THE MAHATMA GANDHI UNIVERSITY

Bachelor in Computer Applications (Honours)

SYLLABUS

MGU-BCA (Honours)

(2024 Admission Onwards)

Faculty: Technology and Applied Sciences

Expert Committee: Computer Application (UG)

Programme: Bachelor in Computer Applications (Honours)

Mahatma Gandhi University
Priyadarshini Hills
Kottayam – 686560, Kerala, India

Contents

External Experts	
1	**Prof. (Dr.) Bindu V R**, Professor and Head, School of Computer Sciences, Mahatma Gandhi University, Kottayam
2	**Prof. (Dr.) Sabu M K**, Professor, Department of Computer Applications, Cochin University of Science and Technology, Kochi
Members of the Expert Committee in Computer Application (UG)	
1	**Dr. Rajimol A,** Associate Professor, Department of Computer Applications, Marian College Kuttikkanam (Autonomous), Kuttikkanam (Chairperson UG Board)
2	**Dr. Ajitha R S,** Assistant Professor, Department of Computer Applications, NSS College, Rajakumari
3	**Mr. Bineesh Jose,** Assistant Professor, Department of Computer Applications, Pavanatma College, Murickassery
4	**Dr. Reji K Kollinal,** Assistant Professor, Department of Computer Applications, BPC College, Piravom
5	**Ms. Simi M,** Associate Professor, Department of Computer Applications, SAS SNDP Yogam College, Konni
6	**Ms. Ambili M S,** Assistant Professor, Department of Computer Science, Sree Sankara Vidyapeetom College, Valayanchirangara
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)

First Semester								
Course Code	Title of the Course	Type of the Course .	Credit	Hours / week	Hour Distribution /week			
					L	T	P	O
MG1DSCBCA100	Fundamentals of Programming using C	DSC	4	4	4	0	0	0
MG1DSCBCA101	Digital Fundamentals	DSC	4	4	4	0	0	0
MG1DSCBCA102	Software lab in C	DSC	2	4	0	0	4	0
MG1DSCBCA103	Discrete Mathematics	DSC	4	4	4	0	0	0
MG1MDCBCA100	Cyber Laws and Online Safety	MDC	3	3	3	0	0	0
	AEC- ENGLISH	AEC 1	3	3	3	0	0	0
	AEC-OL	AEC 2	3	3	3	0	0	0

Mahatma Gandhi University
Kottayam

Programme	**BCA (Honours)**					
Course Name	**Fundamentals of Programming Using C**					
Type of Course	**DSC**					
Course Code	MG1DSCBCA100					
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	
		4	0	0	0	60
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Demonstrate basic programming concepts.	U	1
2	Understand C Programming Basics such as Datatypes and Variables, Different types of operators.	U	2
3	Devise C programs using the concept of Decision statements and loop control statements.	An	2
4	Apply logic to use arrays and functions in C Programming Language.	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 transactions (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Problem Solving Life Cycle – Understanding the Problem Statement, Analysing the problem, Planning Program design using Hierarchy charts, Top-down approach, Bottom-up approach. Understanding basic Problem-Solving Tools: Algorithms: Definition & its attributes, Flowchart: Definition & its attributes, symbols, Statements: Input-Output, Decision-Making &Looping, Module representation	6	1
	1.2	**Introduction to Programming:** Computer program. Classification of computer languages: machine, assembly and high-level languages, Language translators (Assembler, Compiler, Interpreter), Linker, Testing and debugging,	4	1
	1.3	Types of errors- Syntax errors, Logical errors and Runtime errors.	2	1
2	2.1	C Character Set, Delimiters, Types of Tokens, C Keywords, Identifiers, Constants, Variables, Rules for defining variables,	2	2
	2.2	Data types, C data types, Declaring and initialization of variables, Type modifiers, Type conversion, Operators and Expressions-	5	2
	2.3	Properties of operators, Priority of operators, Comma and conditional operator, Arithmetic operators, Relational operators,	3	2
	2.4	Assignment operators and expressions, Logical Operators, Bitwise operators.	4	2
3	3.1	Input and Output in C – Formatted functions, unformatted functions, commonly used library functions,	5	3
	3.2	Decision Statements If, if-else, nested if-else, if-else-if ladder, break, continue, goto, switch, nested switch, switch case and nested if.	6	3
	3.3	Loop control- for loops, nested for loops, while loops, do while loop.	6	3
4	4.1	Array, initialization, array terminology, characteristics of an array, one dimensional array and operations,	5	4

	4.2	Two dimensional arrays and operations. Strings and standard functions, Introduction to pointers. Basics of a function, function definition, return statement,	6	4
	4.3	Types of functions, call by value and reference. Recursion - Rules for recursive function, Advantages and disadvantages of recursion. Storage class, Structure and union, Features of structures, Declaration and initialization of structures, typedef, enumerated data types, Union.	6	4

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 3. Quiz
	B. Semester End Examination **ESE for Theory: Written Test (70 Marks, 2 Hrs)** Part A: Very Short Answer Questions (Answer all) - (10*2=20 Marks) Part B: Short Answer Questions (5 out of 7 Questions) - (5*6=30 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks)

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.

	Mahatma Gandhi University **Kottayam**

Programme	BCA (Honours)					
Course Name	**Digital Fundamentals**					
Type of Course	DSC					
Course Code	MG1DSCBCA101					
Course Level	100					
Course Summary	This course covers the fundamentals of digital electronics, including number systems, Boolean algebra, logic gates, combinational logic circuits, and sequential logic circuits. Students gain a comprehensive understanding of digital logic design principles and their applications Through theoretical concepts and practical examples.					
Semester	1	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	Demonstrate comprehension of number systems.	U,A	2
2	Analyse working of logic gates, solve expressions using laws of Boolean algebra.	An,A	1,2
3	Illustrate the combinational logic circuits using multiplexers, demultiplexers and other circuits	U,An	1,3
4	Design sequential circuits using flip flops and registers	An,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 transactions (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Number Systems, Introduction – Base or radix, Non-positional and Positional number system, Popular number systems (Decimal, Binary, Octal and Hexadecimal), Conversion-From one number system to another, Concept of binary addition and subtraction, 1's Complement, 2's complement.	8	1
	1.2	BCD numbers- concept and 8421 additions	2	1
2	2.1	Logic gates- AND, OR, NOT, NAND, NOR, XOR and XNOR. Truth tables and graphical representation.	5	2
	2.2	Basic laws of Boolean Algebra, Simplification of Expressions, DeMorgan's theorems,	5	2
	2.3	Dual expressions, Canonical expressions. Minterms and Maxterms, SOP and POS expressions	4	
	2.4	Simplification of expressions using K-MAP (up to 4 variables)	5	2
	2.5	Representation of simplified expressions using NAND/NOR Gates, Don't care conditions	4	2
3	3.1	Combinational Logic Circuits: Adders-Half adder, Full adder	7	3
	3.2	Encoders, Decoders (Diagram and working principle)	5	3
	3.3	Multiplexers, Demultiplexers (Diagram and working principle)	5	3
4	4.1	Sequential Logic Circuits: Flip flops- RS, JK, T, D, Triggering of flip flops, Concept of Registers	10	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: 30 Marks 1. Written tests 2. Quiz 3. Assignments
	B. Semester End Examination **ESE for Theory: 70 Marks; Written Test (2 Hrs)** Part A: Very Short Answer Questions (Answer all) - (10*2=20 Marks) Part B: Short Answer Questions (5 out of 7 Questions) - (5*6=30 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*10=20 Marks)

REFERENCES

1. M Morris Mano. Digital Logic and Computer Design (4th Edition). Prentice Hall.
2. A. Anand Kumar (2018). Fundamentals of Digital Circuits (4th Edition). PHI Learning Pvt. Ltd.

SUGGESTED READINGS

1. Thomas C Bartee- Digital computer Fundamentals, Sixth Edition, TATA McGraw Hill Edition
2. Thomas L Floyd- Digital Fundamentals, Ninth edition, PEARSON Prentice Hall.
3. Malvino & Leach- Digital Principles and Applications, Sixth Edition, Tata McGraw Hill, 2006

Mahatma Gandhi University
Kottayam

Programme	**BCA (Honours)**					
Course Name	**Software Lab in C**					
Type of Course	**DSC**					
Course Code	MG1DSCBCA102					
Course Level	**100**					
Course Summary	This course covers problem solving using C Programming, Practical Implementation of Problems using different types of C statements such as control flow structures, loop control structures, arrays, and functions. Students will gain proficiency in solving problems using the C programming language.					
Semester	First	Credits			2	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		0	0	4	0	60
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Develop programs to solve various problems using different types of C statements such as control flow structures, loop control structures, arrays, and functions.	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 Lab Sessions (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Programs to understand the use of Datatypes and variables.	3	1
	1.2	Programs to use different Operators and Type Conversions	5	1
2	2.1	Programs to Apply Input and Output in C, understand Library functions	7	1
	2.2	Program to implement Control structures in C	10	1
	2.3	Programs to Implement Loop Control Structures in C	10	1
3	3.1	Programs to Implement Arrays: One-dimensional and Two-dimensional Arrays	10	1
4	4.1	Program to implement problems using Functions, Recursion and different parameter Passing Methods.	15	1

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** • Practical Lab Sessions • Discussions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **CCA for Practical: 30 Marks** 1. Written tests 2. Lab Assessment 3. Viva 4. Record
	B. Semester End Examination **ESE for Practical: 70 Marks (2.5 Hrs)**

	Lab Examination Test: 70 Marks 1. First Program: 20 Marks 2. Second Program: 30 Marks 3. Viva Voce: 10 Marks 4. Record: 10 Marks

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.

	Mahatma Gandhi University **Kottayam**
Programme	**BCA (Honours)**
Course Name	**Discrete Mathematics**
Type of Course	DSC
Course Code	MG1DSCBCA103
Course Level	**100**
Course Summary	This course introduces basic concepts of Set Theory, Logic, Relations, functions and Matrices. The Basic ideas of Sets and Propositional Logic are further expanded. Mathematical Significance of Relations and functions are explained. Various mathematical manipulations involved in Matrices are properly illustrated. Students acquire skills in applying concepts in Propositional Logic and Relations in different branches of computer science.

Semester	1	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
Pre-requisites, if any	Nil					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand Concepts of Set Theory	U	1
2	Evaluate problems on Set theory.	E	2
3	Understand Propositional Logic.	U	2
4	Identify and Apply Propositional Logic.	A	3
5	Evaluate problems using Truth tables and Logical operators.	E	3
6	Understand And Analyse different types and properties of Relations, functions and Equivalence Relations.	An	2
7	Understand concepts of Matrix and Matrix Operators.	U	2

8	Evaluate the Inverse of a Matrix and solution of a system of Non homogeneous Equations	E	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 transactions (Units)

Module	Units	Course description	Hrs	CO No.
1	Logic and Proofs			
	1.1	Propositional Logic (1.1 of Text 1)	5	3
	1.2	Propositional Equivalences (1.2 of Text 1)	5	4
	1.3	Rules of Inferences for Propositional Logic (Relevant portions of 1.5 of Text 1)	5	5
2	Set Theory			
	2.1	Sets (2. 1 of Text 1)	4	1
	2.2	Set operations. (2. 2 of Text 1)	4	2
	2.3	Functions (2. 3 of Text 1)	4	6
3	Relations			
	3. 1	Relations and their Properties (7. 1 of Text 1)	6	6
	3. 2	Representing relations (7.3 of Text 1)	6	6
	3. 3	Equivalence relations (7.5 of Text 1)	5	6
4	Matrices			
	4. 1	Definition and different types of Matrices, Symmetric and Skew Symmetric Matrices (2.5 of Text 2)	3	7
	4. 2	Matrix operations, Determinant, Matrix inverse (2.6 , Relevant portions of 2.7 of Text 2)	8	7 & 8
	4.3	Solution of a system of Non homogeneous equations by Matrix method and Cramer's rule (Relevant portions of 2.7, 2.10 of Text 2)	5	8

<table>
<tr><td>Teaching and Learning Approach</td><td colspan="5">Classroom Procedure (Mode of transaction)
Brainstorming lectures, Explicit teaching, Active Cooperative learning</td></tr>
<tr><td rowspan="11">Assessment Types</td><td colspan="5">MODE OF ASSESSMENT</td></tr>
<tr><td>A</td><td colspan="4">Continuous Comprehensive Assessment (CCA) (30 marks)</td></tr>
<tr><td></td><td colspan="4">1. Quiz / MCQ
2. Assignment
3. Tests
4. Tutorial</td></tr>
<tr><td rowspan="7">B</td><td colspan="4">End Semester Evaluation (ESE) 70 marks</td></tr>
<tr><td colspan="4">Question Pattern
[Maximum Time 2 Hours, Maximum Marks 70]</td></tr>
<tr><td rowspan="2">Module</td><td>Part A</td><td>Part B</td><td>Part C</td><td rowspan="2">Total</td></tr>
<tr><td>2 Marks</td><td>6 Marks</td><td>10 Marks</td></tr>
<tr><td>I</td><td>2</td><td>2</td><td>2</td><td>6</td></tr>
<tr><td>II</td><td>2</td><td>2</td><td>1</td><td>5</td></tr>
<tr><td>III</td><td>2</td><td>2</td><td>1</td><td>5</td></tr>
<tr><td>IV</td><td>2</td><td>2</td><td>2</td><td>6</td></tr>
<tr><td></td><td>Total no of questions</td><td>8</td><td>8</td><td>6</td><td>22</td></tr>
<tr><td></td><td>Number of questions to be answered</td><td>5</td><td>5</td><td>3</td><td>13</td></tr>
<tr><td></td><td>Total Marks</td><td>10</td><td>30</td><td>30</td><td>70</td></tr>
</table>

REFERENCES

1. Kenneth. H. Rosen - Discrete Mathematics and its applications, 6th edition
2. B.S Grewal - Higher Engineering Mathematics, 40th Edition, Khanna Publications

SUGGESTED READINGS

1. Erwin Kreyszig - Advanced Engineering Mathematics, Wiley, India.
2. S.S Sastry - Engineering Mathematics Volume 1, 4th edition PHI.

	Mahatma Gandhi University **Kottayam**
Programme	**BCA (Honours)**
Course Name	**Cyber Laws and Security**
Type of Course	MDC
Course Code	MG1MDCBCA100
Course Level	100
Course Summary	This comprehensive course on Cyber Laws and Security is designed to provide participants with a thorough understanding of cyber laws, including the IT Act, data protection, and regulations related to cybercrimes, cyberbullying, and harassment, along with internet security practices. It also provides a foundational understanding of cryptography, cyber forensics, and ethical hacking principles to enhance knowledge in securing digital information and systems.

Semester	1	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 cyber laws, IT Act, data protection and various cybercrimes.	U	1
2	Analyze and apply security measures during online transactions and financial activities.	An	1
3	Illustrate basic cryptographic techniques and importance of cyber forensic.	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	Cyber Laws, IT Act and Cyber Crimes			
	1.1	Introduction to Cyber laws: Definition and Scope, Key legal concepts in cyberspace.	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 Cyberbullying.	4	1
	1.6	Harassment Laws and social media, Reporting and preventing cyberbullying.	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).	3	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	Introduction to Cryptography and Cyber Forensics			
	3.1	Security Concepts: Introduction, The need for security, Principles of security, Types of Security attacks	3	3

	3.2	Cryptography Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques,	4	3
	3.3	Encryption and decryption, symmetric and asymmetric key cryptography	3	3
	3.4	Introduction to Cyber forensics - Definition and importance of cyber forensics, Types of cybercrime -hacking, phishing, identity theft, etc., The role of forensics in investigating cybercrime. Introduction to Ethical Hacking.	4	3

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: 25 Marks** 1. Written test 2. Assignments 3. MCQ
	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*2=20 Marks) Part B: Short Answer Questions (6 out of 8 Questions) - (6*5=30 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 Practice" 3rd ed., Pearson Pub., 2017.

5. William Stallings, Cryptography and Network Security Principles and Practice, 4/e,Pearson Ed.

6. Cyber Forensics - Concepts and Approaches, Ravi Kumar & B Jain,2006, icfai university press

SUGGESTED READINGS:

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

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Bachelor in Computer Applications (Honours)

SYLLABUS

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Faculty: Technology and Applied Sciences

Expert Committee: Computer Application (UG)

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Second Semester							
Sl. No.	**Course Code**	**Course Type**	**Course Title**	**Hours per week**			**Credit**
				L	**T**	**P**	
1	MG2CCRBCA100	CC	Mathematics Foundations to Computer Science	4	0	0	4
2	MG2CCRBCA101	CC	Data Structures	4	0	2	5
3	MG2CCRBCA102	CC	Operating Systems	4	0	0	4
4	MG2SECBCA100	SEC	Web Technologies	1	0	2	2
5	MG2VACBCA100	VAC	Indian Constitution: Legal and Ethical Perspectives for IT	2	0	0	2
6		AEC	AEC -English	3	0	0	3
7		AEC-OL	AEC-Other Language	3	0	0	3
TOTAL				21	0	4	
				25			**23**

	Mahatma Gandhi University **Kottayam**
Programme	**BCA (Honours)**
Course Name	**Mathematics Foundation to Computer Science**
Type of Course	**Core Course**
Course Code	MG2CCRBCA100
Course Level	NA
Course Summary	This course will introduce graph theory and mathematical techniques that form the foundation of advanced computational methods focusing on numerical methods and optimization. It enables students to comprehend and apply various problem-solving strategies to address both theoretical and practical challenges in computer science.

Semester	2	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
Pre-requisites, if any	NIL					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Apply Concepts of Graph Theory to solve real-life problems.	A	1
2	Apply numerical methods to approximate solutions to mathematical problems.	A	1,2
3	Understand the concepts of Linear programming and Operations Research, and Apply them using graphical and simplex methods.	A	1,2
4	Formulate and solve transportation problems	C	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 transactions (Units)

Module	Units	Course description	Hrs	CO No.
1		**Elementary Graph Theory**		
	1.1	Basic terminologies of graphs, connected and disconnected graphs, subgraphs, paths and cycles, complete graphs, digraphs, weighted graphs, Planar graphs. (Section 3.1 of REF. 1)	4	1
	1.2	Basic concepts of Euler graphs. Characterisation of Euler graphs. (Section 3.1 of REF. 1)	4	1
	1.3	Basic concepts of Trees and Spanning trees. Properties of trees. (Section 3.2 of REF. 1)	5	1
2		**Numerical Methods**		
	2.1	Roots of Nonlinear equations: Bisection method and Newton-Raphson methods. (Section 6.1, 6.6, 6,8 of REF. 2) *Only formula and problem-solving for all the topics mentioned above.*	6	2
	2.2	Numerical Interpolation: Newton's Forward and Backward Interpolation Formula. (Section 9.1,9.7 of REF. 2) *Only formula and problem-solving for all the topics mentioned above.*	5	2
	2.3	Numerical Integration: Trapezoidal rule and Simpson's 1/3 rule. (Section 12.1- 12.4 of REF. 2) *Only formula and problem-solving for all the topics mentioned above.*	6	2
3		**Linear Programming Problem**		
	3.1	Linear programming: Introduction, Formulation of LPP. (REF. 3)	5	3
	3.2	Graphical method for solving LPP with two variables, Special cases in graphical methods.	5	3

		(REF. 3)		
	3.3	Simplex method, Artificial variable techniques, Big M method. (REF. 3)	6	3
4	**Transportation**			
	4.1	Transportation problem: Definition, Linear form, North-west corner method, Least cost method, Vogel's approximation method for finding a feasible solution. (REF. 3)	4	4
	4.2	MODI method for finding the optimum solution. Degeneracy (REF. 3)	6	4
	4.3	Unbalanced Transportation Problem, Maximisation in transportation problem. (REF. 3)	4	4

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** • Brainstorming lectures • Explicit teaching • Active Cooperative learning
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **CCA for Theory: 30 Marks** • Quiz / MCQ • Assignment • Tests
	B. Semester End Examination **ESE for Theory: Written Test (70 Marks, 2 Hrs)** Part A: Answer any 5 questions out of 8. Each question carries 2 marks. (5 x 2 = 10 marks) Part B: Answer any 5 questions out of 8. Each question carries 6 marks. (5 x 6 = 30 marks). Part C: Answer any 2 questions out of 4. Each question carries 15 marks. (2 x 15 = 30 marks)

REFERENCES

1. Robert J McEliece, Robert B Ash, Carol Ash - Introduction to Discrete Mathematics, McGraw Hill.
2. E Balagurusamy - Numerical Methods, Tata McGraw Hill.
3. V K Kapoor - Operations Research- Concepts, Problems & Solutions, Sultan Chand & Sons

SUGGESTED READINGS

1. Narsingh Deo - Graph Theory with applications to Engineering and Computer Science.
2. P Kandasamy, K Thilagavathy, K Gunavathi - Numerical Methods.
3. Belly E Gillet - Introduction to Operations Research (A Computer Oriented Arithmetic Approach), Tata Mc Graw Hill.

Mahatma Gandhi University

Kottayam

Programme	**BCA (Honours)**					
Course Name	**Data Structures**					
Type of Course	**Core Course**					
Course Code	**MG2CCRBCA101**					
Course Level	NA					
Course Summary	This course module offers a comprehensive introduction to data structures and its applications. It covers foundational topics such as algorithms, arrays, stacks, queues, recursion, and linked lists. It also covers advanced concepts like hashing, graphs, and tree structures, including AVL trees.					
Semester	2	Credits			5	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	1	0	90
Pre-requisites, if any	1. **Programming Fundamentals:** Understanding the basic syntax and semantics of the C programming language. 2. **Problem-Solving Skills:** Ability to break down a problem into smaller steps, devise a step-by-step solution and be familiar with simple algorithms.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand the fundamental concepts of Data Structures, the Representation of single and two-dimensional arrays and the implementation of various operations on them	An	1
2	Analyse the representation of stacks and queues using arrays, operations on them and application of these data structures in problem-solving.	An	1,2
3	Demonstrate the ability to implement and manipulate various types of linked lists (singly, doubly, and circular)	An	1,2
4	Illustrate the basic concepts of Graphs and Trees and the operations on Binary search trees.	An	1,2

5	Implement Data Structures using C programming 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 transactions (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction and Overview: Definition, Classification and Operations of Data Structures. Algorithms: Complexity, Time-Space Trade off.	2	1
	1.2	Arrays: Definition and Classification of Arrays, Representation of Linear Arrays in Memory, Operations on Linear Arrays: Traversing, Inserting, Deleting, Searching, Sorting and Merging.	4	1
	1.3	Searching: Linear Search and Binary Search, Comparison of Methods.	3	1
	1.4	Sorting: Bubble Sort, Selection Sort, and Insertion Sort.	4	1
	1.5	Two-Dimensional Arrays, Representation of Two-Dimensional Arrays in Memory, Matrices	2	1
2	2.1	Stacks: Definition, Representation of Stacks using Arrays, Operations on Stacks using Arrays	3	2
	2.2	Application of Stacks: Arithmetic Expressions, Polish Notation, Conversion of Infix Expression to Postfix Expression, Evaluation of Postfix Expression.	5	2
	2.3	Queues: Definition, Representation of Queues using arrays, Types of Queue: Simple Queue, Circular Queue, Double-Ended Queue, Priority Queue,	4	2
	2.4	Operations on Simple Queues and Circular Queues using Array, Applications of Queues.	5	2
3	3.1	Linked Lists: Definition, Comparison with Arrays, Representation, Types of Linked lists	3	3
	3.2	Traversing, Inserting, Deleting and Searching in Singly Linked List. Doubly Linked List and Circular Linked List. Applications of Linked Lists.	7	3
	3.3	Introduction to Hashing, Hash Tables	2	3
	3.4	Recursion: Definition, Runtime Stack, Applications of Recursion: Factorial of Number, Fibonacci Series	5	3
4	4.1	Graphs: Definition, Terminology.	2	4

	4.2	Trees: Definition, Terminology, Binary Trees, Traversal of Binary Tree, Binary Search Tree, Inserting and Searching in Binary Search Tree	5	4
	4.3	Height Balanced Trees: AVL Trees- Introduction	4	4
5	5.1	(Practical Session) Lab Programs: 1. Write a program for insertion and deletion operations in an array. 2. Write a program to search for an element in an array using Linear Search and Binary Search. 3. Write a program to sort an array using Bubble Sort, Selection Sort and Insertion Sort. 4. Write a program to merge two arrays. 5. Write a program to add and subtract two matrices. 6. Write a program to multiply two matrices. 7. Write a program to insert an element into a Singly Linked List: (a) At the beginning (b) At the end (c) At a specified position 8. Write a program to delete an element from a Singly Linked List: (a) At the beginning (b) At the end (c) A specified element 9. Write a program to perform the following operations in a Doubly Linked List: (a) Create (b) Search for an element 10. Write a program to perform the following operations in a Circular Linked List: (a) Create (b) Search an element 11. Write a program to implement stack operations using an array. 12. Write a program to evaluate a postfix expression using a stack. 13. Write a program to perform the following using recursion: (a) Find the factorial of a number (b)Generate Fibonacci Series 14. Write a program to implement simple queue operations using an array. 15. Write a program to implement circular queue operations using an array.	30	5

		16. Write a program to perform the following operations on a binary search tree. (a) Preorder Traversal (b) Inorder Traversal (c) Postorder Traversal 17. Write a program to perform an insertion operation in a binary search tree.		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** • ICT enabled Lectures • Interactive sessions • Class discussions
Assessment Types	**MODE OF ASSESSMENT** **B. Continuous Comprehensive Assessment (CCA)** **CCA for Theory: 30 Marks** • Written tests • Quiz • Assignments **CCA for Practical: 15 Marks** • Practical assignments • Lab Record • Observation of practical skills • Viva
	C. Semester End Examination **ESE for Theory: Written Test (70 Marks, 2 Hrs)** Part A: Very Short Answer Questions (Answer all) - (5*2=10 Marks) Part B: Short answer Questions (5 out of 7 Questions) - (5*6=30 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*15=30 Marks) **ESE for Practical: 35 Marks (1.5 Hrs)** • Logic - 10 Marks • Successful Compilation - 5 Marks • Output - 5 Marks • Viva - 10 Marks • Record - 5 Mark

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.

