DEPARTMENT OF COMPUTER APPLICATIONS

(Approved by AICTE New Delhi)

NATIONAL COLLEGE (AUTONOMOUS)

(Nationally Re-accredited with "A" Grade by NAAC)

Tiruchirappalli – 620 001.

ESTD. 1919

BACHELOR OF COMPUTER APPLICATIONS
SYLLABUS (2025 onwards)

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(Approved by AICTE New Delhi)

NATIONAL COLLEGE (AUTONOMOUS)

(Nationally Re-accredited with "A" Grade by NAAC)

Tiruchirappalli – 620 001.

Under Graduate Programme Structure under CBCS

(For candidates admitted from the year 2025 onwards)

Bachelor of Computer Applications

PROGRAM OUTCOMES: The program must enable students to attain by the time of graduation

PO1: Disciplinary Knowledge

Apply perceptive, Aesthetic, Creative abilities to design innovative solutions in the global context

PO2: Communication Skills

Clearly communicate technical information to diverse audience

PO3: Critical thinking, Problem Solving &Analytical Reasoning

Utilize the practical skills to enhance critical thinking, analyzing and evaluation of data, theories and idea to solve problem in real-life situations

PO4: Reflective thinking & Scientific reasoning. Team works with leadership qualities

Reflective thinking and Scientific reasoning: The ability to analyze and interpret data, critically evaluate evidence, and draw unbiased conclusions. It involves applying learned knowledge and competencies to solve problems and inform research. This skill extends to real-life situations, enabling practical application of insights. Team Work with leadership: Function effectively as member or leader on multidisciplinary teams to accomplish a common objective.

PO5: Moral & ethical awareness. Appreciating Environmental & Sustainability issues

Heighten the conscious of the graduates on socio-economic concern and to inculcate moral and ethical values to chisel them as better human being.

PO6: Multi-cultural competency and Self –directed lifelong learning

Demonstrate multicultural competency and engage in self-directed, lifelong learning to adapt to evolving technologies and diverse global perspectives in the field of computer applications.

PROGRAM SPECIFIC OUTCOME (PSOs)

PSO 1: Design innovative software and computer-based solutions, considering global challenges.

PSO 2: Communicate technical solutions and system designs clearly to both technical and non-technical audiences.

PSO 3: Apply computing skills to analyze data and solve real-world problems using logical reasoning and problem-solving techniques.

PSO 4: Use scientific reasoning and reflective thinking to evaluate data and solve problems in computer applications. Work collaboratively in multidisciplinary teams, showing leadership and teamwork to meet project goals.

PSO 5: Ensure computing solutions address societal needs, promoting the ethical and responsible use of technology.

PSO 6: Cultivate the ability to work effectively in diverse cultural settings and take initiative in continuous learning to stay updated with emerging technologies and global trends in computer applications.

Programme Code	Course Code	Course Type	Course Title	Category	Hrs/ week	Credits
COAUG1998	U25CA1 TP	Core	PROBLEM SOLVING USING C AND DATA STRUCTURES	Lecture and Practical	8	6

COURSE DESCRIPTION:

- The course covers C programming basics, including data types, operators, loops, functions, pointers, structures, file handling, and data structures like stacks, queues, and trees.

COURSE OBJECTIVES:

- The course is designed to provide an extensive study of the C programming language.
- This course is emphasized the strengths of C which provides students to write a program efficiently.
- This course is offered to design the wide variety of examples and applications in C language.
- This course is underlined to learn some other programming languages and how to choose the particular programming language for solving the problem.
- This course implements fundamental data structures such as stacks, queues, linked lists, and trees using C programming techniques.

UNIT - I:

Basic of C: History of C and its importance – Structure of a C program – Data Types – Constants and Variables – Operators and Expressions – Order of Precedence, Evaluating of Arithmetic Expressions – Type Conversion- Decision Statements: if, if-else, and nested if statements. (12 Hrs)

UNIT - II:

Loops Structures: For Loop, While, Do-while loop – Arrays: - One Dimensional Array, Two-dimensional Arrays, Character Arrays and Strings – Functions: Function with arrays- Function with decision and looping statements - Recursion. (18 Hrs)

UNIT - III:

Pointers: Introduction – Pointer Expressions – Chain of Pointers –Pointers and Arrays – Array of Pointers – Pointers as function arguments – Functions returning Pointers – Pointers to Functions – Function pointer – Structures - declaration, initialization, Array of Structures – Pointer to structures, Structures and functions – Typedef, Enumerated data types, Unions. (15 Hrs)

UNIT - IV:

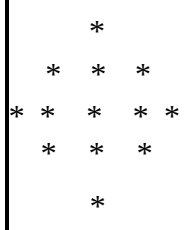
Strings Processing, Standard string library functions – Files: introduction and files functions – Writing and reading in Text mode – Simple application: Display the contents of a file. Write data to a file. Append data to an existing file – File IO – Reading and writing structures. (15 Hrs)

UNIT - V:

Stack: LIFO concept, Stack operations, Array implementation of stack – Queue: FIFO concept, Queue operations, Array implementation of queue – Singly Linked List: concepts, operations – Doubly Linked List: concepts, operations – Trees: General trees, Binary trees.(15 Hrs)

LIST OF EXERCISERS:

1) Converting degrees Celsius to Fahrenheit and vice versa?
2) Display three input numbers in sorted (non-decreasing) order?
3) Display the following patterns of n rows (n > 0), for the below examples n = 5?

Triangle Patterns with numbers:	Diamond Pattern
1 121 12321 1234321 123454321	

4) Given the first term (a), difference/multiplier (d) and number of terms (n > 0), display the first n terms of the arithmetic/geometric progression?
5) Check if a given positive integer number Armstrong number or not?
6) Write a program to display a number in text form. For example, If the number is 5432 the output should be "FIVE FOUR THREE TWO"?
7) Design algorithm/program to perform matrix operations addition, subtraction and transpose?
8) Implement your own string length and string reversal functions?
9) Write a program to implement a stack using singly linked list, Implement Queue using Linked List.
10) Write a program to find binary tree traversal.

TEXT BOOKS:

1. E. Balagurusamy, "Programming in ANSI C", Tata McGraw Hill, New Delhi, Seventh Edition, 2016.

   UNIT – I: 1.1, 1.2, 1.8, Chapter 2, Chapter 3, 5.1, 5.2, 5.3, 5.4, 5.5, 5.6

   UNIT – II: CHAPTER 6, 7, 8, 9

   UNIT – III: CHAPTER 11.1, 11.7, 11.8, 11.10, 11.12, 11.13, 11.14, 11.15, 11.6, 10.1, 10.2, 10.3, 10.5,

   10.8, 10.11, 10.12, 10.13

   UNIT - IV: CHAPTER 12
2. E. Horowitz, S. Sahni and Susan Anderson Freed, "Fundamental Data Structures in C", 2ed, Orient Black Swan Publisher, 2009.

UNIT - V: CHAPTER 2, 3, 5, 6, 9

REFERENCES:

1. Byron S. Gottfried, “Programming with C”, Schaum’s Outline Series, Tata McGraw Hill Edition, New Delhi, 1991.
2. E. Karthikeyan, “A Textbook on C Fundamentals, Data Structures and Problem Solving”, Prentice-Hall of India Private Limited, New Delhi, 2008.
3. Yashavant Kanetkar, “Let us C”, BPB Publications, Tenth Edition, New Delhi, 2010.
4. Szuhay, Jeff, and Szuhay, Jeff, “Learn C Programming: A Beginner's Guide to Learning C Programming the Easy and Disciplined Way”, Packt Publishing, 2020.
5. Jena, Sisir Kumar, and Jena, Sisir Kumar, “C Programming: Learn to Code”, CRC Press, 2021.
6. https://www.tutorialspoint.com/cprogramming/index.htm
7. https://www.w3schools.in/data-structures/intro

COURSE OUTCOME	KNOWLEDGE LEVEL (K1-K6)
CO1: Recall the basics of C programming (history, structure, data types, operators, decision-making).	**K1**
CO2: Understand the concepts of loops, arrays, functions, and recursion for problem-solving.	**K2**
CO3: Apply pointers and structures for memory management and data organization.	**K3**
CO4: Analyze string manipulation and file I/O handling.	**K4**
CO5: Evaluate data structures including stacks, queues, and linked lists.	**K5**
CO6: Create tree structures and their applications in problem-solving.	**K6**

MAPPING COs WITH POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	3	1	1	1	3
CO2	9	3	9	3	1	3
CO3	9	3	9	3	1	3
CO4	9	3	9	3	3	3
CO5	9	3	9	3	9	3
CO6	9	3	9	3	9	9
WEIGHTAGE	54	18	46	16	24	24
WEIGHTED %	29.67%	9.89%	25.27%	8.79%	13.19%	13.19%

COURSE OUTCOMES MAPPED WITH KNOWLEDGE LEVEL (Revised Bloom's Taxonomy) AND POs:

COs	LEVEL OF CORRELATION			
	HIGH	**MEDIUM**	**LOW**	**ZERO**
CO1 / K1	PO1	PO2, PO6	PO3, PO4, PO5	--
CO2 / K2	PO1, PO3	PO2, PO4, PO6	PO5	--
CO3 / K3	PO1, PO3	PO2, PO4, PO6	PO5	--
CO4 / K4	PO1, PO3	PO2, PO4, PO5, PO6	--	--
CO5 / K5	PO1, PO3, PO5	PO2, PO4, PO6	--	--
CO6 / K6	PO1, PO3, PO5, PO6	PO2, PO4	--	--

COURSE OUTCOMES (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3		3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
NON SCHOLASTIC	-	-	-	-	-	5	20
TOTAL	4	10	6	20	5	25	100%

PROCEDURE:

The COs and PSOs for the **PROBLEM SOLVING USING C AND DATA STRUCTURES (TP)** course in the BCA Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge Signature of the HoD

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Programme Code	Course Code	Course Type	Course Title	Category	Hrs/week	Credits
COAUG1998	U25CA2TP	Core	UI & UX DESIGN	Lecture and Practical	7	6

COURSE DESCRIPTION:

- The course covers UI/UX design principles, user research and analysis, popular design tools, advanced visual design techniques, and UI/UX evaluation, including usability testing, feedback analysis, and iteration strategies.

COURSE OBJECTIVES:

- To understand and apply design principles, techniques and tools for creating user-friendly and aesthetically pleasing digital interfaces.
- Understanding the fundamentals of UI/UX design.
- How to create wireframes and prototypes to map out design concepts, Layouts and interactions.
- To develop the ability to apply visual design principles and implement advanced UI components across various platforms.
- To teach methods for evaluating and improving UI/UX designs through usability testing, feedback analysis, and iterative design.

UNIT- I:

UI/UX Design Principles-UI/UX design concepts - Importance's of UI/ UX design – User centered Design (UCD) Principles –Basics of Visual Design -layout, typography, color theory, imagery. (12 Hrs)

UNIT- II:

User Research and Analysis-User research methods–Conducting user interviews andcreating user -Gathering and analyzing user feedback -Introduction to information architecture (IA)-Utilizing user data and analytics to inform design-decisions. (10 Hrs)

UNIT- III:

UI/UX Design Tools-Popular UI/UX design Tools-Sketch, Adobe XD, Figma and in Vision Basics of wire framing and prototyping Principles of responsive, interaction and collaborative design. (14 Hrs)

UNIT- IV:

Visual Design UI Components-Advanced principles of visual design–designing UI components - applying design patterns and frameworks - motion design and animation principles -designing for different platforms. (12 Hrs)

UNIT- V:

UI/ UX evaluation and iteration-Usability testing methods and techniques conducting usability studies and heuristic valuations–analyzing user feedback–strategies for-Effective communication and presentation. (12 Hrs)

LIST OF EXERCISERS:

1) Design wire frames for a simple web or mobile application.
2) Develop an interactive proto type for a specific user flow within an application.
3) Conduct usability testing on an existing website or application.
4) Design a mobile version of a web site or application to ensure responsiveness across different screen sizes.
5) Create user person as based on research and analysis of target users.
6) Develop a style guide or design system for a web site or application
7) Design a single app like a do to list weather app or login screen.
8) Take an existing website or app and redesign its interface using proper UI principles.
9) Pay attention to color contrast, font size and visual hierarchy to make sure the design aesthetically pleasing and easy to navigate.
10) Focus a layout, navigation flow and basic user interactions (button, forms, etc)

TEXT BOOKS:

1. Tom Mulligan, "UX/UIDesign2021-2022Tutorial the Complete step by step guide to UX/UI Design and Best Practices for designers with no experience", 2022.
   Unit I - Chapter 1, 2, 4, 5, 9
   Unit II - Chapter 3
   Unit III- Chapter 7, 8
   Unit IV- Chapter 5, 11
   Unit V - Chapter 4
2. Shineiderman, Plaisant, Cohen, Jacobs, Designing the User Interface - Strategies for Effective Human-Computer-Interaction, Pearson Education, 5th Edition, 2010.
3. Refactoring UI by Adam Wathan & Steve Schoger
   Unit I – Page no : 6 - 187
4. A Practical Guide to Information Architecture by Donna Spencer Second Edition
   Unit II – Chapter 1, 2, 3, 4, 5
5. "How To: Usability & UX: Using Personas, Use Cases, Heuristic Evaluation & User Testing" by Oxana Zhuravkova, First Edition, 2016.
   UNIT V – Page no : 19 - 56

REFERENCES:

1. Alan Dix, Human-Computer Interaction, Pearson Education,2009.
2. Wilber O Galitz, An Introduction to GUI Design Principles and Techniques, John- Wiley &Sons, 2007.
3. Jason Beaird, James George, "The Principles of Beautiful Web Design", Third Edition, O'Reilly,2014.
4. http://www.amazon.com/Design-Everyday-Things-Revised-Edition/dp/0465050654
5. http://www.amazon.com/Lean-UX-Applying-Principles-Experience-ebook/dp/B00B4JZX3I

COURSE OUTCOME	KNOWLEDGE LEVEL (K1-K6)
CO1: Recall fundamental UI/UX principles.	**K1**
CO2: Understand the principles of UI/UX design and the importance of user feedback in the design process.	**K2**
CO3: Analyze user research and design processes.	**K3**
CO4: Apply UI/UX design tools for wireframes and prototypes.	**K4**
CO5: Evaluate UI components for user experience enhancement.	**K5**
CO6: Create strategies for UI/UX evaluation and improvement.	**K6**

MAPPING COs WITH POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	3	1	1	3
CO2	3	3	9	3	1	3
CO3	9	3	9	3	1	3
CO4	9	3	9	3	1	3
CO5	9	3	9	3	1	9
CO6	9	3	9	3	1	9
WEIGHTAGE	42	16	48	16	6	30
WEIGHTED %	26.58 %	10.13 %	30.38 %	10.13 %	3.80 %	18.99 %

COURSE OUTCOMES MAPPED WITH KNOWLEDGE LEVEL (Revised Bloom's Taxonomy) AND POs:

COs	LEVEL OF CORRELATION			
	HIGH	**MEDIUM**	**LOW**	**ZERO**
CO1 / K1	--	PO1, PO3, PO6	PO2, PO4, PO5	--
CO2 / K2	PO3	PO1, PO2, PO4, PO6	PO5	--
CO3 / K3	PO1, PO3	PO2, PO4, PO6	PO5	--
CO4 / K4	PO1, PO3	PO2, PO4, PO6	PO5	--
CO5 / K5	PO1, PO3, PO6	PO2, PO4	PO5	--
CO6 / K6	PO1, PO3, PO6	PO2, PO4	PO5	--

COURSE OUTCOMES (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE:

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3		3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
NON SCHOLASTIC	-	-	-	-	-	5	20
TOTAL	4	10	6	20	5	25	100%

The COs and PSOs for the **UI & UX DESIGN (TP)** course in the BCA Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge Signature of the HoD

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Programme Code	Course Code	Course Type	Course Title	Category	Hrs/week	Credits
COAUG1998	U25UI	Value Added Course	UNDERSTANDING INDIA	Lecture	1	1

COURSE DESCRIPTION:

- This course covers the cultural, educational, and historical foundations of India, exploring its freedom struggle, geographical features, and key elements of the Indian Constitution.

COURSE OBJECTIVES:

- To provide an understanding of India's cultural background, including ancient civilizations and religious philosophies.
- To explore the growth and evolution of Indian education and literature, emphasizing key scholars and institutions.
- To analyze the contributions of leaders and freedom fighters in India's struggle for independence, with a focus on Jharkhand's revolutionaries.
- To study India's geographical features and its position in the world with respect to neighboring countries.
- To gain knowledge of the Indian Constitution, focusing on its preamble, features, fundamental rights, and duties.

UNIT - I: Cultural Foundations of India

Background of India's culture: Harappan civilisation and Vedic age - Buddhism, Jainism, Sanatan (Hinduism) and Islam. (03 Hrs)

UNIT - II: Evolution of Indian Education and Literature

Growth and development of Indian Education and literature: Bharat's Natyashastra, Kalidas, Panini, Patanjali - Taxila, Nalanda, Vishwa Bharati, BHU, AMU, IIT, IISC, AIIMS. (03 Hrs)

UNIT - III: India's Freedom Struggle and Its Leaders

Leaders of India's freedom struggle: Mahatma Gandhi - Jawaharlal Nehru - Subhash Chandra Bose- Freedom fighters of Jharkhand (TilkaManjhi, Sidho-Kanho, Birsa Munda &Jatra Bhagat). (03 Hrs)

UNIT - IV: Geographical Landscape of India

Geographical features of India - India on the map of world and its neighboring countries - Physical features of India including mountain, plateau, plain, coast, island, vegetation, rivers, soils, and climate. (03 Hrs)

UNIT - V: Fundamentals of the Indian Constitution

Indian Constitution: -Preamble -Salient features -Fundamental rights -Fundamental duties. (03 Hrs)

TEXT BOOKS & REFERENCES:

1. **Ancient India** – R.S. Sharma (NCERT & other editions)
2. **The Wonder That Was India** – A.L. Basham
3. **A History of India** – Romila Thapar
4. **India's Struggle for Independence** – Bipan Chandra
5. **Geography of India** – Majid Husain
6. **Indian Polity** – M. Laxmikanth
7. **The Constitution of India** – P.M. Bakshi
8. **Bharatiya Natyashastra** – Manmohan Ghosh (translated version)
9. **The Vedic Age** – D.N. Jha

Swayam Course:

http://ugcmoocs.inflibnet.ac.in/ugcmoocs/view_module_ug.php/240

E-Content:

- **National Digital Library of India (NDLI)** – https://ndl.iitkgp.ac.in
- **NCERT Textbooks (History, Geography, Political Science)** – https://ncert.nic.in
- **Constitution of India (Official Website)** – https://legislative.gov.in/constitution-of-india
- **Archaeological Survey of India (ASI) on Harappan Civilization** – https://asi.nic.in

Other online resources:

- **Indian Culture Portal (by Ministry of Culture, Govt. of India)** – https://indianculture.gov.in
- **Geographical Information on India (Survey of India)** – https://surveyofindia.gov.in
- **Gandhi Heritage Portal** – https://www.gandhiheritageportal.org

COURSE OUTCOME	KNOWLEDGE LEVEL (K1-K6)
CO1: Recall the knowledge of India's historical and cultural foundations, including Harappa and Vedic civilizations.	**K1**
CO2: Understand the development of Indian education and literature, recognizing key scholars and institutions.	**K2**
CO3: Use knowledge of India's physical geography to assess the impact of geographical features (e.g., mountains, rivers) on agricultural practices, infrastructure development, and human settlements.	**K3**
CO4: Analyze the role of freedom fighters in India's independence movement, with a special focus on Jharkhand's leaders.	**K4**
CO5: Interpret the fundamental aspects of the Indian Constitution, including rights, duties, and its guiding principles.	**K5**
CO6: Develop a comprehensive understanding of how history, geography, and governance shape contemporary India.	**K6**

MAPPING COs WITH POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	3	1	1	1	3
CO2	3	9	1	3	3	9
CO3	3	9	3	9	3	9
CO4	9	9	3	3	3	9
CO5	9	9	3	9	9	9
CO6	3	9	3	9	9	9
WEIGHTAGE	36	48	14	34	28	48
WEIGHTED %	17.3 %	23.1 %	6.7 %	16.3 %	13.5 %	23.1 %

COURSE OUTCOMES MAPPED WITH KNOWLEDGE LEVEL (Revised Bloom's Taxonomy) AND POs:

COs	LEVEL OF CORRELATION			
	HIGH	**MEDIUM**	**LOW**	**ZERO**
CO1 / K1	PO1	PO2	PO3, PO4, PO5, PO6	--
CO2 / K2	PO2, PO6	PO1, PO4, PO5	PO3	--
CO3 / K3	PO2, PO4, PO6	PO1, PO3, PO5	--	--
CO4 / K4	PO1, PO2, PO6	PO3, PO4, PO5	--	--
CO5 / K5	PO1, PO2, PO4, PO5, PO6	PO3	--	--
CO6 / K6	PO2, PO4, PO5, PO6	PO1, PO3	--	--

COURSE OUTCOMES (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE:

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3		3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
NON SCHOLASTIC	-	-	-	-	-	5	20
TOTAL	4	10	6	20	5	25	100%

The COs and PSOs for the **UNDERSTANDING INDIA** course in the BCA Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge Signature of the HoD

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Programme Code	Course Code	Course Type	Course Title	Category	Hrs/week	Credits
COAUG1998	U25CASBE1	SBE	WEB PROGRAMMING	Lecture	2	2

COURSE DESCRIPTION:

- The course covers HTML basics, JavaScript programming, cookies management, CSS styling, and an introduction to C# including OOP concepts, variables, control structures, and error handling.

