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BENGALURU CITY UNIVERSITY

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Syllabus of Third and Fourth Semesters for

B.Sc. Computer Science
(CBCS Scheme)

Under
State Education Policy

Effective from the Academic Year
2025 – 2026

Board of Studies in Computer Science for UG

No : BCU/BoS/Comp.Sci. & Appln.(PG & UG)/389/2024-25 dated 19/02/2025

1	Prof. Ramesh B Kudenatti Department of Mathematics Bengaluru City University,Bengaluru-560056	Chairperson
2	Prof. Guru D S Department of Studies in Computer Science University of Mysore, Mysore-570006	Member
3	Prof. Aziz Makandar Department of Computer Science Karnataka State Akkamahadevi Women University, Jnanashakti Campus, Vijayapura-586109	Member
4	Prof. Suneetha Department of Computer Science, Karnataka State Open University, Muktha Gangothri Mysuru-570006	Member
5	Prof. Veena R Department of MCA, Seshadripuram College Seshadripuram, Bengaluru-560020	Member
6	Prof. Kiran Kumar M N Department of Computer Applications, BMS College of Commerce and Management, Bengaluru-560004	Member
7	Prof. Latha B Department of Computer Science Vijaya College, R V Road, Basavanagudi, Bengaluru-560004	Member
8	Prof. R Shanthi Krishna Department of Computer Applications, SSMRV College, Jayanagar, Bengaluru-560041	Member
9	Prof. Roopa H R Department of Computer Applications, Seshadripuram Institute of Commerce and Management, Seshadripuram, Bengaluru-560020	Member
10	Sri Seby Kallarakkal CEO-Nabler Web Solutions, Bengaluru-560052	Member

Name of the Degree Program : B.Sc. Computer Science
Discipline Course : Computer Science
Starting Year of Implementation : 2024-25 (I & II Semesters)
2025-26 (III & IV Semesters)
2026-27 (V & VI Semesters)

Programme Outcomes (POs)

PO 1	Apply knowledge of computer science to design and implement computational solutions.
PO 2	Identify, analyze, and solve structured and unstructured real-world problems using algorithmic thinking, data structures and efficient programming strategies.
PO 3	Create, Solve and apply tools of programming, networking, database and modern technology for solutions to significant problems.
PO 4	Design computer-based solutions for various technical problems.
PO 5	Demonstrate project management skills through projects and practical labs.
PO 6	Build software solutions using multiple paradigms in software development.
PO 7	Understand professional, ethical, legal and societal responsibilities in data usage, privacy, AI implementations and technological impact.
PO 8	Communicate effectively in both verbal and written formats through project reports, lab records presentations and document code.
PO 9	Function effectively as an individual and as a member or leader in diverse teams in multidisciplinary environments such as group projects and internships.
PO 10	Recognize the need for continuous learning in a rapidly evolving tech world and demonstrate readiness to adopt innovations in AI for solving real-world challenges.

ASSESSMENT

Weightage for the Assessments (in percentage)

Type of Course	Formative Assessment/ I.A.	Summative Assessment (S.A.)
Theory	20%	80 %
Practical	20%	80 %

DETAILED STRUCTURE FOR BSc COMPUTER SCIENCE

Semester	Course Code	Paper Title	Teaching Hours / Week	Marks		Duration of Exam in Hours	Credits
				Exam	IA		
I	24BSC-CS-1	Problem Solving Techniques	4	80	20	03	03
	24BSC-CS-1P	Problem Solving Techniques Lab	4	40	10	03	02
II	24BSC-CS-2	Data Structures	4	80	20	03	03
	24BSC-CS-2P	Data Structures Lab	4	40	10	03	02
III	24BSC-CS-3	Database Management System	4	80	20	03	03
	24BSC-CS-3P	Database Management System Lab	3	40	10	03	02
	24BSC-CS-E1	Cyber Security	2	40	10	1.5	02
IV	24BSC-CS-4	Object Oriented Programming using Java	4	80	20	03	03
	24BSC-CS-4P	Java Lab	3	40	10	03	02
	24BSC-CS-E2	Software Testing	2	40	10	1.5	02
	24BSC-CS-SE1	HTML	2	40	10	1.5	02
V	24BSC-CS-5	Python Programming	4	80	20	03	03
	24BSC-CS-6	Operating System	4	80	20	03	03
	24BSC-CS-5P	Python Programming Lab	3	40	10	03	02
	24BSC-CS-6P	Operating System Lab	3	40	10	03	02
	24BSC-CS-SE2	Computer Graphics	2	40	10	1.5	02
VI	24BSC-CS-7	Artificial Intelligence	4	80	20	03	03
	24BSC-CS-8	Computer Networks	4	80	20	03	03
	24BSC-CS-7P	Artificial Intelligence Lab	3	40	10	03	02
	24BSC-CS-8P	Computer Networks Lab	3	40	10	03	02