Mahatma Gandhi University
Kottayam

Programme	**BCA (Honours)**
Course Name	**Operating Systems**
Type of Course	**Core Course**
Course Code	**MG2CCRBCA102**
Course Level	NA
Course Summary	This course provides a comprehensive understanding of operating systems (OS), focusing on their design, functionality, and core components. Students will explore fundamental concepts, including process management, scheduling, synchronization, memory management, and strategies to handle deadlocks and virtual memory.

Semester	2	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	Describe the structure, types, services of operating system.	U	1
2	Analyse the performance of various process scheduling algorithms.	An	2
3	Appraise various techniques for process synchronization and deadlock handling.	An	2
4	Analyse the method employed for memory management in computer systems.	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 transactions (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Operating Systems Overview: Definition. Functions, Structure- Simple, Layered, Microkernels, Modules.	6	1
	1.2	Operating systems Operation-Dual-Mode operation and Timer. Operating System services, User Operating System Interface, System Calls, Types of system calls.	6	1
2	2.1	Process Management: Process Definition, Process states, Process State transitions, Process Scheduling, Process Control Block, Threads, Concept of multithreads.	5	2
	2.2	Process Scheduling: Definition, Scheduling Criteria, CPU scheduling- Preemptive and Non-preemptive. Scheduling algorithms (FCFS, SJF and RR), Performance evaluation of the scheduling Algorithms.	9	2
3	3.1	Process Synchronization: Introduction, Inter-process Communication, Race Conditions. Critical Section Problem, Mutual Exclusion, Semaphores, Monitors.	8	3
	3.2	Deadlocks: System model, deadlock characterization, deadlock prevention, avoidance, Banker's algorithm, Deadlock detection, and recovery from deadlocks.	10	3
4	4.1	**Memory Management**: Logical and Physical address map, Swapping, Contiguous Memory allocation- Internal and External fragmentation and Compaction, Paging, Segmentation.	8	4
	4.2	**Virtual Memory**: Demand paging, Page Replacement algorithms- FIFO, LRU, Optimal. Allocation of frames, thrashing.	8	4

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** • Written tests • Assignments • Quiz • Seminar
	B. Semester End Examination **ESE for Theory: Written Test (70 Marks,2 Hrs)** Part A: Very Short Answer Questions (Answer all) - (5*2=10 Marks) Part B: Short answer Questions (5 out of 7 Questions) - (5*6=30 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*15=30 Marks)

REFERENCES

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne (2006), Operating System Principles, 7th edition. Wiley India Private Limited, New Delhi.
2. William Stallings (2006), Operating Systems, Internals and Design Principles, 5th edition, Pearson Education, India.

SUGGESTED READINGS

1. Andrew S Tanenbaum, Modern Operating Systems, Third Edition, Prentice Hall India.

	Mahatma Gandhi University **Kottayam**
Programme	**BCA (Honours)**
Course Name	**Web Technologies**
Type of Course	**SEC**
Course Code	**MG2SECBCA100**
Course Level	NA
Course Summary	This course introduces the fundamental concepts of web development, focusing on HTML, CSS, and JavaScript to build interactive and responsive web pages. Students will also explore server management, web hosting, and modern techniques like AJAX to enhance web application performance.

Semester	2	Credits			2	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		1	0	1	0	45
Pre-requisites, if any						

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Apply HTML and CSS to design and develop interactive web pages, incorporating forms, tables, multimedia, and navigation components.	A	1
2	Implement JavaScript for dynamic web page behavior, including DOM manipulation, form validation, and event handling, while integrating AJAX for asynchronous web applications.	A	2
3	Design and develop fully functional, responsive, and interactive web applications using HTML, CSS, JavaScript and AJAX	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 transactions (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction to HTML, history of HTML, Objective, basic Structures of HTML, Header Tags, body tags, Paragraph tags.	2	1
	1.2	Tags for FORM Creation, TABLE, FORM, TEXTAREA, SELECT, IMG, IFRAME FIELDSET, ANCHOR.	2	1
	1.3	Lists in HTML, Introduction to DIV tag, NAVBAR Design. Introduction to CSS, types, Selectors, and Responsiveness of a web page.	2	1
	1.4	Introduction to www, Protocols and Programs, Applications and development tools, web browsers, DNS, Web hosting Provider, Setting up of Windows/Linux/Unix web servers, Web hosting in cloud, Types of Web Hosting.	2	1
2	2.1	Introduction to JavaScript: Functions and Events, Document Object model traversing using JavaScript. Output System in JavaScript i.e. Alert, throughput, Input box, Console. Variables and Arrays in JavaScript. Date and String handling in JavaScript.	3	2
	2.2	Manipulating CSS through JavaScript: Form Validation like Required validator, length validator, Pattern validator. Advanced JavaScript, Combining HTML, CSS and JavaScript events and buttons, controlling your browser.	2	2
	2.3	Introduction to AJAX, Purpose, advantages and disadvantages, AJAX based Web applications and alternatives of AJAX.	2	2
3	3.1	**Practical Session** 1. Create your class time table using table tag. 2. Design a Webpage for your college containing description of courses, department, faculties, library etc. using list tags, href tags, and anchor tags. 3. Create web page using Frame with rows and columns where we will have header frame, left frame, right frame,	30	3

		and status bar frame. On clicking in the left frame, information should be displayed in right frame. 4. Create Your Resume using HTML, use text, link, size, color and lists. 5. Create a Web Page of a super market using (internal CSS) 6. Use Inline CSS to format your resume that you have created. 7. Use External CSS to format your time table created. 8. Use all the CSS (inline, internal and external) to format college web page that you have created. 9. Write a HTML Program to create your college website using for mobile device. 10. Write an HTML/JavaScript page to create login page with validations. 11. Develop a Simple calculator for addiction, subtraction, multiplication and division operation using JavaScript. 12. Use Regular Expressions for validations in Login Page using JavaScript. 13. Write a Program to retrieve date from a text file and displaying it using AJAX.		

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: 15 Marks** • Written tests • Quiz • Assignments **CCA for Practical: 15 Marks** • Lab Involvement • Creativity • Lab Record

	• Viva
	B. Semester End Examination **ESE for Theory: Written Test(35 Marks, 1 Hr)** Part A: Short Answer Questions (4 out of 6 Questions) - (4*5=20 Marks) Part **B**: Essay Question (1 out of 2 Questions) - (1*15=15 Marks) **ESE for Practical: 35 Marks (1.5 Hrs)** • Design & Development - 20 Marks • Viva- 10 Marks • Record - 5 Mark

REFERENCES:

1. Laura Lemay, Mastering HTML, CSS & Java Script Web Publishing, BPB Publications, 2016

2. Thomas A. Powell, The Complete Reference HTML & CSS, Fifth Edition, 2017

SUGGESTED READINGS:

1. Silvio Moreto, Bootstrap 4 By Example, ebook, 2016.

2. Tanweer Alam, Web Technologies, Khanna Book Publishing, 2011.

Mahatma Gandhi University
Kottayam

Programme	**BCA (Honours)**					
Course Name	**Indian Constitution: Legal and Ethical Perspectives for IT**					
Type of Course	**VAC**					
Course Code	**MG2VACBCA100**					
Course Level	NA					
Course Summary	This course provides an interdisciplinary exploration of the Indian Constitution and its intersection with Information Technology (IT). Spanning three modules, the course examines the foundational principles of the Constitution, emphasizing their relevance in the digital era. Students will delve into governance frameworks, IT laws, and cybersecurity, gaining insights into e-Governance and digital transparency. The course also addresses the ethical implications of emerging technologies, highlighting constitutional perspectives on privacy, data protection, and accountability.					
Semester	2	Credits			2	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		2	0	0	0	30
Pre-requisites, if any	NIL					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand the fundamental principles of the Indian Constitution	U	6
2	Explain the legal framework governing IT and cybersecurity in India, and evaluate the role of e-Governance in promoting transparency and accountability.	An	1
3	Analyze the ethical and constitutional implications of emerging technologies.	An	7

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	**Foundations of the Indian Constitution**			
	1.1	**Introduction to the Indian Constitution:** Historical background and evolution of the Constitution, Salient features and the Preamble	2	1
	1.2	**Fundamental Rights and Duties:** Fundamental Rights (Articles 12–35), including Right to Privacy in the digital age, Fundamental Duties in the context of digital citizenship and cyber ethics	2	1
	1.3	**Directive Principles of State Policy:** Overview and their impact on governance, Relevance to IT policies and development	3	1
	1.4	**Constitutional Amendments:** Process of amendments, Key amendments impacting IT and technology policies	3	1
2	**Governance, IT Laws, and Cybersecurity**			
	2.1	**Separation of Powers and IT in Governance:** Legislature, Executive, and Judiciary roles in IT policy-making, e-Governance initiatives and digital transformation	2	2
	2.2	**Legal Framework for IT and Cybersecurity:** Overview of the IT Act, 2000 and its amendments, Cybercrime laws, digital signatures, and electronic records	2	2
	2.3	**Right to Information Act and Digital Transparency:** Promoting transparency through RTI, Role of IT in ensuring public accountability and access to information	3	2
	2.4	**Data Protection and Privacy:** Legal provisions on data protection, Emerging challenges with digital data and cybersecurity	3	2
3	**Ethics, Emerging Trends, and IT Applications**			
	3.1	**Digital Ethics and Accountability:** Cyber ethics, misinformation, and online behaviour, Combating challenges like cyberbullying and the digital divide	3	3
	3.2	**Constitutional Perspective on Emerging Technologies:** Legal and ethical implications of AI, blockchain, and IoT, Data sovereignty and balancing innovation with privacy	2	3

	3.3	**IT for Governance and Policy Implementation:** Role of IT in improving public service delivery, Case studies on successful digital governance initiatives in India.	3	3
	3.4	**Future Directions and Challenges:** Technological advancements and constitutional implications, Evolving role of the judiciary in IT disputes and digital rights	2	3

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** • Written test • Assignments • MCQ
	B. Semester End Examination **ESE for Theory: Written Test (35 Marks, 1 Hr)** Part A: Short Answer Questions (7 out of 10 Questions) - (7*5=35 Marks)

REFERENCES:

1. "Introduction to the Constitution of India" by D.D. Basu (Module 1)
2. "Cyber Law in India" by Farooq Ahmad, 6th Edition, New Era Law Publications. (Module 2)
3. "Ethics and Technology: Controversies, Questions, and Strategies for Ethical Computing" by Herman T. Tavani (Module 3)

SUGGESTED READINGS:

1. "The Constitution of India: A Contextual Analysis" by Arun K. Thiruvengadam
2. "Legal Dimensions of Cyber Space" by S.K. Verma and Raman Mittal
3. "Information Technology Law and Practice" by Vakul Sharma
4. "Artificial Intelligence and Law" by Thomas E. Arnold and Michael D. Kirby
5. "E-Governance: Concepts and Case Studies" by C.S.R. Prabhu.
6. The Constitution of India by B.L. Fadia Sahitya Bhawan; New edition (2017).

THE MAHATMA GANDHI UNIVERSITY

Bachelor in Computer Applications (Honours)

SYLLABUS

MGU-BCA (Honours)

(2024 Admission Onwards)

Faculty: Technology and Applied Sciences

Expert Committee: Computer Application (UG)

Programme: Bachelor in Computer Applications (Honours)

Mahatma Gandhi University
Priyadarshini Hills
Kottayam – 686560, Kerala, India

CONTENTS

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2	**Prof. (Dr.) Sabu M K**, Professor, Department of Computer Applications, Cochin University of Science and Technology, Kochi
Members of the Expert Committee in Computer Application (UG)	
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2	**Dr. Ajitha R S,** Assistant Professor, Department of Computer Applications, NSS College, Rajakumari
3	**Mr. Bineesh Jose,** Assistant Professor, Department of Computer Applications, Pavanatma College, Murickassery
4	**Dr. Reji K Kollinal,** Assistant Professor, Department of Computer Applications, BPC College, Piravom
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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)

Third Semester								
Course Code	Course Type	Course Title	Hours / week	*L	*T	*P	*O	Credit
MG3CCRBCA200	CC	Quantitative Techniques	4	4	0	0	0	4
MG3CCRBCA201	CC	Database Management Systems	6	4	0	2	0	5
MG3CCRBCA202	CC	Software Engineering	3	3	0	0	0	3
MG3CCRBCA203	CC	Design and Analysis of Algorithms	3	3	0	0	0	3
MG3SECBCA200	SEC	Python Programming	5	3	0	2	0	4
	*DSE	**Professional Elective – I**	4	2	0	2	0	3
MG3DSEBCA200		Basics of Data Analytics using Spreadsheet (*Data Science specialization*)						
MG3DSEBCA201		Feature Engineering (*Artificial Intelligence & Machine Learning specialization*)						
MG3DSEBCA202		Web Programming -I (*Full Stack Development specialization*)						
		TOTAL	25	19	0	6	0	22
Fourth Semester								
MG4CCRBCA200	CC	Artificial Intelligence	6	4	0	2	0	5
MG4VACBCA200	#VAC	Entrepreneurship and Startup Ecosystem	2	2	0	0	0	2
MG4VACBCA201		IT and Environmental Sustainability						
MG4SECBCA200	SEC	Object Oriented Programming using Java	7	3	0	4	0	5
MG4SECBCA201	SEC	Probability Distributions and Statistical Inference	4	4	0	0	0	4
MG4SECBCA202	SEC	Design Thinking and Innovation	2	2	0	0	0	2
		Professional Elective – II						
MG4DSEBCA200	*DSE	Data Visualization (*Data Science Specialization*)	4	2	0	2	0	3
MG4DSEBCA201		Introduction to Machine Learning (*Artificial Intelligence & Machine Learning Specialization*)						
MG4DSEBCA202		Web Programming -I (*Full Stack Development Specialization*)						
		TOTAL	25	17	0	8	0	21

*L-Lecture; *T-Tutorial; *P-Practical/Practicum; *O- Others

*DSE- The Student can choose one from the available elective options

#VAC- The Student can choose one from the available options

	Mahatma Gandhi University **Kottayam**
Programme	**BCA (Honours)**
Course Name	**Quantitative Techniques**
Type of Course	**Core Course**
Course Code	MG3CCRBCA200
Course Level	NA
Course Summary	Students will learn statistical concepts, including measures of central tendency and dispersion. They will understand correlation, regression, and probability basics. Upon completion, students will apply statistical methods to analyze data and make informed decisions.

Semester	3	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
Pre-requisites, if any	NIL					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe *the fundamental concepts of statistics, including data types, collection methods, and representation techniques, to analyse and interpret data effectively for decision-making in various fields.*	U	1
2	C*ompute and interpret central tendency and dispersion measures to summarize datasets, assess variability, and make data-driven decisions.*	An	1,2
3	E*valuate relationships between variables using correlation coefficients, construct regression models for prediction, and interpret the association between correlation and regression.*	A	1,2

4	*Apply fundamental probability concepts to solve real-world problems involving uncertainty and decision-making.*	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 transactions (Units)

Module	Units	Course description	Hrs	CO No.
1		**Introduction to Statistics**		
	1.1	Origin, Definition, Functions, Applications and Limitations of Statistics	2	1
	1.2	Population and Sample, Qualitative and Quantitative data, Primary and Secondary data, Methods of collecting primary and secondary data, Drafting a Questionnaire	3	1
	1.3	Census and Sampling methods, Different types of sampling methods (Definitions only)	2	1
	1.4	Classification of data, Tabulation of data, Diagrammatic and Graphical representations- Bar diagrams, Pie diagram, Histogram, Frequency Polygon, Frequency curve, Ogives.	4	1
2		**Measures of Central Tendency and Dispersion**		
	2.1	Measures of Central Tendency-Arithmetic mean, Median and Mode, Empirical Relationship between mean, median and mode, Graphical location of Median and Mode	6	2
	2.2	Combined mean, Weighted mean, Partition Values-Quartiles, deciles and Percentiles	5	2
	2.3	Measures of Dispersion-Absolute & Relative Measures-Range, Quartile deviation, Mean deviation, Standard deviation	6	2
	2.4	Variance and Coefficient of Variation.	2	2
3		**Correlation and Regression**		

	3.1	Correlation- Definition of different types of correlation, Scatter diagram, Measures—Karl Pearson's correlation coefficient.	3	3
	3.2	Degree of correlation, Spearman's rank correlation coefficient, Tie in ranks.	3	3
	3.3	Probable error, Interpretation of correlation coefficient on the basis of PE, Coefficient of determination.	3	3
	3.4	Regression: Definition of different types of Regression, Regression line, Simple linear Regression-Regression equation of y on x and x on y.	3	3
	3.5	Relationship between correlation coefficient and Regression coefficients, Identification of regression lines and properties, Comparison of correlation and regression.	4	3
4	**Basic Concepts of Probability**			
	4.1	Basic concepts of probability: Random experiment, Sample space, Different types of events, and operations with events.	4	4
	4.2	Definitions of Probability- Classical, Empirical and Axiomatic. Addition Theorem (up to 3 events).	4	4
	4.3	Conditional Probability, Independence of events, Multiplication theorem (up to 3 events), Bayes Theorem and its applications.	6	4

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** • Brainstorming lectures • Explicit teaching • Active Cooperative learning
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **CCA for Theory: 30 Marks** • Quiz / MCQ • Assignments • Tests

	B. End Semester Examination (ESE) **ESE for Theory: Written Test (70 Marks, 2 Hrs)** (Use of a non-programmable calculator allowed) Part A: Answer any 5 questions out of 8. Each question carries 2 marks. (5 x 2 = 10 marks) Part B: Answer any 5 questions out of 8. Each question carries 6 marks. (5 x 6 = 30 marks). Part C: Answer any 2 questions out of 4. Each question carries 15 marks. (2 x 15 = 30 marks)

REFERENCES

1. S.P. Gupta: Statistical Methods (Sultan Chand & Sons Delhi).
2. S.C. Gupta and V.K. Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand and Sons.
3. B.L. Agarwal: Basic Statistics, New Age International (p) Ltd.
4. Parimal Mukhopadhya: Mathematical Statistics, New Central Book Agency (p) Ltd, Calcutta
5. Murthy M.N: Sampling Theory and Methods, Statistical Publishing Society, Calcutta.