COURSE OBJECTIVES:

- The course is Understanding JavaScript Basics.
- The Course is Mastering JavaScript Objects and the Window Object
- The Course is working with Frames and HTML Forms.
- The Course is Handling Form Elements and User Input Validation.
- The Course is Introduction to Cookies

UNIT- I:

Introduction to HTML: Basic HTML Concepts- HTML: A Structured Language- Document Types- The<HTML> Element- The <HEAD>Element- The <TITLE>Element- The <BODY>Element- Links and Addressing: Linking Basics- What Are URLs? - Linking in HTML- Semantic Linking with the Element- HTML and Images- Image Preliminaries: GIF Images- JPEG Images- PNG Images. - HTML Layout: Backgrounds, Colors, and Text. (7 Hrs)

UNIT- II:

Introduction to JavaScript: JavaScript's Role on the Web – A First JavaScript Program – Working with Variables, Functions: Variables–Defining Functions–Calling Functions. Understanding JavaScript Objects – Object Methods – Variable Scope-Windows: The Window Object Model–Opening and closing-Windows: The Window Object Model–Opening and closing Windows. (6 Hrs)

UNIT- III:

Creating and Consuming Cookies: Understanding Cookies – Creating Cookies with JavaScript – Looking at a Simple Cookie. Setting a Cookie's Expiration Date—Setting the Cookie Path – Setting the Cookie Domain – Working with Secure Cookies – Reading Cookies with JavaScript – Removing Cookies. (5 Hrs)

UNIT- IV:

Introduction to CSS-Rise of CSS- Hello CSS World- The Specification of CSS- Applying Style to a Document- Document Structure and CSS Inheritance- Style Inclusion Methods- CSS Strings and Keywords- Counters- CSS Color Values- CSS Properties: Background - background-attachment - background-color -background-image background-position. (7 Hrs)

UNIT- V:

Introduction to C#: Overview of C#, Literals, Variables, Data Types, Operators, Expressions, Control Structures-Methods, Arrays, Strings, Structures, Enumerations. OOPS with C#: Classes, Objects, Inheritance, Polymorphism, Interfaces, Operator Overloading Delegates, Events, Errors and Exceptions. (5 Hrs)

TEXT BOOKS:

1. Thomas A. Powell, "HTML: The Complete Reference, Second Edition"– McGraw-Hill. Unit I - Chapter 1, 3, 4, 5, 6
2. David Flanagan," JavaScript: The Definitive Guide", Seventh Edition, O'Reilly. Unit II - Chapter 1,2 ,3, 6, 8, 15
3. JavaScript: The Definitive Guide, David Flanagan, O'Reilly, Sixth Edition,2011 UNIT III – Chapter 20
4. Thomas A. Powell," HTML & CSS: The Complete Reference", Fifth Edition, the McGraw-Hill Companies. Unit IV - Chapter 4, 5
5. Programming in C#", E. Balagurusamy, 4th Edition, Tata McGraw-Hill, 2017. Unit V - Chapter 1, 2,3 ,4, 5,6,7,8,9,10,11,12,13,14,15,16,17

REFERENCES:

1. Ivan Bayross, HTML, DHTML, JavaScript, Perl, CGI, BPB, ThirdRevis.
2. "Computing with C# and the .NET Framework", Arthur Gittleman, 2nd Edition, Jones & Bartlett Publishers, 2011
3. Marius Bancila, Raffaele Rialdi, Ankit Sharma "Learn C# Programming"
4. https://web.stevens.edu/academic_files/courses/syllabus/CS546syl.pdf
5. https://www.citytech.cuny.edu/computer-systems/docs/courses/CST2309.pdf
6. https://www.imsa.edu/wp-content/uploads/2019/09/Web-Tech-Syllabus-F19.pdf

COURSE OUTCOME	KNOWLEDGE LEVEL (K1-K6)
CO1: Recall the basic syntax and structure of JavaScript objects.	**K1**
CO2: Understanding JavaScript Fundamentals	**K2**
CO3: Implementation of Cookies in JavaScript.	**K3**
Working with Frames and Forms	**K4**
CO4: Analyze the structure and functionality of various form elements (e.g., input fields, buttons, and checkboxes) in web development.	**K5**
CO5: Evaluate the security implications of using cookies in JavaScript and assess different techniques for storing sensitive data securely.	**K6**

MAPPING COs WITH POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	3	1	1	3
CO2	3	3	9	3	1	3
CO3	9	3	9	3	1	3
CO4	9	3	9	3	1	3
CO5	9	3	9	3	1	9
CO6	9	3	9	3	1	9
WEIGHTAGE	42	16	48	16	6	30
WEIGHTED %	26.58 %	10.13 %	30.38 %	10.13 %	3.80 %	18.99 %

COURSE OUTCOMES MAPPED WITH KNOWLEDGE LEVEL (Revised Bloom's Taxonomy) AND POs:

COs	LEVEL OF CORRELATION			
	HIGH	MEDIUM	LOW	ZERO
CO1 / K1	--	PO1, PO3, PO6	PO2, PO4, PO5	--
CO2 / K2	PO3	PO1, PO2, PO4, PO6	PO5	--
CO3 / K3	PO1, PO3	PO2, PO4, PO6	PO5	--
CO4 / K4	PO1, PO3	PO2, PO4, PO6	PO5	--
CO5 / K5	PO1, PO3, PO6	PO2, PO4	PO5	--
CO6 / K6	PO1, PO3, PO6	PO2, PO4	PO5	--

COURSE OUTCOMES (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE:

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3		3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
NON SCHOLASTIC	-	-	-	-	-	5	20
TOTAL	4	10	6	20	5	25	100%

The COs and PSOs for the **WEB PROGRAMMING** course in the BCA Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge Signature of the HoD

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Programme Code	Course Code	Course Type	Course Title	Category	Hrs/week	Credits
COAUG1998	**U25CA3**	**Core**	**DATABASE MANAGEMENT SYSTEM**	**Lecture**	**6**	**6**

COURSE DESCRIPTION:

- The course covers database systems, design processes using the E-R model, SQL queries and operations, relational database design, data storage techniques, and indexing/hash concepts for efficient data management.

COURSE OBJECTIVES:

- To provide knowledge about RDBMS Concepts, SQL Concepts and PL/SQL Programming and database normalization.
- To learn theory involved in data models and query Languages.
- To introduce the fundamental concepts of database systems, including architecture, data models, database languages, and the roles of users and administrators.
- To develop students' ability to design efficient database schemas using the Entity-Relationship model and apply normalization techniques for relational database design.
- To equip students with practical skills in SQL querying, data manipulation, indexing, and data storage mechanisms for effective database management and optimization.

UNIT I:

Introduction: Database System Applications – Purpose of Database Systems – View of Data – Database Language – Relational Databases – Database Design Data Storage and Querying Transaction Management – Data Mining and Analysis – Database Architecture- Database Users and Administrators. (18 Hrs)

UNIT II:

Database Design and the E- R Model: Overview of the Design Process – The Entity – Relational Ship Model –Constraints – Entity – Relational ship Diagrams – Entity – Relationship Design Issues. (18 Hrs)

UNIT III:

SQL: Data Definition – Basic Structure of SQL Queries – Set Operations – Aggregate Functions – NULL Values – Nested Sub queries – Complex Queries – Views – Modification of the Database – Joined Relations – SQL Data Types and Schemes – Integrity Constraints – Authorization – Embedded SQL. (19 Hrs)

UNIT IV:

Relational Database Design: Features of Good Relational Designs – Atomic Domains and First Normal Form – Decomposition Using Functional Dependencies – Functional Dependency Theory – Decomposition Using Multivalued Dependencies – More Normal Forms – Database Design Process. (18 Hrs)

UNIT V:

Data Storage: Tertiary Storage – File Organization – Organization of Records in Files – Data Dictionary Storage – Database Buffer. Indexing and Hashing: Basic concepts – Ordered Indices – B^+ - Tree Index Files. (17 Hrs)

TEXT BOOKS:

1. Silberschatz.Henry F.Korth and S.Sudarshan "Database System Concepts", 6thEdition- McGraw – Hill –2013.
   Unit 1: chapter 1(sec 1.1,1.2,1.3,1.4,1.5,1.6,1.7,1.8,1.9,1.10,1.12)
   Unit 2: chapter 7(sec 7.1, 7.2, 7.3, 7.5, 7.6, 7.7)
   Unit 3: chapter 3(sec 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9) chapter 4(sec 4.1, 4.2, 4.3, 4.4, 4.5)
   Unit 4: chapter 8(sec 8.1, 8.2, 8.3, 8.4, 8.6, 8.7, 8.8)
   Unit 5: chapter 10(sec 10.4, 10.5, 10.6, 10.7, 10.8) chapter 11(sec 11.1, 11.2, 11.3)

REFERENCES:

1. Ramez Elmasri –Shamkant B.Navathe "Fundamentals of Database Systems" – Third Edition – Addison
2. Wesley Longman Pvt.,Ltd – Delhi 2001.
3. Alexis leon and Matheews Leon "Database Management Systems" – Vikas Publishing House Pvt.,Ltd., -New Delhi – 2002.
4. https://people.inf.elte.hu/kiss/DB/ullman_the_complete_book.pdf
5. https://asolanki.co.in/wpcontent/uploads/2019/02/Fundamentals_of_Database_Systems_6th_Edition-1.pdf
6. https://dl.ebooksworld.ir/motoman/Pearson.Database.Systems.A.Practical.Approach.to.Design.Implementation.and.Management.6th.Global.Edition.www.EBooksWorld.ir.pdf
7. https://ebooks.lpude.in/arts/ba/year_3/DCAP204_MANAGING_DATABASE_DCAP402_DATABASE_MANAGEMENT_SYSTEMS.pdf

COURSE OUTCOME	KNOWLEDGE LEVEL (K1-K6)
CO1: Recall database systems and their applications, architecture, and user roles.	**K1**
CO2: Understand databases using the Entity-Relationship model and address design issues.	**K2**
CO3: Apply SQL queries for data manipulation, complex queries, and database management.	**K3**
CO4: Analyze relational databases through normalization and apply functional dependencies to achieve optimal designs.	**K4**
CO5: Evaluate data storage mechanisms and file organization for efficient database management.	**K5**
CO6: Create indexing and hashing techniques to optimize data retrieval and query performance.	**K6**

MAPPING COs WITH POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	3	3	1	1	3
CO2	9	9	3	3	1	3
CO3	9	3	9	3	1	3
CO4	9	3	9	9	1	3
CO5	9	3	9	3	9	3
CO6	9	3	9	3	9	9
WEIGHTAGE	54	24	42	22	22	24
WEIGHTED %	28.72 %	12.77 %	22.34 %	11.70 %	11.70 %	12.77 %

COURSE OUTCOMES MAPPED WITH KNOWLEDGE LEVEL (Revised Bloom's Taxonomy) AND POs:

COs	LEVEL OF CORRELATION			
	HIGH	**MEDIUM**	**LOW**	**ZERO**
CO1 / K1	PO1	PO2, PO3, PO6	PO4, PO5	--
CO2 / K2	PO1, PO2	PO3, PO4, PO6	PO5	--
CO3 / K3	PO1, PO3	PO2, PO4, PO6	PO5	--
CO4 / K4	PO1, PO3, PO4	PO2, PO6	PO5	--
CO5 / K5	PO1, PO3, PO5	PO2, PO4, PO6	--	--
CO6 / K6	PO1, PO3, PO5, PO6	PO2, PO4	--	--

COURSE OUTCOMES (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE:

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3		3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
NON SCHOLASTIC	-	-	-	-	-	5	20
TOTAL	4	10	6	20	5	25	100%

The COs and PSOs for the **DATABASE MANAGEMENT SYSTEM** course in the BCA Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge Signature of the HoD

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Programme Code	Course Code	Course Type	Course Title	Category	Hrs/week	Credits
COAUG1998	**U25CA4P**	**Core**	**DATABASE MANAGEMENT SYSTEM LAB**	**Practical**	**3**	**3**

COURSE DESCRIPTION:

- The tasks involve SQL queries for data manipulation and PL/SQL programs for arithmetic operations, prime check, factorial, table generation, number swapping, Fibonacci series, Armstrong number, and pattern printing.

COURSE OBJECTIVES:

- To develop proficiency in using SQL for creating, modifying, and managing database structures and data.
- To enable students to perform data retrieval using advanced SQL constructs such as logical operators, set operations, sorting, grouping, subqueries, and joins.
- To introduce the fundamentals of PL/SQL programming**,** including variable declarations, control structures, and loops.
- To enhance problem-solving skills through the development of PL/SQL programs for arithmetic operations, number patterns, and algorithmic logic like prime numbers and Fibonacci series.
- To prepare students to write modular and reusable database code**,** fostering understanding of procedural logic within the database environment for efficient back-end development.

LIST OF EXERCISERS:

1. Develop SQL query to create, update and to insert data in databases
2. Use select statement toper form
    i. AND, OR, NOT Operators, WHERE clause.
    ii. UNION, INTERSECTION, MINUS.
    iii. Sorting and grouping.
    iv. Subqueries
    v. Join
3. Write a PL/SQL Program to Add Two Numbers
4. Construct a PL/SQL Program for Prime Number
5. Formulate PL/SQL Program to Find Factorial of a Number
6. Write down a PL/SQL Program to Print Table of a Number
7. Create PL/SQL Program for Swap two Numbers
8. Generate PL/SQL Program for Fibonacci Series
9. PL/SQL Program for Armstrong Number
10. PL/SQL Program to Print Patterns

COURSE OUTCOME	KNOWLEDGE LEVEL (K1-K6)
CO1: Recall SQL queries for creating, updating, and inserting data in databases.	**K1**
CO2: Understand advanced SQL features such as logical operators, set operations, sorting, grouping, subqueries, and joins.	**K2**
CO3: Apply basic PL/SQL programs to solve arithmetic problems and implement procedural logic.	**K3**
CO4: Analyze PL/SQL programs to solve mathematical problems like prime numbers, factorials, and Fibonacci series.	**K4**
CO5: Evaluate PL/SQL programs for real-world applications, such as swapping numbers and generating multiplication tables.	**K5**
CO6: Create PL/SQL programs to generate number patterns and check number properties like Armstrong numbers.	**K6**

MAPPING COs WITH POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	3	3	1	1	3
CO2	9	3	9	3	1	3
CO3	9	3	9	3	1	3
CO4	9	3	9	9	1	3
CO5	9	3	9	3	9	3
CO6	9	3	9	3	9	9
WEIGHTAGE	54	18	48	22	22	24
WEIGHTED %	28.72 %	9.57 %	25.53 %	11.70 %	11.70 %	12.77 %

COURSE OUTCOMES MAPPED WITH KNOWLEDGE LEVEL (Revised Bloom's Taxonomy) AND POs:

COs	LEVEL OF CORRELATION			
	HIGH	**MEDIUM**	**LOW**	**ZERO**
CO1 / K1	PO1	PO2, PO3, PO6	PO4, PO5	--
CO2 / K2	PO1, PO3	PO2, PO4, PO6	PO5	--
CO3 / K3	PO1, PO3	PO2, PO4, PO6	PO5	--
CO4 / K4	PO1, PO3, PO4	PO2, PO6	PO5	--
CO5 / K5	PO1, PO3, PO5	PO2, PO4, PO6	--	--
CO6 / K6	PO1, PO3, PO5, PO6	PO2, PO4	--	--

The COs and PSOs for the **DATABASE MANAGEMENT SYSTEM LAB** course in the BCA Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge Signature of the HoD

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Programme Code	Course Code	Course Type	Course Title	Category	Hrs/week	Credits
COAUG1998	U25CASBE2	SBE	PYTHON PROGRAMMING	Lecture	2	2

COURSE DESCRIPTION:

- The course covers Python fundamentals, including data types, control flow, functions, OOP, working with packages like NumPy and Pandas, machine learning, data visualization with Matplotlib, and file handling with exception management.

COURSE OBJECTIVES:

- To introduce the fundamentals of Python programming, including data types, syntax, and string manipulation techniques.
- To develop the ability to use Python's built-in data structures, such as lists, tuples, and dictionaries, along with advanced list processing and comprehensions.
- To enable students to write modular programs using control structures, functions, recursion, object-oriented principles, and exception handling.
- To familiarize students with essential Python libraries such as NumPy, Pandas, Scikit-learn, and Matplotlib for data analysis, visualization, and basic machine learning.
- To provide hands-on experience in file handling and error management, including reading/writing files and handling runtime exceptions and command-line inputs.

UNIT- I:

Introduction-Data types- Introduction to Python–Advantages of using Python–Executing Python Programs–Python's Core data types – Numeric Types – String Fundamentals. (6 Hrs)

UNIT- II:

Lists, Tuples, Dictionaries Lists: list operations, list slices– list methods–list loop–mutability–aliasing–cloning lists–list parameters; Tuples: tuple assignment–tuple as return value; Dictionaries: operations and methods; advanced list processing – list comprehension. (7 Hrs)

UNIT- III:

Control Flow, Functions, Modules Python Statements: Assignments–Expressions–If condition–While and For Loops. Functions: Definition, Calls – Scopes – Arguments – Recursive Functions– Functional Programming tools Classes and Object- Oriented programming with Python–modules and Packages: Purpose, using packages– Exception Handling with Python. (7 Hrs)

UNIT- IV:

Packages: NumPy, Pandas, Scikit learn–Machine learning with Python–Cleaning up, Wrangling, Analysis, Visualization - Matplotlib package – Plotting Graphs. (5 Hrs)

UNIT- V:

File Handling-Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions. (5 Hrs)

TEXT BOOKS:

1. Daniel Liang, "Introduction to programming using Python", First Edition, Pearson,2021.
   UNIT I: Chapter 1 (Sec.1.1,1.5, Chapter 2 Sec. 2. 8, Chapter 3 Sec 3.8,
   UNIT – II: Chapter 14 (14.1,14.2,14.3)
   UNIT – III: Chapter 4 (Sec. 4.4) Chapter 5 (Sec. 5. 1, 5 .3) Chapter 6 (sec 6.1,6.2)
   Chapter 7 (Sec. 7.2,1.4, Chapter 2 Sec. 2. 1, 2 .2, 2 .9, Chapter 3 Sec 3.6, Chapter 4)
   UNIT – IV:Chapter 1 Sec. 13.1 – 13.6, Chapter 16 Sec. 16.2,16.3,16.5,16.11 – 16.13,16.15.
   UNIT – V: Chapter 13 (13.1 , 13.2,)
2. Wes Mc Kinney, "Python for Data Analysis", O'Reilly Media,2012.
   UNIT – IV: Chapter 1 (3,4,4,5)
3. Tim Hall and J-P Stacey, "Python3 for Absolute Beginners", First Edition, Apress,2009.
4. Magnus Lie Hetland, "Beginning Python: From Novice to Professional", Second Edition, Apress, 2005.