SEMESTER – III

Theory	24BSC CS-3 : Database Management System
Teaching Hours : 04 Hours/Week	Credits : 03
Duration of Exam : 03 Hours	Maximum Marks : 100 (Exam 80 + IA 20)

Course Outcomes

COs	Description
CO1	Understand the basic concepts of DBMS and its types, data independence and three schema architecture.
CO2	Be familiar with the CODD's rules, E-R Model and the structure of the relational databases.
CO3	Understand the concept of normalization and different types of normalization. Design normalized database objects and process the data in an optimized way.
CO4	Understand the basics of query evaluation techniques and query optimization and transaction processing.

Unit- I Introduction to Databases and Architecture 14 Hours

Introduction to Data and Database. Significance of Database Management System, Types of DBMS, Data Independence, Three Levels of Architecture, Client/Server Architecture, System Structure, Instance and Schema.

Unit -II Data Modeling and SQL Basics 14 Hours

Keys, CODD's Rules, Design Issues, ER – Model, Attribute types, Weak Entity Sets, Extended ER Features, ER to Relational Mapping, Structure of Relational Databases, Creation and Manipulation of Database using SQL commands (DDL, DML,DCL,TCL).

Unit- III Normalization and Functional Dependencies 14 Hours

Functional Dependency, Anomalies, Armstrong's axioms: Closure of a relation and Closure of attribute, Normalization, Types of normal forms(:1NF, 2NF, 3NF, Boyce - Codd Normal Form), Lossless decomposition.

Unit - IV Relational Algebra and Transaction Management 14 Hours

The Relational Algebra, Query Processing and Optimization, Evaluation of Relational algebraic expressions, Query Equivalence, Transaction Processing: ACID properties, states of a transaction, Introduction to concurrency control, Deadlock-Recovery. Introduction to Pl/SQL .

TEXT BOOKS:

1. Elmasri and Navathe: Fundamentals of Database Systems, 7th Edition, Addison – Wesley, 2016.
2. Silberschatz, Korth and Sudharshan Data base System Concepts, 7th Edition, Tata McGraw Hill, 2019.

REFERENCE BOOKS:

1. C.J. Date, A. Kannan, S. Swamynatham: An Introduction to Database Systems, 8th Edition, Pearson education, 2009
2. Database Management Systems :Raghu Ramakrishnan and Johannes Gehrke: 3rd Edition, McGraw-Hill, 2003

Lab	24BSC-CS-3P: Database Management System Lab
Teaching Hours : 03 Hours/Week	Credits : 02
Duration of Exam : 03 Hours	Maximum Marks : 50 (Exam 40 + IA 10)

Part A: SQL COMMANDS

1. Create a table STUDENT with the following fields: RollNo, Name, DOB, Department, Marks.
   - Insert at least 5 records
   - Display all records
   - Update marks for a specific student
   - Delete one student record
2. Create a table COURSE with CourseID, CourseName, Credits.
   - Alter the table to add a field Department
   - Drop the field Credits
3. Create two tables EMPLOYEE1 and EMPLOYEE2.
   - Perform UNION, INTERSECT and MINUS operations on them.
4. Use the STUDENT table to perform the following:
   - Find average marks
   - Display names in uppercase
   - Extract the month from DOB
5. Using the STUDENT and COURSE tables,
   - Find students who scored above average marks using a subquery
   - List students enrolled in 'Computer Science' using a subquery
6. Create DEPARTMENT and STUDENT tables.
   - Write queries to display student names along with their department names using INNERJOIN and LEFT JOIN.
7. Create a view to show student names and marks from the STUDENT table where marks > 75.
   - Query the view
   - Try updating the view
8. Demonstrate the use of GRANT and REVOKE on the STUDENT table.
   - Use COMMIT and ROLLBACK after INSERT and DELETE commands.

Part B: PL/SQL PROGRAMMING

9. Write a PL/SQL block to accept a number and check if it is even or odd.
10. Write a PL/SQL program to divide two numbers and handle the exception if the denominator is zero.
11. Create an explicit cursor to display all student records with marks greater than 80.
12. Use a parameterized cursor to display students based on department input.
13. Create a stored function to calculate grade based on marks:
    - Above 80: Distinction
    - 60–79: First Class
    - 40–59: Second Class
    - Below 40: Fail
14. Write a stored procedure to update the marks of a student given their RollNo and marks.

Theory : Elective - I	24BSC-CS-E1 : Cyber Security
Teaching Hours : 02 Hours/Week	Credits : 02
Duration of Exam : 1.5 Hours	Maximum Marks : 50 (Exam 40 + IA 10)

Course Outcomes

COs	Description
CO1	Understand the fundamentals of cyber security and adopt safe internet practices and responsible digital behavior, and concepts of cryptography, password security and secure communication protocols.
CO2	Apply system and personal security measures to protect devices and data from threats, vulnerabilities and online attacks.

