GURU NANAK COLLEGE (AUTONOMOUS)
A Sikh Minority Institution | Unit of Guru Nanak Educational Society (Regd.)
Affiliated to University of Madras | Approved by AICTE
Accredited at A++ Grade by NAAC (CGPA 3.68/4)
Guru Nanak Salai, Velachery, Chennai - 600042

SCHOOL OF INFORMATION TECHNOLOGY

COMPUTER SCIENCE PROGRAMME

(SEMESTER PATTERN WITH CHOICE BASED CREDIT SYSTEM)

Syllabus

(For the UG Batch of 2026-29 and thereafter)

LOCF - LEARNING OUTCOME BASED CURRICULUM FRAMEWORK

PREAMBLE

1. ABOUT THE PROGRAMME

B.Sc. Computer Science refers to the study of algorithmic processes, computational devices, and computing itself. The course covers everything from the theoretical and practical study of algorithms and information to the real-world challenges of implementing computational systems in hardware and software. Through the review and modification of an extensive array of frameworks pertaining to agree upon/expected graduate attributes, qualification descriptors, and learning objectives for programming, the curriculum is intended to support the maintenance of national standards used in Hardware and Software Technologies. These are subjects that all computer science students need to study. The curriculum planning strategy that is based on practical experience aims to impart information and concepts in a range of areas, such as programming techniques, operating systems, software and firmware, and networking. Among the most important skill sets that employers have recognized are the core courses. Any exposure to the IT sector requires a deep understanding of these subjects. Given that advancement from this point may lead to jobs in IT, R&D, or as an entrepreneur, each course is essential to the students' chances of success in the industry. With the use of sophisticated tools and latest technology, such as graphical representations and online resources for implementing the written code, students should be able to learn the curriculum in the best way possible. The curriculum's design exposes students to contemporary tools. This curriculum places more of an emphasis on needy areas like entrepreneurship, skill development, and sustainability. In the future, Students will be able to apply the abilities they have learned through a variety of teaching-learning methodologies. In order to keep up with industry demands, requests for information, and technological changes, students are required to be knowledgeable in every area. According to BLOOM's Taxonomy, the curriculum, instructional strategies, and evaluation techniques are matched with suitable cognitive levels. The assessment of students' cognitive abilities and the evaluation of the attainment of expected course outcomes will be made possible by the OBE- based evaluation methodologies.

2. VISION

To empower students with the knowledge, skills, and values needed to thrive in a rapidly evolving technological landscape, while also making positive contributions to society with a distinct environment that provides quality higher education in Computer Science both to the Indian Society and on the global scale which bring forth excellent subject and practical knowledge to all students.

3. MISSION

To offer student-centric education in Computer Science with a focus on research and innovation. Diversity, inclusion and social responsibility are imparted to students to prepare them for lucrative professions in technology. The programme aims to lead Computer Science education to make a beneficial impact on society by means of community participation and continued enhancement.

4. PROGRAM EDUCATIONAL OBJECTIVES

PEO1: **Technical and Professional Excellence**: Graduates will demonstrate strong foundations in computer science, software engineering, data management, and emerging technologies, enabling them to excel in industry, academia, and research.

PEO2: **Innovation and Problem Solving**: Graduates will apply analytical thinking, creativity, and modern IT tools to design, develop, and implement solutions for complex technological and societal challenges.

PEO3: **Ethics and Responsible Computing**: Graduates will uphold ethical standards, practice responsible computing, and contribute to sustainable development by leveraging technology for societal benefit.

PEO4: **Leadership and Collaboration**: Graduates will exhibit effective communication, teamwork, and leadership skills, preparing them to manage diverse projects and collaborate across multidisciplinary environments.

PEO5: **Adaptability and Lifelong Learning**: Graduates will engage in continuous professional development, research, and upskilling to remain adaptable in dynamic global IT environments and contribute to innovation and knowledge creation.