REFERENCES:

1. Mark Lutz, "Learning Python", Fifth Edition, O'Reilly, 2013.
2. Geeks for Geeks(http://www.geeksforgeeks.org)
3. W3Schools(http://www.w3schools.com)

COURSE OUTCOME	KNOWLEDGE LEVEL (K1-K6)
CO1: Remember and Understand Python Basics.	**K1**
CO2: Understand the advantages of using Python and how to run Python programs.	**K2**
CO3: Apply Data Structures (Lists, Tuples, Dictionaries).	**K3**
CO4: Analyze control flow mechanisms (if, while, for loops) and how functions work in Python.	**K4**
CO5: Evaluate the use of packages like NumPy, Pandas, and Scikit-learn for data manipulation and machine learning.	**K5**
CO6: Create modular Python programs using functions, classes, and packages.	**K6**

MAPPING COs WITH POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	1	1	1	1
CO2	3	3	1	1	1	3
CO3	9	3	9	3	1	3
CO4	9	3	9	3	1	3
CO5	9	3	9	9	3	9
CO6	9	3	9	9	1	3
WEIGHTAGE	42	16	38	26	8	22
WEIGHTED %	27.63 %	10.53 %	25.00 %	17.11 %	5.26 %	14.47 %

COURSE OUTCOMES MAPPED WITH KNOWLEDGE LEVEL (Revised Bloom's Taxonomy) AND POs:

COs	LEVEL OF CORRELATION			
	HIGH	MEDIUM	LOW	ZERO
CO1 / K1	--	PO1	PO2, PO3, PO4, PO5, PO6	--
CO2 / K2	--	PO1, PO2, PO6	PO3, PO4, PO5	--
CO3 / K3	PO1, PO3	PO2, PO4, PO6	PO5	--
CO4 / K4	PO1, PO3	PO2, PO4, PO6	PO5	--
CO5 / K5	PO1, PO3, PO4, PO6	PO2, PO5	--	--
CO6 / K6	PO1, PO3, PO4	PO2, PO6	PO5	--

COURSE OUTCOMES (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE:

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3		3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
NON SCHOLASTIC	-	-	-	-	-	5	20
TOTAL	4	10	6	20	5	25	100%

The COs and PSOs for the **PYTHON PROGRAMMING** course in the BCA Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge Signature of the HoD

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Programme Code	Course Code	Course Type	Course Title	Category	Hrs/ week	Credits
COAUG1998	**U25CASBE3P**	**SBE**	**PYTHON PROGRAMMING LAB**	**Practical**	**2**	**2**

COURSE DESCRIPTION:

- The tasks include variable exchange, finding minimums, sorting, student mark generation, mathematical operations, array summing, matrix operations with NumPy, data frame operations with Pandas, data visualization with Matplotlib, and file operations.

COURSE OBJECTIVES:

- To develop foundational programming skills in Python, including variable manipulation, control structures, and basic arithmetic operations.
- To build problem-solving abilities using Python's built-in functions and standard libraries for tasks such as sorting, GCD, square root, and array processing.
- To enable the use of NumPy for efficient numerical and matrix operations**,** supporting scientific and mathematical computing.
- To introduce data handling and analysis using Pandas**,** including working with Data Frames and performing basic data manipulation.
- To equip students with skills in data visualization and file handling**,** including plotting graphs with Matplotlib and performing file I/O and text processing operations.

LIST OF EXERCISES:

1) Exchange the values of two variables
2) Finding minimum among n variables
3) Perform Simple sorting
4) Generate Students marks statement
5) Find square root, GCD, exponentiation
6) Sum the array of numbers
7) Perform Matrix operations using NumPy
8) Perform Data frame operations using Pandas
9) Use Matplotlib on data set and visualize
10) Perform Word count, copy file operations

COURSE OUTCOME	KNOWLEDGE LEVEL (K1-K6)
CO1: Remember key programming concepts such as variable assignments, loops, conditionals, and data structures that form the foundation for solving problems like swapping values or summing arrays.	**K1**
CO2: Understand the fundamental concepts behind basic programming operations such as variable exchange, searching, sorting, mathematical functions, file handling, and data visualization.	**K2**
CO3: Implement solutions using appropriate programming techniques and libraries like NumPy, Pandas, and Matplotlib.	**K3**
CO4: Analyze the efficiency, time complexity, and space complexity of algorithms and solutions implemented for various computational problems.	**K4**
CO5: Evaluate the correctness and efficiency of algorithms, and assess their suitability for various types of datasets or problem sizes.	**K5**
CO6: Create algorithms and solutions for various problems and integrate them in to larger systems (e.g., report generation, data analysis, matrix operations).	**K6**

MAPPING COs WITH POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	3	1	1	3
CO2	3	3	9	3	1	3
CO3	9	3	9	3	1	3
CO4	9	3	9	9	1	3
CO5	9	3	9	9	3	9
CO6	9	3	9	9	3	9
WEIGHTAGE	42	16	48	34	10	30
WEIGHTED %	23.33 %	8.89 %	26.67 %	18.89 %	5.56 %	16.67 %

COURSE OUTCOMES MAPPED WITH KNOWLEDGE LEVEL (Revised Bloom's Taxonomy) AND POs:

COs	LEVEL OF CORRELATION			
	HIGH	MEDIUM	LOW	ZERO
CO1 / K1	--	PO1, PO3, PO6	PO2, PO4, PO5	--
CO2 / K2	PO3	PO1, PO2, PO4, PO6	PO5	--
CO3 / K3	PO1, PO3	PO2, PO4, PO6	PO5	--
CO4 / K4	PO1, PO3, PO4	PO2, PO6	PO5	--
CO5 / K5	PO1, PO3, PO4, PO6	PO2, PO5	--	--
CO6 / K6	PO1, PO3, PO4, PO6	PO2, PO5	--	--

The COs and PSOs for the **PYTHON PROGRAMMING LAB** course in the BCA Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge Signature of the HoD

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Programme Code	Course Code	Course Type	Course Title	Category	Hrs/week	Credits
COAUG1998	U25CA5	Core	JAVA PROGRAMMING	Lecture	4	5

COURSE DESCRIPTION:

- The course covers OOPS principles in Java, including classes, objects, inheritance, method overloading, interfaces, multithreading, exception handling, file I/O, event handling, GUI controls, layouts, and applet development.

COURSE OBJECTIVES:

- To understand pure object-oriented programming paradigm
- To familiarize with the fundamentals of Java features
- To introduce console and GUI based applications using Java
- To know the basic approaches to the design of software applications.
- To learn basic GUI components, event handling, and applet development in Java.

UNIT – I

Benefits of OOPS – Java History – Java Features – Java Environment – Java Tokens – Constants – Variables – Data Types – Operators and Expressions – Decision-making and Branching – Decision Making and Looping. (12 Hrs)

UNIT – II

Classes and Objects – Constructors – Method Overloading – Static Members –Inheritance – Overriding Methods – Final Variables, Final Methods and Final Classes –Finalizer Method – Abstract Methods and Abstract Classes – Visibility Control – Arrays– Strings. (12 Hrs)

UNIT – III

Defining Interface– Extending Interfaces – Implementing Interfaces – Packages – Multithreaded Programming: Thread Life Cycle – Thread Exceptions – Thread Priority – Synchronization. (10 Hrs)

UNIT – IV

Types of Errors – Exceptions – Syntax of Exception Handling Code – MultipleCatch Statements – Using Finally Statements – Managing Input / Output Files in Java:Concept of Streams – Stream Classes – Character Stream Classes – Reading / Writing Characters – Reading / Writing Bytes – Handling Primitive Data Types – Random Access files. (14 Hrs)

UNIT – V

Event Handling Methods – Labels – Button Control – CheckBox Control – RadioButton Control – Choice Control – List Control – Flow Layout – Border Layout –Grid Layout– Menus – Mouse Events – Applets: Life cycle of an Applet – Development and Execution of a Simple Applet. (12 Hrs)

TEXT BOOKS:

1. E. Balagurusamy, “Programming with JAVA”, Tata McGraw Hill, New Delhi, 4 th Edition. (UNIT I, II, III &IV)
2. C. Muthu, “Programming with JAVA”, Vijay Nicole Imprints Private Limited, Chennai, 2 rd Edition, 2011. (UNIT V)

   UNIT I: Chapter 1 Sec.1.3,1.4, Chapter 2 Sec. 2. 1, 2 .2, 2 .9, Chapter 3 Sec 3.6, Chapter Sec. 4.2 – 4.4, Chapter 5 Sec. 5.1 – 5.15, Chapter 6 Sec. 6.1 – 6.8, Chapter 7 Sec. 7.1 7.6.
   UNIT II: Chapter 8 Sec. 8.5,8.7 to 8.9 ,8.11 – 8.16,8.18 Chapter 9 Sec. 9.1 – 9.9.

UNIT III: Chapter 10 Sec.10.2 – 10.5, Chapter 11, Sec. 11.1 – 11.10. Chapter 12 Sec. 12.5, 12.7 -12.9.

UNIT IV: Chapter 13 Sec. 13.1 – 13.6, Chapter 16 Sec. 16.2, 16.3, 16.5, 16.11 – 16.1316.15.

UNIT V: Chapter 9 Sections 9.4,9.6 – 9.11,9.13 – 9.15, Chapter 10 Sections 10.3,10.5, Chapter 8 Sections 8.2,8.4

REFERENCES:

1. Herbert Schildt, "Complete Reference JAVA 2", Tata MeGraw – Hill Publishing Company Ltd., 5 th Edition, 2009
2. https://freecomputerbooks.com/top-java-books.html#google_vignette
3. https://guides.nyu.edu/dibner-ebooks/free-ebooks
4. https://www.iitk.ac.in/esc101/share/downloads/javanotes5.pdf

COURSE OUTCOME	KNOWLEDGE LEVEL (K1-K6)
CO1: Recall OOP principles and the fundamentals of Java programming (syntax, variables, operators, and flow control).	**K1**
CO2: Understand classes, objects, constructors, method overloading, inheritance, abstract classes, and visibility control.	**K2**
CO3: Implement interfaces, packages, and multithreaded applications in Java.	**K3**
CO4: Analyze exceptions, manage I/O operations, and understand error handling mechanisms in Java.	**K4**
CO5: Evaluate interactive GUI applications by handling events and using layout managers in Java.	**K5**
CO6: Develop and deploy applets in Java, understanding their life cycle and execution process.	**K6**

MAPPING COs WITH POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	3	3	1	1	3
CO2	9	3	9	3	1	3
CO3	9	3	9	3	1	3
CO4	9	3	9	9	1	3
CO5	9	3	9	3	9	3
CO6	9	3	9	3	9	9
WEIGHTAGE	54	18	48	22	22	24
WEIGHTED %	28.72 %	9.57 %	25.53 %	11.70 %	11.70 %	12.77 %

COURSE OUTCOMES MAPPED WITH KNOWLEDGE LEVEL (Revised Bloom's Taxonomy) AND POs:

COs	LEVEL OF CORRELATION			
	HIGH	MEDIUM	LOW	ZERO
CO1 / K1	PO1	PO2, PO3, PO6	PO4, PO5	--
CO2 / K2	PO1, PO3	PO2, PO4, PO6	PO5	--
CO3 / K3	PO1, PO3	PO2, PO4, PO6	PO5	--
CO4 / K4	PO1, PO3, PO4	PO2, PO6	PO5	--
CO5 / K5	PO1, PO3, PO5	PO2, PO4, PO6	--	--
CO6 / K6	PO1, PO3, PO5, PO6	PO2, PO4	--	--

COURSE OUTCOMES (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE:

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3		3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
NON SCHOLASTIC	-	-	-	-	-	5	20
TOTAL	4	10	6	20	5	25	100%

The COs and PSOs for the **JAVA PROGRAMMING** course in the BCA Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge Signature of the HoD

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Programme Code	Course Code	Course Type	Course Title	Category	Hrs/week	Credits
COAUG1998	**U25CA6P**	**Core**	**JAVA PROGRAMMING LAB**	**Practical**	**2**	**3**

COURSE DESCRIPTION:

- The tasks include working with classes and objects, inheritance, built-in and user-defined packages, vector manipulation, exception handling, applets, multithreading, AWT components, and file operations.

COURSE OBJECTIVES:

- To understand and apply the concepts of classes, objects, and inheritance in Java programming.
- To utilize built-in and user-defined packages for effective code organization and reuse.
- To implement exception handling and multithreading for robust and concurrent applications.
- To develop GUI applications using AWT components and applet programming.
- To perform file input/output operations and manipulate data structures like vectors in Java.

LIST OF EXERCISES:

1) Classes and Objects.
2) Inheritance
3) Built-in package.
4) User defined package
5) Vector Manipulation
6) Exception handling.
7) Applet
8) Multithreading.
9) AWT components.
10) File operations.

COURSE OUTCOME	KNOWLEDGE LEVEL (K1-K6)
CO1: Recall classes, objects, and inheritance to develop object-oriented solutions.	**K1**
CO2: Understand both built-in and user-defined packages for better code organization and modularity.	**K2**
CO3: Apply vectors and use Java's collection framework to manage dynamic data structures.	**K3**
CO4: Analyze exception handling mechanisms to ensure robust and fault-tolerant Java applications.	**K4**
CO5: Evaluate multithreaded applications to perform concurrent operations and manage thread synchronization.	**K5**
CO6: Create AWT components to design GUIs and perform file operations for data management.	**K6**

MAPPING COs WITH POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	3	9	3	1	3
CO2	9	3	9	3	1	3
CO3	9	3	9	3	1	3
CO4	9	3	9	9	1	3
CO5	9	3	9	3	9	3
CO6	9	3	9	3	3	9
WEIGHTAGE	54	18	54	24	16	24
WEIGHTED %	28.42 %	9.47 %	28.42 %	12.63 %	8.42 %	12.63 %

COURSE OUTCOMES MAPPED WITH KNOWLEDGE LEVEL (Revised Bloom's Taxonomy) AND POs:

COs	LEVEL OF CORRELATION			
	HIGH	MEDIUM	LOW	ZERO
CO1 / K1	PO1, PO3	PO2, PO4, PO6	PO5	--
CO2 / K2	PO1, PO3	PO2, PO4, PO6	PO5	--
CO3 / K3	PO1, PO3	PO2, PO4, PO6	PO5	--
CO4 / K4	PO1, PO3	PO2, PO4, PO6	PO5	--
CO5 / K5	PO1, PO3, PO5	PO2, PO4, PO6	--	--
CO6 / K6	PO1, PO3, PO6	PO2, PO4, PO5	--	--

The COs and PSOs for the **JAVA PROGRAMMING LAB** course in the BCA Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge Signature of the HoD

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Programme Code	Course Code	Course Type	Course Title	Category	Hrs/week	Credits
COAUG1998	**U25ACA3TP**	**Allied**	**DIGITAL MARKETING**	**Lecture and Practical**	**4**	**2**

COURSE DESCRIPTION:

- The course covers online market strategies, SEO, email marketing, social media marketing, and digital transformation, including analytics, campaign strategies, and the latest trends in digital marketing.

COURSE OBJECTIVES:

- Understand core concepts like SEO, SEM, social media, email marketing, and content creation.
- Use analytics tools to optimize campaigns for better performance.
- Improve rankings and drive targeted traffic through SEO and SEM techniques.
- Design and manage effective campaigns on platforms like Facebook, Instagram, and LinkedIn.
- Apply conversion rate techniques and analyze ROI to maximize marketing effectiveness.

UNIT – I

Introduction to Online Market: Online Market space- Digital Marketing Strategy- Components - Opportunities for building Brand Website - Planning and Creation - Content Marketing. (12 Hrs)

UNIT – II

Search Engine Optimization: Search Engine optimization - Keyword Strategy- SEO Strategy - SEO success factors - On-Page Techniques - Off-Page Techniques. Search Engine Marketing - SEM components - PPC advertising. (12 Hrs)

UNIT – III

E- Mail Marketing: Types of E- Mail Marketing - Email Automation – Integrating Email - Email campaign - Mobile Marketing - Location based - Context based - SMS Campaigns - Profiling and targeting. (12 Hrs)

UNIT – IV

Social Media Marketing: Social Media Channels- Leveraging social media for brand conversations and buzz. Benchmark social media campaigns. Engagement Marketing- Creating Loyalty drivers - Influencer Marketing. (11 Hrs)

UNIT – V

Digital Transformation: Digital Transformation & Channel Attribution- Analytics- Ad-words, Email, Mobile, social media, Web Analytics - Changing your strategy based on analysis- Recent trends in Digital marketing. (13 Hrs)

PRACTICAL:

LIST OF EXERCISES:

1. Digital Marketing Implementation in Business Scenario
2. Create the Digital Marketing Website
3. Conducting the Search Engine Optimization and Search Engine Marketing
4. Using Google Analytics to analyze website performance
5. Creating Promotional banner through Canva
6. Facebook Promotion using banners
7. Creating YouTube Channel for Marketing
8. Twitter Marketing
9. Instagram Marketing
10. Email Marketing

TEXT BOOKS:

1. Puneet Singh Bhatia, "Fundamentals of Digital Marketing, Pearson Education", First Edition, 2017.
Unit - I : Chatper 1, 2, 5, chapter 9 (Pg. No.: 327-329)
Unit - II : Chapter 6 (Pg. no.: 227 -230)
Unit -III : Chapter
Unit -IV : Chapter 6 (Pg. no.: 233 – 239), chapter 8 (287-309)
Unit -V : Chapter 7 (Pg. No.: 245 – 265)

REFERENCES:

1. https://www.slideshare.net/slideshow/digital-marketing-227045801/227045801
2. https://www.simplilearn.com/tutorials/digital-marketing-tutorial/what-is-digital-marketing
3. https://guides.nyu.edu/dibner-ebooks/free-ebooks
4. https://dpl.gov.in/index.php/e-Resources

COURSE OUTCOME	KNOWLEDGE LEVEL (K1-K6)
CO 1: Remember the basics of online market space, digital marketing strategies, and brand website creation.	**K1**
CO 2: Understand SEO techniques, keyword strategies, and PPC advertising in search engine marketing.	**K2**
CO 3: Apply the various types of email marketing and automation techniques.	**K3**
CO 4: Analyze and adapt Digital Marketing strategies based on comprehensive data analytics.	**K4**
CO 5: Evaluate digital transformation strategies and analytics for optimizing marketing efforts.	**K5**
CO 6: Create a comprehensive digital marketing strategy using analytics and recent trends.	**K6**

MAPPING COs WITH POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	1	1	1	3
CO2	3	3	3	3	1	3
CO3	3	3	3	1	1	3
CO4	3	3	9	9	1	3
CO5	9	3	9	9	3	9
CO6	9	3	9	9	3	9
WEIGHTAGE	30	18	34	32	10	30
WEIGHTED %	19.48 %	11.69 %	22.08 %	20.78 %	6.49 %	19.48 %

COURSE OUTCOMES MAPPED WITH KNOWLEDGE LEVEL (Revised Bloom's Taxonomy) AND POs:

COs	LEVEL OF CORRELATION			
	HIGH	MEDIUM	LOW	ZERO
CO1 / K1	--	PO1, PO2, PO6	PO3, PO4, PO5	--
CO2 / K2	--	PO1, PO2, PO3, PO4, PO6	PO5	--
CO3 / K3	--	PO1, PO2, PO3, PO6	PO4, PO5	--
CO4 / K4	PO3, PO4	PO1, PO2, PO6	PO5	--
CO5 / K5	PO1, PO3, PO4, PO6	PO2, PO5	--	--
CO6 / K6	PO1, PO3, PO4, PO6	PO2, PO5	--	--

COURSE OUTCOMES (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE:

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 2 Marks	T2 4 Marks	Assignment 4 Marks	10 Marks	5 Marks	15 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3		3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
NON SCHOLASTIC	-	-	-	-	-	5	20
TOTAL	4	10	6	20	5	25	100%

The COs and PSOs for the **DIGITAL MARKETING** course in the BCA Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge Signature of the HoD

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Programme Code	Course Code	Course Type	Course Title	Category	Hrs/ week	Credits
COAUG1998	**U25CANME1**	**NME**	**FOUNDATION OF INFORMATION TECHNOLOGY**	**Lecture**	**2**	**2**

COURSE DESCRIPTION:

- The course covers IT basics, hardware and software management, networking essentials, data management and security, and IT support/troubleshooting, including current trends in IT.