Unit-I Basics of Cyber Security and Cryptography 14 Hours

Introduction to cyber security, Importance of cyber safety in the digital world, Types of cyber threats – viruses, worms, trojans, phishing, ransomware, fake websites, social engineering, Goals of cyber security – confidentiality, integrity, availability, Difference between threats, vulnerabilities and risks, Common security terms – firewall, antivirus, malware, hacking, Overview of safe internet practices and responsible digital behavior.

What is cryptography – Purpose of encryption and decryption, Difference between secret key (symmetric) and public key (asymmetric) encryption, Simple examples – Caesar cipher, concept of public/private keys, Introduction to passwords and password policies, Importance of HTTPS and SSL in secure communication,

Unit- II System and Personal Security Practices 14 Hours

Basics of operating system security, User authentication and access control, Password policies and best practices, Role of antivirus and anti-malware software, Common web security issues – SQL injection, XSS, CSRF (conceptual overview), Mobile app security – permissions and safe usage, Importance of software updates and patch management. Safe use of mobile devices, laptops, and social media, Secure browsing practices and identifying fake or unsafe websites, Safe use of public Wi-Fi and avoiding data leaks, Risks of pop-ups, cookies, and online tracking, Introduction to firewalls and VPNs (concept only), Email safety – detecting phishing and spam, Responsible online behaviour and data sharing.

TEXT BOOKS:

1. Chirag Shah (2018). A Hands-On Introduction to Cyber security. Wiley.
2. Nina Godbole & Sunit Belapure (2011). Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives. Wiley India.
3. Rao, U. & Nayak, P. (2014). Cyber Security. Cengage Learning.
4. Moeti J. (2021). Cyber security for Beginners. Amazon Digital Services (for simple reading-level coverage).

SEMESTER – IV

Theory	24BSC-CS-4 : Object Oriented Programming using Java
Teaching Hours : 04 Hours/Week	Credits : 03
Duration of Exam : 03 Hours	Maximum Marks : 100 (Exam 80 + IA 20)

Course Outcome

Cos	Description
CO1	Understand OOPs concepts.
CO2	Analyze Polymorphism and different forms of Inheritance and packages
CO3	Understand different GUI layouts and design GUI applications
CO4	Understand different kinds of file I/O, Multithreading and Exception handling

UNIT- I Introduction to Java and Oop's concepts 14 Hours

Basics of Java programming, Data types, Variables, Operators, Control structures including selection, Looping, Java methods, Overloading, Math class, Arrays in java. Objects and Classes: Basics of objects and classes in java, Constructors, Finalizer, Visibility modifiers, Methods and objects, Inbuilt classes like String, Character, String Buffer, File, this reference.

UNIT-II Inheritance and Packages 14 Hours

Inheritance in java, Super and sub class, Overriding, Object class, Polymorphism, Dynamic binding, Generic programming, Casting objects, Instance of operator, Abstract class, Interface in java, Package in java, UTIL package.

UNIT-III Event Handling and GUI Programming: 14 Hours

Event handling in java, Event types, Mouse and key events, GUI Basics, Panels, Frames, Layout Managers: Flow Layout, Border Layout, Grid Layout, GUI components : Buttons, Check Boxes, Radio Buttons, Labels, Text Fields, Text Areas, Combo Boxes, Lists, Scroll Bars, Sliders, Windows, Menus, Dialog Box, Applet and its life cycle, Introduction to swing.

UNIT-IV Exception handling, Multithreading and I/O Programming 14 Hours

Exception handling mechanism, try-catch-finally, Thread life cycle and methods, Runnable interface, Thread synchronization. I/O programming: Text and Binary I/O, Binary I/O classes, Object I/O, Random Access Files.

TEXT BOOKS

E. Balagurusamy, Programming with JAVA, McGraw Hill, New Delhi, 2007

REFERENCE BOOKS

1. Herbert Schildt, Java A Beginner's Guide – Create, Compile, and Run Java Programs Today, Sixth Edition, Oracle Press, 2014
2. Ken Arnold, James Gosling, "The Java Programming Language, Fourth Edition, Addison Wisely, 2005
3. Herbert Schildt, 'The Complete Reference Java, 7th Edition, McGraw Hill, 2007

Lab	24BSC-CS-4P: Java Lab
Teaching Hours : 03 Hours/Week	**Credits : 02**
Duration of Exam : 03 Hours	**Maximum Marks : 50 (Exam 40 + IA 10)**

PART -A

1. Write a Java Program to implement the usage of static, local and global variables.
2. Write a Java Program to implement default and parameterized constructors.
3. Write a Java Program to implement java String functions.
4. Write a Java Program to implement array of objects.
5. Write a Java Program to implement multiple inheritance using interface.
6. Write a Java Program to implement run time polymorphism
7. Write a Java Program to catch negative array size exception.
8. Write a Java Program to add two integers and two float numbers. When no arguments are supplied, give a default value to calculate the sum. Use function overloading.
9. Create a simple applet which reveals your personal information.
10. Write a Java Program to create a thread using Runnable interface.