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Programme	**BCA (Honours)**					
Course Name	**Database Management Systems**					
Type of Course	**Core Course**					
Course Code	**MG3CCRBCA201**					
Course Level	**NA**					
Course Summary	The Database Management Systems (DBMS) course provides an in-depth understanding of the design, implementation, and management of databases, which are crucial for storing and retrieving structured data efficiently. This course covers theoretical concepts, practical techniques, and modern advancements in database technologies.					
Semester	3	Credits			5	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	1	0	90
Pre-requisites, if any	Basic knowledge of programming, data structures, algorithms, set theory, logical reasoning, and computer fundamentals					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Analyse the Basic Concept of DBMS	An	1
2	Proficiency in Database design and SQL	An	2
3	Understand Normalization and Transaction Management	An	2
4	Analyse MongoDB Database and Operations.	An	2
5	Implement SQL query, and administer MongoDB databases.	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 transactions (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	**Introduction to Databases:** Definition of Data, Database, and DBMS, Overview of Database Applications, Advantages and Disadvantages of DBMS, Roles of Database Users and Administrators	4	1
	1.2	**Data Models:** Introduction to Data Models, Types of Data Models (Hierarchical, Network, Relational, Object-oriented), Importance of Data Models in DBMS.	5	1
	1.3	**Database Design:** Keys: Primary Key, Candidate Key, Super Key, Foreign Key, Composite Key, Alternate Key, Unique Key, Surrogate Key, Constraints in a table: Primary Key, Foreign Key, Unique Key, NOT NULL, CHECK	6	1
2	2.1	**Entity-Relationship (ER) Model**, Entities and Entity Sets, Attributes and Relationships, ER Diagrams, Key Constraints and Weak Entity Sets, Introduction to the Relational Model and Relational Schema	4	2
	2.2	**Relational Algebra and Calculus:** Introduction to Relational Algebra, Operations: Selection, Projection, Set Operations, Join Operations, Division, Tuple and Domain Relational Calculus.	5	2
	2.3	**Structured Query Language (SQL):** SQL Basics: DDL and DML, Aggregate Functions (Min(), Max(), Sum(), Avg(), Count()), Logical operators (AND, OR, NOT), Predicates (Like, Between, Alias, Distinct), Clauses(Group By, Having, Order by, top/limit), Inner Join, Natural Join, Full Outer Join, Left Outer Join, Right outer Join, Equi Join	6	2
3	3.1	**Normalization and Database Design:** Functional Dependencies: Armstrong's Axioms, Definition, Properties (Reflexivity, Augmentation, Transitivity), Types (Trivial, Non-Trivial, Partial and Full Functional Dependency), Closure of	5	3

		Functional Dependencies, Normal Forms (1NF, 2NF, 3NF, BCNF), Denormalization.		
	3.2	**Transaction Management:**ACID Properties, Transactions and Schedules, Concurrent Execution of Transactions, Lock-Based Concurrency Control, Performance of Locking,	5	3
	3.3	Transaction Support in SQL,Introduction to Crash Recovery, 2PL, Serializability, and Recoverability, Introduction to Lock Management, Dealing with Deadlocks	5	3
4	4.1	NoSQL Databases and Big Data: Introduction to NoSQL, Data Models: Document, Key value, Column family, Graph.	5	4
	4.2	Uses and Features of NO/SQL document databases. CAP theorem, BASE vs ACID, CRUD operations, MongoDB operators.	5	4
	4.3	Overview of Big Data Technologies: Hadoop, MongoDB, Cassandra	5	4
5	5.1	(Practical Session) Implement SQL query, and administer MongoDB databases. (List of Programs attached)	30	5
		List of Practicals: 1. Draw an ER Diagram of Registrar Office 2. Draw an ER Diagram of Hospital Management System 3. Reduce The ER diagram in question no 1 into tables 4. Reduce the ER diagram of question no 2 into tables Consider the following Schema Supplier(SID, Sname, branch, city, phone) Part(PID, Pname, color, price) Supplies(SID, PID, qty, date_supplied) **DDL Commands**		

		5. Create the above tables 6. Add a new attribute state in supplier table 7. Remove attribute city from supplier table 8. Modify the data type of phone attribute 9. Change the name of attribute city to address 10. Change a table's name, supplier to sup 11. Use truncate to delete the contents of supplies table 12. Remove the part table from database **DML Commands** 1. Insert at least 10 records in tables supplier, part and supplies 2. Show the contents in tables supplier, part and supplies 3. Find the name and city of all suppliers 4. Find the name and phoneno of all suppliers who stay in 'Delhi' 5. Find all distinct branches of suppliers 6. Delete the record of the supplier whose SID is 204001 7. Delete all records of supplier table 8. Delete all records of suppliers whose city starts with capital A. 9. Find the supplier names which have 'lk' in any position 10. Find the supplier name where 'R' is in the second position 11. Find the name of supplier whose name starts with 'V' and ends with 'A' 12. Change the city of all suppliers to 'BOMBAY' 13. Change the city of supplier 'Vandana' to 'Goa' **Queries with Constraints** 1. Create the supplier table with Primary Key Constraint		

		2. Create supplies table with Foreign key Constraint 3. Create a part table with UNIQUE Constraint 4. Create supplier Table with Check Constraints 5. Create Supplier table with Default Constraint **Queries on TCL** 1. Create Savepoints 2. Rollback to SavePoints 3. Use Commit to save on **Aggregate Functions:** 1. Find the minimum, maximum, average and sum of costs of parts 2. Count the total number of parts present 3. Retrieve the average cost of all parts supplied by 'Mike' **Queries on GROUP BY, HAVING AND ORDER BY Clauses** 1. Display total price of parts of each color 2. Find the branch and the number of suppliers in that branch for branches which have more than 2 suppliers 3. Find all parts sorted by pname in ascending order and cost in descending order 4. Find the branch and the number of suppliers in that branch **Queries on Analytical, Hierarchical and Recursive nature.** 1. Find out the 5th highest earning employee details. 2. Which department has the highest number of employees with a salary above $80,000, and what percentage of employees in that department have a salary above $80,000 3. Retrieve employee table details using the hierarchy query and display that hierarchy path		

		starting from the top level indicating if it is a leaf and there exists a cycle. 4. What is the average salary for employees in the top 2 departments with the highest average salary, and what is the hierarchy of departments and sub-departments for these top 2 departments? 5. Use recursion to retrieve the employee table and display the result in breadth first and depth first order. 6. Write a recursive query to show the equivalent of level, connect_by_root and connect_by_path 7. Use recursion to retrieve the employee table and display the result in depth first order showing id, parent_id, level, root_id, path and leaf. **Queries on Operators** 1. Find the pname, phoneno and cost of parts which have cost equal to or greater than 200 and less than or equal to 600. 2. Find the sname , SID and branch of suppliers who are in 'local' branch or 'global' branch 3. Find the pname, phoneno and cost of parts for which cost is between 200 and 600 4. Find the pname and color of parts , which has the word 'NET' anywhere in its pname. 5. Find the PID and pname of parts with pname either 'NUT' or 'BOLT' 6. List the suppliers who supplied parts on '1st may2000', '12 JAN 2021' ,'17 dec 2000' ,'10 Jan 2021' 7. Find all the distinct costs of parts **Join Operators** 1. Perform Inner join on two tables 2. Perform Natural Join on two tables 3. Perform Left Outer Join on tables 4. Perform Right Outer join on tables		

		5. Perform Full Outer Join on tables **Set Theory Operators** 1. Show the use of UNION operator with union compatibility 2. Show the use of intersect operator with union compatibility 3. Show the use of minus operator with union compatibility 4. Find the cartesian product of two tables **Queries on Set Theory Operators** 1. List all parts except 'NUT' and 'BOLT' in ascending order of costs 2. display all parts that have not been supplied so far 3. To display the supplier names who have supplied 'green' part with cost 500 Rupees AND 'red' part with cost 400 Rupees. 4. To Display the name of suppliers who have supplied all parts that are 'red' in color. **PL/SQL Programs** 1. Write a PL/SQL Code to add two numbers 2. Write a PL/SQL code for Fibonacci series 3. Write a PL/SQL Code for greatest of 3 numbers 4. Write a PL/SQL code for area and circumference of a circle **PL/SQL Programs on Cursors** 1. Write a Program using CURSOR to display SID and city of 1st record of supplier 2. Write a program using cursors to display the SID and City of all suppliers and then print the count of suppliers. **PL/SQL Programs on Triggers, Procedures and Functions** 1. Write a Program using TRIGGER on UPDATE		

		2. Write a command to See the effect of trigger 3. Write a Program using PROCEDURE to increase the cost by Rs.1000 for part whose PID is passed as an argument. 4. Write a procedure to update the city of an supplier whose SID and city are passed as arguments and the procedure returns the name of supplier whose city is updated. 5. Write a function to return the total number of suppliers 6. Write a function to return the PID of part, for which the part name is passed 7. Write a function to find the sum total of costs of all parts. **PL/SQL Programs on Implicit Cursors** 1. Insert a record using %ROWTYPE 2. Write a code using %NOTFOUND, %FOUND, %ROWCOUNT 3. Write a code using %TYPE **MongoDB Queries** 1. Create a collection and insert documents into it using insertOne() and insertMany() 2. Select all documents in collection 3. Find the count of all suppliers 4. Find all records that have city = 'Delhi' 5. Retrieve all documents that have color equal to 'red' or 'green' 6. Retrieve all documents where part_name is 'P1' or price is less than 200. 7. Update the record of 'Geeta' ,set city = 'Bombay' and phoneno = '11223344' 8. Delete all records where price is greater than 5000 9. Display only the name and city of the supplier 10. Sort all suppliers on city and display only the first two records.		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** • Lecture • Demonstration • Practical sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **CCA for Theory: 30 Marks** • Written test • Assignments • Viva • MCQ, etc. **CCA for Practical: 15 Marks** • Practical assignments • Lab Record • Observation of practical skills • Viva etc.
	C. End Semester Examination (ESE) **ESE for Theory: Written Test (70 Marks, 2 Hrs.)** Part A: Very Short Answer Questions (Answer all) - (5*2=10 Marks) Part B: Short Answer Questions (5 out of 7 Questions) - (5*6=30 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*15=30 Marks) **ESE for Practical: (35 Marks, 1.5 Hrs.)** • Logic - 10 Marks • Successful Compilation - 5 Marks • Output - 5 Marks • Viva - 10 Marks • Record - 5 Marks

REFERENCES:

1. Ramez Elmasri and Shamkant B. Navathe - Database Systems, Seventh 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. Benjamin Rosenzweig, Elena Rakhimov, "Oracle PL/SQL by Example", fifth edition, Prentice Hall, 2015
3. Brad Dayley, "NoSQL with MongoDB in 24 Hours", 1st edition, Sams Publishing, 2024
4. Andreas Meier, Michael Kaufmann, - SQL & NoSQL Databases-Models, Languages, Consistency, Options and Architectures for Big Data Management.

WEB RESOURCES:

1. https://oracle-base.com/articles
2. https://forums.oracle.com/ords/apexds/domain/devcommunity/category/sql_and_pl_sql
3. https://www.mongodb.com/docs/manual/MongoDB-manual.pdf

Mahatma Gandhi University
Kottayam

Programme	**BCA(Honours)**					
Course Name	**Software Engineering**					
Type of Course	**Core Course**					
Course Code	**MG3CCRBCA202**					
Course Level	**NA**					
Course Summary	This course provides a comprehensive understanding of the software development lifecycle (SDLC) and equips students with the skills to manage, design, develop, and test robust software solutions. Emphasizing contemporary practices and strategic decision-making, it prepares students to excel in project management and deliver efficient, maintainable software systems.					
Semester	3	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	0	0	45
Pre-requisites, if any	Basic understanding of software, applications, and programming fundamentals.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
Upon completion of this course, the students will be able to:			
1	Illustrate the software development lifecycle and its application in contemporary software engineering practices.	An	1
2	Analyse project management methodologies and strategic decision making for successful software project execution.	An	1,2
3	Analyse software design, development, and testing processes to produce robust and efficient software solutions.	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 transactions (Units)

Module	Units	Course description	Hrs.	CO No.
1	1.1	The evolving role of software, changing nature of software, layered technology, a process framework	5	1
	1.2	Process models: The waterfall model, incremental process models, evolutionary process models, the unified process.	5	1
	1.3	Agile software development: Agility Principles, Agile methods, Plan-driven and agile development, Extreme programming, Scrum, A Tool Set for the Agile Process.	5	1
2	2.1	Software Requirements Engineering: Functional and non-functional requirements, the software requirements document, Requirements specification, Requirements engineering processes, Requirements elicitation and analysis, Requirements validation, Requirement management.	5	2
	2.2	Risk management: Reactive Vs proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM, RMMM plan.	5	2
	2.3	Project planning- Software pricing, Plan-driven development, Project scheduling, Agile planning, Estimation techniques.	5	2
3	3.1	Design: Design process and design quality, design concepts, the design model, software architecture, data design, architectural design, Basic structural modeling, class diagrams, sequence diagrams, collaboration diagrams, use case diagrams, component diagrams.	5	3
	3.2	Testing Strategies: A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, the art of debugging.	5	3

	3.3	Product metrics: Software quality, metrics for analysis model, metrics for design model, metrics for source code, metrics for testing, metrics for maintenance.	5	3

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lecturing, Demonstration through ICT tools
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **CCA for Theory: 25 Marks** • Written test • Assignment • MCQ/Quiz
	D. End Semester Examination (ESE) **ESE for Theory: Written test (50 Marks, 1.5 Hrs)** Part A: Very Short Answer Questions (Answer all) - (10*2=20 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*15=15 Marks)

REFERENCES

1. Software Engineering A practitioner's Approach, 8th edition, Roger S Pressman, Bruce R. Maxim. McGraw Hill Education, 2015.
2. Software Engineering, Ian Somerville, 9th edition, Pearson education
3. Software Engineering, N.S. Gill, Khanna Publishing House, 2023

SUGGESTED READINGS

1. Stephen Schach, Software Engineering 7th ed, McGraw-Hill, 2007
2. Software Engineering: Principles and Practice Hans van Vliet

Mahatma Gandhi University
Kottayam

Programme	**BCA (Honours)**					
Course Name	**Design and Analysis of Algorithms**					
Type of Course	**Core Course**					
Course Code	**MG3CCRBCA203**					
Course Level	**NA**					
Course Summary	The course provides a comprehensive understanding of fundamental algorithm design techniques and emphasizes the analysis of algorithm efficiency through time and space complexity. Students will gain the skills to design and implement efficient algorithms to solve practical problems in various domains.					
Semester	3	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	0	0	45
Pre-requisites, if any	Thorough understanding of Data Structures and algorithms.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
Upon completion of this course, the students will be able to:			
1	Illustrate basic algorithm designing paradigms and analyse the performance of algorithms	An	1
2	Analyse the design approaches- Divide and Conquer and the greedy method and apply them in real-life problems	An	2
3	Synthesize algorithms using Dynamic Programming, Backtracking approaches and apply to common real-life problems.	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 transactions (Units)

Module	Units	Course description	Hrs.	CO No.
1	1.1	Algorithm: Introduction, Definition of Algorithm, Algorithm design techniques.	3	1
	1.2	Performance Analysis :Space complexity, Time Complexity, Asymptotic notations :(O, Ω, θ) to measure growth of a function and application to measure	3	1
	1.3	Recursion: Basic concept. Analysis of recursive algorithms.	3	1
2	2.1	Divide & Conquer Design Technique: The general concept. Binary search, finding the maximum and minimum, merge sort, quick sort. Best and worst case analysis for the mentioned algorithms. Strassen's matrix multiplication.	10	2
	2.2	The Greedy Design Technique: The general concept. Applications to general Knapsack problem.	4	2
	2.3	Spanning trees: Prim's and Kruskal's algorithms, Dijkstra's Algorithm for finding single source shortest paths problem.	5	2
3	3.1	The Dynamic Programming Design Technique: The general concept, All pair of shortest paths problem (Floyd-Warshall's algorithm)	5	3
	3.2	Algorithms on Graphs: Breadth First Search, Depth First Search, finding connected components, depth-first search of a directed graph	7	3
	3.3	Backtracking Method: concept, N-Queen problem; Sum of subsets problem, Hamiltonian circuit problem	5	3

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lecturing, ICT enabled Sessions, Discussions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **CCA for Theory: 25 Marks** ● Written test ● Assignments ● MCQ
	E. End Semester Examination (ESE) **ESE for Theory: Written Test (50 Marks, 1.5 Hrs)** Part A: Very Short Answer Questions (Answer all) - (10*2=20 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*15=15 Marks)

REFERENCES

1. Horowitz Ellis, Sahni Sartaj and Rajasekaran Sanguthevar, Fundamentals of Computer Algorithms, University Press (I) Pvt. Ltd., 2012.

2. Gajendra Sharma, Design and Analysis of Algorithms, Khanna Publishing House

3. Cormen Thomas H., Leiserson Charles E., Rivest Ronald L. and Stein Cliffo Introduction to Algorithms, PHI publication, 3rd Edition, 2009

SUGGESTED READINGS

1. Aho Alfred V., Hopcroft John E. & Ullman Jeffrey D., The Design & Analysis of Computer Algorithms, Addison Wesley Publications, Boston, 1983.

2. Kleinberg Jon & Tardos Eva, Algorithm Design, Pearson Education, 2006. Web Resources.

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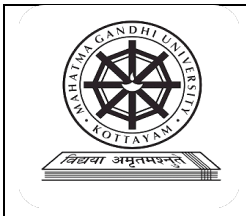
<tr><td>  </td><td colspan="6">Mahatma Gandhi University
Kottayam</td></tr>
<tr><td>Programme</td><td colspan="6">BCA (Honours)</td></tr>
<tr><td>Course Name</td><td colspan="6">Python Programming</td></tr>
<tr><td>Type of Course</td><td colspan="6">SEC</td></tr>
<tr><td>Course Code</td><td colspan="6">MG3SECBCA200</td></tr>
<tr><td>Course Level</td><td colspan="6">NA</td></tr>
<tr><td>Course Summary</td><td colspan="6">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.</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 rowspan="2">Learning Approach</td><td>Lecture</td><td>Tutorial</td><td>Practical</td><td>Others</td></tr>
<tr><td>3</td><td></td><td>1</td><td></td><td>75</td></tr>
<tr><td>Pre-requisites, if any</td><td colspan="6">Understanding of Problem-solving techniques using a programming language and basic data structures.</td></tr>
</table>

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Analyse Python programming concepts.	An	1
2	Apply suitable Python programming constructs, built-in data structures using Python libraries to solve problems.	An	2
3	Analyse basic Data visualization and File handling in Python.	An	2
4	Solve problems using Python Programming.	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 transactions (Units)

Module	Units	Course description	Hrs.	CO No.
1	1.1	**Introduction:** History and Application areas of Python; Structure of Python Program; Identifiers and Keywords; Operators and Precedence; Basic Data Types and type conversion; Statements and expressions; Input/Output statements.	5	1
	1.2	**Strings:** Creating and Storing Strings, Built-in functions for strings; string operators, String slicing and joining; Formatting Strings.	5	1
	1.3	**Control Flow Statements:** Conditional Flow statements; Loop Control Statements; Nested control Flow; continue and break statements, continue, Pass and exit.	5	1
2	2.1	**Functions:** Built-In Functions, Function Definition and call; Scope and Lifetime of Variables, Default Parameters, Command Line Arguments; Lambda Functions; Assert statement; Importing User defined module;	5	2
	2.2	**Mutable and Immutable objects:** Lists, Tuples and Dictionaries; Commonly used Functions on Lists, Tuples and Dictionaries. Passing Lists, tuples and Dictionaries as arguments to functions. Using Math and Numpy module for list of integers and arrays.	10	2
3	3.1	**Files:** Types of Files; Creating, Reading and writing on Text and Binary Files;The Pickle Module, Reading and Writing CSV Files. Reading and writing of csv and JSON files.	5	3
	3.2	**Exception Handling:** Try-except-else-finally block, raise statement, hierarchy of exceptions, adding exceptions.	5	3
	3.3	**Data visualization:** Plotting various 2D and 3D graphics; Histogram; Pi charts; Sine and cosine curves.	5	3
4	4.1	**Practical List:** 1. Write a program to find whether a number is a prime number. 2. Write a program to print m raise to power n, where m and n are read from the user.	30	4

		3. Write a program having a parameterised function that returns True or False depending on whether the parameter passed is even or odd. 4. Write a program to print the summation of the following series upto n terms:1-2+3-4+5 6+7 - - - - - - - -n 5. Write a menu driven program to perform the following operations on strings using string built in functions. a. Find the frequency of a character in a string. b. Replace a character by another character in a string. c. Remove the first occurrence of a character from a string. d. Remove all occurrences of a character from a string. 6. Write a program that accepts two strings and returns the indices of all the occurrences of the second string in the first string as a list. If the second string is not present in the first string, then it should return -1 7. Using Numpy module write menu driven program to do following a. Create an array filled with 1's. b. Find maximum and minimum values from an array c. Dot product of 2 arrays. d. Reshape a 1-D array to 2-D array. 8. Write a function that takes a sentence as input from the user and calculates the frequency of each letter. Use a variable of dictionary type to maintain the count. 9. Consider a tuple t1=(1,2,5,7,9,2,4,6,8,10). Write a program to perform following operations: a. Print contents of t1 in 2 separate lines such that half values come on one line and other half in the next line. b. Print all even values of t1 as another tuple t2. c. Concatenate a tuple t2=(11,13,15) witht1. d. Return maximum and minimum value from t1.. 10. Write a function that reads a file file1 and copies only alternative lines to another file file2. Alternative lines copied should be the odd numbered lines. 11. Write a Python program to handle a ZeroDivisionError exception when dividing a number by zero. 12. Write a program that reads a list of integers from the user and throws an exception if any numbers are duplicates. 13. Write a program that makes use of a function to display sine, cosine, polynomial and exponential curves. 14. Take as input in the months and profits made by a company ABC over a year. Represent this data using a line plot. Generated line plot must include X axis label		

		name = Month Number and Y axis label name = Total profit.		

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

REFERENCES

1. Fabio Nelli, "Python Data Analytics Data Analysis and Science Using Pandas, Matplotlib, and the Python Programming Language", Edition 1, 2015, Apress.
2. Wes Mckinney ,"Python for Data Analysis: Data Wrangling with pandas, NumPy, and Jupyter" 3rd Edition, O'Reilly, 2022.

SUGGESTED READINGS

1. Think Python, by Allen Downey, 2 nd edition, 2015, O'Reilly.
2. An introduction to Python for absolute beginners, by Bob Dowling, Cambridge Univ.
3. Introduction to Computation and Programming using Python, by John Guttag, 2 nd edition, 2016, PHI India.

Web Resources:

1. https://www.learnpython.org/
2. https://www.w3schools.com/python/default.asp
3. https://wesmckinney.com/book/

<table>
<tr><td>  </td><td colspan="5">Mahatma Gandhi University
Kottayam</td></tr>
<tr><td>Programme</td><td colspan="5">BCA (Honours)</td></tr>
<tr><td>Course Name</td><td colspan="5">Basics of Data Analytics using Spreadsheet</td></tr>
<tr><td>Type of Course</td><td colspan="5">DSE</td></tr>
<tr><td>Course Code</td><td colspan="5">MG3DSEBCA200</td></tr>
<tr><td>Course Level</td><td colspan="5">NA</td></tr>
<tr><td>Course Summary</td><td colspan="5">This course introduces the fundamentals of data analytics and its practical applications, focusing on building a strong foundation in data manipulation and analysis. Students will develop proficiency in using spreadsheet software to create and analyze data models, enabling effective decision-making. The course also emphasizes communicating data insights clearly, equipping students with the skills needed for real-world problem-solving and business analytics.</td></tr>
<tr><td>Semester</td><td>3</td><td colspan="2">Credits</td><td>3</td><td rowspan="2">Total Hours</td></tr>
<tr><td>Course Details</td><td rowspan="2">Learning Approach</td><td>Lecture</td><td>Tutorial</td><td>Practical</td><td>Others</td></tr>
<tr><td></td><td>2</td><td>0</td><td>1</td><td>0</td><td>60</td></tr>
<tr><td>Pre-requisites, if any</td><td colspan="5">Knowledge of the basics of mathematical & Statistical concepts such as arithmetic, percentages, averages, and basic algebra.</td></tr>
</table>

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
Upon completion of this course, the students will be able to:			
1	Understand the basics of data analytics and its applications.	U	1
2	Develop proficiency in using spreadsheet software for data manipulation and analysis.	A	2
3	Build and use spreadsheet models for decision making & Communicate data insights effectively	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 transactions (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Understanding data and its types (structured, unstructured, semi-structured)-What is Data Analytics- Types of data Analytics	5	1
	1.2	Importance of Data Analytics- Applications of Data Analytics.	5	1
2	2.1	Data Collection Methods - Different Data Sources & format - Data Cleaning and Transformation - Handling Missing Data and Outliers.	8	2
	2.2	Ethical considerations in data analytics	4	2
	2.3	Real-world Applications of Data Analytics- Industry-specific applications (finance, marketing, operations) - Case Study Note: Case study is for discussion not to be considered for evaluation.	8	2
3	**Lab Practice**			
	3.1	Introduction to Spreadsheet tool- Basic Functions, Data importing and pre-processing	5	3
	3.2	Descriptive Statistics Using Spreadsheet, Advanced Spreadsheet functions	10	3
	3.3	Data visualization techniques, Dashboard creation	15	3

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lecture, Practical, Demonstration through ICT tools
Assessment Types	**MODE OF ASSESSMENT** **Continuous Comprehensive Assessment (CCA)**

	CCA for Theory: 15 Marks • Written test • Assignment • MCQ/Quiz **CCA for Practical: 15 Marks** • Practical assignments • Lab Record • Observation of practical skills • Viva
	G. End Semester Examination (ESE) **ESE for Theory: Written test (35 Marks, 1 Hr)** Part A: Short Answer Questions (7 out of 10 Questions) - (7*5=35 Marks) **ESE for Practical: (35 Marks, 1.5 Hr.)** • Procedure - 10 Marks • Output – 10 Marks • Viva - 10 Marks • Record - 5 Marks

REFERENCES

1. "Data Analytics" by V.K. Jain, Khanna Book Publishing Company, 2024.
2. "Excel Data Analysis For Dummies" by Stephen L. Nelson and E. C. Nelson, John Wiley & Sons; 3rd edition, 2016
3. "Data Analysis Using Microsoft Excel" by Michael R. Middleton, Thomson, Brooks/Cole, 3rd edition, 2004

SUGGESTED READINGS

1. "Excel 2019 Bible" by Michael Alexander, Richard Kusleika, and John Walkenbach, John Wiley & Sons, 25 Sept 2018
2. "Spreadsheet Modeling and Decision Analysis: A Practical Introduction to Business Analytics" by Cliff T Ragsdale, Cegage learning asia pet. 2015
3. "Mastering Excel" by WebTech Solutions, Khanna Publishing House, 2024.