COURSE OBJECTIVES:

- This course emphasizes the fundamentals of IT, including computers, software, and networking.
- This course focuses on managing hardware, installing software, and working with cloud technologies.
- This course highlights network operation, including protocols and security practices.
- This course covers data management, cyber security, and encryption techniques.
- This course equips students with troubleshooting and IT support skills for resolving technical issues.

UNIT- I:

Overview of IT–Computer Basics–Software Fundamentals–Networks & Internet–IT Ethics and Policies. (05 Hrs)

UNIT- II:

Hardware and Software Management: Computer Assembly and Maintenance - Operating Systems–Software Installation and Maintenance–Virtualization, Cloud Computing. (07 Hrs)

UNIT- III:

Networking Essentials: Network Fundamentals– Hardware–Protocols and Services–Wireless Networking–Security. (06 Hrs)

UNIT- IV:

Data Management and Security: Data and Fundamentals of Database – Data Backup and Recovery–Cyber Security–Encryption and Cryptography. (06 Hrs)

UNIT- V:

IT Support and Troubleshooting: Help Desk and IT Support–Trouble shooting Methodologies– Diagnostic Tools and Utilities–Future Trends in IT. (06 Hrs)

TEXT BOOKS:

1. Floyd Fuller, Brian Larson, "Computers: Understanding Technology, Fourth Edition, EMC Paradigm, 2011.
   Unit I – chapter 1, 3, 4, 5
   Unit II – chapter 2, 3
2. Ramez Elmasri, Shamkant B. Navathe, " Fundamentals of Database systems", sixth edition, Addison-Wesley, Pearson, 2011
   Unit IV – chapter 1, 2, chapter 23

3. Jeffrey S. Beasley, Piyasat Nilkaew, "Networking essentials", Third Edition, Prentice Hall Certification, 2012.
   Unit III – Chapter 1.1, 1.2, 1.3, 1.4, chapter 4, chapter 12
   Unit V – Chapter 11
4. Charles J.Brooks ,Christophe rGrow, PhilipCraig, and DonaldShor, "Cyber security Essentials", First Edition, Sybex Publisher, 2018.
   Unit III – Chapter 12, 13, 22

REFERENCES:

1. https://digitalcommons.usf.edu/dit_tb_eng/
2. https://www.onlineprogrammingbooks.com/free-information-technology-books/
3. https://books.infotoday.com/ebooks/
4. https://github.com/EbookFoundation/free-programming-books

COURSE OUTCOME	KNOWLEDGE LEVEL (K1-K6)
CO1: Remember the basics of IT, including computer fundamentals, software, networks, and IT ethics.	**K1**
CO2: Understand the concepts of hardware and software management, including cloud computing and virtualization.	**K2**
CO3: Apply networking fundamentals, protocols, and wireless networking concepts to ensure secure communication.	**K3**
CO4: Analyze data management techniques, including backup, recovery, and cybersecurity practices like encryption.	**K4**
CO5: Evaluate IT support methodologies and the effectiveness of diagnostic tools in troubleshooting IT issues.	**K5**
CO6: Create innovative solutions for IT challenges by integrating future trends and advanced IT tools.	**K6**

MAPPING COs WITH POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	1	1	1	3
CO2	3	3	3	3	1	3
CO3	9	3	9	3	1	3
CO4	9	3	9	9	3	3
CO5	3	3	9	3	9	3
CO6	9	3	9	9	3	9
WEIGHTAGE	36	18	40	28	18	24
WEIGHTED %	21.95 %	10.98 %	24.39 %	17.07 %	10.98 %	14.63 %

COURSE OUTCOMES MAPPED WITH KNOWLEDGE LEVEL (Revised Bloom's Taxonomy) AND POs:

COs	LEVEL OF CORRELATION			
	HIGH	MEDIUM	LOW	ZERO
CO1 / K1	--	PO1, PO2, PO6	PO3, PO4, PO5	--
CO2 / K2	--	PO1, PO2, PO3, PO4, PO6	PO5	--
CO3 / K3	PO1, PO3	PO2, PO4, PO6	PO5	--
CO4 / K4	PO1, PO3, PO4	PO2, PO5, PO6	--	--
CO5 / K5	PO3, PO5	PO1, PO2, PO4, PO6	--	--
CO6 / K6	PO1, PO3, PO4, PO6	PO2, PO5	--	--

COURSE OUTCOMES (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE:

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3		3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
NON SCHOLASTIC	-	-	-	-	-	5	20
TOTAL	4	10	6	20	5	25	100%

The COs and PSOs for the **FOUNDATION OF INFORMATION TECHNOLOGY** course in the BCA Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge Signature of the HoD

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Programme Code	Course Code	Course Type	Course Title	Category	Hrs/week	Credits
COAUG1998	**U25CA7**	**Core**	**BUSINESS INTELLIGENCE AND DATA ANALYTICS**	**Lecture**	**5**	**5**

COURSE DESCRIPTION:

- The course covers data analytics, predictive modeling, decision analysis, text mining, and applying data science to business strategy for competitive advantage.

COURSE OBJECTIVES:

- The course is designed to provide an extensive study of the data analytics and BI concepts.
- This course is emphasized the processes of data collection, cleaning, and preprocessing to ensure data quality and consistency for analysis.
- This course is offered to gain hands-on experience in using popular data analytics and BI tools & techniques.
- This course is underlined to learn how to leverage data analytics and BI to make informed, data-driven business decisions, optimizing business processes and strategies
- To understand how data science drives business strategy and competitive advantage through real-world case studies.

UNIT- I: Data Analytic Thinking

Ubiquity of Data Opportunities - Data Science, Engineering, and Data -Driven Decision Making - Data Processing and "Big Data" – Data Mining – Process – Statistics - Database Querying - Data Warehousing - Regression Analysis. (16 Hrs)

UNIT- II: Predictive Modeling

Models Induction and Prediction - Supervised Segmentation - Visualizing Segmentation- Probability Estimation–Classification–Regression. (14 Hrs)

UNIT- III: Decision Analytical Thinking

Evaluating Classifiers - Generalizing Beyond Classification - Evaluation and Performance for Investments in Data – Ranking - Profit Curves - ROC Graphs and Curves. (15 Hrs)

UNIT- IV: Representing and Mining Text

Representation - Beyond BOW - Link Prediction and Social Recommendation - Data Reduction – Bias – Variance - Ensemble Methods. (15 Hrs)

UNIT-V: Data Science and Business Strategy

Achieving and Sustaining Competitive Advantage - Nurturing Data Scientists - Examine Data Science Case Studies. (15 Hrs)

TEXT BOOKS:

1. Foster Provost, Tom Fawcett, "Data Science for Business", First Edition, O'Reilly Medi, 2013.
2. Ramesh Sharda, Dursun Delen and Efraim Turban, "Business Intelligence, Analytics, Data Science and AI – A Managerial Perspective", 5th edition, Global Edition, Pearson Education Limited, 2024.

Unit I -Chapter 1.1, 1.4, 1.5, 2
Unit II - Chapter 3, 4
Unit III - Chapter 7, 8
Unit IV - Chapter 12
Unit V - Chapter 13

REFERENCES:

1. Steve Williams, Business Intelligence Strategy and Big Data Analytics - A General Management Perspective, Morgan Kaufmann (Elsevier), 2016.
2. Vincent Charles, Pratibha Garg, Neha Gupta and Mohini Agarwal, Data Analytics and Business Intelligence - Computational Frameworks, Practices, and Applications, CRC Press, 2023.
3. Ira J. Haimowitz, DATA ANALYTICS FOR BUSINESS - Lessons for Sales, Marketing, and Strategy, Routledge (Taylor & Francis), 2023.
4. https://www.tableau.com/business-intelligence/what-is-business-intelligence
5. https://www.geeksforgeeks.org/what-is-data-analytics/

COURSE OUTCOME	KNOWLEDGE LEVEL (K1-K6)
CO 1: Recall the basic concepts of Data Analytics	**K1**
CO 2: Understand the fundamental principles of data analysis, data warehousing, and business intelligence.	**K2**
CO 3: Working with machine learning and statistical methods for data analytics	**K3**
CO 4: Analyzing case studies to inform strategic decision-making	**K4**
CO 5: Evaluation and performance measure for business analytics	**K5**
CO 6: Design and develop an end-to-end data analytics project, from data collection and cleaning to analysis and reporting	**K6**

MAPPING COs WITH POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	3	1	1	3
CO2	3	3	9	3	1	3
CO3	9	3	9	3	3	3
CO4	3	3	9	9	3	3
CO5	9	3	9	3	9	3
CO6	9	3	9	9	9	9
WEIGHTAGE	36	16	48	28	26	24
WEIGHTED %	20.22 %	8.99 %	26.97 %	15.73 %	14.61 %	13.48 %

COURSE OUTCOMES MAPPED WITH KNOWLEDGE LEVEL (Revised Bloom's Taxonomy) AND POs:

COs	LEVEL OF CORRELATION			
	HIGH	MEDIUM	LOW	ZERO
CO1 / K1	--	PO1, PO3, PO6	PO2, PO4, PO5	--
CO2 / K2	PO3	PO1, PO2, PO4, PO6	PO5	--
CO3 / K3	PO1, PO3	PO2, PO4, PO5, PO6	--	--
CO4 / K4	PO3, PO4	PO1, PO2, PO5, PO6	--	--
CO5 / K5	PO1, PO3, PO5	PO2, PO4, PO6	--	--
CO6 / K6	PO1, PO3, PO4, PO5, PO6	PO2	--	--

COURSE OUTCOMES (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE:

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3		3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
NON SCHOLASTIC	-	-	-	-	-	5	20
TOTAL	4	10	6	20	5	25	100%

The COs and PSOs for the **BUSINESS INTELLIGENCE AND DATA ANALYTICS** course in the BCA Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge Signature of the HoD

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Programme Code	Course Code	Course Type	Course Title	Category	Hrs/ week	Credits
COAUG1998	**U25CA8P**	**Core**	**DATA ANALYTICS LAB**	**Practical**	**3**	**3**

COURSE DESCRIPTION:

- The tasks involve data cleaning, analysis, visualization, model selection, ethical considerations, reporting in Excel, creating interactive dashboards, using DAX, tracking sales, geographic data visualization, and trend forecasting with Power BI.

COURSE OBJECTIVES:

- To clean and prepare data effectively for accurate analysis.
- To identify key variables and apply visualization and statistical techniques for customer data analysis.
- To select appropriate features, models, and evaluation metrics for predictive analytics while addressing challenges.
- To understand ethical considerations when handling sensitive customer information.
- To develop interactive dashboards and reports using Excel, DAX, and Power BI for business insights.

LIST OF EXERCISES: (Using Power BI)

1) Provide specific steps and techniques you would use to clean and prepare the data for analysis.
2) Identify key variables to analyze, and describe the visualizations and statistical techniques for Customer Dataset.
3) Discuss the choice of features, model selection, evaluation metrics, and potential challenges in the predictive analytics
4) What ethical considerations should you keep in mind when handling sensitive customer information?
5) Generate business reports and analyze data using Excel.
6) Create a dynamic, interactive dashboard to visualize business data.
7) Learn how to create calculated columns and measures using **DAX (Data Analysis Expressions)**.
8) Build a comprehensive dashboard to track and analyze sales performance.
9) Analyze and visualize geographic data using map visualizations.
10) Use Power BI to predict trends and perform basic forecasting.

COURSE OUTCOME	KNOWLEDGE LEVEL (K1-K6)
CO 1: Recalling basic functions and features of tools	**K1**
CO 2: Understanding of Ethical Data Handling.	**K2**
CO 3: Data Cleaning and Preparation Expertise.	**K3**
CO 4: Proficiency in Predictive Analytics, Effective Visualization and Statistical Analysis.	**K4**
CO 5: Evaluate the effectiveness of different data analytics techniques and tools	**K5**
CO 6: Create Business Intelligence and Dashboard Development.	**K6**

MAPPING COs WITH POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	3	1	1	3
CO2	3	3	9	3	1	3
CO3	9	3	9	3	1	3
CO4	9	3	9	9	3	3
CO5	9	3	9	3	9	3
CO6	9	3	9	9	3	9
WEIGHTAGE	42	16	48	28	18	24
WEIGHTED %	23.86 %	9.09 %	27.27 %	15.91 %	10.23 %	13.64 %

COURSE OUTCOMES MAPPED WITH KNOWLEDGE LEVEL (Revised Bloom's Taxonomy) AND POs:

COs	LEVEL OF CORRELATION			
	HIGH	MEDIUM	LOW	ZERO
CO1 / K1	--	PO1, PO3, PO6	PO2, PO4, PO5	--
CO2 / K2	PO3	PO1, PO2, PO4, PO6	PO5	--
CO3 / K3	PO1, PO3	PO2, PO4, PO6	PO5	--
CO4 / K4	PO1, PO3, PO4	PO2, PO5, PO6	--	--
CO5 / K5	PO1, PO3, PO5	PO2, PO4, PO6	--	--
CO6 / K6	PO1, PO3, PO4, PO6	PO2, PO5	--	--

The COs and PSOs for the **DATA ANALYTICS LAB** course in the BCA Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge Signature of the HoD

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Programme Code	Course Code	Course Type	Course Title	Category	Hrs/week	Credits
COAUG1998	U25CA9	Core	SOFTWARE ENGINEERING	Lecture	6	6

COURSE DESCRIPTION:

- The course covers software engineering fundamentals, including software characteristics, planning, cost estimation, requirements definition, design concepts, implementation, and verification/validation techniques for quality assurance and innovative problem-solving.

COURSE OBJECTIVES:

- To prepare students for successful careers in software engineering.
- To develop skills in software development systematically.
- To understand software cost estimation techniques and define clear software requirements using formal specification methods.
- To apply fundamental software design principles, modularization, and coding best practices for effective implementation.
- To implement verification and validation techniques to ensure software quality through testing, inspections, and formal methods.

UNIT- I:

Introduction to Software Engineering: Definitions - Size factors – Quality and Productivity Factors – Managerial Issues. The Product: The evolving role of software – Software – characteristics - applications. The process: Software engineering: A Layered Technology – The software process –Evolutionary software process models: Spiral model. (18 Hrs)

UNIT- II:

Planning a Software Project: Defining the problem– Developing a solution Strategy – Planning the development Process – Planning an organizational structure – Other Planning Activities. (20 Hrs)

UNIT- III:

Software Cost Estimation: Software Cost Factors – Software Cost Estimation Techniques – Staffing Level Estimation. Software Requirements Definition: The Software Requirements Specification – Formal Specification Techniques. (16 Hrs)

UNIT- IV:

Software Design: Fundamental Design Concepts – Modules and Modularization Criteria – Design Notation – Design techniques – Design Guidelines. Implementation Issues: Structured coding techniques – coding style – Documentation guidelines. (18 Hrs)

UNIT- V:

Verification and Validation Techniques: Quality Assurance – Walkthroughs and inspections – Static analysis –Unit testing and debugging – System testing – Formal verification - Solving Problems through innovative design concepts & creative solution. (18 Hrs)

TEXT BOOKS:

1. Richard E. Fairley– "*Software Engineering Concepts*", Tata Mc Graw Hill Publication, 1997 edition. [517.9]
   Unit1: chapter 1 (sec1.1-1.4)
   Unit2: chapter 2 (sec2.1-2.5)
   Unit3: chapter 3(sec3.1-3.4) chapter 4(sec4.1-4.2)
   Unit4: chapter 5 (sec5.1-5.2, 5.9) chapter 6(sec6.1,6.2, 6.4)
   Unit5: chapter 8 (sec8.1-8.3, 8.5-8.7)

2. Roger S. Pressman – "*Software Engineering A Practitioner's Approach",* 5th edition, Mc Graw Hill, 2001. [517.9]
   Unit1: Chapter 1(Sec1.1, 1.2)

REFERENCES:

1. Watts S. Humphery– "*A Discipline for Software Engineering*", Addition Wesley Company, 1995.
2. https://engineering.futureuniversity.com/BOOKS%20FOR%20IT/Software-Engineering-9th-Edition-by-Ian-Sommerville.pdf
3. https://ebooks.lpude.in/computer_application/mca/term_2/DCAP405_SOFTWARE_ENGINEERING.pdf
4. https://www.geeksforgeeks.org/software-engineering-introduction-to-software-engineering/
5. https://www.studytonight.com/
6. https://www.tpointtech.com/software-engineering

COURSE OUTCOME	KNOWLEDGE LEVEL (K1-K6)
CO1: Recall the basics of software engineering, its characteristics, and the software process models, including the Spiral model.	**K1**
CO2: Understand a software project by defining problems, developing solution strategies, and structuring the development process.	**K2**
CO3: Apply software costs and develop software requirements using formal specification techniques.	**K3**
CO4: Analyze software systems by using modularization principles and various design techniques and notations.	**K4**
CO5: Evaluate software using structured coding techniques and adhere to documentation guidelines.	**K5**
CO6: Create verification and validation techniques to ensure software quality, correctness, and reliability.	**K6**

MAPPING COs WITH POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	3	9	3	1	3
CO2	9	9	9	3	3	3
CO3	9	3	9	3	3	3
CO4	9	3	9	9	3	3
CO5	9	3	3	9	9	3
CO6	9	3	3	3	3	9
WEIGHTAGE	54	24	42	30	22	24
WEIGHTED %	27.55 %	12.24 %	21.43 %	15.31 %	11.22 %	12.24 %

COURSE OUTCOMES MAPPED WITH KNOWLEDGE LEVEL (Revised Bloom's Taxonomy) AND POs:

COs	LEVEL OF CORRELATION			
	HIGH	MEDIUM	LOW	ZERO
CO1 / K1	PO1, PO3	PO2, PO4, PO6	PO5	--
CO2 / K2	PO1, PO2, PO3	PO4, PO5, PO6	--	--
CO3 / K3	PO1, PO3	PO2, PO4, PO5, PO6	--	--
CO4 / K4	PO1, PO3, PO4	PO2, PO5, PO6	--	--
CO5 / K5	PO1, PO4, PO5	PO2, PO3, PO6	--	--
CO6 / K6	PO1, PO6	PO2, PO3, PO4, PO5	--	--

COURSE OUTCOMES (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE:

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3		3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
NON SCHOLASTIC	-	-	-	-	-	5	20
TOTAL	4	10	6	20	5	25	100%

The COs and PSOs for the **SOFTWARE ENGINEERING** course in the BCA Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge Signature of the HoD

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Programme Code	Course Code	Course Type	Course Title	Category	Hrs/week	Credits
COAUG1998	U25CA10E1	Core – Elective	COMPUTER GRAPHICS	Lecture	6	5

COURSE DESCRIPTION:

- The course covers computer graphics concepts, including graphics systems, output primitives, attributes, 2D geometric transformations, and viewing functions like clipping and window-to-viewport mapping.