PART -B

11. To find the area and circumference of the circle by accepting the radius from the user.
12. Write a Java Program to find maximum of three numbers.
13. Write a Java Program to list the factorial of numbers from 1 to 10.
14. Write a Java Program to implement single inheritance
15. Write a Java Program to import user defined package .
16. Write a Java Program to demonstrate division by zero exception.

Theory: Elective-II	24BSC-CS-E2: Software Testing
Teaching Hours : 02 Hours/Week	Credits : 02
Duration of Exam : 1.5 Hours	Maximum Marks : 50 (Exam 40 + IA 10)

Course Outcomes

Cos	Description
CO1	Understand software development life cycle, models and various testing concepts.
CO2	Understand defect management to improve software quality and reliability. Learning Agile to collaborate effectively in modern development environments.

UNIT - I Software Development and Testing **14 Hours**

Software Development Life Cycle**,** Waterfall model, Prototype model, Spiral model. Manual Software Testing Concepts: Introduction to Manual Testing, Types Of Software Testing: Unit Testing. Integration Testing, System Testing, Acceptance Testing. White Box Testing ,Grey Box Testing, Black Box Testing. Software Testing Life Cycle (STLC).

UNIT- II Defect and Agile Methodology **14 Hours**

Blocker defect, Critical defect, Major defect. Defect Life Cycle, Agile methodology: definition, principles and model, Scrum: Sprint Planning ,Meeting, Scrum Master, Scrum meeting. Automation Testing: Introduction to Selenium.

TEXT BOOKS

1. Dorothy Graham, Rex Black, Erik van veenendaal, Foundations of Software Testing(Paperback), 4 edition, Cengage Learning India Pvt. Ltd., 2020
2. Rahul Verma, The Last Book on Testing Paperback, 1 edition, India, 2025

Theory: Skill Enhancement Course-1	24BSC-CS-SE1: HTML
Teaching Hours : 02 Hours/Week	Credits : 02
Duration of Exam : 1.5 Hours	Maximum Marks : 50 (Exam 40 + IA 10)

Course Outcomes

COs	Description
CO1	Understand WWW, Importance of HTML, Basic tags
CO2	Work with Lists ,Tables, forms and Practice Hyper linking.

UNIT I: Introduction to WWW and HTML tags **14 Hours**

Basic principles involved in developing a web site, Brief History of Internet, introduction to World Wide Web and Web site, Web Standards, HTML: definition, significance, applications and limitations. Basic structure of an HTML document, Creating an HTML document, Basic Formatting Tags. Mark up Tags, Headings, Paragraphs, Line Breaks, Grouping Using Div and Span, Comments, HTML Code Example.

UNIT III: Elements of HTML **14 Hours**

Introduction to elements of HTML, Working with Text, Lists **:** Tags, significance of lists, types of Lists, creating lists, Tables**:** table tags, Creating tables, Forms and Controls**:** Importance of forms in websites, Form syntax ,creating html forms, Hyperlink**:** Working with Hyperlinks, Images and Multimedia, anchor tag, the importance of hyperlinks in web pages. HTML Meta tag, XHTML.

TEXT BOOKS:

1. Kogent Learning Solutions Inc., web technologies HTML, javascript, PHP, Dreamtech Press, 1 Edition,2009

2. Steven M. Schafer,HTML, XHTML, and CSS Bible(paper back), 3 Edition, John Wiley & Sons, 004

BLUEPRINT FOR QUESTION PAPER						
FOR 03 CREDITS						
Marks	**Unit I**	**Unit II**	**Unit III**	**Unit IV**	**Number of questions to be answered**	**Total**
2	**3**	**3**	**3**	**3**	**10**	**20**
6	**2**	**2**	**2**	**2**	**5**	**30**
10	**1**	**1**	**1**	**1**	**3**	**30**
					Total	**80**
FOR 02 CREDITS						
Marks	**Unit I**	**Unit II**	**Number of questions to be answered**			**Total**
2	**3**	**3**	**5**			**10**
5	**3**	**3**	**4**			**20**
10	**1**	**1**	**1**			**10**
					Total	**40**

Formative Assessment - 03 Credits

Category	Marks Allotted
Tests	10
Assignments	10
Total Marks	**20**

Formative Assessment - 02 Credits

Category	Marks Allotted
Tests	5
Assignments	5
Total Marks	**10**