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Programme	**BCA (Honours)**
Course Name	**Feature Engineering**
Type of Course	**DSE**
Course Code	**MG3DSEBCA201**
Course Level	**NA**
Course Summary	This course covers the essential concepts of feature engineering and preprocessing techniques in machine learning. It explores the importance of features, differentiating between structured and unstructured data, and various feature types such as categorical, numerical, text, and date-time. Students will learn how to handle missing data, clean datasets, and apply scaling and normalization. The course also delves into advanced techniques like binning, polynomial features, log transformation, one-hot encoding, label encoding, and feature selection methods, including filter and wrapper methods, while emphasizing the application of Principal Component Analysis (PCA) for dimensionality reduction.

Semester	3	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		2	0	1	0	60
Pre-requisites, if any	Basic knowledge of data analytics/machine learning and familiarity with any programming language					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
Upon completion of this course, the students will be able to:			
1	Understand the importance of features in machine learning and differentiate between various types of data and features.	U	1
2	Apply basic feature preprocessing techniques such as handling missing data, data cleaning, and feature scaling and normalization	A	2

3	Implement feature engineering techniques for numerical data, including binning, discretization, polynomial and interaction features, and log transformation.	A	2
4	Utilize categorical data techniques, such as one-hot encoding and label encoding, and understand feature selection methods, including filter and wrapper methods.	A	2
5	Perform feature transformation using techniques like Principal Component Analysis (PCA) and understand its application in machine learning.	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 transactions (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction to Feature Engineering: Introduction to Data and Features, Importance of Features in Machine Learning.	4	1
	1.2	Data types and features: Numerical, Categorical, Ordinal, Discrete, Continuous, Interval and Ratio.	4	1
	1.3	Basic Feature Preprocessing: Handling Missing Data, Data Cleaning, Feature Scaling, Normalization, and Transformation.	6	2
2	2.1	Techniques for Numerical Data: Binning and Discretization, Polynomial and Interaction Features.	6	3
	2.2	Categorical Data Techniques: One Hot Encoding, Label Encoding.	4	4
	2.3	Feature extraction vs. feature selection, Steps in feature selection. Feature Selection Methods: Filter, Wrapper, and Hybrid. Feature Reduction: Introduction and application of Principal Components Analysis.	6	4
3	**Lab Practice**			
	3.1	Introduction to Python relevant libraries such as numpy, pandas, sklearn, nltk, matplotlib, and seaborn. Kaggle.	10	2

		Dataset access and preprocesing: Handling Missing Data (Mean, Median, Mode Imputation), Data Cleaning		
	3.2	Exploratory Data Analysis (EDA): Histograms and Boxplots, Correlation Matrix Computation and Visualization. Binning and Discretization of Numerical Data,	10	3,4
	3.3	Polynomial and Interaction Feature Creation, Logarithmic Transformation for Skewed Data. Text Data Preprocessing, Principal Component Analysis.	10	2,3,5

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lecture, Practical, Demonstration through ICT tools, Discussion
Assessment Types	**A. Continuous Comprehensive Assessment (CCA)** **CCA for Theory: 15 Marks** ● Written test ● Assignment ● MCQ/Quiz **CCA for Practical: 15 Marks** ● Practical assignments ● Lab Record ● Observation of practical skills ● Viva
	B. End Semester Examination (ESE) **ESE for Theory: Written test (35 Marks, 1 Hr)** Part A : Very Short Answer Questions(Answer all) - (10*2=20 Marks) Part B : Short answer questions (3 out of 5 questions) - (3*5=15 Marks) **ESE for Practical: (35 Marks, 1 Hr.)** 1. Design and Development - 20 Marks 2. Viva - 10 Marks 3. Record - 5 Marks

REFERENCES

1. M.C. Trivedi, Data Science and Data Analytics Using Python Programming, Khanna Publishing House, 2024.

2. Han, Jiawei, Kamber, Micheline, & Pei, Jian. (2011). Data mining: Concepts and techniques (3rd ed.). Morgan Kaufmann Publishers. ISBN 978-0123814791.
3. Zheng, Alice, & Casari, Amanda. (2018). Feature engineering for machine learning: Principles and techniques for data scientists. O'Reilly Media, Inc.
4. Kalita, J. K., Bhattacharyya, D. K., & Roy, S. (2023). Fundamentals of Data Science: Theory and Practice. Elsevier. ISBN-13: 9780323917780

SUGGESTED READINGS:

1. Duda, R. O., Hart, P. E., Stork, D (2007). Pattern classification (2Ed), John Wiley &Sons, ISBN-13: 978-8126511167.
2. N. Bhaskar, Vasundhara, Machine Learning, Khanna Publishing House, 2024.
3. M.C. Trivedi, Deep Learning and Neural Network_MC Trivedi, Khanna Publishing House, 2024.
4. Ng, Andrew. (2018). Machine learning yearning (Draft, MIT Licensed). GitHub. ISBN10: 199957950X, ISBN-13: 978-1999579500.
5. Tan, Pang-Ning, Steinbach, Michael, Karpatne, Anuj, & Kumar, Vipin. (2021). Introduction to data mining (2nd ed.). Pearson. ISBN 978-9354491047.
6. Provost, Foster, & Fawcett, Tom. (2013). Data science for business: What you need to know about data mining and data-analytic thinking. O'Reilly Media, Inc.
7. Galli, Soledad. (2020). Python feature engineering cookbook: Over 70 recipes for creating, engineering, and transforming features to build machine learning models. Packt Publishing, Limited.
8. Nielsen, Aileen. (2019). Practical time series analysis: Prediction with statistics and machine learning. O'Reilly Media.
9. Rajiv Chopra, Deep Learning, Khanna Publishing House, 2024.
10. Jeeva Jose, Machine Learning, Khanna Publishing House, 2024.
11. Chollet, François. (2017). Deep learning with Python. Manning Publications. ISBN 9781617294433.

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Programme	**BCA(Honours)**
Course Name	**Web Programming-I**
Type of Course	**DSE**
Course Code	**MG3DSEBCA202**
Course Level	**NA**
Course Summary	This course covers the essential concepts of feature engineering and preprocessing techniques in machine learning. It explores the importance of features, differentiating between structured and unstructured data, and various feature types such as categorical, numerical, text, and date-time. Students will learn how to handle missing data, clean datasets, and apply scaling and normalization. The course also delves into advanced techniques like binning, polynomial features, log transformation, one-hot encoding, label encoding, and feature selection methods, including filter and wrapper methods, while emphasizing the application of Principal Component Analysis (PCA) for dimensionality reduction.

Semester	3	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		2	0	1	0	60
Pre-requisites, if any	Basic Understanding of HTML					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
Upon completion of this course, the students will be able to:			
1	Understand the fundamental concepts and components of web development.	U	1
2	Apply intermediate-level web development techniques and develop PHP Programming Skills:	A	2
3	Integrate PHP with Databases	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 transactions (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction to web, WWW architecture .Introduction to PHP, Server-side scripting, XAmPP, Role of web server software, PHP comments, variables, echo and print, PHP operators, data types.	3	1
	1.2	PHP branching statements and loping statements, arrays in PHP-numeric array, associative array, multidimensional array, array functions in PHP.	6	1,2
	1.3	Multidimensional array, array functions in PHP push, pop, shift, unshift, array_search, in_array, sort(), rsort, asort, arsort, ksort, krsort.	6	1,2
2	2.1	PHP form:$_GET,$_POST,$_SERVER, $_REQUEST, $_GLOBALS, include and require function	6	2
	2.2	Basic MYSQL commands CRUD	4	2,3
	2.3	PHP- MYSQL database connectivity using procedure oriented methods-mysqli_connect, mysqli_clos	3	2,3
	2.4	ysqli_query, mysqli_fetch_row, mysqli_fetch_assoc, ysqli_fetch_array	2	2,3
3	**Lab Practice**			
	3.1	Using PHP, create dynamic websites, form handling applications	10	1,2
	3.2	CRUD (Create, Read, Update, Delete) applications, arrays and data manipulation programs	10	2
	3.3	Dynamic content display and PHP-MySQL database connectivity applications.	10	3

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Lecture,, Demonstration through ICT tools
Assessment Types	**A. Continuous Comprehensive Assessment (CCA)** **CCA for Theory: 15 Marks** ● Written test ● Assignment ● MCQ/Quiz **CCA for Practical: 15 Marks** ● Practical assignments ● Lab Record ● Observation of practical skills ● Viva
	B. End Semester Examination (ESE) **ESE for Theory: Written test (35 Marks, 1 Hr)** Part A: Very Short Answer Questions (Answer all) - 10 X2 = 20 Marks Part B: Short answer questions (3 out of 5 questions) - 3X5 = 15 Marks **ESE for Practical: (35 Marks, 1 Hr.)** 1. Design and Development - 20 Marks 2. Viva - 10 Marks 3. Record - 5 Marks

REFERENCES:

1. Dave W Mercer, Allan Kent, Steven D Nowicki, David Mercer, Dan Squier, Wankyu Choi- "Beginning PHP5", Wiley Publishing, Inc.
2. 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

SUGGESTED READINGS:

1. Mike O'Kane, Essential Algorithms, Syntax, and Control Structures Using PHP, HTML, and MariaDB/MySQL, Carolina Academic Press, Fourth Edition.
2. Julie C. Meloni, Teach Yourself PHP, MySQL® and Apache All in One, Fifth Edition.

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Programme	**BCA (Honours)**					
Course Name	**Artificial Intelligence**					
Type of Course	**Core Course**					
Course Code	**MG4CCRBCA200**					
Course Level	**NA**					
Course Summary	The course introduces the fundamental concepts of Artificial Intelligence (AI). It covers AI problem-solving search techniques, including both uninformed and informed search methods. The role of logic and reasoning in AI is explored, along with essential inference techniques. Various domains and applications of AI are examined, such as Machine Learning, Computer Vision, Robotics, Natural Language Processing, and Deep Neural Networks. The course also examines the architecture and role of expert systems through case studies. Additionally, it addresses the legal and ethical issues related to AI, discussing privacy, bias, and societal impacts.					
Semester	4	Credits			5	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	1	0	90
Pre-requisites, if any	Basic understanding of computer science concepts, including data structures and algorithms. Proficiency in any one programming language, such as Python.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe the characteristics of rational agents and gain insights about problem-solving agents.	An	1,2
2	Analyse Uninformed and informed search techniques.	An	1, 2

3	Apply knowledge representation using Propositional logic and Predicate calculus for inference/reasoning and handling uncertainty through probabilistic reasoning and fuzzy sets	An	1, 2, 3
4	Illustrate AI domains and their applications and examine the legal and ethical issues of AI	An	2
5	Apply search strategies, solve constraint-based problems, build rule-based systems, evaluate optimization methods, and use basic NLP techniques in intelligent systems.	E	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 transactions (Units)

Module	Units	Course description	Hrs	CO No.
1	1	Introduction to Al What is AI? Intelligent Agents: Agents and environment, the concept of Rationality, the nature of environment, the structure of Agents	5	1
	2	Knowledge-Based Agents: Introduction to Knowledge-Based Agents, The Wumpus World as an Example World.	5	1
	3	Problem-solving: Problem-solving agents	5	1
2	1	Advanced Search Techniques Uninformed Search: DFS, BFS.	3	2
	2	Informed Search: Best First Search, A* search, AO* search.	4	2
	3	Constraints and Constraint Satisfaction Problems (CSPs), Backtracking search for CSP. Adversarial Search & Games: Two-player zero-sum games, Minimax Search, Alpha-Beta pruning.	4	2
	4	Evolutionary Search Techniques: Introduction to evolutionary algorithms, Genetic algorithms, Applications of evolutionary search in AI.	4	2
	1	Logical Reasoning and Uncertainty Logic: Propositional logic, First-order predicate logic, Propositional versus first-order inference, Unification and lifting.	5	3

3	2	First Order Inference: Forward chaining, Backward chaining, Resolution, Truth maintenance systems.	5	3
	3	Handling Uncertainties:, Probabilistic reasoning, Introduction to Fuzzy set theory	5	3
4	1	Domains and Applications of AI: Introduction to Machine Learning, Computer Vision, Robotics, Natural Language Processing, Neural Networks.	6	4
	2	Expert Systems: The architecture and role of expert systems (include two case studies).	6	4
	3	Legal and Ethical Issues: Concerns related to AI	3	4
	Case Studies of each module of the syllabus, providing real-world relevance and practical insights		30	5

5	Group – 1	**Case Study 1**: **AI in Customer Service (Intelligent Agents)** • **Scenario**: A leading e-commerce platform implements AI-powered chatbots to handle customer queries efficiently. • **Details**: Discuss how intelligent agents operate in dynamic environments, adapt to user inputs, and learn over time. Focus on concepts like rationality, agent structure, and agent-environment interaction. **Case Study 2**: **The Wumpus World** • **Scenario**: The classic Wumpus World problem illustrates knowledge-based agents navigating an environment with uncertainty. • **Details**: Extend the problem to real-world examples, such as robot navigation in unknown terrains or automated cleaning robots in dynamic home environments. **Case Study 3**: **Google Maps and Navigation Systems (Search Techniques)** • **Scenario**: Explore how Google Maps uses A* search for route optimization and heuristic-based problem-solving. • **Details**: Discuss the trade-offs between uninformed (DFS, BFS) and informed searches like A*, and their real-world implications for user experience. **Case Study 4**: **Chess and Adversarial Search** • **Scenario**: AI systems like Deep Blue playing chess against world champions. • **Details**: Analyze how the Minimax algorithm and Alpha-Beta pruning were used to evaluate game states, optimize moves, and win against human players.

	Group - 2	**Case Study 1: Solving the 4-Queens Problem** • **Objective**: Demonstrate CSP techniques like backtracking and constraint propagation. • **Scenario**: The 4-Queens Problem requires placing four queens on a chessboard such that no two queens threaten each other. • **Details**: Formulate the problem as a CSP where variables represent columns, and domains represent rows. Use backtracking to place queens, ensuring constraints (no same row, column, or diagonal placement) are satisfied. Explore improvements with forward checking and arc consistency. **Case Study 2: Solving a Sudoku Puzzle** • **Objective**: Apply constraint propagation and backtracking to a classic problem. • **Scenario**: A partially filled Sudoku grid must be completed so that each row, column, and subgrid contains unique digits. • **Details**: Represent rows, columns, and grids as variables. Apply initial constraint propagation to reduce possible values for each cell. Use backtracking to fill cells while maintaining consistency. **Case Study 3: Scheduling Problem (Timetable Generation)** • **Objective**: Analyze constraints and use CSP techniques for optimization. • **Scenario**: A university needs to generate a timetable for courses, ensuring no instructor or student group has overlapping schedules. • **Details**: Variables: Time slots for courses. Domains: Available time slots. Constraints: Instructors and classrooms must not overlap, and prerequisites must be scheduled in sequence. Use constraint propagation to eliminate invalid slots and backtracking to finalize the schedule. **Case Study 4: Cryptarithmetic Problem**

		• **Objective**: Solve a CSP involving digits and arithmetic operations. • **Scenario**: Solve a problem like SEND + MORE = MONEY, where each letter represents a unique digit. • **Details**: Variables: Letters (S, E, N, D, M, O, R, Y). Domains: Digits 0-9. Constraints: Each letter must have a unique digit, and the arithmetic sum must be valid. Apply constraint propagation and backtracking to identify valid digit assignments. **Case Study 5: Resource Allocation for a Project** • **Objective**: Optimize resource allocation using CSP techniques. • **Scenario**: Assign tasks to team members while ensuring deadlines are met and workloads are balanced. • **Details**: Variables: Tasks. Domains: Available team members. Constraints: Skillset match, task dependencies, and workload distribution. Use constraint propagation to filter infeasible assignments and backtracking for optimal allocation.
	Group - 3	**Case Study 1**: **Expert Systems for Medical Diagnosis** • **Scenario**: Implementation of an expert system for diagnosing diseases based on patient symptoms and history. • **Details**: Discuss the use of propositional logic and first-order predicate logic in building rule-based systems for accurate diagnosis. **Case Study 2**: **Handling Uncertainty in Weather Forecasting** • **Scenario**: Probabilistic reasoning and Bayesian networks used in weather prediction systems. • **Details**: Explore how these systems manage incomplete or uncertain data to provide accurate forecasts.

	Group - 4	**Case Study 1: Loan Approval System** • **Objective**: Design a rule-based system for automating loan approval processes in banks. • **Scenario**: A system evaluates loan applications based on predefined criteria like credit score, income, and existing debt. • **Details**: **Knowledge Base**: Rules like IF credit_score > 700 AND income > 50000 THEN approve_loan. **Inference Mechanism**: Backward chaining to verify whether a specific loan can be approved, tracing required conditions. **Outcome**: Faster decision-making and reduced manual intervention in loan processing. **Case Study 2: Smart Home Automation** • **Objective**: Implement a rule-based system for automating home appliances. • **Scenario**: A smart home system adjusts lighting, temperature, and security based on user preferences and external conditions. • **Details**: **Knowledge Base**: Rules like IF time = night AND motion_detected = true THEN turn on the lights. **Inference Mechanism**: Forward chaining to trigger actions based on sensor inputs. **Outcome**: Enhanced user convenience and energy efficiency. **Case Study 3: Rule-Based Chatbot** • **Objective**: Create a chatbot for answering customer queries using predefined rules. • **Scenario**: A rule-based chatbot helps users with common issues like order tracking or account settings. • **Details**: **Knowledge Base**: Rules like IF user_query = "Where is my order?" THEN respond = "Please provide your order ID." **Inference Mechanism**: Forward chaining to determine the appropriate response based on input queries. **Outcome**: Seamless user interaction and improved customer support.

	Group - 5	**Case Study 1**: **AI in Autonomous Vehicles** • **Scenario**: Self-driving cars developed by companies like Tesla and Waymo. • **Details**: Discuss the integration of computer vision, machine learning, and robotics to enable vehicles to navigate safely. **Case Study 2**: **AI in Natural Language Processing (NLP)** • **Scenario**: Language translation systems like Google Translate or voice assistants like Alexa. • **Details**: Examine the challenges of context understanding, ambiguity resolution, and real-time processing in NLP. **Case Study 3**: **Legal and Ethical Issues in AI** • **Scenario**: Controversy around AI bias in hiring systems and facial recognition technologies. **Details**: Discuss ethical considerations, data privacy issues, and the importance of fairness and accountability in AI systems.
Students must prepare a report based on at least one case study analysis from each group of Module 5.		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** • Use of ICT tools in conjunction with traditional classroom teaching methods • Interactive sessions • Class discussions • Practical sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **CCA for Theory : 30 Marks** • Written Exam • Oral Presentations • Assignments **CCA for Practical : 15 Marks** • Evaluation of Case Study Assignments/report based on Module 5 • Report must include at least one case study from each of the five groups.
	B. End Semester Examination **ESE for Theory: Written test (70 Marks, 2 Hours)** Part A: Very Short Answer Questions (Answer all) - (5*2=10 Marks)

	Part B: Short answer Questions (5 out of 7 Questions) - (5*6=30 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*15=30 Marks) **ESE for Practical Component: 35 Marks** Lab Record : 15 Marks Viva : 20 Marks • Viva Voce based on the submitted report. • No Practical Examination.

REFERENCES:

1. Russell, S. and Norvig, P., "Artificial Intelligence - A Modern Approach", 3rd edition, Prentice Hall
2. Dan W Patterson, Introduction to Artificial Intelligence & Expert Systems, PHI Learning 2010.
3. Lavika Goel, Artificial Intelligence: Concepts and Applications, Wiley, 2021

Suggested Reading:

1. Elaine Rich and Kevin Knight, "Artificial Intelligence" Second Edition, Tata McGraw-Hill Edition.
2. Nilsson Nils J, Artificial Intelligence: A new Synthesis, Morgan Kaufmann Publishers Inc. San Francisco, CA, ISBN: 978-1-55-860467-4.
3. Rajiv Chopra, Data Science with Artificial Intelligence, Machine Learning and Deep Learning, Khanna Book Publishing Company, 2024.
4. M.C. Trivedi, Introduction to AI and Machine Learning, Khanna Book Publishing Company, 2024.
5. Van Hirtum, A. & Kolski, C. (2020). Constraint Satisfaction Problems: Algorithms and Applications. Springer
6. Rajiv Chopra, Machine Learning and Machine Intelligence, Khanna Book Publishing Company, 2024

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Programme	**BCA (Honours)**					
Course Name	**Entrepreneurship and Startup Ecosystem**					
Type of Course	**VAC**					
Course Code	**MG4VACBCA200**					
Course Level	**NA**					
Course Summary	This course provides a comprehensive introduction to Design Thinking, a human-centered approach to innovation that integrates the needs of people, the possibilities of technology, and the requirements for business success. Students will explore creative thinking processes, problem-solving approaches, and the importance of customer-centricity in the modern business landscape.					
Semester	4	Credits			2	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		2	0	0	0	30
Pre-requisites, if any	Nil					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Understand the legacy of family businesses and key differentiations from entrepreneurship. Be able to identify a business opportunity and translate it into a viable business model.	An	1,3
2	Understand the basic building blocks of creating a venture. Identify the elements of the Indian entrepreneurship ecosystem and leverage the relevant benefits from its constituents.	An	1,3

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

COURSE CONTENT

Content for Classroom transactions (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Introduction to Entrepreneurship & Family Business : Definition and Concept of entrepreneurship, Entrepreneur Characteristics, Classification of Entrepreneurs,	2	1
	1.2	Role of Entrepreneurship in Economic Development –Start-ups,	2	1
	1.3	Knowing the characteristics of Family business with discussion on few Indian cases of Family Business like Murugappa, Dabur, Wadia, Godrej, Kirloskar etc.	3	1
	1.4	Evaluating Business opportunity: Sources of business ideas and opportunity recognition, Guesstimating the market potential of a business idea,	4	1
	1.5	Feasibility analysis of the idea, Industry, competition and environment analysis.	4	1
2	2.1	Building Blocks of starting ventures, Low cost Marketing using digital technologies,	2	2
	2.2	Team building from scratch, Venture Funding, Establishing the value-chain and managing operations,	3	2
	2.3	Legal aspects like IPR and compliances.	2	2
	2.4	Start-up Ecosystem: Know the components of the start-up ecosystem including Incubators, Accelerators, Venture Capital Funds, Angel Investors etc.,	4	2
	2.5	Know various govt. schemes like Start-up India, Digital India, MSME etc., Sources of Venture Funding available in India, Source of Technology, Intellectual Property management.	4	2

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** **Continuous Comprehensive Assessment (CCA)** **CCA for Theory : 15 Marks** • Oral Presentations • Assignments • Written Exam
	B. End Semester Examination **ESE for Theory: 35 Marks (1 Hour)** Part A: Very Short Answer Questions (5 out of 7 Questions) - (5*3=15 Marks) Part B: Short Answer Questions (4 out of 6 Questions) - (4*5=20 Marks)

REFERENCES:

1. Startup India Learning Program by Start Up India available at www.startupindia.gov.in
2. Entrepreneurship, Rajeev Roy, Oxford University Press
3. Entrepreneurship: Successfully Launching New Ventures by R. Duane Ireland Bruce R. Barringer, Pearson Publishing
4. Family Business Management by Rajiv Agarwal, Sage Publishing Anish Tiwari (2003), "Mapping the Startup Ecosystem in India", Economic & Political Weekly
5. Ramachandran, K, Indian Family Businesses: Their survival beyond three generations, ISB Working Paper Series

	Mahatma Gandhi University **Kottayam**
Programme	**BCA (Honours)**
Course Name	**IT and Environmental Sustainability**
Type of Course	**VAC**
Course Code	**MG4VACBCA201**
Course Level	NA
Course Summary	This course aims to familiarize students with fundamental environmental concepts and their relevance to IT and business operations, preparing them to address forthcoming sustainability challenges. It is designed to equip students with the knowledge and skills needed to make decisions that account for environmental consequences, fostering environmentally sensitive and responsible future managers.