COURSE OBJECTIVES:

- To learn about various technologies in computer graphics.
- To understand and implement fundamental output primitives and line-drawing algorithms such as DDA and Bresenham's algorithms.
- To apply attributes to output primitives including line styles, area fills, character attributes, and implement antialiasing techniques.
- To perform two-dimensional geometric transformations using matrix operations and composite transformations.
- To develop skills in viewing transformations, coordinate mapping, and clipping algorithms for points, lines, and polygons

UNIT - I:

A survey of computer graphics: Computer aided design – Presentation graphics–computer art – Entertainment – Education and training – Visualization – Image Processing– Graphical user interfaces. Overview of graphics systems: Video display devices – Raster-scan systems – Random scan systems – Graphics monitors and workstation – Input devices –Hard-copy devices –Graphics software. (20 Hrs)

UNIT - II:

Output primitives: Points and lines – Line-drawing algorithms – DDA algorithm– Bresenham's line algorithm – Circle-generating algorithms – Filled-area primitives–Boundary-fill algorithm. (18 Hrs)

UNIT - III:

Attributes of output primitives: Line attributes – Area-fill attributes – Character Attributes-Bundled attributes – Inquiry functions – Antialiasing. (16 Hrs)

UNIT - IV:

Two-dimensional Geometric transformations: Basic transformations – Matrix representations – Composite transformations – Other transformations. (18 Hrs)

UNIT - V:

Window-to-viewport coordinate – Two-dimensional viewing functions – Clipping operations – Point clipping – Line clipping – Polygon clipping. (18 Hrs)

TEXT BOOKS:

1. Donald Hearn and M.Pauline Baker "Computer Graphics" C Version 2nd Edition, - Pearson Education, 2006. [517.9]
   Unit 1: chapter 1(sec 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8)
   chapter 2(sec 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7)
   Unit 2: chapter 3(sec 3.1, 3.2, 3.5, 3.11)
   Unit 3: chapter 4(sec 4.1, 4.4, 4.5, 4.6, 4.7, 4.8)
   Unit 4: chapter 5(sec 5.1, 5.2, 5.3, 5.4)
   Unit 5: chapter 6(sec 6.4, 6.5, 6.6, 6.7, 6.8)

REFERENCES:

1. Jeffrey J. McConnell," Computer Graphics: Theory Into Practice",Jones and barlett publishers,2006.
2. Peter Shirley, Michael Ashikhmin, Steve Marschner" Fundamentals of Computer Graphics",CRC Press,2009.
3. https://ebooks.lpude.in/computer_application/mca/term_3/DCAP504_COMPUTER_GRAPHICS.pdf
4. https://students.aiu.edu/submissions/profiles/resources/onlineBook/a6A8H5_computer%20graphics.pdf
5. http://repo.darmajaya.ac.id/5422/1/Fundamentals%20of%20Computer%20Graphics%2C%20Fourth%20Edition%20%28%20PDFDrive%20%29.pdf

COURSE OUTCOME	KNOWLEDGE LEVEL (K1-K6)
CO 1: Draw primitive graphical shapes using existing built-in functions.	**K1**
CO 2: Apply various algorithms to draw lines, Circles and ellipses.	**K2**
CO 3: Implement basic transformation such as translation, scaling and rotation using matrices.	**K3**
CO 4: Perform Point clipping, line and polygon clipping.	**K4**
CO 5: Evaluate the techniques for window-to-viewport transformations and apply two-dimensional clipping operations to optimize graphical rendering.	**K5**
CO 6: Design and implement practical graphical applications by integrating various graphical algorithms and transformations.	**K6**

MAPPING COs WITH POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	3	1	1	3
CO2	3	3	9	3	1	3
CO3	9	3	9	3	1	3
CO4	9	3	9	3	3	3
CO5	9	3	9	9	3	9
CO6	9	3	9	9	3	9
WEIGHTAGE	42	16	48	28	12	30
WEIGHTED %	23.86 %	9.09 %	27.27 %	15.91 %	6.82 %	17.05 %

COURSE OUTCOMES MAPPED WITH KNOWLEDGE LEVEL (Revised Bloom's Taxonomy) AND POs:

COs	LEVEL OF CORRELATION			
	HIGH	**MEDIUM**	**LOW**	**ZERO**
CO1 / K1	--	PO1, PO3, PO6	PO2, PO4, PO5	--
CO2 / K2	PO3	PO1, PO2, PO4, PO6	PO5	--
CO3 / K3	PO1, PO3	PO2, PO4, PO6	PO5	--
CO4 / K4	PO1, PO3	PO2, PO4, PO5, PO6	--	--
CO5 / K5	PO1, PO3, PO4, PO6	PO2, PO5	--	--
CO6 / K6	PO1, PO3, PO4, PO6	PO2, PO5	--	--

COURSE OUTCOMES (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE:

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3		3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
NON SCHOLASTIC	-	-	-	-	-	5	20
TOTAL	4	10	6	20	5	25	100%

The COs and PSOs for the **COMPUTER GRAPHICS** course in the BCA Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge Signature of the HoD

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Programme Code	Course Code	Course Type	Course Title	Category	Hrs/week	Credits
COAUG1998	**U25CA10E2**	**Core – Elective**	**MOBILE APPLICATION DEVELOPMENT**	**Lecture**	**6**	**5**

COURSE DESCRIPTION:

- The course covers Android OS basics, app development, UI design, fragments, intents, broadcasts, and database handling using SQLite for data management in Android applications.

COURSE OBJECTIVES:

- Understand the foundational concepts of mobile application development, including Platform-specific requirements and the mobile app development lifecycle.
- Develop user-friendly and intuitive mobile interfaces using platform-specific design Guidelines
- Integrate SQLite databases into mobile and desktop applications, leveraging SQLite Capabilities for local data storage and management
- To understand and implement intents, broadcast receivers, and intent filters for inter-component communication in Android.
- To learn SQLite database operations including creating databases, tables, and performing CRUD operations in Android applications.

UNIT- I:

Introduction to Android Operating System: Android OS and Features – Android development framework; Installing and running applications on Android Studio, Creating AVDs, Types of Android application; Creating Activities, Activity Life Cycle, Activity states, monitoring state changes. (18 Hrs)

UNIT- II:

Android application components – Android Manifest file, Externalizing recourses like Simple Values, Drawables, Layouts, Menus, etc., Building User Interfaces: Fundamental Android UI design, Layouts – Linear, Relative, Grid and Table Layouts. User Interface (UI) Components. (18 Hrs)

UNIT- III:

Fragments – Creating fragments, Lifecycle of fragments, Fragment states, adding fragments to Activity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities. (18 Hrs)

UNIT- IV:

Intents and Broadcasts: Using intents to launch Activities, Types of Intents, passing data to Intents, getting results from Activities, Broadcast Receivers – Using Intent filters to service implicit Intents, Resolving Intent filters. (18 Hrs)

UNIT- V:

Database: Introduction to SQLite database, creating and opening a database, creating tables, inserting retrieving and deleting data. (18 Hrs)

TEXT BOOKS:

1. Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox), 2012
   Unit I - Chapter 1, 2, 3
   Unit II - Chapter 3, 4
   Unit III - Chapter 8
   Unit IV - Chapter 5
   Unit V - Chapter 6
2. Android Application Development for Java Programmers, James C Sheusi, Cengage Learning, 2013

REFERENCES:

1. Engelsma, J., & amp; Dulimarta, H. (2021). Learning Ios and Android Side-By-Side. Lean pub.
2. This e-book offers a comparative approach to developing native apps on Ios and Android, enabling readers to leverage knowledge across platforms.
3. https://bookauthority.org/books/beginner-mobile-development-ebooks
4. https://www.benthamscience.com/ebook_volume/3092/related-ebooks
5. https://www.barnesandnoble.com/b/books/computer-programming/mobile-app-development/_/N-29Z8q8Zvmg

COURSE OUTCOME	KNOWLEDGE LEVEL (K1-K6)
CO1: Recalling the basic concepts of the Android platform, including its architecture, components, and key features that enable mobile application development.	**K1**
CO2: Understanding the principles of user interface design and describe the process of developing user interfaces for Android applications, including the use of layouts, views, and UI components.	**K2**
CO3: Apply different data storage techniques, such as Shared Preferences, SQLite, and file storage, to store and retrieve data in Android applications.	**K3**
CO4: Analyze and implement networking techniques in Android, such as making API calls and handling JSON data, while ensuring effective data persistence using databases and local storage solutions.	**K4**
CO5: Critically evaluate and optimize the performance of Android applications, applying best practices in memory management, threading, and security to ensure efficient, scalable, and secure apps.	**K5**
CO6: Design and integrate advanced Android features, such as background services, content providers, and push notifications, into mobile applications to enhance functionality and user engagement.	**K6**

MAPPING COs WITH POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	1	1	3
CO2	3	3	9	3	1	3
CO3	9	3	9	3	1	3
CO4	9	3	9	9	3	3
CO5	9	3	9	9	9	3
CO6	9	3	9	9	9	9
WEIGHTAGE	42	18	48	34	24	24
WEIGHTED %	22.11 %	9.47 %	25.26 %	17.89 %	12.63 %	12.63 %

COURSE OUTCOMES MAPPED WITH KNOWLEDGE LEVEL (Revised Bloom's Taxonomy) AND POs:

COs	LEVEL OF CORRELATION			
	HIGH	**MEDIUM**	**LOW**	**ZERO**
CO1 / K1	--	PO1, PO2, PO3, PO6	PO4, PO5	--
CO2 / K2	PO3	PO1, PO2, PO4, PO6	PO5	--
CO3 / K3	PO1, PO3	PO2, PO4, PO6	PO5	--
CO4 / K4	PO1, PO3, PO4	PO2, PO5, PO6	--	--
CO5 / K5	PO1, PO3, PO4, PO5	PO2, PO6	--	--
CO6 / K6	PO1, PO3, PO4, PO5, PO6	PO2	--	--

COURSE OUTCOMES (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE:

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3		3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
NON SCHOLASTIC	-	-	-	-	-	5	20
TOTAL	4	10	6	20	5	25	100%

The COs and PSOs for the **MOBILE APPLICATION DEVELOPMENT** course in the BCA Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge Signature of the HoD

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Programme Code	Course Code	Course Type	Course Title	Category	Hrs/week	Credits
COAUG1998	U25CA10E3	Core – Elective	COMPUTER GAMING	Lecture	6	5

COURSE DESCRIPTION:

- The course covers game design fundamentals, 3D programming, game programming basics with Torque Script, game play modules, and integrating sound and music into games.

COURSE OBJECTIVES:

- To understand game programming fundamentals using Torque Script and client-server design principles.
- To develop and manage gameplay modules and create GUI elements for interactive game experiences.
- To implement and integrate various game sound effects and music to enhance player immersion.
- To analyze the structure and workflow of game engines including initialization and control flows.
- To apply scripting techniques to customize game behavior and optimize multiplayer interactions.

UNIT- I:

Game Designing - Magic Words - Importance of Skills a Game Designer Need - The Five Kinds of Listening - the Secret of the Gifted. (18 Hrs)

UNIT- II:

3D Programming - 3D Models - Shapes - Transformation - Rendering - Scene Graphs - 3D Audio - 3D Programming - Translation - Rotation - Scaling – Animation - Basic Programming Concepts. (20 Hrs)

UNIT- III:

Game Programming Basics - Torque Script - Strings - Objects - Data-Blocks - Game Structure - Server versus Client Design Issues - Common Functionality - Preparation - Root Main - Control Main - Initialization - Client, Server &Player - Running Emaga4. (20 Hrs)

UNIT- IV:

Game Play Modules - The Changes - Folders - Modules - Control Modules - Client Control Modules - Server Control Modules - Running Emaga5 - Creating GUI Elements. (16 Hrs)

UNIT- V:

Game Sound and Music – Player Sounds – Footsteps – Weapon Sounds – Vehicle Sounds –Environmental Sounds – Interface Sounds – Music. (16 Hrs)

TEXT BOOKS:

1. Jesse Schell, “Art of Game Design”, Third Edition, A K Peters/CRC Press, 2019.
   Unit I: Chapter 1
2. Kenneth C. Finney, “3D Game Programming – All in One”, Third Edition, Cengage Learning, Inc, 2012.
   Unit II: Chapter 3
   Unit III: chapter 4
   Unit IV: chapter 5
   Unit V: Chapter 20

REFERENCES:

1. Ranjan Parekh, “Principles of Multimedia”, Second Edition, Tata McGraw Hill, 2013.
2. Tay Vaughan, “Multimedia Making It Works”, Eighth Edition,Tata McGraw Hill, 2013.
3. Magesh Chandramouli, “3D Modeling & Animation: A Primer”, CRC Press, 2021.
4. Kenneth C. Finney, “3D Game Programming – All in One”, Third Edition, Cengage Learning, Inc, 2012.
5. Jesse Schell, “Art of Game Design”, Third Edition, A K Peters/CRC Press, 2019.
6. Kenneth C. Finney, “3D Game Programming – All in One”, Third Edition, Cengage Learning, Inc, 2012.
7. https://www.scribd.com/document/527397770/Gaming-and-Animation
8. http://repo.darmajaya.ac.id/5463/1/The%20Fundamentals%20of%20Animation%20%28%20PDFDrive%
9. https://researchguides.austincc.edu/c.php?g=435233&p=7896292

COURSE OUTCOME	KNOWLEDGE LEVEL (K1-K6)
CO1: Recall the concepts of designing a Game and the basics of Game Programming	**K1**
CO2: Understand the concepts of 3D programming	**K2**
CO3: Apply the basics of Game Programming	**K3**
CO4: Analyze the core mechanics and structure of gameplay modules to identify key components and how they interact with each other.	**K4**
CO5: Evaluate the impact of music and sound effects on the player's immersion and overall gaming experience.	**K5**
CO6: Create the concepts of designing a Game and the basics of Game Programming	**K6**

MAPPING COs WITH POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	1	1	3
CO2	9	3	9	3	1	3
CO3	3	3	9	3	1	3
CO4	9	3	9	9	3	3
CO5	3	3	3	3	9	3
CO6	3	3	3	1	1	3
WEIGHTAGE	30	18	36	20	16	18
WEIGHTED %	21.74 %	13.04 %	26.09 %	14.49 %	11.59 %	13.04 %

COURSE OUTCOMES MAPPED WITH KNOWLEDGE LEVEL (Revised Bloom's Taxonomy) AND POs:

COs	LEVEL OF CORRELATION			
	HIGH	MEDIUM	LOW	ZERO
CO1 / K1	--	PO1, PO2, PO3, PO6	PO4, PO5	--
CO2 / K2	PO1, PO3	PO2, PO4, PO6	PO5	--
CO3 / K3	PO3	PO1, PO2, PO4, PO6	PO5	--
CO4 / K4	PO1, PO3, PO4	PO2, PO5, PO6	--	--
CO5 / K5	PO5	PO1, PO2, PO3, PO4	PO6	--
CO6 / K6	--	PO1, PO2, PO3, PO6	PO4, PO5	--

COURSE OUTCOMES (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE:

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3		3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
NON SCHOLASTIC	-	-	-	-	-	5	20
TOTAL	4	10	6	20	5	25	100%

The COs and PSOs for the **COMPUTER GAMING** course in the BCA Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge Signature of the HoD

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Programme Code	Course Code	Course Type	Course Title	Category	Hrs/week	Credits
COAUG1998	U25CA11E1	Core – Elective	COMPUTER NETWORKS	Lecture	6	5

COURSE DESCRIPTION:

- The course covers networking fundamentals, signal transmission, error handling, wireless communication, network protocols, internetworking, routing, and transport/application layer services, including IPv4/IPv6, DNS, and FTP.

COURSE OBJECTIVES:

- To understand fundamental concepts of data communications, network models, protocols, and addressing schemes.
- To analyze signal transmission methods, multiplexing techniques, and various transmission media.
- To apply error detection, correction techniques, and explore wireless communication technologies.
- To learn network layer protocols, IP addressing, routing algorithms, and internetworking concepts.
- To comprehend transport layer protocols, network performance metrics, and key application layer services.

UNIT- I:

Fundamentals of Networking Introduction to Data Communications and Networks, Over view of the Internet: Protocols and Standards Network Models and Layered Tasks, Network Types and Classifications, The OSI Model: Layers and Functions, The TCP/IP Protocol Suite: Structure and Applications, Addressing in Networks. (18 Hrs)

UNIT- II:

Signal Transmission and Media Analog and Digital Signals: Concepts and Differences, Analog-to-Digital Conversion Techniques. Transmission Modes: Simplex, Half-Duplex, Full-Duplex, Digital-to-Analog Conversion: Methods and Applications, Multiplexing: Frequency, Time and Code Division, Transmission Media: Guided Media: Twisted Pair, Coaxial, Fiber Optics, Unguided Media: Radio Waves, Microwaves, Infrared Switching Techniques: Circuit-Switched Networks, Datagram Networks, Virtual Circuit Networks. (18 Hrs)

UNIT- III:

Error Handling and Wireless Communication Error Detection and Correction Methods: Block Coding, Cyclic Codes, Checksum. Communication Protocols: Noiseless and Noisy Channels. Point-to-Point Protocol (PPP)Wireless Technologies: IEEE 802.11 (Wi-Fi), Bluetooth and Cellular Telephony, Satellite Networks and Applications. (18 Hrs)

UNIT- IV:

Network Layer Protocols and Internetworking IPv4 and IPv6 Addressing Schemes, Internetworking and Transition from IPv4 to IPv6, Address Mapping Techniques: ARP, Protocols, Packet Delivery and Forwarding Mechanisms, Routing Protocols: Unicast Routing: RIP, BGP, Multicast Routing: PIM. (18 Hrs)

UNIT- V:

Transport and Application Layers Process-to-Process Delivery: UDP, TCP, and SCTP Protocols, Network Performance: Data Traffic and Congestion Control, Quality of Service (QoS) Metrics, Application Layer Services: Name Space and Domain Name System (DNS), Remote Logging, Email Protocols (SMTP, POP, IMAP), File Transfer Protocol (FTP) and Secure Alternatives. (18 Hrs)

TEXT BOOKS:

1. Stallings, W. (2020). *Data and Computer Communications* (10th Ed.). Pearson Education.
   Unit -1 Chapter 1, Chapter 2
   Unit -2 Chapter 3, Chapter 4, Chapter 10
   Unit-3 Chapter 6, Chapter 7
   Unit-4 Chapter 19, Chapter 21
   Unit-5 Chapter 20, Chapter 23
2. Tanenbaum, A.S., Wetherall, D.J., & Feamster, N. (2021). *Computer Networks*(6thEd.). Pearson Education.
   Unit-3 Chapter 6, Chapter 7
   Unit-4 Chapter 8
   Unit-5 Chapter 7
3. Kurose, J.F., &Ross, K.W. (2021). *Computer Networking: A Top- Down Approach*(8thEd.). Pearson Education.
   Unit-3 Chapter 4
   Unit-4 Chapter 5
4. Forouzan, B.A. (2017). *Data Communications and Networking* (5th Ed.). McGraw-Hill Education. Microsoft Networking
   Unit-5 Chapter 24 Chapter 24, Chapter 26

REFERENCES:

1. Stallings, W. (2020). Data and Computer Communications (10th Ed.). Pearson Education.
2. Tanenbaum, A.S., Wetherall, D.J., & Feamster, N. (2021). Computer Networks (6th Ed.). Pearson Education.
3. Kurose, J.F., & Ross, K.W. (2021). Computer Networking: A Top-Down Approach (8th Ed.). Pearson Education.
4. Forouzan, B.A. (2017). Data Communications and Networking (5th Ed.). McGraw-Hill Education.
5. https://computer.howstuffworks.com/computer-networking-channel.htm
6. https://www.slideshare.net/slideshow/computer-networks-ppt-255837143/255837143
7. https://www.mangoud.com/wp-content/uploads/2020/10/ebook-networks.pdf
8. https://www.freebookcentre.net/Networking/networkCategory.html
9. https://csc-knu.github.io/sys-prog/books/Andrew%20S.%20Tanenbaum%20-%20Computer%20Networks.pdf

COURSE OUTCOME	KNOWLEDGE LEVEL (K1-K6)
CO1: Recall the services, functions, and inter-relationships of layers in network models.	**K1**
CO2: Understand the functionality of the physical layer and transmission media.	**K2**
CO3: Analyze and apply various communication protocols across different layers.	**K3**
CO4: Apply inter-operability among network modules and enactment across layers.	**K4**
CO5: Evaluate switching concepts and network types for real-world applications.	**K5**
CO6: Build tools or frameworks that can monitor and improve the performance of networking technologies by analyzing and fine-tuning protocol behavior.	**K6**

MAPPING COs WITH POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	3	9	3	1	3
CO2	9	3	9	3	1	3
CO3	9	3	9	3	3	3
CO4	9	3	9	9	3	3
CO5	9	3	9	9	3	3
CO6	9	3	9	9	3	9
WEIGHTAGE	54	18	54	36	14	24
WEIGHTED %	27.00 %	9.00 %	27.00 %	18.00 %	7.00 %	12.00 %

COURSE OUTCOMES MAPPED WITH KNOWLEDGE LEVEL (Revised Bloom's Taxonomy) AND POs:

COs	LEVEL OF CORRELATION			
	HIGH	MEDIUM	LOW	ZERO
CO1 / K1	PO1, PO3	PO2, PO4, PO6	PO5	--
CO2 / K2	PO1, PO3	PO2, PO4, PO6	PO5	--
CO3 / K3	PO1, PO3	PO2, PO4, PO5, PO6	--	--
CO4 / K4	PO1, PO3, PO4	PO2, PO5, PO6	--	--
CO5 / K5	PO1, PO3, PO4	PO2, PO5, PO6	--	--
CO6 / K6	PO1, PO3, PO4, PO6	PO2, PO5	--	--

COURSE OUTCOMES (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE:

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3		3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
NON SCHOLASTIC	-	-	-	-	-	5	20
TOTAL	4	10	6	20	5	25	100%

The COs and PSOs for the **COMPUTER NETWORKS** course in the BCA Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge Signature of the HoD

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Programme Code	Course Code	Course Type	Course Title	Category	Hrs/week	Credits
COAUG1998	U25CA11E2	Core – Elective	NETWORK SECURITY	Lecture	6	5

COURSE DESCRIPTION:

- The course covers network security fundamentals, attacks, vulnerabilities, encryption, authentication, firewalls, web security, intrusion detection systems, and wireless network security protocols like WEP and WPA.

