on Variational Auto encoders (VAEs). 3: Introduction to Generative Adversarial Networks (GANs): Building a simple GAN model for generating synthetic data. Understanding the generator and discriminator networks. Training a GAN on a small dataset. 4: Advanced GANs and Applications: Implementing conditional GANs for specific tasks. Exploring image-to-image translation using Pix2Pix or CycleGAN. Applying GANs in medical imaging or other domains. 5: Variational Auto encoders (VAEs) in Depth: Building a VAE for image generation. Understanding the concept of latent space. Exploring applications in semi-supervised learning. 6: Attention Mechanisms and Self-Supervised Learning: Implementing attention mechanisms in generative models. Hands-on with self-supervised learning techniques.	30	4
5		Teacher specific content		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction) • ICT Enabled lecture • Interactive sessions • Class discussions • Lab exercise
Assessment Types	MODE OF ASSESSMENT A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 25 Marks 1. Written test 2. Assignments 3. Quiz 4. Viva CCA for Practical: 15 Marks 1. Practical assignments 2. Lab Record 3. Observation of practical skills 4. Viva
	B. Semester End Examination ESE for Theory: 50 Marks (1.5 Hrs) Written Test (50 Marks) Part A: Very Short Answer Questions (Answer all) - (10*1=10 Marks) Part B: Short Answer Questions (4 out of 6 Questions) - (4*5=20 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks) ESE for Practical: 35 Marks (1.5 Hrs) 1. Coding and Output - 20 Marks 2. Viva - 10 Marks 3. Record - 5 Mark

REFERENCES

1. Ian Goodfellow, Yoshua Bengio, and Aaron Courville(2016) . Deep Learning" . MIT Press

2. David Foster(2019)."Generative Deep Learning". O'Reilly Media

3. "Hands-On Generative Adversarial Networks with Keras" by Rajalingappaa Shanmugamani

SUGGESTED READING:

1. Generative Adversial Networks(GANs):"GANs in Action" by Jakub Langr and Vladimir Bok
2. "Generative Adversarial Networks: Building Intelligent Applications" by Kailash Ahirwar

Variational Autoencoders(VAEs):

3. "Autoencoder and Variational Autoencoder (VAE) Tutorial" by Ian Goodfellow (Chapter 14 of the "Deep Learning" textbook mentioned above).
4. "Understanding Variational Autoencoders (VAEs)" by Carl Doersch.

Ethics In AI

5. "Artificial Intelligence: A Guide for Thinking Humans" by Melanie Mitchell
6. "AI and Machine Learning for Everyone" by Jeff Heaton

Advanced Topics:

7. "Attention Is All You Need" by Ashish Vaswani et al. (for attention mechanisms).
8. "Self-Supervised Learning" by Philip Bachman et al.

Generative AI in industry:

9. "AI Superpowers: China, Silicon Valley, and the New World Order" by Kai-Fu Lee
10. Industry reports and case studies from organizations like OpenAI, Google AI, and Microsoft Research.

Research Trends:

11. Read papers from top conferences like NeurIPS, ICML, and CVPR for the latest research.

	Union Christian College, Aluva **(Autonomous)**					
Programme	BSc (Honours) Computer Science					
Course Name	PROJECT/Dissertation					
Type of Course	PRJ					
Course Code	UC8PRJCSC400					
Course Level	400					
Course Summary	Students are required to take up research projects under the guidance of a faculty member. The students are required to complete the Research Project in the eighth semester.					
Semester		Credits			12	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Design research problem and align research objective	A	1,2,3,8
2	Demonstrate skills in literature review, data collection, analysis, interpretation, and reporting.	A	1,2,3
3	Appraise research design, methods and experiments used.	A	1,2,3
4	Interpret the findings in relation to research objective	A	1,2,3
5	Communicates clearly and effectively, both verbally, visually and in writing	A	1,2,3,4
**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*			

COURSE CONTENT

Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	The students who want to graduate as BSc (Honours with Research) are required to complete the Research Project in the eighth semester. Research Project must be done under the guidance of an eligible faculty.		

Teaching and Learning Approach	Classroom Procedure (Mode of transaction)
Assessment Types	MODE OF ASSESSMENT **A.** Continuous Comprehensive Assessment (CCA) - (60 marks) i. Review 1: Problem statement (CO1)– (10 marks) ii. Review 2: Literature Review, Gap Analysis, Research Objectives (CO2) -(20 marks) iii. Review 3 (CO3): Methodology and Design- (20 marks) iv. Review 4 (CO4 & CO5): (20 marks) a) Experiments and Results b) Presentation and Viva Voce
	B. Semester End examination (140 marks) i. Problem statement (CO1): 10 marks ii. Literature Review, Gap Analysis, Research Objectives – (CO2): 30 marks iii. Methodology and Design (CO3): 30 marks iv. Experiments and Results (CO4): 30 marks v. Thesis Presentation and Viva Voce (CO5): 25 marks vi. Publication (CO5):15 marks