Semester	4	Credits			2	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		2	0	0	0	30
Pre-requisites, if any	NIL					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe the components of the environment, natural resources, and ecosystems, and explain sustainable practices for their conservation.	U	1,3
2	Identify types of pollution and waste, explain sustainable development goals, and summarize key environmental laws and their impact on society and businesses.	An	1,3, 6
3	Explain key social issues, environmental laws, and the role of population dynamics in promoting sustainable development.	An	1,6, 7,8

**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	**Understanding Environment, Natural Resources, and Sustainability**:			
	1.1	Components and segments of the environment, the man-environment relationship, Concept of sustainability; Classification of natural resources, issues related to their overutilization, and strategies for their conservation.	2	1
	1.2	sustainable practices in managing resources, including deforestation, water conservation, energy security, and food security issues. importance of public awareness and education.	3	1
	Ecosystems, Biodiversity, and Sustainable Practices:			
	1.3	Various natural ecosystems, learning about their structure, functions, and ecological characteristics.	2	1
	1.4	The importance of biodiversity, the threats it faces, and the methods used for its conservation.	2	1
	1.5	Need for sustainable ecosystem management, Significance of India as a mega diverse nation.	2	1
2	**Environmental Pollution, Waste Management, and Sustainable Development:**			
	2.1	Various types of environmental pollution, including air, water, noise, soil, marine pollution, E-waste, and their impacts on businesses and communities. Causes of pollution, such as global climate change, ozone layer depletion, the greenhouse effect, and acid rain, with a particular focus on pollution episodes in India.	2	2
	2.2	Classification of waste: solid, liquid, hazardous, and electronic waste. Principles of waste management: 3Rs – Reduce, Reuse, Recycle.	2	2
	2.3	Methods of waste disposal: landfilling, composting, incineration, recycling. E-waste management: Challenges and best practices. Role of IT in efficient waste management (smart bins, waste tracking apps).	3	2
	2.4	Concept and need for sustainability. Principles of sustainable development: Economic growth, Environmental protection, Social inclusion.	2	2
	2.5	UN Sustainable Development Goals (SDGs) with a focus on environmental goals. Green technologies and innovations: Renewable	2	2

		energy, Green computing, Eco-friendly products. Role of individuals and technology professionals in promoting sustainability.		
3	**Social Issues and Legislation:**			
	3.1	Dynamic interactions between society and the environment, with a focus on sustainable development and environmental ethics.	3	3
	3.2	Overview of key environmental legislation and the judiciary's role in environmental protection, including the Water (Prevention and Control of Pollution) Act of 1974, the Environment (Protection) Act of 1986, and the Air (Prevention and Control of Pollution) Act of 1981.	2	3
	3.3	Environmental justice, environmental refugees, and the resettlement and rehabilitation of affected populations; Ecological economics, human population growth, and demographic changes in India.	3	3

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** • Written test • Assignments • MCQ
	B. End Semester Examination (ESE) **ESE for Theory: Written Test (35 Marks, 1 Hr)** Part A: Short Answer Questions (7 out of 10 Questions) - (7*5=35 Marks)

REFERENCES:

1. Text Book of Environmental Studies by Bharucha, E., 3rd Edition, Orient Blackswan Private Ltd.
2. Environmental Studies, 3rd ed., Poonia, M.P. Khanna Book Publishing Co.
3. Sustainable Development: Environment, Energy and Water Resources. Roy, M. G., Ane Books.
4. Fundamentals of environmental studies, Basu, M., & Xavier Savarimuthu, S. J., Cambridge University Press.
5. Text Book of Environmental Studies, Dave, D., & Katewa, S. S Cengage Learning India Pvt Ltd.

6. Rajagopalan, R. *Environmental studies: from crisis to cure* (4th ed.). Oxford University Press.

SUGGESTED READINGS:

Web links:

- https://www.ourplanet.com
- https://www.undp.org/content/undp/en/home/sustainable-development-goals.html
- www.myfootprint.org
- https://www.globalchange.umich.edu/globalchange1/current/lectures/kling/ecosystem/ecosystem.html

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Programme	**BCA (Honours)**					
Course Name	**Object Oriented Programming using Java**					
Type of Course	**SEC**					
Course Code	**MG4SECBCA200**					
Course Level	**NA**					
Course Summary	This course covers basic object-oriented programming concepts, swing and database connectivity.					
Semester	4	Credits			5	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		3	0	2	0	105
Pre-requisites, if any	Knowledge about programming logic					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
CO1:	Understand the fundamental concepts of object-oriented programming using Java.	U	2
CO2:	Utilize arrays, String, Vectors, Wrapper Classes and inheritance in Java programming	An	2
CO3:	Utilize packages, Exceptions and Threads in Java programming	An	2
CO4:	Apply basic java Programming concepts, Multithreading Exceptions, and packages for problem solving.	An	2
CO5:	Understand basic GUI and JDBC architecture, and develop Java GUI applications to communicate with databases using JDBC.	A	2
**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate I, Create (C), Skill (S), Interest (I) and Appreciation (Ap)*			

COURSE CONTENT

Theory Content for Classroom transaction (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Concepts of Object-Oriented Programming, Benefits of OOP, Features of Java, Java Environment, defining a class, fields declaration, method declaration, creating object, accessing class members	6	1
	1.2	Decision Making, Branching & Looping: Decision Making with Control Statements, Looping statements, Jump in loops, Labelled loops.	2	1
	1.3	method overloading, constructors, constructor overloading, command line arguments, super keyword, static members	7	1
2	2.1	Arrays-one dimensional arrays, declaration, creation, initialization of arrays, two dimensional arrays.	5	2
	2.2	String class, Vectors, Wrapper Classes, Enumerated Types.	4	2
	2.3	Inheritance, overriding methods, dynamic method despatch, final (variables, methods and classes), abstract methods and classes, interfaces, visibility control	6	2
3	3.1	Packages: -Java API packages overview (lang, util, io, swing, applet), Creating and accessing packages, creating user defined packages, Adding class to a package.	5	3
	3.2	Exception Handling: Using the main keywords of exception handling: try, catch, throw, throws and finally; Nested try, Multiple catch statements, Creating user defined exceptions	4	3
	3.3	Multithreading-creation of multithreaded program-Thread class –Runnable interface-thread life cycle.	6	3
4	4.1	**Simple Java Programs:** 1. Read numeric data from user and output results.(Fibonacci series & Factorial etc.) 2. Numeric and String data as Command line arguments.	4	4
	4.2	1. Simple Programs using arrays: Sorting, searching, matrix operations, palindrome etc. 2. Programs to Utilize String Methods	6	4

	4.3	Programs to implement 1. Method Overloading, Constructor Overloading 2. Inheritance, Method overriding, Dynamic Method Despatch. 3.super, this, final and static keywords 4.Abstract class, interface, Package 5. Exception handling. 6.Multithreading	20	4
5	5.1	**Using NetBeans IDE Implement Simple Programs for Swing :** GUI programming using Swing-Window(Jframe, Jdialog), Containers(Jpanel, JtabbedPane, JscrollPane, JdesktopPane) Controls (Jlabel, JtextField, JtextArea, Jbutton, JcheckBox, JradioButton, Jlist, JcomboBox, Jtable), Layout managers (FlowLayout, BorderLayout, GridLayout, GridBagLayout, CardLayout, Null Layout)	20	5
	5.2	**Programs for Database Connectivity** JDBC – The Structured Query Language, The Connection Interface, The Prepared Statement Interface, ResultSets.	10	5

Teaching and Learning Approach	**Classroom Procedure (Mode of Transaction)** ICT Enabled lectures, Practical Sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) : 40 Marks** **CCA for Theory : 25 Marks** • Written Exam • Oral Presentations • Assignments **CCA for Practical : 15 Marks** • Lab assignments Based on Module 4.
	B. End Semester Examination **ESE for Theory: Written Test (50 Marks, 1.5 Hrs)** Part A: Very Short Answer Questions (Answer all) - (5*3=15 Marks) Part B: Short Answer Questions (4 out of 5 Questions) - (4*5=20 Marks) Part C: Essay Questions (1 out of 2 Questions) - (1*15=15 Marks) **ESE for Practical: 35 Marks (2 Hrs)** Question 1- (From Module 4): 10 Marks. Question 2- (From Module 5): 15 Marks. ***(Use NetBeans IDE for implementing the programs)*** Record: 5 Marks. Viva: 5 Marks.

REFERENCES:

1. Patrick Naughton – Java 2, The Complete Reference, Seventh Edition.

SUGGESTED READINGS::

1. Advanced Java Programming - Uttam K Roy, Oxford University Press; UK ed. Edition
2. E. Balagurusamy-Programming with Java, Third edition, McGraw Hill Publishers.
3. Cay S. Horstmann & Gary Cornell – Core Java Volume 1 – Fundamentals, Eighth edition.
4. K. Somasundaram – Programming in Java 2 , First edition, Jaico Publishing House.

	Mahatma Gandhi University Kottayam					
Programme	**BCA (Honours)**					
Course Name	**Probability Distributions and Statistical Inference**					
Type of Course	**SEC**					
Course Code	MG4SECBCA201					
Course Level	NA					
Course Summary	This course covers statistical concepts like data analysis, distributions, and hypothesis testing, enabling students to apply statistical methods to real-world problems.					
Semester	4	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	0	0	60
Pre-requisites, if any	NIL					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Analyse random variables, probability distributions, and statistical moments to model uncertainty, compute key metrics, and solve practical problems in data science and decision-making.	An	1
2	Apply key theoretical distributions to model real-world data, compute statistical properties, and solve probability problems—equipping them with essential tools for data analysis and predictive modelling.	A	1,2
3	Describe commonly used sampling distributions and their interrelationships.	U	1,2

4	Illustrate hypothesis testing, including types of hypotheses and errors, critical concepts like p-value and power, tests based on t, z, and chi-square distributions.	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 transactions (Units)

Module	Units	Course description	Hrs	CO No.
1		**Random Variables**		
	1.1	Random Variables: Definition of discrete and continuous random variables.	2	1
	1.2	Probability density(mass) function and distribution function (discrete case) with properties (without Proof),	4	1
	1.3	Expectation, variance and Moment generating function of a discrete random variable with properties (without proof), Related problems.	4	1
2		**Standard Probability Distributions**		
	2.1	Theoretical distributions: Discrete Distribution-Bernoulli, Binomial and Poisson-mean, variance, moment generating functions (without proof) and fitting of data, Problems based on the distributions.	9	2
	2.2	Problems based on the distributions, Continuous Distribution-Normal distribution, Important properties (without proof) of the distribution (mean, variance, moments, MGF, M.D. and Q.D, etc. fitting excluded).	5	2
	2.3	Area under the normal curve related problems.	4	2
3		**Sampling Distributions**		
	3.1	Sampling distribution, Statistic, Parameter, Standard Error.	2	3

	3.2	Sampling Distributions of Mean of the sample from Normal population and distribution of Variance (without derivation).	3	3
	3.3	Statement of the form of the distributions Z, t, Chi-square and F (form alone), properties (without derivation) and uses, Inter relationships.	8	3
4	**Testing of Hypothesis**			
	4.1	Statistical inference definition, Testing of hypotheses procedure, Statistical hypotheses, Simple and composite hypotheses, Null and Alternate hypothesis, Parametric and Non-parametric hypotheses.	2	4
	4.2	Type-1 and Type-II errors, Critical Region, One-tailed and Two-tailed tests, Size of the test, Significance level, P value, Power.	2	4
	4.3	Tests based on t and Z- Testing of Population mean (One sample and two samples).	4	4
	4.4	Testing of Population Proportion (One sample and Two samples), Paired sample t-test.	6	4
	4.5	Chi-square test of goodness of fit, Chi-square test of independence.	5	4

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** • Brainstorming lectures • Explicit teaching • Active Cooperative learning
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **CCA for Theory: 30 Marks** • Quiz / MCQ • Assignments • Tests

	B. End Semester Examination (ESE) **ESE for Theory: Written Test (70 Marks, 2 Hrs)** (Use of non-programmable calculator and statistical tables allowed) Part A: Answer any 5 questions out of 8. Each question carries 2 marks. (5 x 2 = 10 marks) Part B: Answer any 5 questions out of 8. Each question carries 6 marks. (5 x 6 = 30 marks). Part C: Answer any 2 questions out of 4. Each question carries 15 marks. (2 x 15 = 30 marks)

REFERENCES

1. S.C. Gupta and V.K. Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand and Sons
2. S.P. Gupta: Statistical Methods (Sultan Chand & Sons Delhi)
3. V.K. Rohatgi: An Introduction to Probability Theory and Mathematical Statistics, Wiley Eastern.
4. B.L. Agarwal: Basic Statistics, New Age International (p) Ltd.

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Programme	**BCA (Honours)**					
Course Name	**Design Thinking and Innovation**					
Type of Course	**SEC**					
Course Code	**MG4SECBCA202**					
Course Level	NA					
Course Summary	This course provides a comprehensive introduction to Design Thinking, a human-centered approach to innovation that integrates the needs of people, the possibilities of technology, and the requirements for business success. Students will explore creative thinking processes, problem-solving approaches, and the importance of customer-centricity in the modern business landscape.					
Semester	4	Credits			2	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		2	0	0	-	30
Pre-requisites, if any	Basic awareness of problem solving.					

COURSE OUTCOMES(CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
CO1:	Propose real-time innovative product designs and Choose appropriate frameworks, strategies, techniques during prototype development	An	1,3
CO2:	Know wicked problems and how to frame them in a consensus manner that is agreeable to all stakeholders using appropriate frameworks, strategies, techniques during prototype development.	An	1

CO3:	Analyze emotional experience and Inspect emotional expressions to better understand users while designing innovative products.	An	1,3
Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)			

COURSE CONTENT

Content for Classroom transactions (Units)

Module	Units	Course description	Hrs	CO No.
1	1	Basics of Design Thinking: Understand the concept of innovation and its significance in business. Understanding creative thinking process and problem solving approaches. Know Design Thinking approach and its objective.	2	1
	2	Design Thinking and customer centricity – real world examples of customer challenges, use of Design Thinking to Enhance Customer Experience, Parameters of Product Experience, Alignment of Customer Expectations with Product.	4	1
	3	Discussion of a few global success stories like AirBnB, Apple, IDEO, Netflix etc. Explain the four stages of Design Thinking Process – Empathize, Define, Ideate, Prototype, Implement	4	1
2	1	Learning to Empathize and Define the Problem : Know the importance of empathy in innovation process – how can students develop empathy using design tools Observing and assimilating information	2	2
	2	Individual differences & Uniqueness Group Discussion and Activities to encourage the understanding, acceptance and appreciation of individual differences.	3	2
	3	What are wicked problems? Identifying wicked problems around us and the potential impact of their solution	3	2
	4	Know the various templates of ideation like brainstorming, systems thinking Concept of	2	2

		brainstorming – how to reach consensus on wicked problems		
3	1	Ideate, Prototype and Implement: Mapping customer experience for ideation. Know the methods of prototyping, purpose of rapid prototyping. Implementation	4	3
	2	Feedback, Re-Design & Re-Create: Feedback loop, focus on User Experience, address ergonomic challenges, user focused design	3	3
	3	Final concept testing, Final Presentation – Solving Problems through innovative design concepts & creative solution	3	3

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 : 15 Marks** ○ Written test ○ Assignments ○ Oral Presentations
	B. End Semester Examination **ESE for Theory : Written Test (35 Marks, 1 Hour)** **Part A: Short Answer Questions (7 out of 10 Questions) – (7*5=35 Marks)**

REFERENCES:

1. E Balaguruswamy (2023), Developing Thinking Skills (The way to Success), Khanna Book Publishing Company .

2. Tim Brown, (2008), "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation", Harvard Business Review.

3. 8 steps to Innovation by R T Krishnan & V Dabholkar, Collins Publishing.

SUGGESTED READINGS:

1. Design Thinking by Nigel Cross, Bloomsbury.

	Mahatma Gandhi University Kottayam

Programme	**BCA (Honours)**					
Course Name	**Data Visualization**					
Type of Course	**DSE**					
Course Code	**MG4DSEBCA200**					
Course Level	NA					
Course Summary	This course provides a comprehensive introduction to data visualization, covering various types of data and the entire data visualization process. The course also addresses the challenges and limitations of data visualization and offers an overview of popular visualization tools and data storytelling principles. Additionally, it introduces the Power BI interface, data transformations and preparations, data models and visualizations, and the process of publishing and sharing reports.					
Semester	4	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		2	0	1	-	60
Pre-requisites, if any	Familiarity with using a computer, including file management and basic software navigation. Basic knowledge of data structures, such as tables and databases. Basic understanding of data analysis concepts and familiarity with data types.					

COURSE OUTCOME

CO No.	Expected Course Outcome	Learning Domains *	PO No
CO1:	Analyze the fundamentals of data visualization and its importance.	An	1
CO2:	Compare and contrast different types of visualizations and their appropriate uses.	An	2,3
CO3:	Use Power BI to create and customize various types of visualizations	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 transactions (Units)

Module	Units	Course description	Hrs	CO No.
1	1	Introduction to Data Visualization Definition and importance of data visualization-Role of data visualization in decision making, Types of data (numerical, categorical, temporal, geographical)-	2	1
	2	Data visualization process (data collection, exploration, analysis, visualization, interpretation)	4	1
	3	Challenges and limitations of data visualization	4	1
2	1	Visualization tools & Data Storytelling Overview of Visualization Tools (e.g., Excel, Tableau, Power BI, Python)- Comparing and contrasting features and Use Cases among these tools.	5	2
	2	Principles of Data Storytelling: Narrative and Context-Best Practices for Dashboard Layout and Interactivity.	5	2
	3	Designing Effective Visualizations Principles of Good Visualization Design.	3	2
	4	Understanding and Using Color in Visualizations	3	2
	5	Importance of Data Modelling in Visualization.	4	2
Practical Component: Lab Programs for Data Visualization Using Power BI				
3	1	**Introduction to Power BI Interface and Basics** 1. Installation and interface overview 2. Exploring the Power BI workspace: Ribbon, panes, and canvas. 3. Importing data from Excel and CSV files. 4. Introduction to multiple data sources 5. Basic report creation: Adding visuals and saving a report.	6	3
	2	**Data Transformation and Preparation** 1. Using Power Query Editor	6	3

		2. Cleaning data: Removing duplicates, handling missing values. 3. Transforming data: Splitting columns, changing data types, renaming columns. 4. Merging and appending queries. 5. Creating custom columns and calculated columns		
	3	**Data Modelling** 1. Creating relationships between tables 2. Identifying and resolving data inconsistencies 3. Creating calculated columns and measures	6	3
	4	**Creating Basic Visualizations** 1. Creating various chart types (bar, column, line, pie, area, etc.,) 2. Formatting and customizing visualizations	6	3
	5	**Publishing and Sharing Reports** 1. Publishing a report to Power BI Service. 2. Sharing reports and dashboards with team members. 3. Setting up data refresh schedules and managing permissions	6	3

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** **Continuous Comprehensive Assessment (CCA)** **CCA for Theory : 15 Marks** • Written Exam • Oral Presentations • Assignments **CCA for Practical : 15 Marks** • Lab assignments
	B. End Semester Examination **ESE for Theory: Written Test (35 Marks, 1 Hr)** Part A: Very Short Answer Questions (5 out of 7) - (5*3=15 Marks) Part B: Short Answer Questions (4 out of 6 Questions) - (4*5=20 Marks)

	ESE for Practical: 35 Marks • Implementation: 15 Marks. • Record : 10 Marks • Viva : 10 Marks

REFERENCES:

1. "Storytelling with Data: A Data Visualization Guide for Business Professionals" Cole Nussbaumer Knaflic, Wiley; 1st edition, 2015.

2. “The Visual Display of Quantitative Information” by Edward Tufte, Graphics Press USA; 2nd edition, 2001.

SUGGESTED READINGS:

1. "Data Visualization: A Practical Introduction" Kieran Healy, Princeton University Press, 2018.

2. "Analyzing Data with Power BI and Power Pivot for Excel", Alberto Ferrari and Marco Russo, Microsoft Press; 1st edition, 2017.

3. "Microsoft Power BI Complete Reference", Devin Knight, Brian Knight, Mitchell Pearson, and Manuel Quintana, Packt Publishing; 1st edition, 2018.

WEB RESOURCES:

1. https://learn.microsoft.com/en-us/power-bi/

2. https://www.storytellingwithdata.com/

3.https://jpsm.umd.edu/sites/jpsm.umd.edu/files/syllabi/Syllabus_Introduction%20to%20 Data%20Visualization_Spring%202024.pd

	Mahatma Gandhi University Kottayam
Programme	**BCA (Honours)**
Course Name	**Introduction to Machine Learning**
Type of Course	**DSE**
Course Code	**MG4DSEBCA201**
Course Level	NA
Course Summary	This course provides a comprehensive overview of machine learning, covering both theoretical concepts and practical applications, preparing students to apply ML techniques in various domains.

Semester	4	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		2	0	1	-	60
Pre-requisites, if any	Basic knowledge of statistics and probability. Familiarity with fundamental programming concepts and proficiency in Python. With libraries such as NumPy, pandas, Scikit-Learn, NLTK, Matplotlib, and Seaborn					

COURSE OUTCOMES(CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
CO1:	Define and explain machine learning concepts, types, and basic metrics.	An	1
CO2:	Understand supervised and unsupervised learning techniques	An	1
CO3:	Implement and evaluate supervised learning techniques, including K-Nearest Neighbors, linear regression, and logistic regression, and measure model performance using accuracy, precision, recall, and F1 score.	A	1
CO4:	Apply and visualize clustering algorithms such as K-Means, hierarchical clustering, and DBSCAN on	A	2,3

	datasets. This practical application helps you understand their real world use.		
CO5:	Perform dimensionality reduction using Principal Component Analysis (PCA) and interpret the results.	A	2,3
CO6:	Develop and assess classification models using random forests, support vector machines, and neural networks	A	2,3
CO7	Demonstrate ensemble learning concepts through bagging with random forests and boosting with the AdaBoost algorithm	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 transactions (Units)

Module	Units	Course description	Hrs	CO No.
1	1	Introduction to Machine Learning Introduction: Definition, History and Application of Machine Learning,	2	1
	2	Types of Machine Learning: Supervised, Unsupervised, Semi-Supervised, and Reinforcement Learning. Labeled and Unlabelled Dataset. Supervised Learning Tasks: Regression vs. Classification,	5	1
	3	Learning Framework: Training, Validation and Testing of ML models. Performance Evaluation Parameters: Confusion matrix, Accuracy, Precision, Recall, F1 Score, and AUC	8	1
2	1	Supervised Learning and Unsupervised Learning Regression: Linear and non-linear Regression, Logistic Regression. Classification: Naïve Bayes, K-Nearest Neighbors, Decision Trees.	3	2
	2	Linear model: Introduction to Artificial Neural Networks, Perceptron Learning Algorithm, Single Layer Perceptron, Introduction to Support Vector Machine for linearly separable data.	6	2
	3	Clustering: K-Means, Hierarchical Clustering, DBSCAN, Clustering Validation Measures. ML Applications: Ethical Considerations in Machine Learning, Case study and Real-world Applications	6	2

Introduction to Machine Learning Lab				
3	1	1.Implement linear regression on a dataset and visualize the regression line. 2. Implement logistic regression on a binary classification dataset and plot the decision boundary.3 Implement and evaluate the performance of Decision tree ID3/Cart classifier for any given dataset. 4.Implement and evaluate the performance of the Naive Bayes Classifier on a given dataset.	5	3
	2	1.Implement K-Means clustering on a point dataset and visualize and evaluate the clusters. 2. Implement hierarchical clustering on a dataset and plot the dendrogram. 3. Implement DBSCAN clustering on a dataset and visualize and evaluate the clusters.	5	4
	3	1. Perform Principal Components Analysis (PCA) and apply any one or more classifiers to show the performance variation with or without feature reduction.	5	5
	4	1. Build and evaluate a random forest classifier using a numerical dataset. 2. Implement a support vector machine for linearly separable classes and visualize the margins and decision boundary	8	6
	5	1.Build a single layer perceptron model to classify AND, OR, and XOR problems (may use TensorFlow/Keras) and visualize their decision boundaries. Also evaluate its performance. 2. Demonstrate the concept of boosting using the AdaBoost algorithm	7	7

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) : 30 Marks** **CCA for Theory : 15 Marks** • Written Exam • Oral Presentations • Assignments **CCA for Practical : 15 Marks** • Lab assignments Based on Module 3.