COURSE OBJECTIVES:

- To understand the fundamentals of network security, types of attacks, and vulnerabilities in the TCP/IP protocol suite.
- To learn authentication mechanisms, cryptographic hash functions, and intrusion detection techniques.
- To explore firewall architectures, secure communication protocols, and web/email security methods.
- To analyze different types of malware and security mechanisms like IDS, firewalls, and deception systems.
- To examine wireless network security threats and protocols for securing WLANs.

UNIT- I:

Over view of Network Security, Security services, attacks, Security Issues in TCP/IP suite- Sniffing, spoofing, buffer over flow, ARP poisoning, ICMP Explo its, IP address spoofing, IP fragment attack, routing exploits, UDP exploits, TCP exploits, Conventional encryption model. (20 Hrs)

UNIT- II:

Media- Based-Vulnerabilities, Authentication requirements, Authentication functions - Message Authentication Codes - Hash Functions - Security of Hash Functions and MACs - MD5 message Digest algorithm - Secure hash algorithm (SHA) - RIPEMD - HMAC Digital Signatures, Authentication protocols- Kerberos, X.509- Network Intrusion Detection Systems (NIDS). (20 Hrs)

UNIT- III:

Firewalls and Web Security: Application-level gate ways, IP Security-AHand ESP, SSL/TLS, SSH, Web Security-HTTPS, DNS Security, Electronic Mail Security (PGP, S/MIME). Security applications in wireless sensor. (18 Hrs)

UNIT- IV:

Intruders, Viruses, Worms, Trojan horses, Distributed Denial-Of-Service (DDoS), Firewalls, IDS, Honey nets, Honey pots. (16 Hrs)

UNIT- V:

Introduction to wireless network security, Risks and Threats of Wireless networks, Wireless LAN Security (WEP, WPA). (16 Hrs)

TEXT BOOKS:

1. "Computer Networking: A Top-Down Approach" by James F. Kurose and Keith W. Ross Latest Edition: 8th Edition, 2020

Unit-1 Chapter 1, Chapter 3, Chapter 5, Chapter 8
Unit-2 Chapter 8
Unit-3 Chapter 2, Chapter 8.9,
Unit-4 Chapter 1
Unit-5 Chapter 7

2. "Network Security Essentials: Applications and Standards" by William Stallings Latest Edition: 6th Edition, 2022

Unit-1 Chapter 1.7,
Unit-2 Chapter 4, Chapter 15
Unit-3 Chapter 6, Chapter 12
Unit-4 Chapter 10,

3. "Cryptography and Network Security: Principles and Practice" by William Stallings Latest Edition: 8th Edition, 2020

Unit-4 Chapter 21
Unit-5 Chapter 18

REFERENCES:

1. "Hacking: The Art of Exploitation" by Jon Erickson Latest Edition: 2nd Edition, 2008
2. "The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws" by Dafydd Stuttard and Marcus Pinto, Latest Edition: 2nd Edition, 2011
3. https://www.javatpoint.com/computer-network-security
4. https://www.tutorialspoint.com/network_security/index.html

COURSE OUTCOME	KNOWLEDGE LEVEL (K1-K6)
CO1: Recall the core principles of network security, including security services, attacks, and vulnerabilities in the TCP/IP suite.	**K1**
CO2: Understand the knowledge of crypto graphic algorithms, message authentication codes, and digital signatures to ensure data integrity and confidentiality.	**K2**
CO3: Apply security protocols such as IPsec, SSL/TLS, HTTPS, and DNS security to safe guard communication and data exchange over networks.	**K3**
CO4: Analyze common network threats like intrusions, malware, and DDoS attacks and design appropriate counter measures using firewalls, IDS, and honey pots.	**K4**
CO5: Evaluate the security challenges and vulnerabilities of wireless networks, considering factors like data interception, unauthorized access, and signal interference.	**K5**
CO6: Develop a custom intrusion detection algorithm or protocol that improves upon existing NIDS technologies for better detection and response to specific threats.	**K6**

MAPPING COs WITH POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	3	9	3	1	3
CO2	9	3	9	3	1	3
CO3	9	3	9	3	3	3
CO4	9	3	9	9	3	3
CO5	9	3	9	9	3	3
CO6	9	3	9	9	3	9
WEIGHTAGE	54	18	54	36	14	24
WEIGHTED %	27.00 %	9.00 %	27.00 %	18.00 %	7.00 %	12.00 %

COURSE OUTCOMES MAPPED WITH KNOWLEDGE LEVEL (Revised Bloom's Taxonomy) AND POs:

COs	LEVEL OF CORRELATION			
	HIGH	**MEDIUM**	**LOW**	**ZERO**
CO1 / K1	PO1, PO3	PO2, PO4, PO6	PO5	--
CO2 / K2	PO1, PO3	PO2, PO4, PO6	PO5	--
CO3 / K3	PO1, PO3	PO2, PO4, PO5, PO6	--	--
CO4 / K4	PO1, PO3, PO4	PO2, PO5, PO6	--	--
CO5 / K5	PO1, PO3, PO4	PO2, PO5, PO6	--	--
CO6 / K6	PO1, PO3, PO4, PO6	PO2, PO5	--	--

COURSE OUTCOMES (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE:

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3		3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
NON SCHOLASTIC	-	-	-	-	-	5	20
TOTAL	4	10	6	20	5	25	100%

The COs and PSOs for the **NETWORK SECURITY** course in the BCA Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge Signature of the HoD

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Programme Code	Course Code	Course Type	Course Title	Category	Hrs/week	Credits
COAUG1998	U25CA11E3	Core – Elective	SOFTWARE TESTING	Lecture	6	5

COURSE DESCRIPTION:

- The course covers software testing methods, including white-box, black-box, integration, system, acceptance, performance, and regression testing, along with test planning, execution, management, reporting, and metrics.

COURSE OBJECTIVES:

- To understand software development life cycle models and white-box testing techniques.
- To learn black-box testing methods, integration testing strategies, and related challenges.
- To explore system and acceptance testing including functional and non-functional aspects.
- To gain knowledge of performance and regression testing methodologies and best practices.
- To develop skills in test planning, execution, reporting, and applying test metrics for quality assurance.

UNIT- I:

Software Development Life Cycle models: Phases of Software project – Quality, Quality Assurance, Quality control – Testing, Verification and Validation – Process Model to represent Different Phases - Life Cycle models. White-Box Testing: Static Testing – Structural Testing – Challenges in White-Box Testing. (18 Hrs)

UNIT- II:

Black-Box Testing: What is Black-Box Testing? - Why Black-Box Testing? – When to do Black-Box Testing? – How to do Black-Box Testing? – Challenges in White Box Testing - Integration Testing: Integration Testing as Type of Testing – Integration Testing as a Phase Testing – Scenario Testing – Defect Bash. (18 Hrs)

UNIT- III:

System and Acceptance Testing: system Testing Overview – Why System testing is done? – Functional versus Non-functional Testing – Functional testing - Nonfunctional Testing – Acceptance Testing – Summary of Testing Phases. (18 Hrs)

UNIT- IV:

Performance Testing: Factors governing Performance Testing – Methodology of Performance Testing – tools for Performance Testing – Process for Performance Testing – Challenges. Regression Testing: What is Regression Testing? – Types of Regression Testing – When to do Regression Testing – How to do Regression Testing – Best Practices in Regression Testing. (18 Hrs)

UNIT- V:

Test Planning, Management, Execution and Reporting: Test Planning – Test Management – Test Process – Test Reporting –Best Practices. Test Metrics and Measurements: Project Metrics – Progress Metrics – Productivity Metrics – Release Metrics. (18 Hrs)

TEXT BOOKS:

1. Software Testing Principles and Practices – Srinivasan Desikan & Gopalswamy Ramesh, Pearson Education, 2014 [517.9]
   Unit 1 – Chapter 1, 2
   Unit 2 – Chapter 4, 5
   Unit 3 – chapter 6
   Unit 4 – chapter 7, 8
   Unit 5 - Chapter 15, 17

REFERENCES:

1. Foundations of Software Testing, Aditya P. Mathur, Pearson Education, 2013
2. https://www.tutorialspoint.com/software_testing/index.htm
3. https://www.tpointtech.com/software-testing-tutorial

COURSE OUTCOME	KNOWLEDGE LEVEL (K1-K6)
CO1: Recall the importance of testing.	**K1**
CO2: Understand the Various types of Testing.	**K2**
CO3: Apply the various Phases of Software Project	**K3**
CO4: Analyze the various types of Software testing	**K4**
CO5: Evaluate the different Types of testing in his project work	**K5**
CO6: Create Testing report and Measure the Test Metrics	**K6**

MAPPING COs WITH POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	1	1	3
CO2	3	9	9	3	1	3
CO3	3	3	9	3	1	3
CO4	9	3	9	9	3	3
CO5	9	3	9	9	9	3
CO6	9	3	9	9	3	9
WEIGHTAGE	36	24	48	34	18	24
WEIGHTED %	19.57 %	13.04 %	26.09 %	18.48 %	9.78 %	13.04 %

COURSE OUTCOMES MAPPED WITH KNOWLEDGE LEVEL (Revised Bloom's Taxonomy) AND POs:

COs	LEVEL OF CORRELATION			
	HIGH	MEDIUM	LOW	ZERO
CO1 / K1	--	PO1, PO2, PO3, PO6	PO4, PO5	--
CO2 / K2	PO2, PO3	PO1, PO4, PO6	PO5	--
CO3 / K3	PO3	PO1, PO2, PO4, PO6	PO5	--
CO4 / K4	PO1, PO3	PO2, PO4, PO6	PO5	--
CO5 / K5	PO1, PO3, PO4, PO5	PO2, PO6	--	--
CO6 / K6	PO1, PO3, PO4, PO6	PO2, PO5	--	--

COURSE OUTCOMES (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE:

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3		3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
NON SCHOLASTIC	-	-	-	-	-	5	20
TOTAL	4	10	6	20	5	25	100%

The COs and PSOs for the **SOFTWARE TESTING** course in the BCA Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge Signature of the HoD

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Programme Code	Course Code	Course Type	Course Title	Category	Hrs/week	Credits
COAUG1998	U25CANME2	NME	DIGITAL TECHNOLOGY	Lecture	2	2

COURSE DESCRIPTION:

- The course covers digital systems, communication tools, cybersecurity, e-governance, and emerging technologies like AI, cloud computing, and IoT. It includes ICT basics, networking, online safety, digital payments, and innovations like 5G and 3D printing.

COURSE OBJECTIVES:

- To understand the fundamentals of digital systems, ICT tools, and basic computer architecture.
- To learn about communication systems, internet usage, and responsible digital communication.
- To gain awareness of cyber security threats and safe practices to prevent cybercrimes.
- To explore Digital India initiatives and secure online financial and governance services.
- To get a basic introduction to emerging technologies and their modern applications.

UNIT – I:

Introduction: Digital Systems – Information & Communication Technology- ICT Tools. Computer Architecture–Software–Hardware-OperatingSystem-Algorithms-Flowcharts. (06 Hrs)

UNIT – II:

Communication Systems: Transmission Media - Computer Networks – Internet Web Browsers - Search Engines - Messaging, Email - social media – Online Ethics. (06 Hrs)

UNIT – III:

Cyber security: Threats, Significance, Challenges, Precautions, Safety Measures. Cyber Crime Awareness. (06 Hrs)

UNIT – IV:

Digital India& e-Governance: Initiatives- Unified Payment Interface –Aadhar online services - Credit/Debit Cards -e-Wallets–Mobile and Internet Banking– NEFT/RTGS /IMPS - Online Payments & PoS. (06 Hrs)

UNIT – V:

Emerging Technologies & Applications: (Basic introduction only). Overview of Artificial Intelligence, Cloud Computing, Big Data, Internet of Things, Virtual Reality,5G, 3DPrinting. (06 Hrs)

TEXT BOOKS:

1. Pramod Kumar, Anuradha Tomar, R. Sharmila, "Emerging Technologies in Computing -Theory, Practice, and Advances", First Edition, Chapman and Hall / CRC, 2021.
2. V. Rajaraman, "IntroductiontoInformationTechnology",PHI,2018.
   Unit 2— chapter 8 chapter 15(sec 15.2)
3. E. Balagurusamy, "Fundamentals of Computers", Third Edition, Tata Mc GrawHill, Second Edition, 2011.
   Unit—1 (sec 2.3.1 2.4.1 3.3.2 3.3.3 3.7 3.8 3.9 3.10)
   Unit—2 (sec 2.6.5)
   Unit—3 (chapter 18)
   Unit – 4 (chapter 17 and https://egyankosh.ac.in/bitstream/123456789/95923/1/Block-3.pdf)
   Unit—5 (refer the Reference link and Reference book)
4. Behrouz A. Forouzan, "Data Communications and Networking", Fourth Edition, McGraw Hill, 2007.

REFERENCES:

1. Rajkumar Buvya, James Broberg, and Andrzej Gosciniski, "Cloud Computing-Principals and Paradigms", Wiley, 2011.
2. Stuart Russel and Peter Norvig, "Artificial Intelligence - A Modern Approach",Third Edition, Pearson Education, 2010.
3. Samuel Greengard, "Internet of Things",The MIT Press, 2015.
4. C.S.V. Murthy, "E- Commerce – Concept, Models &Strategies", Himalaya Publishing House, 2015.
5. Hurwith, Nugent Halper, Kaufman, "Big Data for Dummies", First Edition,Wiley & Sons, 2013.
6. https://www.slideshare.net/slideshow/edtechfinal-copy/14620557
7. https://www.vaia.com/en-us/explanations/business-studies/business-development/digital-technology/
8. https://ndl.iitkgp.ac.in/
9. https://guides.nyu.edu/dibner-ebooks/free-ebooks
10. https://dpl.gov.in/index.php/e-Resources

COURSE OUTCOME	KNOWLEDGE LEVEL (K1-K6)
CO1: Remember the fundamentals of digital systems, ICT tools, and basic computer architecture.	**K1**
CO2: Understand how the Digital Communication happens and to Learn the advantages and disadvantages including Cyber security.	**K2**
CO 3: Apply e-Governance initiatives and digital payment systems for efficient transactions and services.	**K3**
CO 4: Analyze the role and impact of emerging technologies like AI, IoT, and Big Data in modern Applications.	**K4**
CO 5: Evaluate the effectiveness of digital transformation strategies through case studies of emerging technology.	**K5**
CO 6: Create a detailed report on a case study showcasing the application of emerging technologies.	**K6**

MAPPING COs WITH POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	3	3	1	1	3
CO2	9	3	9	3	3	3
CO3	9	9	9	3	3	3
CO4	9	3	9	9	3	3
CO5	9	3	9	9	9	3
CO6	9	3	9	9	3	9
WEIGHTAGE	54	24	48	34	22	24
WEIGHTED %	26.21 %	11.65 %	23.30 %	16.50 %	10.68 %	11.65 %

COURSE OUTCOMES MAPPED WITH KNOWLEDGE LEVEL (Revised Bloom's Taxonomy) AND POs:

COs	LEVEL OF CORRELATION			
	HIGH	**MEDIUM**	**LOW**	**ZERO**
CO1 / K1	PO1	PO2, PO3, PO6	PO4, PO5	--
CO2 / K2	PO1, PO3	PO2, PO4, PO5, PO6	--	--
CO3 / K3	PO1, PO2, PO3	PO4, PO5, PO6	--	--
CO4 / K4	PO1, PO3, PO4	PO2, PO5, PO6	--	--
CO5 / K5	PO1, PO3, PO4, PO5	PO2, PO6	--	--
CO6 / K6	PO1, PO3, PO4, PO6	PO2, PO5	--	--

COURSE OUTCOMES (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE:

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3		3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
NON SCHOLASTIC	-	-	-	-	-	5	20
TOTAL	4	10	6	20	5	25	100%

The COs and PSOs for the **DIGITAL TECHNOLOGY** course in the BCA Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge Signature of the HoD

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Programme Code	Course Code	Course Type	Course Title	Category	Hrs/week	Credits
COAUG1998	**U25CA12**	**Core**	**WEB TECHNOLOGIES**	**Lecture**	**6**	**6**

COURSE DESCRIPTION:

- This course teaches Full Stack Development, covering Git, JavaScript, Node.js, MongoDB, React.js, and REST API development with testing.

COURSE OBJECTIVES:

- To provide a comprehensive understanding of full stack development concepts and tools.
- To gain hands-on experience with Git and JavaScript programming.
- To learn backend development with Node.js and MongoDB.
- To design responsive, dynamic web applications using React.js.
- To build and test robust REST APIs and integrate them with frontend applications.

UNIT- I: Introduction to Git and Javascript

Introduction to Full Stack Development - Intro to Git - Git Commands using CLI - Git vs. GitHub - Git Work Flow - Pull Requests. JavaScript: Variables – Datatypes - Operators - Expressions – Data structures – Control statements – Functions – this keyword – AJAX – Callbacks – Promises – Classes – Modules – Debugging. (15 Hrs)

UNIT- II: Node Js Basics

Introduction to Node.js – Modules: Common JS – ESM – Custom Modules. Package Manager: npm. Error Handling: Types of Errors – Handling Async Errors – Stack Trace – Asynchronous Programming – Command Line Apps – Working with APIs – Templating Engines. (15 Hrs)

UNIT- III: Working with Mongodb

Introduction to MongoDB – MongoDB through the JavaScript's Shell – Creating and Querying through Indexes – Collections and Documents – MongoDB Query Language – Connecting node.js with MongoDB. (15 Hrs)

UNIT- IV: Frontend Development with React Js

Introduction to ReactJS – CLI tools – Components: Component Basics – Functional Components. Rendering – Hooks: Basic Hooks – Common Hooks – Custom Hooks – Routing using React Router – State Management with Context – Styling using Material UI and Tailwind. (15 Hrs)

UNIT- V: Rest API and Testing

API calls: Axios – react-query – SWR – Testing: React Testing Library – Jest – Playwright – Forms with React Hook Form – Connecting react application to the backend. (15 Hrs)

TEXT BOOKS:

1. Scott Chacon, Ben Straub," Pro Git", Second Editions, Apress®
   UNIT I - Chapter 1, 2.4, 3, 4.4, 7.1
2. Vasan Subramanian, "Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node", Apress Media LLC, Second Edition, 2019.
   UNIT II – Chapter 1, 2, 5
3. Mithun Satheesh, Bruno Joseph D'mello, Jason Krol Web Development with MongoDB and NodeJS - Second Edition,2015.
4. MongoDB: The Definitive Guide, Kristina Chodorow, Second Edition.
   UNIT III - Chapter 1, 2, 3, 4, 6, 16.

5. React and React Native: A complete hands-on guide to modern web and mobile development with React.js 3rd ed. Edition.
   UNIT IV – Chapter 2, 11
   UNIT V - Chapter 14, 17
6. Hoque Shama,"Full-Stack React Projects" - Second Edition, published by Packt

REFERENCES:

1. Alex Banks and Eve Porce llo, "Learning React: Functional Web Development with React and Redux", O'Reilly Media, First Edition, 2017.
2. Sebastian Springer, "Node.js: The Comprehensive Guide to Server-Side JavaScript Programming", Shroff publishers, First Edition, 2022.
3. Shannon Bradshaw, Eoin Brazil and Kristina Chodorow, "MongoDB: The Definitive Guide", O'Reilly Media, Third Edition, 2020.
4. https://www.w3schools.com/jsrEF/default.asp
5. https://devdocs.io/javascript/
6. https://reactjs.org/docs/getting-started.html
7. https://nodejs.org/en/docs/

COURSE OUTCOME	KNOWLEDGE LEVEL (K1-K6)
CO1: Recall the basic syntax and concepts of React.js, including components, JSX, props, and state.	**K1**
CO2: Understand the fundamentals Full Stack Development, including Git and JavaScript programming	**K2**
CO3: Apply concepts of Node.js, including module management, error handling, and asynchronous programming.	**K3**
CO4: Analyze and manage data using Mongo DB and its query language.	**K4**
CO5: Evaluate the performance and functionality of web applications using testing frameworks and REST APIs.	**K5**
CO 6: Create the complete Full Stack workflow to build scalable, efficient, and robust web applications.	**K6**

MAPPING COs WITH POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	3	3	1	1	3
CO2	9	9	3	3	1	3
CO3	9	3	9	3	3	3
CO4	9	3	3	9	3	3
CO5	9	3	3	3	9	3
CO6	9	3	9	9	9	9
WEIGHTAGE	54	24	30	28	26	24
WEIGHTED %	29.03 %	12.90 %	16.13 %	15.05 %	13.98 %	12.90 %

COURSE OUTCOMES MAPPED WITH KNOWLEDGE LEVEL (Revised Bloom's Taxonomy) AND POs:

COs	LEVEL OF CORRELATION			
	HIGH	MEDIUM	LOW	ZERO
CO1 / K1	PO1	PO2, PO3, PO6	PO4, PO5	--
CO2 / K2	PO1, PO2	PO3, PO4, PO6	PO5	--
CO3 / K3	PO1, PO3	PO2, PO4, PO5, PO6	--	--
CO4 / K4	PO1, PO4	PO2, PO3, PO5, PO6	--	--
CO5 / K5	PO1, PO5	PO2, PO3, PO4, PO6	--	--
CO6 / K6	PO1, PO3, PO4, PO5, PO6	PO2	--	--

COURSE OUTCOMES (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE:

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3		3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
NON SCHOLASTIC	-	-	-	-	-	5	20
TOTAL	4	10	6	20	5	25	100%

The COs and PSOs for the **WEB TECHNOLOGIES** course in the BCA Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge Signature of the HoD

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Programme Code	Course Code	Course Type	Course Title	Category	Hrs/ week	Credits
COAUG1998	**U25CA13P**	**Core**	**WEB TECHNOLOGIES LAB**	**Practical**	**3**	**3**

COURSE DESCRIPTION:

- Create JavaScript programs, perform MongoDB operations, build Express.js apps with authentication, create Node.js web apps, and develop simple React.js applications.

COURSE OBJECTIVES:

- Programming with Understand the MERN Stack Architecture
- Develop Backend Applications with Node.js and Express.js.
- Build Dynamic Frontend Applications with React.js
- Integrate Full-Stack Applications.
- Deploy Full-Stack MERN Applications

LIST OF EXERCISES:

Visual Programming Lab:

Program to implement the following concepts.

Java Script:

1) To write a java script program using Swap two variable.
2) To write a java script program **to Check if a number is Positive, Negative, or Zero.**

Mongo DB:

3) Illustration of Where Clause, AND, OR operations in MongoDB.
4) Execute the Commands of MongoDB and operations in MongoDB: Insert, Query, Update, Delete and Projection. (Note: use any collection)

Express js:

5) To write an express js using Authentication with login and password.
6) To write an express js using Transferring files to client.

Node js:

7) Build a web application with registration, login
8) To Write a Node js using Executing Commands in REPL

React js:

9) Create a Simple Login form using React JS
10) Create a blog using React JS

COURSE OUTCOME	KNOWLEDGE LEVEL (K1-K6)
CO1: Recall the key concepts of full-stack web development.	**K1**
CO2: Understand the Backend Development with Node.js and Express.js.	**K2**
CO3: Use MongoDB to design and implement a database schema for a given application, ensuring proper data organization and structure.	**K3**
CO4: Analyze Frontend Development with React.js.	**K4**
CO5: Evaluate Cloud Integration and Debugging, Testing, and Optimization	**K5**
CO6: Create a project setup that includes version control, testing frameworks, and development tools to ensure a smooth and efficient development pipeline for the entire team.	**K6**

MAPPING COs WITH POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	3	9	3	1	3
CO2	9	3	9	3	1	3
CO3	9	3	9	3	3	3
CO4	9	3	3	9	1	3
CO5	9	3	3	3	9	3
CO6	9	9	3	3	3	9
WEIGHTAGE	54	24	36	24	18	24
WEIGHTED %	30.00 %	13.33 %	20.00 %	13.33 %	10.00 %	13.33 %

COURSE OUTCOMES MAPPED WITH KNOWLEDGE LEVEL (Revised Bloom's Taxonomy) AND POs:

COs	LEVEL OF CORRELATION			
	HIGH	MEDIUM	LOW	ZERO
CO1 / K1	PO1, PO3	PO2, PO4, PO6	PO5	--
CO2 / K2	PO1, PO3	PO2, PO4, PO6	PO5	--
CO3 / K3	PO1, PO3	PO2, PO4, PO5, PO6	--	--
CO4 / K4	PO1, PO4	PO2, PO3, PO6	PO5	--
CO5 / K5	PO1, PO5	PO2, PO3, PO4, PO6	--	--
CO6 / K6	PO1, PO2, PO6	PO3, PO4, PO5	--	--

The COs and PSOs for the **WEB TECHNOLOGIES LAB** course in the BCA Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge Signature of the HoD

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Programme Code	Course Code	Course Type	Course Title	Category	Hrs/week	Credits
COAUG1998	**U25CAP14**	**Core**	**PROJECT**	**Project**	**8**	**6**

DESIGN ANALYSIS & INNOVATION:

1. Problem identification.
2. Aim, Objective & Motivation.
3. Review-1
4. Data collection
5. Designing Architecture, DFD, UML diagrams, ER-Models.
6. Review-2
7. Coding
8. Implementation.
9. Testing
10. Review-3
11. Result analysis
12. Conclusion
13. Future work & References.
14. Review-4
15. Project submission.

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Programme code	Course Code	Course Type	Course Title	Category	Hrs/week	Credits
COAUG1998	U25CA15	Core	ARTIFICIAL INTELLIGENCE	Lecture	6	6

COURSE DESCRIPTION:

- This course explores AI foundations, intelligent agents, search strategies, propositional and first-order logic, and various learning methods like supervised learning and decision trees.

COURSE OBJECTIVES:

- To understand the foundations of AI and the structure and behavior of intelligent agents in various environments.
- To learn different search strategies and optimization techniques for problem solving and decision making in games.
- To explore propositional logic for knowledge representation and reasoning in intelligent agents.
- To understand first-order logic, inference mechanisms, and logical reasoning techniques.
- To learn various learning methods in AI including decision trees and Prolog-based programming.

UNIT- I:

Introduction Foundation and History of AI - Intelligent Agents - Agents and Environments - The Concept of Rationality - Nature of Environments - Structure of Agents - Problem Solving Agents – Examples. (15 Hrs)

UNIT- II:

Searching for Solutions, Uniformed Search Strategies - Heuristics Search Strategies - Local Search Algorithms and Optimization Problems-Hill Climbing-Simulated Annealing-Local Beam Search- Genetic Algorithms - Optimal Decisions in Games - Alpha–Beta Pruning. (15 Hrs)

UNIT- III:

Propositional Theorem Proving - Effective Propositional Model Checking - Agents Based on Propositional Logic. (15 Hrs)

UNIT- IV:

First Order Logic Introduction- Syntax and Semantics - Inference - Propositional Vs. First-Order Inference –Unification and Lifting –Forward Chaining - Backward Chaining- Resolution. (15 Hrs)

UNIT- V:

Learning Forms of Learning- Supervised Learning- Learning Decision Trees- Hypothesis- Theory of Learning -Prolog -Programs - Data Objects. (15 Hrs)

TEXT BOOKS:

1. S. Russell and P. Norvig, “Artificial Intelligence – A Modern Approach”, Fourth Edition, Pearson Education, 2022.
   UNIT I - CHAPTER 1, 2 AND SEC 3.1,3.2
   UNIT II - CHAPTER 3 SEC 3.4, 3.5 CHAPTER 4 SEC 4.1,4.2
   UNIT III - CHAPTER 7 SEC 7.5,7.6,7.7

2. Artificial Intelligence – A Modern Approach (3rd Edition) by Stuart Russell & Peter Norvig –
   UNIT IV - CHAPTER 8 AND CHAPTER 9
   UNIT V - CHAPTER 18

REFERENCES:

1. Max Bramer, "Logic Programming with Prolog", Springer, 2013.
2. http://www.aisuperpowers.com/
3. http://repo.darmajaya.ac.id/5272/1/Artificial%20IntelligenceA%20Modern%20Approach%20%283rd%20Edition%29%20%28%20PDFDrive%20%29.pdf
4. https://www.free-ebooks.net/artificial-intelligence
5. https://www.simplilearn.com/resources/artificial-intelligence-machine-learning/ebooks
6. https://dlabs.ai/blog/free-ebooks-on-artificial-intelligence-to-read/
7. https://blog.re-work.co/free-ai-online-resources/

COURSE OUTCOME	KNOWLEDGE LEVEL (K1-K6)
CO 1: Recall the fundamental concepts including its definitions, history, and of a problem-solving agent.	**K1**
CO 2: Explain the basic search algorithms such as breadth-first search and depth-first search, and understand their applications in solving problems.	**K2**
CO 3: Apply the concepts of intelligent agents to design and implement simple problem-solving agents, demonstrating an understanding of their functions and environments.	**K3**
CO 4: Analyze and interpret logical expressions in First Order Logic, evaluating their use in representing knowledge and reasoning in Artificial Intelligence systems.	**K4**
CO 5: Critically evaluate various learning theories assessing their effectiveness in different scenarios and proposing improvements for optimizing learning algorithms based on real-world data.	**K5**
CO 6: Design and propose learning strategies for integrating different forms of learning such as supervised, unsupervised, and reinforcement learning to solve complex real-world problems.	**K6**

MAPPING COs WITH POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	3	3	1	1	3
CO2	9	3	9	3	1	3
CO3	9	3	9	3	3	3
CO4	9	3	3	9	1	3
CO5	9	3	9	3	9	3
CO6	9	3	9	9	9	9
WEIGHTAGE	54	18	42	28	24	24
WEIGHTED %	28.42 %	9.47 %	22.11 %	14.74 %	12.63 %	12.63 %

COURSE OUTCOMES MAPPED WITH KNOWLEDGE LEVEL (Revised Bloom's Taxonomy) AND POs:

COs	LEVEL OF CORRELATION			
	HIGH	**MEDIUM**	**LOW**	**ZERO**
CO1 / K1	PO1	PO2, PO3, PO6	PO4, PO5	--
CO2 / K2	PO1, PO3	PO2, PO4, PO6	PO5	--
CO3 / K3	PO1, PO3	PO2, PO4, PO5, PO6	--	--
CO4 / K4	PO1, PO4	PO2, PO3, PO6	PO5	--
CO5 / K5	PO1, PO3, PO5	PO2, PO4, PO6	--	--
CO6 / K6	PO1, PO3, PO4, PO5, PO6	PO2	--	--

COURSE OUTCOMES (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE:

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3		3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
NON SCHOLASTIC	-	-	-	-	-	5	20
TOTAL	4	10	6	20	5	25	100%

The COs and PSOs for the **ARTIFICIAL INTELLIGENCE** course in the BCA Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge Signature of the HoD

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Programme Code	Course Code	Course Type	Course Title	Category	Hrs/week	Credits
COAUG1998	U25CA16E1	Core – Elective	CLOUD COMPUTING	Lecture	6	6

COURSE DESCRIPTION:

- This course covers the fundamentals of cloud computing, including its evolution, architecture, software security, risk issues, and security architecture.

COURSE OBJECTIVES:

- To understand the fundamentals, evolution, features, advantages, and limitations of cloud computing.
- To learn about cloud architecture, delivery and deployment models, and their benefits.
- To explore cloud software security principles, objectives, and secure development practices.
- To identify cloud computing risks, security challenges, and policy implementation strategies.
- To understand cloud security architecture including identity management, secure communication, and trusted computing.

UNIT-I:

Cloud Computing fundamentals: Evolution and History of Cloud Computing, Introduction to Cloud Computing, Why Cloud Computing is Becoming Highly Important, Features of Cloud Computing, Cloud Computing for various users, Advantages of Cloud Computing, Limitations of Cloud Computing. (15 Hrs)

UNIT-II:

Cloud Computing Architecture: Cloud Delivery models, The SPI Framework, Cloud Software as a Service (SaaS), Cloud Platform as a Service (PaaS), Cloud Infrastructure as a Service (IaaS), Cloud deployment models, Public Clouds, Community Clouds, Hybrid Clouds, Alternative Deployment models, Expected benefits. (15 Hrs)

UNIT- III:

Cloud Computing Software Security fundamentals: Cloud Information Security Objectives, Confidentiality, Integrity, Availability, Cloud Security Services, Relevant Cloud Security Design Principles, Secure Cloud Software Requirements, Secure Development practices, Approaches to Cloud Software Requirement Engineering, Cloud Security Policy Implementation. (15 Hrs)

UNIT- IV:

Cloud Computing Risk Issues: The CIA Traid, Privacy and Compliance Risks, Threats to Infrastructure, Data and Access Control, Cloud Access Control Issues, Cloud Service Provider Risks. Cloud Computing Security challenges: Security Policy Implementation, Policy Types, and Computer Security Incident Response Team (CSIRT). (15 Hrs)

UNIT- V:

Cloud Computing Security Architecture: Architectural Considerations, General Issues, Trusted Cloud Computing, Secure Execution environments and Communications, Micro architectures, Identity Management and Access Control, Autonomic Security. (15 Hrs)

TEXT BOOKS:

1. Ronald L. Krutz, Russell Dean Vines, "Cloud Security a Comprehensive Guide to secure Cloud Computing" Wiley.
   UNIT I - CHAPTER 1
   UNIT II - CHAPTER 2
   UNIT III - CHAPTER 3
   UNIT IV - CHAPTER 4
   UNIT V - CHAPTER 6

REFERENCES:

1. John Witing house james F. Ransome, "Cloud Computing Implementation, Management and Security", CRC Press.
2. Borko Furht. Armando Escalante, "Handbook of Cloud Computing", Springer Charles Badcock, "Cloud Revolution", TMH.
3. https://www.tutorialride.com/cloud-computing/cloud-computing-tutorial.htm
4. https://www.tutorialspoint.com/cloud_computing/index.h

COURSE OUTCOME	KNOWLEDGE LEVEL (K1-K6)
CO 1: Recall the main concepts, key technologies, strengths, limitations of cloud computing and the possible applications for state-of-the-art cloud computing.	**K1**
CO 2: Understand the architecture and infrastructure of cloud computing, including cloud delivery and deployment models.	**K2**
CO 3: Apply cloud computing technologies to real-world applications such as IoT, big data, and AI.	**K3**
CO 4: Analyze the core issues of cloud computing such as security, privacy, and interoperability.	**K4**
CO 5: Evaluate various cloud computing solutions.	**K5**
CO 6: Design a customized cloud architecture that integrates various cloud services (e.g., compute, storage, networking) to meet the specific requirements of a given application.	**K6**

MAPPING COs WITH POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	3	3	1	1	3
CO2	9	3	9	3	3	3
CO3	9	3	9	9	3	3
CO4	9	3	9	9	3	3
CO5	9	3	9	3	9	3
CO6	9	3	9	3	9	9
WEIGHTAGE	54	18	48	28	28	24
WEIGHTED %	27.00 %	9.00 %	24.00 %	14.00 %	14.00 %	12.00 %

COURSE OUTCOMES MAPPED WITH KNOWLEDGE LEVEL (Revised Bloom's Taxonomy) AND POs:

COs	LEVEL OF CORRELATION			
	HIGH	MEDIUM	LOW	ZERO
CO1 / K1	PO1	PO2, PO3, PO6	PO4, PO5	--
CO2 / K2	PO1, PO3	PO2, PO4, PO5, PO6	--	--
CO3 / K3	PO1, PO3, PO4	PO2, PO5, PO6	--	--
CO4 / K4	PO1, PO3, PO4	PO2, PO5, PO6	--	--
CO5 / K5	PO1, PO3, PO5	PO2, PO4, PO6	--	--
CO6 / K6	PO1, PO3, PO5, PO6	PO2, PO4	--	--

COURSE OUTCOMES (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE:

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3		3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
NON SCHOLASTIC	-	-	-	-	-	5	20
TOTAL	4	10	6	20	5	25	100%

The COs and PSOs for the **CLOUD COMPUTING** course in the BCA Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge Signature of the HoD

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Programme Code	Course Code	Course Type	Course Title	Category	Hrs/week	Credits
COAUG1998	U25CA16E2	Core	OPERATING SYSTEM	Lecture	6	6

COURSE DESCRIPTION:

- The course covers the evolution and functions of operating systems, memory management techniques, processor management, I/O handling, and file management systems.

COURSE OBJECTIVES:

- To understand the evolution, functions, and fundamental concepts of operating systems and I/O processing.
- To learn various memory management techniques and their implementation in operating systems.
- To explore processor management, process scheduling, synchronization, and deadlock handling.
- To understand the components and functions of I/O management including spooling and device handling.
- To learn the structure and functionality of file systems including physical and logical organization.