	B. End Semester Examination **ESE for Theory: 35 Marks (1 Hour)** **Written Examination for Modules 1 and 2.** Part A: Very Short Answer Questions (5 out of 7) - (5*3=15 Marks) Part B: Short Answer Questions (4 out of 6 Questions) - (4*5=20 Marks) **ESE for Practical Component: 35 Marks** Lab Record : 10 Marks Viva : 25 Marks (5 Marks for each CO in Module 3, 5*5= 25 Marks) **(No Practical Examination)**

REFERENCES:

1.Rajiv Chopra (2024), Machine Learning and Machine Intelligence, Khanna Publishing House.

2. Jeeva Jose (2023), Introduction to Machine Learning, Khanna Publishing House.

3. Mitchell T. (1997). Machine Learning, First Edition, McGraw-Hill.

4. Kalita, J. K., Bhattacharyya, D. K., & Roy, S. (2023). Fundamentals of Data Science: Theory and Practice. Elsevier. ISBN9780323917780

SUGGESTED READINGS:

1.Flach, P. A. (2012). Machine Learning: The Art and Science of Algorithms that Make Sense of Data. Cambridge University Press. ISBN: 9781107422223, 2012.

2. Duda, R. O., Hart, P. E., Stork, D (2007). Pattern classification (2Ed), John Wiley & Sons, ISBN-13: 978-8126511167.

3. Haykin S. (2009). Neural Networks and Learning Machines, Third Edition, PHI Learning.

4. Chollet, F. (2018). Deep Learning with Python. Manning Publications.

5. Bishop, C. M. (2006). Pattern Recognition and Machine Learning. Springer.

6. Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep Learning. MIT Press.

7. Géron, A. (2017). Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems* (1st ed.). O'Reilly Media

Mahatma Gandhi University
Kottayam

Programme	**BCA (Honours)**					
Course Name	**Web Programming –II**					
Type of Course	**DSE**					
Course Code	**MG4DSEBCA202**					
Course Level	NA					
Course Summary	This course covers the Node.js environment, the REPL terminal, Node.js modules, Node Package Manager (NPM), file management, event handling, database operations, and an introduction to the Express framework.					
Semester	4	Credits			3	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		2	0	1	0	60
Pre-requisites, if any	Basic Knowledge of JavaScript and OOPS					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
Upon completion of this course, the students will be able to:			
1	Understand Node JS and REPL terminal and Experiment with Node JS Modules and Node Package Manager	U	1
2	Make use of Web Server to manage files.	U	1
3	Understand event handling and database operations	A	1,2
4	Develop applications in Node JS and Express	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	Features and advantages of Node JS, Traditional Web Server Model, Node.js Process Model, Asynchronous programming with Node.js, Types of applications that can be developed using Node.js	2	1
	1.2	Primitive Types, Object Literal, Functions, NODE.JS MODULES: Module, Module Types: Core Modules, Local Modules, Third Party Modules, Module Exports. Using Modules in a Node.js File, Using the Built in HTTP, URL.	5	1
	1.3	Node Package Manager: NPM, Installing Packages Locally, Adding dependency in package.json, Installing packages globally, Updating packages.	3	1
2	2.1	Handling HTTP requests, Sending requests.	2	2
	2.2	File System-Reading, Writing a File, Writing a file asynchronously, Opening a file, deleting a file, Other IO Operations: Append, Rename, Truncate. File System Module with URL Module Create, Read, Remove a Directory.	5	2
3	3.1	EventEmitter class, Methods and Events of EvenEmitter Class, returning event emitter, Extend EventEmitter Class, Passing Arguments and 'this' to listeners, Asynchronous and Synchronous call, Handle Events only Once, Error Events	3	3
	3.2	Database Connectivity-Connection string, Configuring, working with insert, select command, updating records, delete records, drop tables, Ordered Result Set	4	3
	3.3	Express And Node Js-Introduction to Express Framework, Express Server Request-Response Routes, Route Parameters, Multiple Route Callback/Handler Functions, Methods of Response Object, Chaining Route Handlers, Send Static Files, Accept User Input, Send file as a response, Templates and Express.	6	3

4	4.1	Explore the Node.js REPL, Use Core Modules, Create and Import Custom Modules, Install and Use a Third-Party Module, Install a local package (e.g., chalk for colorful console output), Add dependencies in package.json and update them, Install a global package (e.g., nodemon) and use it to run a server, Create file and perform read and write operations, Perform asynchronous file operations like appending and renaming,Create a directory, add files, and remove the directory.	10	4
	4.2	Create and Send HTTP requests using the http module, Create an EventEmitter instance (Handle a custom event with a listener, Pass arguments to the listener function.), Implement an EventEmitter that triggers events based on asynchronous tasks (e.g., file read completion), Handle error events, Set up a connection to a database (e.g., MySQL or MongoDB) and Perform basic CRUD operations.	10	4
	4.3	Build an Express server (Handles GET and POST routes, Sends JSON and HTML responses.), Implement route parameters and query string handling, send static files using Express, Accept and validate user input through forms, implement file upload functionality, use a template engine like Pug to render dynamic views.	10	4

Teaching and Learning Approach	**Classroom Procedure (Mode of Transaction)** Lecture & Lab Sessions
Assessment Types	**MODE OF ASSESSMENT** **Continuous Comprehensive Assessment (CCA)** **CCA for Theory : 15 Marks** • Written Exam • Oral Presentations • Assignments **CCA for Practical : 15 Marks** • Lab assignments
	B. End Semester Examination **ESE for Theory: Written Test (35 Marks, 1 Hour)** **Written Examination for Modules 1, 2 and 3.**

	Part A: Very Short Answer Questions (5 out of 7) - (5*3=15 Marks) Part B: Short Answer Questions (4 out of 6 Questions) - (4*5=20 Marks) **ESE for Practical: (35 Marks, 2 Hrs)** 1. Design & Development - 20 Marks 2. Viva- 10 Marks 3. Record - 5 Mark

REFERENCES:

1. Dhruti Shah, "Node.JS Guidebook", BPB Publications, 2018.

SUGGESTED READINGS:

1. Basarat Ali Syed, Beginning Node.js, A press, 2014,

WEB REFERENCES:

1. https://nodejs.org/en/docs/
2. https://www.tutorialsteacher.com/nodejs

THE MAHATMA GANDHI UNIVERSITY

Bachelor in Computer Applications (Honours)

SYLLABUS

MGU-BCA (Honours)

(2024 Admission Onwards)

Faculty: Technology and Applied Sciences

Programme: Bachelor in Computer Applications (Honours)

Mahatma Gandhi University Priyadarshini Hills
Kottayam – 686560, Kerala, India

CONTENTS

Fifth Semester								
Course Code	Course Type	Course Title	Hours / week	*L	*T	*P	*O	Credit
MG5CCRBCA300	CC	Computer Networks	3	3	0	0	0	3
MG5CCRBCA301	CC	Digital Marketing	2	2	0	0	0	2
MG5VACBCA300	VAC	Disaster Management	2	2	0	0	0	2
# Professional Elective – III, IV and V								
MG5DSEBCA300	DSE	Introduction to Data Science (*Data Science specialization*)	6	4	0	2	0	5
MG5DSEBCA301		Time Series Analysis (*Data Science specialization*)	6	4	0	2	0	5
MG5DSEBCA302		Machine Learning (*Data Science specialization)*	6	4	0	2	0	5
MG5DSEBCA303		Neural Network (*Artificial Intelligence & Machine Learning specialization*)	6	4	0	2	0	5
MG5DSEBCA304		Digital Image Processing (*Artificial Intelligence & Machine Learning specialization*)	6	4	0	2	0	5
MG5DSEBCA305		Natural Language Processing (*Artificial Intelligence & Machine Learning specialization*)	6	4	0	2	0	5
MG5DSEBCA306		Web Development with Python - Django/Flask (*Full Stack Development specialization*)	6	4	0	2	0	5
MG5DSEBCA307		Cross-Platform Application Development with Dart and Flutter (*Full Stack Development specialization*)	6	4	0	2	0	5
MG5DSEBCA308		Modern Web Application Development with React.js (*Full Stack Development specialization*)	6	4	0	2	0	5
MG5SECBCA300	**SEC	Internship	0	0	0	0	0	4
		TOTAL	25	19	0	6	0	26
Sixth Semester								
MG6CCRBCA300	CC	Generative AI	5	3	0	2	0	4
MG6SECBCA300	SEC	Software Development Lab	8	0	0	8	0	4
#Professional Elective – VI & VII								
MG6DSEBCA300	DSE	Big Data Analytics (*Data Science Specialization*)	6	4	0	2	0	5
MG6DSEBCA301		Exploratory Data Analysis (*Data Science Specialization*)	6	4	0	2	0	5
MG6DSEBCA302		Deep Learning for Computer Vision (*Artificial Intelligence & Machine Learning Specialization*)	6	4	0	2	0	5

MG6DSEBCA303		Predictive Analysis (*Artificial Intelligence & Machine Learning Specialization*)	6	4	0	2	0	5
MG6DSEBCA304		DevOps Fundamentals with Docker and Jenkins (*Full Stack Development Specialization*)	6	4	0	2	0	5
MG6DSEBCA305		Web Security and Penetration Testing with Kali (*Full Stack Development Specialization*)	6	4	0	2	0	5
		TOTAL	25	11	0	14	0	18

*L-Lecture; *T-Tutorial; *P-Practical/Practicum; *O- Others

The student can choose any ***three*** DSE courses from the available options in fifth semester and any ***two*** in the sixth semester.

** At the end of the Fourth Semester every student shall undergo Internship for Eight Weeks or 240 hours in the industry/Research/ Academic Institute. This component will be evaluated during the fifth semester based on the guidelines provided by the university.

	Mahatma Gandhi University **Kottayam**
Programme	**BCA (Honours)**
Course Name	**Computer Networks**
Type of Course	**Core Course**
Course Code	**MG5CCRBCA300**
Course Level	**NA**
Course Summary	This course focuses on the theoretical foundations of networking and provides an overview of key networking concepts, topologies and network models. It also covers network protocols, security mechanisms, applications and emerging technologies.

Semester	5	Credits			3	
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	Total Hours
		3	0	0	0	45
Pre-requisites, if any	Basic knowledge of computer fundamentals.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe the concepts of Computer Networks, networking devices, circuit-switched and packet-switched networks.	U	1
2	Discuss network models, Data link layer and Network protocols .	A	1,2
3	Illustrate network applications, network security issues and emerging trends in networking.	A	2,3,10

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

COURSE CONTENT

Content for Classroom transactions (Units)

Module	Units	Course description	Hrs	CO No.
1	1.1	Overview of Computer Networks: Definition and Objectives, Applications and Examples, Types of Networks. Network Topologies: Physical vs. Logical Topologies Common Topologies: Star, Ring, Bus, Mesh, Hybrid. Advantages and Disadvantages of Each Topology.	6	1
	1.2	Data Transmission: Analog vs. Digital Signals. Transmission Modes: Simplex, Half-Duplex, Full-Duplex. Networking Devices: Routers, Switches, Hubs, Bridges, Gateways, Functions of each device.	5	1
	1.3	Switching: Circuit Switched Network, Three Phases, Packet Switching, Datagram Networks. Virtual Circuit Networks, Three Phases, Connection Oriented and Connectionless Services.	4	1
2	2.1	Network Models: OSI Model -Layers and Functions, TCP/IP Model - Layers and Functions, Comparison between OSI and TCP/IP Models.	5	2
	2.2	Data Link Layer: Error Detection and Error correction Framing, Flow and Error Control Mechanisms, protocols - Noiseless channels (Simplest, Stop and Wait) and Noisy channels (Stop and Wait and Piggy Backing). Multiple Access Protocols. Random Access-ALOHA, CSMA. Wired LANs-IEEE standards, standard Ethernet Wireless LANs-IEEE standard, Bluetooth. WirelessWAN-Cellular Telephony.	6	2
	2.3	Network Protocols: Introduction to TCP/IP Protocol Suite, IP Addressing: IPv4 and IPv6 .	4	2
3	3.1	Transport Layer: TCP vs. UDP: Characteristics and Use Cases, TCP Handshake and Connection Management,Flow Control and Congestion Control in TCP. Congestion Control Techniques: Slow Start, Congestion Avoidance, Fast Retransmit, Fast Recovery. Application Layer Protocols: HTTP/HTTPS: Structure and Operation, FTP, SMTP, POP3, IMAP: Protocols and Uses, DNS: Domain Name System and Resolution.	7	3
	3.2	Network Security Fundamentals: Common Threats and Vulnerabilities. Basic Security Mechanisms: Firewalls, VPNs, Encryption.	4	3
	3.3	Emerging Technologies: Software-Defined Networking (SDN), Network Function Virtualization (NFV), Internet of Things (IoT) and Its Impact on Networking.	4	3

		Network Management: SNMP: Simple Network Management Protocol, Network Monitoring Tools and Techniques. Future Trends in Networking: 5G and Beyond, Network Automation and Artificial Intelligence in Networking.		

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: 25 Marks** • Written test • Assignment • MCQ, Viva etc. **B. End Semester Examination (ESE)** **ESE for Theory: Written test (50 Marks, 1.5 Hrs)** Part A: Very Short Answer Questions (Answer all) - (10*2=20 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*15=15 Marks)

REFERENCES:

1. Behrouz A. Forouzan, "Data Communications and Networking", 5th Edition, McGraw-Hill Education, 2012.
2. Andrew S. Tanenbaum, "Computer Networks", 5th Edition, Pearson Education, 2011.
3. James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach", 8th Edition, Pearson, 2021.

SUGGESTED READINGS:

1. Larry L. Peterson and Bruce S. Davie, "Computer Networks: A Systems Approach", 6th Edition, Morgan Kaufmann, 2019.
2. Bhavneet Sidhu, An Integrated Approach to Computer Networks, Khanna Publishing House, 2023.

Mahatma Gandhi University
Kottayam

Programme	**BCA (Honours)**
Course Name	**Digital Marketing**
Type of Course	**Core Course**
Course Code	**MG5CCRBCA301**
Course Level	**NA**
Course Summary	This course introduces the fundamentals of digital marketing and search engine optimization (SEO). It covers digital marketing strategies, customer journey mapping, search engine mechanics, social media marketing, content creation, influencer marketing, online reputation management, and performance analytics. Students will gain practical knowledge of digital tools and emerging trends to design and evaluate effective digital marketing campaigns.

Semester	5	Credits			2	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		2	0	0	0	30
Pre-requisites, if any	Fundamentals of computer.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Implement both on-page and off-page SEO strategies to improve a website's search engine rankings.	An	1,3,4
2	Create engaging content and manage social media communities to build a positive online brand reputation and track campaign performance using analytics platforms.	An	2,3, 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	**Overview and Landscape:** Key differences between digital and traditional marketing, digital marketing channels, and the modern business environment.	3	1
	1.2	**Strategy & The Consumer:** The digital customer journey and strategic planning.	3	1
	1.3	**Search Engine Mechanics:** Understanding how search engines crawl, index, and rank pages.	3	1
	1.4	**On-Page SEO:** Keyword research, meta tags, URL structure, and content optimization.	3	1
	1.5	**Off-Page SEO & Tools:** Link building techniques, common mistakes to avoid, and using SEO analysis tools (e.g., Google Search Console).	3	1
2	2.1	**Social Media Strategy:** The role of social media, advertising, and building online communities.	3	2
	2.2	**Content Marketing:** Creation, curation strategies, and influencer marketing.	3	2
	2.3	**Reputation Management:** social media listening and managing online brand perception.	3	2
	2.4	**Performance Analytics:** Tracking campaign performance using data-driven insights and analytics platforms to optimize ROI.	3	2
	2.5	**Future Trends:** Emerging technologies in SEO, content, and social media marketing.	3	2

Teaching and Learning Approach	**Class room 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 : 15 Marks** ● Presentations ● Assignments ● Written Exam etc.
	B. End Semester Examination **ESE for Theory: 35 Marks (1 Hour)** Part A: Very Short Answer Questions (5 out of 7 Questions) - (5*3=15 Marks) Part B: Short Answer Questions (4 out of 6 Questions) - (4*5=20 Marks)

REFERENCES

1. Digital Marketing: Strategy, Implementation and Practice by Dave Chaffey and Fiona Ellis-Chadwick (7th Edition) , Pearson Publication

SUGGESTED READING

1. Fundamentals of Digital Marketing by Puneet Singh Bhatia (2nd Edition), Pearson Publication
2. Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation by Damian Ryan
3. The Art of SEO: Mastering Search Engine Optimization by Eric Enge, Stephan Spencer, and Jessie Stricchiola

Mahatma Gandhi University
Kottayam

Programme	**BCA(Honours)**
Course Name	**Disaster Management**
Type of Course	**VAC**
Course Code	**MG5VACBCA300**
Course Level	**NA**
Course Summary	The challenges emerge in diverse forms, transcending borders and intertwining economic, societal, and environmental realms profoundly affect vulnerable communities, magnifying their susceptibility to climate-related shocks and disasters. It is evident that aligning strategies with global Sustainable Development Goals (SDGs) across various geographical scales is paramount and it incorporates perspectives of environmental sustainability, climate adaptation, and disaster resilience. This course aims to equip students with the knowledge and skills necessary to address and mitigate the impacts of disasters in a holistic manner.

Semester	5	Credits			2	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		2	0	0	0	30

Pre-requisites, if any	NIL

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe the concepts related to disaster management and its importance and role.	An	1,10
2	Analyse institutional processes and management strategies to mitigate the impacts of disasters.	An	6,8
3	Illustrate different types of emergencies and steps to manage their impact.	An	1,6

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

COURSE CONTENT

Content for Classroom transactions (Units)

Module	Units	Course description	Hrs	CO No.
1	**Concepts and Terminologies**			
	1.1	Understanding key concepts of Hazards, disasters; Disaster types and causes (Geophysical, Hydrological, Meteorological, Biological and Atmospheric; Human-made)	2	1
	1.2	Global trends in disasters - Impacts (Physical, Social, Economic, Political, Environmental and Psychosocial)	3	1
	1.3	Defining Vulnerability (Physical Vulnerability; Economic Vulnerability; Social Vulnerability)	2	1
	1.4	Components of disaster management cycle (Phases: Response and recovery, Risk assessment, Mitigation and prevention, Preparedness planning, Prediction and warning)	3	1
2	**Initiatives at national and international level**			
	2.1	Disaster risk reduction (DRR), Community based disaster risk reduction.	3	2
	2.2	Disaster Risk Management in India and at international level: Related policies, plans, programmes and legislation.	4	2
	2.3	International strategy for disaster reduction and other initiatives.	3	2
3	**Emergency Management**			
	3.1	Explosion and accidents (Industrial, Nuclear, Transport and Mining) - Spill (Oil and Hazardous material);	5	3
	3.2	Threats (Bomb and terrorist attacks) - Stampede and conflicts	5	3

NOTE: At least two Training and Demonstration Workshops be organized in association with the organizations like NIDM, NDRF, NCDC, Para Military, Fire Brigade, CISF, Fire and safety, local administration.

Students should prepare a report based on

i. Any three case studies from the give list.

ii. Two workshops conducted.

Case Studies for Disaster Management Topics

1. 2004 Indian Ocean Tsunami
2. 2018 Kerala Floods

3. COVID-19 Pandemic

4. Chernobyl Disaster

5. 2013 Uttarakhand Floods

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** Demonstration, Discussions, Case Analysis etc.
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **CCA for Theory- 15 Marks** • Assignment • MCQ/Quiz • Viva etc.
	B. End Semester Examination (ESE) **ESE for Theory :35 Marks** Report - 15 Marks Viva - 20Marks (Viva based on CO1, CO2, CO3 and Report.

REFERENCES

1. Sharma, S.C. (2022), Disaster Management, Khanna Book Publishing. (AICTE Recommended Textbook).

2. Clements, B. W., (2009): Disasters and Public Health: Planning and Response, Elsevier Inc.

3. Dunkan, K., and Brebbia, C. A., (Eds.) (2009): Disaster Management and Human Health Risk: Reducing Risk, Improving Outcomes, WIT Press, UK.

4. Singh, R. B. (ed.), (2006) Natural Hazards and Disaster Management: Vulnerability and Mitigation, Rawat Publications, New Delhi.

5. Ramkumar, Mu, (2009) Geological Hazards: Causes, Consequences and Methods of Containment, New India Publishing Agency, New Delhi.

6. Modh, S. (2010) Managing Natural Disaster: Hydrological, Marine and Geological Disasters, Macmillan, Delhi.

7. Carter, N. (1991) Disaster Management: A Disaster Management Handbook. Asian Development Bank, Manila.

8. Govt. of India (2008) Vulnerability Atlas of India. BMTPC, New Delhi.

9. Govt. of India (2011) Disaster Management in India. Ministry of Home Affairs, New Delhi.

10. Matthews , J.A., (2002) Natural Hazards and Environmental Change, Bill McGuire, Ian Mason.

11. Gupta, O.P. (2023), Elements of Solid Hazardous Waste and Management, Khanna Publishing House.

12. Poonia, M.P. & Sharma, S.C. (2022), Environmental Studies, Khanna Publishing House.

Web Resources

http://www.ndma.gov.in/en/

http://nidm.gov.in/

https://www.unisdr.org/

http://www.emdat.be

https://www.weather.gov/safety/ https://www.preventionweb.net/risk/vulnerability

	Mahatma Gandhi University Kottayam
Programme	**BCA (Honours)**
Course Name	**Introduction to Data Science**
Type of Course	**DSE**
Course Code	**MG5DSEBCA300**
Course Level	**NA**
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	5	Credits			5	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	1	0	90
Pre-requisites, if any	Knowledge in computer programming and statistical calculations.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe the need, evolution, roles, life cycle, applications, prerequisites, tools, and security issues in data science.	U	1
2	Illustrate data types, sources, collection methods, statistical descriptions, and pre-processing techniques.	An	1,2
3	Analyse the importance, types, techniques, steps, and tools for performing exploratory data analysis.	An	2,3
4	Analyze the steps in data science modeling,	An	2
5	Implement data analysis using R.	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 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.	10	1
2	2.1	Introduction to Data - Types of data - Sources of data – Data Collection methods - Basic Statistical Descriptions of Data.	5	2
	2.2	Data Pre-Processing Overview: Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization.	5	2
	2.3	Introduction to R – Basics - RStudio - R Data Types - Operators - Basic Read and Write functions. R Objects: Vector, Matrix, Array, Data Frame, Factor, List ()– Decision Making Statements – Control Structures.	5	2
3	3.1	Exploratory Data Analytics – Importance of EDA – Types of EDA.	5	3
	3.2	Univariate Analysis, Bivariate Analysis, Multivariate Analysis Specialized EDA Techniques - Steps for performing EDA - Tools for Performing EDA.	5	3
	3.3	Exploratory Data Analysis using R- Data Preprocessing	5	3
4	4.1	Data Science Modelling – Steps in Data Science Modelling - Simple Linear Regression - Multiple LinearRegression	5	4
	4.2	Linear Model Selection and Diagnostics. - Mode Evaluation and Metrics in Data Science - Common Evaluation Metrics: Confusion matrix - Mean Absolute Error (MAE) - Mean Squared Error (MSE) - Root MeanSquared Error (RMSE) Cross Validation: K-fold cross-validation - stratified cross-validation.	7	4
	4.3	Descriptive Statistics in R- Central Tendency - Variability - Mean - Median - Range - Variance.	3	4

	Lab Practice			
5		1. Import and export Data into and from R: CSV Text file Excel file 2. Implement Exception Handling – Progress and Timing. 3. Implement data visualization in R: Scatter Plot, Boxplot, Bar Chart, Histogram, Box and Whiskers plot 4. Implementation of Multiple Linear Regression in R. 5. Implement Descriptive Statistics in R: Central Tendency - Variability - Mean - Median - Range - Variance.	30	5

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** • Lecture • Demonstration • Practical sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **CCA for Theory: 30 Marks** • Written test • Assignments • Viva, MCQ etc. **CCA for Practical: 15 Marks** • Practical assignments • Observation of practical skills • Viva etc.

	B. End Semester Examination (ESE) **ESE for Theory: Written Test (70 Marks, 2 Hrs.)** Part A: Very Short Answer Questions (Answer all) - (5*2=10 Marks) Part B: Short Answer Questions(5 out of 7 Questions) - (5*6=30 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*15=30 Marks) **ESE for Practical: (35 Marks, 1.5 Hrs.)** • Logic - 10 Marks • Successful Compilation - 5 Marks • Output - 5 Marks • Viva - 10 Marks • Record - 5 Marks

REFERENCES:

1. Cathy O'Neil and Rachel Schutt , "Doing Data Science", O'Reilly, 2015.

2. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big data Analytics", EMC 2013

3. Mark Gardener, "Beginning R - The Statistical Programming Language", John Wiley & Sons, Inc., 2012.

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

	Mahatma Gandhi University Kottayam					
Programme	**BCA (Honours)**					
Course Name	**Time Series Analysis**					
Type of Course	**DSE**					
Course Code	**MG5DSEBCA301**					
Course Level	**NA**					
Course Summary	This course covers key concepts of Time Series Analysis, time series model for forecasting, time series regression models, ARIMA modelling of stationary and nonstationary time series.					
Semester	5	Credits			5	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	1	0	90
Pre-requisites, if any	NIL					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Illustrate basic concepts in time series analysis and forecasting.	U	1
2	Analyse statistical methods and forecasting techniques to analyse, model,and interpret time series data.	An	1
3	Analyse various time series regression models.	An	2
4	Distinguish the ARIMA modelling of stationary and nonstationary time series.	An	2
5	Implement time series analysis with Tableau	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 OF TIMESERIES ANALYSIS: Introduction to Time Series and Forecasting -Different types of data-Internal structures of time series Models for time series analysis - Autocorrelation and Partial autocorrelation.	10	1
	1.2	Nature and uses of forecasting-Forecasting Process-Data for forecasting – Resources for forecasting.	5	1
2	2.1	STATISTICS BACKGROUND FOR FORECASTING: Graphical Displays -Time Series Plots - Plotting Smoothed Data - Numerical Description of Time Series Data - Use of Data Transformations and Adjustments	10	2
	2.2	General Approach to Time Series Modeling and Forecasting-Evaluating and Monitoring Forecasting Model Performance.	5	2
3	3.1	TIME SERIES REGRESSION MODEL: Introduction - Least Squares Estimation in Linear Regression Models - Statistical Inference in Linear Regression - Prediction of New Observations - Model Adequacy Checking -Variable Selection	5	3
	3.2	Methods in Regression - Generalized and Weighted Least Squares- Regression Models for General Time Series Data-Exponential Smoothing-First order and Second order.	10	3
4	4.1	Multivariate Time Series Models and Forecasting - Multivariate Stationary Process- Vector ARIMA Models - Vector AR (VAR) Models.	10	4
	4.2	Neural Networks and Forecasting -Spectral Analysis - Bayesian Methods in Forecasting.	5	4
5	5.1	Practical Component: Working with Tableau: Navigating Tableau. design flow, File types, Data types, Fields Operations, adding colours, Adding Labels and formatting, Joining and blending data. Tableau Worksheets, Tableau calculations, sort, Charts, Time Series, Aggregation and Filters, Working with Data extracts in Tableau , Working with Time Series, Adding Filter and Quick Filter, Tableau dashboard. 1.Time Series Data Cleaning 2.Loading and Handling Times series data 3. Preprocessing Techniques 4. Joining and blending data	30	5

		5. Working with data extracts 6.Creating various types of charts in Tableau. 7. Adding filter and quick filter 8. Regression analysis using Tableaus		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** • Lecture • Demonstration • Practical sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **CCA for Theory: 30 Marks** • Written test • Assignments • Viva • MCQ etc. **CCA for Practical: 15 Marks** • Practical assignments • Observation of practical skills • Viva etc.
	B. End Semester Examination (ESE) **ESE for Theory: Written Test (70 Marks, 2 Hrs.)** Part A: Very Short Answer Questions (Answer all) - (5*2=10 Marks) Part B: Short Answer Questions (5 out of 7 Questions) - (5*6=30 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*15=30 Marks) **ESE for Practical: (35 Marks, 1.5 Hrs.)** • Logic - 10 Marks • Successful Compilation - 5 Marks • Output - 5 Marks • Viva - 10 Marks • Record - 5 Marks

REFERENCES:

1. Introduction To Time Series Analysis And Forecasting, 2nd Edition, Wiley Series In Probability And Statistics, By Douglas C. Montgomery, Cheryl L. Jen(2015)
2. Master Time Series Data Processing, Visualization, And Modeling Using Python Dr. Avishek Pal Dr. Pks Prakash (2017)
3. Time Series Analysis And Forecasting By Example Søren Bisgaard Murat Kulahci Technical

SUGGESTED READINGS:

1. Peter J. Brockwell Richard A. Davis Introduction To Time Series And Forecasting Third Edition.(2016),

2. Multivariate Time Series Analysis and Applications William W.S. Wei Department of Statistical Science Temple University, Philadelphia, PA, SA This edition first published 2019 John Wiley & Sons Ltd.

	Mahatma Gandhi University Kottayam
Programme	**BCA (Honours)**
Course Name	**Machine Learning**
Type of Course	**DSE**
Course Code	**MG5DSEBCA302**
Course Level	**NA**
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	5	Credits			5	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	1	0	90
Pre-requisites, if any	NIL					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe fundamental concepts of machine learning.	U	1
2	Analyse regression and classification techniques , perform data preprocessing and feature engineering.	An	1,2
3	Describe the fundamentals of Artificial Neural Networks, Perceptron Learning Algorithm.	An	2
4	Apply clustering algorithms and evaluate their performance using validation measures.	A	2,3
5	Implement various machine learning algorithms	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 Machine Learning, History of Machine Learning, Examples of Machine Learning applications.	5	1
	1.2	Types of learning: supervised, unsupervised, semi-supervised learning and Reinforcement Learning. Labelled and Unlabeled Dataset.	5	1
	1.3	Learning Framework: Training, Validation and Testing of ML Models. Performance Evaluation Parameters: Confusion Metric, Accuracy, Precision, Recall, F1 Score and AUC	5	1
2	2.1	Regression, Classification, Training versus testing. Model Selection and Generalization, Data Preprocessing, Feature Selection, Feature Extraction.	5	2
	2.2	Regression: Simple Linear Regression, Multiple Linear Regression, Ridge Regression, Lasso Regression, Metrics for evaluating regression problems – MAE, MSE, RMSE, MAPE, R^2 .	5	2
	2.3	Classification- Logistic Regression, KNN, Decision Trees- Entropy, Information Gain, Tree construction, Issues in Decision Tree learning.	5	2
3	3.1	Linear model: Introduction to Artificial Neural Networks, Biological Neurons, Idea of computational units, Linear Perceptron, Multilayer Perceptron, Perceptron Learning Algorithm, Linear Separability, Loss Functions- Various Types, Hyper Parameter Tuning, Feed Forward Neural Networks, Forward Propagation, Activation Functions and its Derivatives, Back Propagation and optimization Functions	10	3
	3.2	Introduction to Support Vector Machine for linearly separable data.	5	3
4	4.1	Clustering: K-Means, K-Medoids, Hierarchical Clustering – Agglomerative Vs Divisive Clustering, BIRCH, Chameleon, DBSCAN, Grid Based methods- STING, Clustering Validation Measures.	10	4
	4.2	ML Applications: Ethical Considerations in Machine Learning, Real-world Applications.	5	4
	5.1	1.Implement linear regression on a dataset and visualize the regression line.		

5		2. Implement logistic regression on a binary classification dataset and plot the decision boundary. 3 Implement and evaluate the performance of Decision tree ID3/Cart classifier for any given dataset. 4.Implement and evaluate the performance of the Naive Bayes Classifier on a given dataset. 5.Implement K-Means clustering on a point dataset and visualize and evaluate the clusters. 6. Implement hierarchical clustering on a dataset and plot the dendrogram. 7. Implement DBSCAN clustering on a dataset and visualize and evaluate the clusters. 8. Implement a support vector machine for linearly separable classes and visualize the margins and decision boundary.	30	5

REFERENCES:

1. Mitchell T M. (2017). Machine Learning, McGraw-Hill.

2.Rajiv Chopra (2024), Machine Learning and Machine Intelligence, Khanna Publishing House.

3. Kalita, J. K., Bhattacharyya, D. K., & Roy, S. (2023). Fundamentals of Data Science: Theory and Practice. Elsevier. ISBN9780323917780

SUGGESTED READINGS:

1.Flach, P. A. (2012). Machine Learning: The Art and Science of Algorithms that Make Sense of Data. Cambridge University Press. ISBN: 9781107422223, 2012.

2. Duda, R. O., Hart, P. E., Stork, D (2007). Pattern classification (2Ed), John Wiley & Sons, ISBN-13: 978-8126511167.

3. Haykin S. (2009). Neural Networks and Learning Machines, Third Edition, PHI Learning.

4. Chollet, F. (2018). Deep Learning with Python. Manning Publications.

5. Bishop, C. M. (2006). Pattern Recognition and Machine Learning. Springer.

6. Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep Learning. MIT Press.

7. Géron, A. (2017). Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems* (1st ed.). O'Reilly Media.

	Mahatma Gandhi University Kottayam
Programme	BCA (Honours)
Course Name	**Neural Networks**
Type of Course	**DSE**
Course Code	**MG5DSEBCA303**
Course Level	NA
Course Summary	This course provides a comprehensive introduction to neural networks and deep learning, covering both theoretical foundations and practical implementation. It begins with the fundamental concepts of artificial neural networks and progresses to advanced architectures such as Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs), Generative Adversarial Networks (GANs), and reinforcement learning models. Learners will gain practical experience using modern deep learning frameworks such as TensorFlow and PyTorch, enabling them to design, train, and evaluate models effectively.

Semester	5	Credits			5	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	1	0	90
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	Illustrate the fundamentals of neural networks, and deep learning frameworks.	An	1,2
2	Design Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs), and analyse transfer learning techniques.	An	1,2
3	Analyse advanced RNN architectures and reinforcement learning algorithms to solve complex problems.	An	2,3

4	Analyse Generative Adversarial Networks (GANs), including DCGAN and WGAN, as well as clustering and dimensionality reduction techniques.	An	1,2
5	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 I, 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.	3	1
	1.2	Activation functions – sigmoid, ReLU. Feedforward process and the role of weights and biases.	3	1
	1.3	Backpropagation algorithm for training neural networks.	3	1
	1.4	Deep Learning Frameworks:-Introduction to TensorFlow and PyTorch.	3	1
	1.5	Setting up the development environment, Overview of basic operations and syntax.	3	1
2	2.1	Fundamentals of Convolutional Neural Networks (CNNs), Convolution operation and feature extraction, Understanding filters/kernels, Basics of Feature maps and representation	2	2
	2.2	Convolutional Layer Design: Stride and its impact on output size, Padding, Filter design and parameter selection, Output dimension calculations	2	2
	2.3	Purpose of pooling, Types of pooling: Max pooling and Average pooling, Role in dimensionality reduction, Impact on model performance	3	2
	2.4	Over view of popular CNN Architectures- LeNet, AlexNet, VGG, ResNet. Parameters and design choices.	4	2
	2.5	Transfer Learning: Concept and importance of transfer learning, Pre-trained models, Fine-tuning models for custom datasets.	4	2
3	3.1	Basics of Recurrent Neural Networks:- Concept of sequential data processing, Need for RNNs in handling temporal data, Architecture and working of basic RNNs	3	3

	3.2	Training Challenges in RNNs: Vanishing and exploding gradient problems, Techniques to mitigate these issues	3	3
	3.3	Advanced RNN Architectures: Long Short-Term Memory (LSTM) networks, Gated Recurrent Unit (GRU), Handling long-term dependencies, Comparison of LSTM and GRU	3	3
	3.4	Fundamentals of Reinforcement Learning-Introduction to Reinforcement Learning, Markov Decision Processes (MDPs), Exploration vs exploitation trade-off.	3	3
	3.5	Reinforcement Learning Algorithms: Q-Learning algorithm, Deep Q Networks (DQN) for Handling complex and high-dimensional state spaces.	3	3
4	4.1	Introduction to Generative Models and GANs: Generative models and their Applications of GANs, Concept of adversarial training.	2	4
	4.2	Advanced GAN Architectures: Deep Convolutional GAN (DCGAN), Wasserstein GAN (WGAN), Variations and improvements in GAN models.	4	4
	4.3	Fundamentals of Unsupervised Learning: Introduction to unsupervised learning, Importance and applications, Types of unsupervised learning methods.	3	4
	4.4	Clustering algorithms :K-Means	3	4
	4.5	Dimensionality reduction techniques : PCA.	3	4
5	Lab Practice			
	5.1	Implement using Python: 1. Basic neural network using TensorFlow or PyTorch. 2. Single artificial neuron using NumPy (with weights, bias, and input). 3. Visualize activation functions (Sigmoid vs ReLU) using plots. 4. Feedforward neural network (FFNN), Perform forward propagation for a given dataset. 5. Train a neural network using a small dataset (e.g., XOR problem). 6. Backpropagation for a simple neural network. 7. Train the model using gradient descent. Plot loss vs epochs. Compare learning with different learning rates. 8. Train a basic classifier 9. Perform 2D convolution operation on an image. 10. Apply different filters (edge detection, blur, sharpen). 11. Visualize feature maps after convolution. 12. Write a program to compute output dimensions of convolution layers. Experiment with: Different stride values, Padding techniques 13. Design a CNN architecture for image classification.	30	5

		14. Max Pooling and Average Pooling. Compare outputs of both pooling techniques. 15. Analyze dimensionality reduction effects. 16. Load a pre-trained CNN model, Perform feature extraction using the model. Fine-tune the model for a custom dataset. 17. Basic RNN for sequence prediction, Train on time-series or text data. 18. Image Classification using CNNs, Generating Synthetic Images with GANs, 19. k-mean Clustering Algorithm, 20. Apply PCA for a sample dataset and classify.		

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: 30 Marks** 1. Written test 2. Assignments 3. Viva 4. MCQ etc. **CCA for Practical: 15 Marks** • Practical assignments • Observation of practical skills • Viva etc. • Lab Record
	B. Semester End Examination **ESE for Theory: Written Test (70 Marks, 2 Hrs)** Part A: Very Short Answer Questions. (Answer all) - (5 x 2 = 10 marks) Part B: Short answer questions (5 out of 7 Questions) - (5 x 6 = 30 marks). Part C: Essay questions (2 out of 3 Questions) - (2 x 15 = 30 marks) **ESE for Practical: (35 Marks, 1.5 Hrs)** 1. Coding - 10 Marks 2. Output - 10 Marks 3. Viva - 10 Marks 4. 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;

Mahatma Gandhi University
Kottayam

Programme	BCA (Honours)					
Course Name	**Digital Image Processing**					
Type of Course	**DSE**					
Course Code	**MG5DSEBCA304**					
Course Level	NA					
Course Summary	The course imparts a comprehensive knowledge about the digital image processing techniques					
Semester	5	Credits			5	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	1	0	90
Pre-requisites, if any	Computer fundamentals and Python Programming.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Illustrate digital images, processing steps, acquisition, sampling, quantization and color models.	U	1,2,3
2	Analyse spatial domain techniques for image enhancement effectively.	An	1,2,3
3	Examine the role of morphological image processing techniques in pattern detection.	An	1,2,3
4	Analyse image restoration and segmentation techniques proficiently.	An	1,2,3
5	Implement image processing 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	Digital Image Fundamentals: Image, Digital Image, Digital image processing-definitions, Elements of visual perception- Brightness adaptation and Discrimination	3	1
	1.2	Fundamental steps in Digital Image Processing	2	1
	1.3	Components of Digital Image Processing system,	4	1
	1.4	Digital Image Formation Model: Image sensing and acquisition, Image sampling and quantization	3	1
	1.5	Color image fundamentals, Color Models-RGB, CMY, HSI	3	1
2	2.1	Spatial and Intensity resolution, Basic relationship among Pixels.	3	2
	2.2	Basic Intensity transformation functions - Image Negatives, Log Transformations, Power Law Transformations, Piecewise Linear Transformations,	3	2
	2.3	Histogram processing: Histogram Matching, Histogram Stretching, Histogram Equalization.	3	2
	2.4	Spatial filtering – Spatial correlation and convolution; Smoothing Spatial Filters, Sharpening Spatial Filters - Laplacian Filter - Unsharp masking - High Boost Filter. Gradient operators	3	2
	2.5	Fourier transform and frequency domain- Introduction to Fourier transform: 1- DFT, 2 –D DFT and its Inverse Transform, Properties of 2-D DFT	3	2
3	3.1	Introduction to Morphological Image Processing: Fundamentals of image morphology, Applications of morphological operations, Basic concepts and terminology	3	3
	3.2	Set Theory Foundations for Morphology: Basics of set theory, Basic Set operations in image processing.	3	3
	3.3	Basic Morphological Operations: Dilation: concept and effects, Erosion: concept and effects, Role of structuring elements.	3	3
	3.4	Advanced Morphological Operations: Opening operation Closing operation, Applications in noise removal and shape analysis.	3	3
	3.5	Hit-or-Miss Transformation: Concept and definition Pattern detection using hit-or-miss	3	3
4	4.1	Noise models-Gaussian Noise, Rayleigh Noise, Gamma Noise, Exponential Noise, Impulse Noise	3	4

	4.2	Restoration using Mean Filters, Order Statistics filters, Adaptive filters	3	4
	4.3	Image Segmentation basics: Point, Line, Edge detection- detection of isolated points, Basic edge detection;	3	4
	4.4	Thresholding- Global Thresholding using otsu's method	3	4
	4.5	Region based segmentation – Region growing, Region splitting and merging, watershed segmentation	3	4
5	Lab Practice			
	5.1	Implement using Python: 1. Load a grayscale and color image and display, Convert a color image to grayscale. 2. Simulate image sampling and quantization by reducing resolution and gray levels. 3. Demonstrate spatial and intensity resolution differences using image resizing and quantization. 4. Compute and visualize adjacency and connectivity in a binary image. 5. Read an image and separate it into RGB components. Convert RGB image to CMY and HSI color models. 6. Modify hue, saturation, and intensity and display the output. 7. Plot color histograms for each channel. 8. Image negative transformation. 9. Apply log transformation and analyze contrast enhancement. 10. Pwer-law (gamma) transformation for different gamma values. 11. Perform piecewise linear transformations (contrast stretching, thresholding). 12. Perform histogram equalization and compare results. 13. Implement histogram stretching. 14. Apply histogram matching (specification) with a reference image. 15. Perform spatial correlation and convolution using custom kernels. 16. Apply smoothing filters (mean, Gaussian). 17. Sharpening filters using Laplacian, 18. Perform unsharp masking and high-boost filtering. 19. Apply gradient operators (Sobel, Prewitt) for edge detection. 20. Compute and visualize the 2D Fourier Transform of an image. Implement inverse DFT and reconstruct the image. 21. Apply low-pass and high-pass filters in frequency domain. 22. Demonstrate properties of DFT (translation, scaling). 23. Perform basic morphological operations: dilation and erosion. Use different structuring elements and analyze effects,Opening and closing operations. 24. Hit-or-miss transformation for pattern detection. 25. Add different types of noise: Gaussian, Salt & Pepper (Impulse), Rayleigh / Gamma / Exponential, Apply mean filters and analyze results.	30	5

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 3. Viva 4. MCQ etc **CCA for Practical: 15 Marks** • Practical assignments • Observation of practical skills • Lab Record • Viva
	B. Semester End Examination **ESE for Theory: Written Test (70 Marks, 2 Hrs)** Part A: Very Short Answer Questions. (Answer all) - (5 x 2 = 10 marks) Part B: Short answer questions (5 out of 7 Questions) - (5 x 6 = 30 marks). Part C: Essay questions (2 out of 3 Questions) - (2 x 15 = 30 marks) **ESE for Practical: (35 Marks**, 1.5 Hrs) 1. Coding -10 Marks 2. Output - 10 Marks. 3. Viva - 10 Marks. 4. Record - 5 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.

Mahatma Gandhi University
Kottayam

Programme	BCA (Honours))					
Course Name	**Natural Language Processing**					
Type of Course	**DSE**					
Course Code	**MG5DSEBCA305**					
Course Level	**NA**					
Course Summary	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.					
Semester	5	Credits			5	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	1	0	90
Pre-requisites, if any	Basic knowledge of programming and statistics.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe different levels of linguistic analysis.	U	2
2	Distinguish between various NLP techniques used for managing and analyzing linguistic data.	An	1
3	Compare and contrast various aspects of natural language structure and linguistic analysis methods.	An	2,3
4	Analyze word sense disambiguation techniques and examine key applications of Natural Language Processing.	An	2,3
5	Develop and implement basic NLP algorithms using programming tools such as Python.	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 NLP: Human languages, models, ambiguity NLP processing paradigms,	3	1
	1.2	Levels of Language Analysis: Syntax, Semantics, Pragmatics	3	1
	1.3	Phonetics- Speech Sounds and Phonetic, Articulatory Phonetics, Prosody.	3	1
	1.4	Text representation in computers, encoding schemes.	3	1
	1.5	Linguistics resources- Introduction to corpus, elements in balanced corpus, TreeBank, PropBank, WordNet, VerbNet etc. Resource management with XML	3	1
2	2.1	Management of linguistic data with the help of GATE, NLTK.	3	2
	2.2	Regular expressions, Finite State Automata, word recognition, lexicon.	3	2
	2.3	Morphology, acquisition models, Finite State Transducer. N-grams, smoothing, entropy, HMM, ME, SVM, CRF.	3	2
	2.4	Part of Speech tagging- Stochastic POS tagging, HMM,	3	2
	2.5	Transformation based tagging (TBL), Handling of unknown words, named entities, multi word expressions.	3	2
3	3.1	Overview of natural language grammars, Basic linguistic units - lexeme, phonemes, phrases and idioms, word order, agreement, tense, aspect and mood and agreement	3	3
	3.2	Formal Grammar and Spoken Language: Introduction to formal grammars, Context Free Grammar, spoken language syntax	3	3
	3.3	Parsing Techniques: Introduction to parsing in NLP, Top-down and bottom-up parsing, Chart parsing techniques, Unification-based parsing, Probabilistic parsing (PCFGs).	3	3
	3.4	TreeBank: structure and applications, Evaluation of parsing systems, Applications of parsing in NLP systems.	3	3

	3.5	Semantics and Meaning Representation: Introduction to semantics in NLP, Meaning representation techniques, Semantic analysis and interpretation, Lexical semantics, Semantic networks and resources – WordNet.	3	3
4	4.1	Fundamentals of Word Sense Disambiguation (WSD)-Introduction to Word Sense Disambiguation, Types of lexical ambiguity, Importance of context in determining meaning, Overview of WSD approaches	2	4
	4.2	Techniques in Word Sense Disambiguation: Selectional restrictions and semantic constraints, Dictionary-based approaches, Machine learning approaches, Performance evaluation of WSD systems	2	4
	4.3	Discourse and Reference Resolution: Introduction to discourse in Natural Language Processing, Reference resolution: anaphora, cataphora, and deixis, Constraints on co-reference, Linguistic features used in discourse processing	4	4
	4.4	Discourse Analysis and Structure: Algorithms for pronoun resolution, Text coherence and cohesion, Discourse structure models (RST, discourse representation), Applications of discourse analysis in NLP	4	4
	4.5	Applications of Natural Language Processing: Machine Translation, Information Retrieval and Information Extraction, Text Categorization and Text Summarization, Automatic Speech Recognition (ASR), Text-to-Speech (TTS) systems	3	4
5	Lab Practice			
		Implement using Python: 1.Write a Python program to tokenize a paragraph into sentences and words using NLTK. 2. Build a simple unigram language model for a given corpus. 3. Implement a rule-based system to identify parts of a sentence. 4. Perform basic semantic analysis using word similarity. 5. Demonstrate pragmatics by identifying speech acts (question, command, statement). 6. Use Python libraries to analyze speech signals. 7. Convert text to phoneme representation using a phonetic dictionary. 8. Write a program to demonstrate ASCII vs Unicode encoding. 9. Handle multilingual text input and normalization in Python. 10. Implement text preprocessing: tokenization, stopword removal, stemming, lemmatization. 11. Load and explore a corpus using NLTK. 12. Access and query WordNet for synonyms, antonyms, and	30	5

		hypernyms. 13. Parse and extract information from an XML-based linguistic resource. 14. Write regex patterns to extract emails, dates, and URLs from text. 15. Implement a simple Finite State Automaton (FSA) for word recognition. 16. Implement a simple morphological analyzer (prefix, suffix stripping). 17. Implement a simple Hidden Markov Model (HMM) for sequence prediction. 18. Train a classifier using Naïve Bayes / SVM for text classification. 19. Apply Conditional Random Fields (CRF) for sequence labeling (NER). 20. Perform POS tagging using NLTK. 21. Implement a stochastic POS tagger using HMM. 22. Demonstrate Transformation-Based Learning (TBL) tagging. 23. Handle unknown words in POS tagging. 24. Identify named entities and multiword expressions. 25. Define a Context-Free Grammar (CFG) in Python and parse sentences. 26. Implement top-down and bottom-up parsing. 27. Use chart parsing to analyze ambiguous sentences. 28. Implement probabilistic parsing using PCFG. 29. Load and analyze TreeBank data using NLTK. 30. Evaluate parsing performance using precision and recall. 31. Visualize parse trees for given sentences. 32. Represent sentence meaning using logical forms. 33. Perform lexical semantic analysis using WordNet similarity measures. 34. Build a semantic network from a small dataset. 35. Implement the Lesk algorithm for WSD. 36. Use WordNet to disambiguate word meanings in context. 37. Build a supervised WSD model using machine learning. 38. Analyze text coherence using sentence similarity. 39. Build a simple Machine Translation system using sequence models. 40. Implement Information Retrieval using TF-IDF. 41. Perform text classification (spam detection / sentiment analysis). 42. Generate text summaries using extractive methods.		