UNIT- I:

Evolution of operating systems–Functions–Different views of OS–Batch processing, Multiprocessing, Time sharing OS – I / O programming concepts – Interrupt Structure & processing. (15 Hrs)

UNIT- II:

Memory Management – Single Contiguous Allocation – Partitioned Allocation – Relocatable Partitions allocations – Paged and Demand paged Memory Management –Segmented Memory Management–SegmentedandDemandpagedMemoryManagement–overlayTechniques– Swapping. (15 Hrs)

UNIT- III:

Processor Management – Job Scheduling – Process Scheduling – Functions and Policies – Evolution of Round Robin Multiprogramming Performance – Process Synchronization– Wait and Signal mechanisms – Semaphores P & V Operations – Deadlock – Banker's Algorithm. (15 Hrs)

UNIT- IV:

I/O Traffic Controller, I/O Scheduler, I/O Device Handlers –Spooling. (15 Hrs)

UNIT- V:

File Management: Simple File System, General Model of a File System, Physical and Logical File System. (15 Hrs)

TEXT BOOKS:

1. E. Madnick & John J. Donavan, "Operating Systems" Tata McGraw Hill Publishing Co., Limited.
2. Pradeep K. Sinha," Distributed Operating Systems", Prentice – Hall of India Private Limited.
   UNIT I: Chapter 1, 2, UNIT II: Chapter 3 UNIT III: Chapter 4
   UNIT IV: Chapter 5, UNIT V: Chapter 6

REFERENCES:

1. D.M. Dhamdhere, "System Programming and Operating Systems" Tata McGraw Hill Publishing Co., Limited.
2. https://www.geeksforgeeks.org/operating-systems/
3. https://www.tpointtech.com/operating-system
4. https://dpl.gov.in/index.php/e-Resources

COURSE OUTCOME	KNOWLEDGE LEVEL (K1-K6)
CO1**:** Recall the evolution, functions, and various types of operating systems and their structures.	**K1**
CO2: Understand memory management techniques and allocation strategies such as paging, segmentation, and swapping.	**K2**
CO3: Apply job scheduling, process synchronization, and deadlock management techniques in operating systems.	**K3**
CO4: Analyze the concepts of I/O management, device handling, and spooling within an operating system.	**K4**
CO5: Evaluate file system structures and how operating systems manage files and directories.	**K5**
CO6: Design a custom operating system component or feature that integrates multiple OS subsystems (e.g., memory management, process scheduling, file systems) to solve a specific system-level challenge.	**K6**

MAPPING COs WITH POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	3	9	3	1	3
CO2	9	3	9	3	3	3
CO3	9	3	9	3	3	3
CO4	9	3	9	9	3	3
CO5	9	3	3	9	9	3
CO6	9	3	9	9	3	9
WEIGHTAGE	54	18	48	36	22	24
WEIGHTED %	26.73 %	8.91 %	23.76 %	17.82 %	10.89 %	11.88 %

COURSE OUTCOMES MAPPED WITH KNOWLEDGE LEVEL (Revised Bloom's Taxonomy) AND POs:

COs	LEVEL OF CORRELATION			
	HIGH	**MEDIUM**	**LOW**	**ZERO**
CO1 / K1	PO1, PO3	PO2, PO4, PO6	PO5	--
CO2 / K2	PO1, PO3	PO2, PO4, PO5, PO6	--	--
CO3 / K3	PO1, PO3	PO2, PO4, PO5, PO6	--	--
CO4 / K4	PO1, PO3, PO4	PO2, PO5, PO6	--	--
CO5 / K5	PO1, PO4, PO5	PO2, PO3, PO6	--	--
CO6 / K6	PO1, PO3, PO4, PO6	PO2	PO5	--

COURSE OUTCOMES (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE:

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3		3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
NON SCHOLASTIC	-	-	-	-	-	5	20
TOTAL	4	10	6	20	5	25	100%

The COs and PSOs for the **OPERATING SYSTEM** course in the BCA Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge Signature of the HoD

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Programme Code	Course Code	Course Type	Course Title	Category	Hrs/week	Credits
COAUG1998	U25CA16E3	Core – Elective	CYBER SECURITY	Lecture	6	6

COURSE DESCRIPTION:

- This course covers the key concepts of information security, including the need for security, security technologies, cryptography, and risk management in protecting systems and data.

COURSE OBJECTIVES:

- To understand the components of information systems and security in software development.
- To identify security threats, attacks, and secure software development practices.
- To explore security technologies like firewalls, access controls, and intrusion detection systems.
- To learn cryptographic algorithms and their applications in securing communication.
- To analyze risk management processes, including identification, assessment, and control strategies.

UNIT – I: Introduction to Information Security

Components of Information System - Software Development Life Cycle –Security Software Development Life Cycle - Security Professionals and the Organization - Communicates of Interest. (15 Hrs)

UNIT – II: Need for Security

Introduction - Business Need First - Threats - Attacks - Secure Software Development. (15 Hrs)

UNIT – III: Security Technologies

Introduction - Access Control – Firewall - Protecting Remote Connections - Intrusion Detection and Prevention System – Honeypots, Honeynets and Padded Cell - System Scanning and Analysis Tools - Biometric Access Control. (15 Hrs)

UNIT – IV: Cryptography

Foundation of Cryptology - Cipher Methods – Cryptographic Algorithms – Cryptographic Tools –Protocols for Communication - Attacks on cryptosystems. (15 Hrs)

UNIT – V: Risk Management

Introduction – An over view of Risk Management – Risk Identification – Risk Assessment – Risk Control Strategies – Selecting a Risk Control Strategy – Risk management Discussion Points - Recommended Risk Control Practices. (15 Hrs)

TEXT BOOKS:

1. Michael E. Whitman, Herbert J. Mattord," Principles of Information Security", CENGAGE Learning, 4th Edition. (I, II, III, IV, V UNIT)
   Unit I Chapter 1
   Unit II Chapter 2
   Unit III Chapter 6, 7
   Unit IV Chapter 8
   Unit V Chapter 4

2. Principles of Information Security by Michael E. Whitman and Herbert J. Mattord.

REFERENCES:

1. William Stallings," Cryptography and Network Security – Principles and Practice", Pearson Education, 7th Edition.
2. Atul Kahate," Cryptography and Network Security", McGraw Hill, 4th Edition
3. Elementary Information Security by Richard E. Smith.
4. Fundamentals of Information Systems Security by David Kim and Michael G. Solomon.
5. https://www.tpointtech.com/cyber-security-tutorial
6. https://www.geeksforgeeks.org/cyber-security-tutorial/
7. https://www.w3schools.com/cybersecurity/

COURSE OUTCOME	KNOWLEDGE LEVEL (K1-K6)
CO1: Remembering the components of an information system and the importance of security in software development.	**K1**
CO2: Understanding the need for security, various threats, and attacks that impact business operations.	**K2**
CO3: Applying security measures and cryptographic techniques to protect data and systems effectively.	**K3**
CO4: Analyzing different security technologies and risk management strategies to identify potential vulnerabilities.	**K4**
CO5: Evaluating the effectiveness of implemented security controls and suggesting improvements.	**K5**
CO6: Creating secure software solutions and risk management frameworks to enhance organizational security.	**K6**

MAPPING COs WITH POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	3	1	1	1	3
CO2	9	9	3	3	3	3
CO3	9	9	9	3	3	3
CO4	9	9	9	9	3	3
CO5	9	9	9	3	9	3
CO6	9	9	9	9	9	9
WEIGHTAGE	54	48	40	28	28	24
WEIGHTED %	24.32 %	21.62 %	18.02 %	12.61 %	12.61 %	10.81 %

COURSE OUTCOMES MAPPED WITH KNOWLEDGE LEVEL (Revised Bloom's Taxonomy) AND POs:

COs	LEVEL OF CORRELATION			
	HIGH	MEDIUM	LOW	ZERO
CO1 / K1	PO1	PO2, PO6	PO3, PO4, PO5	--
CO2 / K2	PO1, PO2	PO3, PO4, PO5, PO6	--	--
CO3 / K3	PO1, PO2, PO3	PO4, PO5, PO6	--	--
CO4 / K4	PO1, PO2, PO3, PO4	PO5, PO6	--	--
CO5 / K5	PO1, PO2, PO3, PO5	PO4, PO6	--	--
CO6 / K6	PO1, PO2, PO3, PO4, PO5, PO6	--	--	--

COURSE OUTCOMES (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE:

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3		3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
NON SCHOLASTIC	-	-	-	-	-	5	20
TOTAL	4	10	6	20	5	25	100%

The COs and PSOs for the **CYBER SECURITY** course in the BCA Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge Signature of the HoD

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Programme Code	Course Code	Course Type	Course Title	Category	Hrs/week	Credits
COAUG1998	U25ACC1CA	Allied	BASICS OF ACCOUNTANCY	Lecture	5	3

COURSE DESCRIPTION:

- It provides a clear picture of the financial health of an organization and its performance, which can serve as a catalyst for resource management and strategic growth.

COURSE OBJECTIVES:

- Students will develop a strong understanding of basic accounting concepts, including accounting principles.
- Students will gain the ability to record and maintain accurate financial data
- Students will acquire practical knowledge of preparing a Bank Reconciliation Statement and understand the principles of the single-entry system.
- Students will understand the concept of depreciation and its impact on financial reporting
- Students will gain the ability to prepare final accounts for a sole trader

UNIT - I: Journal and Ledger

Definition of Accounting-Accounting Concepts and Conventions-Double entry system-Rules–Advantages*-Journal–Ledger-Trial Balance. (15 Hrs)

UNIT - II: Subsidiary Books

Purchase Day Book-Sales Day Book-Cash Book- Petty Cash Book. (15 Hrs)

UNIT - III: Single Entry system

Single Entry system (Simple Problems only)-statement of affairs method only. (15 Hrs)

UNIT - IV: Depreciation accounting

Depreciation Accounting#-Meaning–Causes*-Methods-Straight Line Method-Written Down Value Method (Simple Problems only). (15 Hrs)

UNIT - V: Final Accounts

Final Accounts of Sole Trader#–Adjustment and Closing Entries-(Simple Problems Only). (15 Hrs)

ExtraCredit:

#CaseStudy
*SelfLearning
Activities:1. Quiz 2. GropDiscussion 3. ChartWork

TEXT BOOKS:

1. Reddy, T.S.,& Murthy.Y(2021).Financial Accounting, Margham Publications, Chennai.

REFERENCE BOOKS:

1. Jain, S.P., & Narang, K.L. (2022). Financial Accounting, Kalyani Publications, LudhianaGupta, R.L.& Radhaswamy,M.(2021). Financial Accounting. Sultan Chand & Sons.

2. Gupta R.L and Gupta, V.K. (2019). Financial Accounting, Sultan Chand & Sons, NewDelhi.
3. Shukla, M.C.,Grewal T.S.,& Gupta,S.P.(2021).Advanced Accounts,S.Chand & Co.,NewDelhi.

Swayam Course:

- http://ugcmoocs.inflibnet.ac.in/ugcmoocs/view_module_ug.php/249
- http://ugcmoocs.inflibnet.ac.in/ugcmoocs/view_module_ug.php/194

E-Content:

- https://www.youtube.com/watch?v=nUgQYs47w2U
- https://www.youtube.com/watch?v=vuetn_PQOvM
- https://www.youtube.com/watch?v=Y4azRCTTWoU
- https://www.learnpick.in/prime/documents/ppts/details/4026/accounting-concepts-principles

COURSE OUTCOME	KNOWLEDGE LEVEL (K1-K6)
CO1: Recall various concepts of accounting and learn how to prepare ledger and trial balance	**K1**
CO2: Understand problems relating to single entry	**K2**
CO3: Apply methods of depreciation for ascertaining the value of assets	**K3**
CO4: Analyze various adjustments in preparation of final accounts	**K4**
CO5: Evaluate Trial balance of a firm and BRS	**K5**
CO6: Create final accounts of a sole trader	**K6**

MAPPING COs WITH POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	3	9	3	3	1
CO2	9	3	9	3	3	3
CO3	3	9	9	3	3	3
CO4	9	3	9	9	9	3
CO5	9	3	9	9	9	9
CO6	9	9	9	9	9	9
WEIGHTAGE	48	30	54	39	39	28
WEIGHTED %	20.1 %	12.6 %	22.6 %	16.3 %	16.3 %	11.7 %

COURSE OUTCOMES MAPPED WITH KNOWLEDGE LEVEL (Revised Bloom's Taxonomy) AND POs:

COs	LEVEL OF CORRELATION			
	HIGH	MEDIUM	LOW	ZERO
CO1 / K1	PO1, PO3	PO2 PO4, PO5	PO6	--
CO2 / K2	PO1, PO3	PO2, PO4, PO5, PO6	--	--
CO3 / K3	PO2, PO3	PO1, PO4, PO5, PO6	--	--
CO4 / K4	PO1, PO3, PO4, PO5	PO2, PO6	--	--
CO5 / K5	PO1, PO3, PO4, PO5, PO6	PO2	--	--
CO6 / K6	PO1, PO2, PO3, PO4, PO5, PO6	--	--	--

COURSE OUTCOMES (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE:

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
	T1 4 Marks	T2 10 Marks	Assignment 6 Marks	20 Marks	5 Marks	25 Marks	
K1	1	1	1	3	-	3	12
K2	1	1	1	3		3	12
K3	1	2	1	4	-	4	16
K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
NON SCHOLASTIC	-	-	-	-	-	5	20
TOTAL	4	10	6	20	5	25	100%

The COs and PSOs for the **BASICS OF ACCOUNTANCY** course in the BCA Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge Signature of the HoD

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Programme Code	Course Code	Course Type	Course Title	Category	Hrs/ week	Credits
COAUG1998	U25ACC2CA	Allied	ENTREPRENEURSHIP AND START-UP ECOSYSTEM	Lecture	4	2

COURSE DESCRIPTION:

- The Entrepreneurship and Startup Ecosystem course is designed to provide students with a comprehensive understanding of the processes, challenges, and opportunities involved in launching and managing successful startups.

COURSE OBJECTIVES:

- To provide students with a comprehensive understanding of entrepreneurship, including its definition, characteristics, functions, and various types of entrepreneurships.
- To equip students with the skills to discover and evaluate business ideas, create detailed business plans, and apply marketing and financial planning techniques.
- To enable students to craft and analyze business models, create strong value propositions, and apply lean startup principles
- To help students understand product development processes, including the concept of Minimum Viable Product (MVP), achieving product-market fit, and utilizing agile development methodologies for tech startups.
- To familiarize students with the legal aspects of starting a business, such as selecting the appropriate entity type, equity splits, co-founder agreements, and the registration of intellectual property rights.

UNIT - I: Introduction to Entrepreneurship and Start – Ups

Definition of Entrepreneurship-characteristics of Entrepreneurship-Functions of Entrepreneurship-Different types of Entrepreneurships-7-M Resources-Micro, Small, Medium Enterprise/ MSME - Industry Registration-Start up India registration process. (12 Hrs)

UNIT - II: Business Ideas and their implementation

Discovering ideas and visualizing the business with Activity map-Business Plan- The Marketing Plan and Financial Plan/ Sources of Capital-Business Model Canvas-Market research-Marketing Mix (4Ps- product, price, promotion, place)- PLC, Mortality Curve and New product Development-. Importance and concept of Innovation-. Risk analysis and mitigation by SWOT Analysis. (12 Hrs)

UNIT - III: Crafting a business model and lean start-ups

Understanding Business Models-Modern Business Models- Creating Value Proposition-Challenges In Building A Strong Value Proposition- building & analyzing business models-Testing And Validating The Business Model- Lean Startups- Business Pitching. (12 Hrs)

UNIT - Product Development And Funding

Minimum viable product (MVP)-product market fit-minimum viable product (MVP) to achieving product-market fit-prototype and agile development methodology for tech startups-challenges-identifying critical success elements of product development-understanding basics of startup funding-stages and sources of startup funding-prerequisite of startup funding-seed capital-financial modelling basics for startups-angel investors & VC firms. (12 Hrs)

UNIT - V: Legal Considerations for A Start up

Selecting the right entity type-registration process for startups-startup equity split among co-founders and equity vesting-importance of startup equity split-equity vesting-ESOP planning and other best practices-co-founder agreement-registering intellectual property rights. (12 Hrs)

TEXT BOOKS:

1. The Lean Start up by Eric Ries, penguin,Uk, 2011
2. Startup Compass by Ujwal Kalra, Shobhit Shubhankar, HarperCollins publications,2022
3. Entrepreneurship and start up Eco System in India, CA Virendra K, Pamecha Edition,2024-25

REFERENCE BOOKS:

1. Fundamentals of Entrepreneurship, Dr. O. P. Gupta, SBPD Publishing house,2021
2. Startup eco system in India Texts and Cases,Ganeh Waghmare, Ramesh Sardar, Himalayan Publishing Company.
3. Entrepreneurship and start ups, Sekar Manickam, walnut publications, Sep 2023

Swayam Course:

- https://onlinecourses.nptel.ac.in/noc21_mg70/preview
- https://onlinecourses.swayam2.ac.in/cec20_mg19/preview
- https://onlinecourses.swayam2.ac.in/imb24_mg32/preview

E-Content:

- https://www.youtube.com/watch?v=rA4uKIy5gO0&list=PLsh2FvSr3n7fQlIDbfKutmSL26TsWitGQ
- https://www.youtube.com/watch?v=eHJnEHyyN1Y
- https://www.youtube.com/watch?v=itRVzjk9mkg
- https://www.youtube.com/watch?v=rezFGdFxVFA
- https://www.youtube.com/watch?v=s4RVEZl4etc

COURSE OUTCOME	KNOWLEDGE LEVEL (K1-K6)
CO1: Recall the entrepreneurship and describe the key characteristics and functions of an entrepreneur.	**K1**
CO2: Understand the business ideas and effectively visualize them through business plans. Apply marketing and financial planning techniques using the Business Model Canvas, and conduct market research using the 4Ps of marketing.	**K2**
CO3: Apply concepts and develop a business model by creating a strong value proposition. Analyze modern business models and test and validate business models through lean startup methodology, including business pitching techniques.	**K3**
CO4: Analyze product development by applying the concept of Minimum Viable Product (MVP) and product-market fit.	**K4**
CO5: Evaluate and navigate legal considerations for startups, including selecting the right entity type, understanding equity splits among co-founders, and establishing equity vesting plans.	**K5**
CO6: Create various business models and choose the one best suited for the organization	**K6**

MAPPING COs WITH POs:

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	9	3	9	3	3	1
CO2	9	3	9	3	9	3
CO3	9	3	9	9	3	9
CO4	9	3	9	9	3	9
CO5	9	9	3	9	9	9
CO6	9	3	9	9	9	3
WEIGHTAGE	54	24	48	42	36	34
WEIGHTED %	22.6 %	10.08 %	20.1 %	17.6 %	15.12 %	14.2 %

COURSE OUTCOMES MAPPED WITH KNOWLEDGE LEVEL (Revised Bloom's Taxonomy) AND POs:

COs	LEVEL OF CORRELATION			
	HIGH	MEDIUM	LOW	ZERO
CO1 / K1	PO1, PO3	PO2 PO4, PO5	PO6	--
CO2 / K2	PO1, PO3, PO5	PO2, PO4, PO6	--	--
CO3 / K3	PO1, PO3, PO4, PO6	PO2, PO5	--	--
CO4 / K4	PO1, PO3, PO4, PO6	PO2, PO5	--	--
CO5 / K5	PO1, PO2, PO4, PO5, PO6	PO3	--	--
CO6 / K6	PO1, PO3, PO4, PO5	PO2, PO6	--	--

COURSE OUTCOMES (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE:

K Levels	C1	C2	C3	Total Scholastic Marks	Non Scholastic Marks C4	CIA Total	% of Assessment
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K4	1	2	1	4	-	4	16
K5	-	2	1	3	-	3	12
K6	-	2	1	3	-	3	12
NON SCHOLASTIC	-	-	-	-	-	5	20
TOTAL	4	10	6	20	5	25	100%

The COs and PSOs for the **ENTREPRENEURSHIP AND START-UP ECOSYSTEM** course in the BCA Programme is effectively matched by the Course In-charge.

Signature of the Course In-charge Signature of the HoD

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