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 3. Viva 4. MCQs **CCA for Practical: 15 Marks** • Practical assignments • Observation of practical skills • Lab Record • Viva etc.
	B. Semester End Examination **ESE for Theory: Written Test (70 Marks, 2 Hrs)** Part A: Very Short Answer Questions. (Answer all) - (5 x 2 = 10 marks) Part B: Short answer questions (5 out of 7 Questions) - (5 x 6 = 30 marks). Part C: Essay questions (2 out of 3 Questions) - (2 x 15 = 30 marks) **ESE for Practical: (35 Marks, 1.5 Hrs)** 1. Coding -10 Marks 2. Output - 10 Marks 3. Viva - 10 Marks 4. Record - 5 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

Mahatma Gandhi University
Kottayam

Programme	**BCA (Honours)**					
Course Name	**Web Development with Python - Django/Flask**					
Type of Course	**DSE**					
Course Code	**MG5DSEBCA306**					
Course Level	**NA**					
Course Summary	This course covers the Flask framework, Jinja2 templating, Bootstrap integration, form handling with Flask-WTF, database operations using SQLAlchemy and Flask-Migrate, email integration with Flask-Mail, RESTful API development, and automated testing. It also introduces Django fundamentals including the MVT architecture, URL routing, views, templates, models, the ORM, and the Admin interface. Advanced topics include Django forms, authentication, password management, permissions, and deployment with WhiteNoise, Gunicorn, and Heroku.					
Semester	5	Credits			5	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	1	0	90
Pre-requisites, if any	Basic to Intermediate knowledge of Python programming (including OOP concepts), HTML, CSS, and fundamental understanding of web technologies (HTTP protocol, client-server architecture).					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Build structured Flask applications with dynamic pages and secure form handling.	A	1
2	Design databases, integrate email, develop RESTful APIs, and implement automated testing in Flask.	A	2
3	Apply Django's MVT architecture, configure routing, create models, and manage data with the ORM and Admin interface.	A	2
4	Implement CRUD operations with GCBVs, manage user accounts and permissions, and deploy Django applications securely.	A	2
5	Apply theoretical knowledge through hands-on projects, gaining	A	3

	practical experience in building and deploying Flask and Django applications.		
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	**Basic Application Structure:** Understanding the Flask application instance, setting up routes, view functions, and the request-response cycle.	3	1
	1.2	**Jinja2 Templates:** Rendering dynamic HTML by utilizing template variables, control structures and template inheritance.	4	1
	1.3	**Frontend Integration:** Integrating the Flask-Bootstrap extension for styling, serving static files, and setting up custom error pages.	4	1
	1.4	**Web Forms:** Safely handling form data, rendering forms, and using validators with the Flask-WTF extension. Implementing the Post/Redirect/Get pattern and message flashing for user feedback.	4	1
2	2.1	**Databases & Migrations:** Introduction to SQL vs NoSQL, configuring the Flask-SQLAlchemy extension, defining models, establishing database relationships, and performing CRUD database operations. Tracking schema changes using Flask-Migrate.	5	2
	2.2	**Email Integration:** Sending asynchronous emails on a background thread using Flask-Mail.	3	2
	2.3	**RESTful APIs:** Understanding REST architectural principles,handlingJSON serialization/deserialization, and implementing token-based authentication using Flask-HTTPAuth.	4	2
	2.4	**Testing:** Writing unit tests with the Python unittest package and the Flask test client to verify application logic, and generating code coverage reports.	3	2
3	3.1	**Django Architecture & Setup:** The Model-View-Template (MVT) pattern, configuring settings.py, working with the command line, and isolating code into apps.	3	3
	3.2	**URLs, Views, and Templates:** Configuring URL dispatchers, transitioning from Function-Based Views (FBVs) to Generic Class-Based Views (GCBVs) like	4	3

		TemplateView, and utilizing the Django Template Language.		
	3.3	**Models and the ORM:** Designing relational database models, understanding primary and foreign keys, executing makemigrations and migrate, and querying the database via the ORM.	4	3
	3.4	**The Django Admin:** Registering models and visually interacting with database tables using Django's built-in Admin interface.	4	3
4	4.1	**Forms & Generic Editing Views:** Rendering HTML forms and handling validation automatically by extending GCBVs like ListView, DetailView, CreateView, UpdateView, and DeleteView.	3	4
	4.2	**User Accounts & Custom Models:** Leveraging Django's built-in auth app for secure login, logout, and signup flows. Overriding the default User model by extending AbstractUser.	3	4
	4.3	**Password Management:** Configuring built-in views and custom templates to support secure password change and password reset via email.	3	4
	4.4	**Permissions & Authorizations:** Restricting view access using LoginRequiredMixin and adding object-level authorization via UserPassesTestMixin.	3	4
	4.5	**Deployment:** Moving to production using environment variables with environs, securing settings (DEBUG, SECRET_KEY, ALLOWED_HOSTS), serving static files with WhiteNoise, transitioning to a Gunicorn WSGI server, and configuring a Procfile for Heroku deployment.	3	4
. 5	5.1	**Practical Exercises and Labs** **Flask** 1. **Flask Setup & Routing:** Create a virtual environment, install Flask, and build an application with static and dynamic routes. 2. **Jinja2 Templates:** Implement template inheritance and integrate Flask-Bootstrap to dynamically style web pages. 3. **Web Forms:** Use Flask-WTF to build a secure user input form, handle a POST request, and display flashed messages. 4. **Database & Models:** Configure Flask-SQLAlchemy, define models, perform CRUD operations, and upgrade schemas using Flask-Migrate. 5. **Application Structure & Email:** Refactor the	30	5

		application using Blueprints and integrate Flask-Mail for asynchronous emails. 6. **RESTful** APIs: Build an API Blueprint that serializes database resources to JSON and secures endpoints with token-based authentication. 7. **Automated** Testing: Write an automated test suite utilizing the Flask test client to verify routes and generate a code coverage report. **Django** 8. **Django Setup & Views:** Initialize a project, configure apps, and build generic class-based views with URL routing. 9. **Models & The Admin:** Construct database models, generate/apply migrations, and register the models to populate data via the Admin panel. 10. **Generic Class-Based Views (CRUD):** Implement ListView, CreateView, UpdateView, and DeleteView to allow users to interact with database records from the frontend. 11. **Custom User Models:** Override the default Django user model using AbstractUser to add custom database fields. 12. **Authentication Flow:** Build login, logout, and customized signup flows utilizing Django's built-in auth views. 13. **Password Resets:** Implement custom templates for the full password change and password reset by email workflows. 14. **Permissions & Relationships:** Restrict access to views using LoginRequiredMixin and establish foreign key relationships. 15. **Live Deployment:** Extract secrets to a .env file, compile static files with WhiteNoise, configure a Procfile, and deploy the application to Heroku		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** ● Lecture ● Demonstration ● Practical sessions
Assessment Types	**MODE OF ASSESSMENT** **Continuous Comprehensive Assessment (CCA)**

	CCA for Theory : 30 Marks • Written Exam • Oral Presentations • Assignments **CCA for Practical : 15 Marks** • Practical assignments • Observation of practical skills • Viva etc.
	B. End Semester Examination • **ESE for Theory: Written Test (70 Marks , 2 Hour)** Part A: Very Short Answer Questions (Answer all) - (5*2=10 Marks) Part B: Short Answer Questions (5 out of 7 Questions) - (5*6=30 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*15=30 Marks) • **ESE for Practical: 35 Marks (1.5 Hours)** • Logic - 10 Marks • Implementation - 10 Marks • Output - 5 Marks • Viva - 5 Marks • Record - 5 Marks

REFERENCES:

1. Miguel Grinberg – Flask Web Development: Developing Web Applications with Python, 2nd Edition, O'Reilly Media.
2. William S. Vincent – Django for Beginners: Build Modern Web Applications with Python, 5th Edition.

Web Resources

Flask: https://flask.palletsprojects.com/
Django: https://docs.djangoproject.com/
Django REST Framework: https://www.django-rest-framework.org/

Mahatma Gandhi University
Kottayam

Programme	**BCA (Honours)**					
Course Name	**Cross-Platform Application Development with Dart and Flutter**					
Type of Course	**DSE**					
Course Code	**MG5DSEBCA307**					
Course Level	**NA**					
Course Summary	This course covers Dart fundamentals including variables, data types, object-oriented programming, conditionals, loops, functions, and classes. It advances into Dart operators, asynchronous programming, and the basics of Flutter project structure and widgets. Key topics include building UIs, responsive layouts, state management with Provider and BLoC, navigation, animations, networking, JSON/XML parsing, and local data persistence. Practical labs reinforce these concepts through hands-on Dart and Flutter applications.					
Semester	5	Credits			5	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	1	0	90
Pre-requisites, if any	Basic to Intermediate knowledge of any programming language (preferably with OOP concepts), HTML, and CSS.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Develop structured Dart programs applying object-oriented principles.	A	1
2	Apply advanced Dart operators to implement asynchronous programming and describe the basics of Flutter.	A	2
3	Build responsive user interfaces, manage application state using Provider and BLoC patterns and implement navigation and routing between pages.	A	2
4	Create smooth animations with Flutter's animation library, handle networking and JSON/XML data parsing, and implement local data persistence using Shared Preferences, SQLite, and Hive.	A	2

5	Develop Dart and Flutter programs, covering collections, exception handling, asynchronous programming, widgets, state management, navigation, animations, and data storage.	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 DART, Key Features, Dart Basics: Variables and Data types.	3	1
	1.2	Dart Object-oriented Programming: Classes and Objects, Inheritance, Polymorphism, Encapsulation, Abstraction, Collections and Iteration, Error handling with Exceptions.	3	1
	1.3	Conditionals: if statement, else block, ternary operator, switch statement. Loops: while loop, for loop, for-in loop, do-while loop, iterable specific loops.	3	1
	1.4	Functions: structure of a Dart function, optional parameters, positional parameters, named parameters, passing default values to optional parameters, functions as first-class objects, defining function types in Dart, extensions methods.	3	1
	1.5	Classes: dart classes, constructors in dart, named constructors, inheritance, interfaces, mixins.	3	1
2	2.1	Operators: Ternary operator, ?? operator, ?. operator, ??= operator, cascade(..) notation, fat arrow (=>) operator, ~/ operator, spread (…) operator, null-aware index (?[]) operator, null-aware cascade(?..) operator.	5	2
	2.2	Asynchronous Programming in Dart: Need of asynchronous programming, Understanding the async/await structure, Futures, Handling Futures, delayed futures, future builder, Streams, Isolates.	3	2
	2.3	Basics of Flutter: Structure and tools, Folder structure, pubspec.yaml file, Hot Reload, Linter rules, Tree shaking and constants.	3	2
	2.4	Basic widgets: Text, Row, Column, ListView, Container, Stack and Positioned, Stateless and Stateful widgets, Keys, Rebuilds and optimization, const constructor, Prefer widget composition over functions, Architecture, Element and RenderObject, Foreign Function Interface, Method channels.	4	2

3	3.1	Building UIs in Flutter: Material, Scaffold, Material widgets, Buttons, Dialogs, Cupertino, CupertinoPageScaffold, Cupertino widgets.	3	3
	3.2	Building layouts: Platform support, Single OS, Multiple OSes. Responsive UIs, LayoutBuilder, MediaQuery, Scrolling and constraints, Using themes.	4	3
	3.3	State management: Updating the UI, Passing the state with Provider. BLoC pattern: BlocListener class, BlocObserver class, Persisting the state with HydratedBloc, Undo and redo with ReplayBloc, The internals of Bloc: Cubit.	4	3
	3.4	Routes and navigation: Basics of navigation and routing, Passing data between pages and widgets, other routing techniques.	4	3
4	4.1	Animations: Implicit animations, The animation library, AnimatedWidget, AnimationBuilder, Curves, Tweens, Custom animations.	4	4
	4.2	Working with JSON and other formats: Parsing JSON, Manual parsing, Automatic parsing, Parsing XML, parsing strings, Building XML strings.	4	4
	4.3	Networking in Flutter: Connecting to the internet, Http packages.	3	4
	4.4	Local Data Persistence: Shared preferences, SQLite, Hive.	4	4
. 5	5.1	**Practical Exercises and Labs** **Dart Programs** 1. Programs to familiarize Collections (lists, maps) in Dart. 2. Programs to familiarize Polymorphism with method overriding. 3. Programs to familiarize Exception handling in Dart. 4. Programs to familiarize if-else statements, switch statement to handle multiple cases. 5. Programs to familiarize Loops (while, for, for-in, do-while) and Iterable-specific loops to process collections. 6. Programs to familiarize Function with optional parameters. 7. Programs to familiarize Class (constructors, methods, named constructors), inheritance, interfaces and mixins. 8. Programs to familiarize Asynchronous programming using async/await, Future and Stream objects in a program.	30	5

		Flutter Programs 9. Programs to familiarize Widgets and its state management. 10. Programs to familiarize State management with Provider. 11. Programs to familiarize Bloc pattern, BlocListener and BlocObserver. 12. Programs to familiarize Navigation and routing between pages. 13. Programs to familiarize Passing data between pages and widgets using various techniques. 14. Programs to familiarize Implicit animations using Flutter, Animation library, AnimatedWidget, and AnimationBuilder. 15. Programs to familiarize Curves and Tweens for custom animations. 16. Programs to familiarize Parse JSON data manually and automatically. 17. Programs to familiarize Local data management (Shared preferences, SQLite, Hive).		

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** • Lecture • Demonstration • Practical sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 30 Marks** • Written test • Assignments • Viva • MCQ, etc. **CCA for Practical: 15 Marks** • Practical assignments • Observation of practical skills • Viva etc.
	B. End Semester Examination (ESE) **ESE for Theory: Written Test (70 Marks, 2 Hrs.)**

	Part A: Very Short Answer Questions (Answer all) - (5*2=10 Marks) Part B: Short Answer Questions (5 out of 7 Questions) - (5*6=30 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*15=30 Marks) **ESE for Practical: (35 Marks, 1.5 Hrs.)** • Logic - 10 Marks • Successful Compilation - 5 Marks • Output - 5 Marks • Viva - 10 Marks • Record - 5 Marks

REFERENCES:

1. Deven Joshi - Building Cross- platform Apps with Flutter and Dart, BPB publications.
2. Kris Hermans - Mastering Dart: A Comprehensive Guide to Learn Dart Programming, Cybellium Ltd.
3. Alberto Miola - Flutter Complete Reference, AWS Kindle Edition.

SUGGESTED READING:

1. Dr. Deepti Chopra, Roopal Khurana - Flutter and Dart: Up and Running, BPB publications.

Eric Windmill - Flutter in Action 1st Edition, Manning publications.

Mahatma Gandhi University
Kottayam

Programme	**BCA (Honours)**					
Course Name	**Modern Web Application Development with React.js**					
Type of Course	**DSE**					
Course Code	**MG5DSEBCA308**					
Course Level	**NA**					
Course Summary	This course provides comprehensive knowledge and hands-on experience in building modern, scalable, and performant single-page web applications using React.js. It covers React fundamentals, component architecture, hooks, state management, data fetching, styling strategies, TypeScript integration, performance optimization, and testing. The course emphasizes clean code principles, design patterns, and best practices to develop production-ready applications. Extensive practical sessions enable students to build real-world projects.					
Semester	5	Credits			5	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		4	0	1	0	90
Pre-requisites, if any	Basic Knowledge of HTML, CSS, JavaScript (ES6+) and OOP Concepts.					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Describe React fundamentals, JSX, component architecture, props, and clean code principles.	U	1
2	Apply React Hooks, state management techniques, and handle forms and side effects effectively.	A	2
3	Develop responsive UIs, implement navigation, and manage application state using modern patterns.	A	2
4	Perform data fetching, apply performance optimization, styling strategies, TypeScript, and testing in React applications.	A	2
5	Apply theoretical concepts through hands-on development of complete React applications including CRUD operations, API integration, optimization, and testing.	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 React.js, Single Page Applications (SPAs), Virtual DOM, and Component-based Architecture.	3	1
	1.2	JSX Syntax, Expressions, Rendering, and List Rendering with Keys.	3	1
	1.3	Functional and Class Components, Props, and Component Composition.	3	1
	1.4	React Anti-Patterns and Clean Code Principles (DRY, Separation of Concerns).	3	1
	1.5	Project Setup using Vite/Create React App and Project Structure.	3	1
2	2.1	Introduction to Hooks and Rules of Hooks.	3	2
	2.2	Local State with useState, Controlled vs Uncontrolled Components, and Form Handling.	4	2
	2.3	useEffect for Side Effects, useRef, Lifting State Up.	4	2
	2.4	useReducer, Custom Hooks, and Complex State Management.	4	2
3	3.1	Data Fetching using Fetch API, Axios, Async/Await, and Error Handling.	4	3
	3.2	Conditional Rendering, React Router for Navigation and Routing.	4	3
	3.3	State Management with Context API and Introduction to Redux Toolkit.	4	3
	3.4	REST vs GraphQL, and Introduction to Server-Side Rendering with Next.js.	3	3
4	4.1	Styling in React: CSS Modules, Styled Components, Tailwind CSS, and BEM Convention.	4	4
	4.2	Performance Optimization: useMemo, useCallback, React.memo, and Code Splitting.	3	4
	4.3	TypeScript in React: Interfaces, Typing Props & State.	4	4

	4.4	Testing React Applications: Jest, React Testing Library, and Cypress basics.	4	4
. 5	5.1	**Practical Exercises and Labs** 1. Programs on JSX, Components, Props, and List Rendering with Keys. 2. State Management using useState, useReducer, and Form Handling. 3. Programs using useEffect, useRef, and Custom Hooks. 4. CRUD Application with Local State. 5. Data Fetching from Public APIs (e.g., Hacker News / JSONPlaceholder). 6. Navigation and Routing using React Router with Data Passing. 7. Responsive UI Development using Tailwind CSS / Styled Components. 8. State Management with Context API. 9. Performance Optimization using Memoization. 10. Integration of TypeScript in React Project. 11. Writing Unit & Integration Tests using Jest and React Testing Library. ***Note:*** *Students should develop a Full-featured Application (E-commerce / Blog / Dashboard / Todo with API) as mini project by the end of the semester. Evaluation of this project will be done as ESE for practical.*	30	5

Teaching and Learning Approach	**Classroom Procedure (Mode of transaction)** • Lecture • Demonstration • Practical sessions
Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA) CCA for Theory: 30 Marks** • Written test • Assignments • Viva • MCQ etc. **CCA for Practical: 15 Marks** • Practical assignments • Observation of practical skills • Viva etc.

	B. End Semester Examination **ESE for Theory: Written Examination (70 Marks , 2 Hrs)** Part A: Very Short Answer Questions (Answer all) - (5*2=10 Marks) Part B: Short Answer Questions (5 out of 7 Questions) - (5*6=30 Marks) Part C: Essay Questions (2 out of 3 Questions) - (2*15=30 Marks) **ESE for Practical: 35 Marks** *Project Report - 15 Marks* *Viva / Presentation - 20 Marks*

REFERENCES:

1. Robin Wieruch - The Road to React (2025 Edition)
2. Anthony Onyekachukwu Okonta - React.js Design Patterns, BPB Publications

SUGGESTED READINGS:

1. Official React Documentation (react.dev)

Mahatma Gandhi University
Kottayam

Programme	**BCA (Honours)**
Course Name	**Internship**
Type of Course	**SEC**
Course Code	**MG5SECBCA300**
Course Level	NA
Course Summary	Internship provides learners with first-hand exposure to professional environments, enabling them to understand organisational work practices, enhance job-related skills and aptitudes, and develop research capabilities through structured learning opportunities. Students shall complete a 4-credit Summer Internship, after the completion of the 4th semester of Honours degree programme and learners must complete 240 hours of internship engagement to earn 4 credits.

Semester	5	Credits			4	Total Hours
Course Details	Learning Approach	Lecture	Tutorial	Practical	Others	
		0	0	0	0	240
Pre-requisites, if any	NIL					

COURSE OUTCOMES (CO)

CO No.	Expected Course Outcome	Learning Domains *	PO No
1	Analyse workplace practices and task requirements to identify issues, interpret patterns, and propose logical, evidence-based improvements.	An	1,2,3, 6,7,8, 10
2	Carry out assigned professional tasks using appropriate tools, methods, or procedures, demonstrating accuracy, efficiency, and responsible work practices.	S	1,2,3, 4,5,9, 10

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

Assessment Types	**MODE OF ASSESSMENT** **A. Continuous Comprehensive Assessment (CCA)** **CCA: 30 Marks** • Activity logbook and the evaluation report submitted by the Mentor/Internship Supervisor • Evaluation based on work quality • Teamwork and collaboration • Acquisition of relevant skill sets • Attendance and regularity • Feedback from the Mentor
	B. End Semester Examination (ESE) **ESE : 70 Marks** • Internship Report: 20 Marks • Originality and innovative contributions made during the Summer Internship: 20 Marks • Viva Voce:20 Marks • Performance feedback from the IPO: 10 Marks