5. PROGRAM OUTCOMES

PO 1: Knowledge Component: Acquire core knowledge in programming and information technology

PO 2: Problem Solving: Develop technical solutions using problem-solving skills

PO 3: Critical Thinking: Analyse problems with critical and innovative thinking

PO 4: Individual and Teamwork: Create technical projects through collaborative teamwork

PO 5: Communication and Lifelong Learning: Engage in lifelong learning in the field of technology.

6. PROGRAM SPECIFIC OUTCOMES

PSO 1: Specialized / Uniqueness of the Programme: Design efficient solutions using algorithms and programming techniques

PSO 2: Experiential Learning through tools: Build software applications using modern development tools

PSO 3: Investigation / Problem Solving: Utilize research-oriented thinking in advanced computing areas

PSO 4: Employability and Ethics: Strengthen competencies for careers in IT, research, academia, and entrepreneurship

PSO5: Interdisciplinary and Multidisciplinary: Integrate computing across interdisciplinary and multidisciplinary domains

7. PEO – PO MAPPING

	PEO1	PEO2	PEO3	PEO4	PEO5
PO1	1	3	3	3	3
PO2	1	3	3	3	2
PO3	1	3	3	3	2
PO4	2	3	3	3	3
PO5	3	3	3	3	3

8. PEO – PSO MAPPING

	PEO1	PEO2	PEO3	PEO4	PEO5
PSO1	3	3	3	3	3
PSO2	3	3	3	3	3
PSO3	1	3	3	3	2
PSO4	2	3	3	3	3
PSO5	2	3	3	3	3

9. CHOICE BASED CREDIT SYSTEM (CBCS)

The College follows the CBCS with Grades under the Semester pattern. Each course is provided with a credit point based on the quantum of subject matter, complexity of the content and the hours of teaching allotted. This is done after a thorough analysis of the content of each subject paper by the members of the Board of Studies and with the approval of the Academic Council. Students are also offered a variety of Job oriented Elective, Multidisciplinary skill-based courses as part of the curriculum. Students can earn extra credits by opting for Massive Open Online Courses (MOOCs) and Certificate Courses.

The evaluation method under CBCS involves a more acceptable grading system that reflects the personality of the student. This is represented as Cumulative Grade Point Average (CGPA) and Grade Point Average (GPA) which are indicators of the Academic Performance of the student. It provides students with a scope for horizontal mobility and empowers them with the flexibility of learning at their convenience.

Eligibility for Admission

Candidates admitted to the first year B.Sc. Computer Science should have passed the higher Secondary Examinations (Academic or Vocational Stream) with Mathematics as a compulsory subject conducted by the Government of Tamil Nadu or an examination accepted as equivalent thereof by the Syndicate of the University of Madras. Students applying for the PG programme should have taken the UG degree in the relevant subject from a recognized university as per the norms of the University of Madras.

Duration of the Course

The UG programme is of three years duration with six semesters. The period from June to November is termed as the odd semester and the period from December to April is referred to as the even semester. Each semester must compulsorily have 90 working days before the students appear for the final End Semester Exam.

Course of Study

The main course of study for the Bachelor's Degree shall consist of the following:

Foundation Courses

PART - I: Tamil / Hindi / Sanskrit / French

PART - II: English

Core Courses

PART - III: Consisting of (a) Main subject (b) Allied Subjects (c) Elective subjects related to the main subject of study and project work.

PART – IV: Those who have not studied Tamil up to XII standard and have taken a non- Tamil language under Part – I, shall opt for Basic Tamil in the first two semesters.

Those who have studied Tamil up to XII standard, and taken a non -Tamil language under Part – I, shall opt for Advanced Tamil in the first two semesters.

Others, who do not come under either of the clauses mentioned above, can choose a Non-Major Elective (NME) in the first two semesters.

Ability Enhancement Skills (I, II, III & IV Semesters)

Value Education (I Semester)

Self-Study (Compulsory) Course (III Semester)

Indian Knowledge System (Domain Specific) – (IV Semester)

Summer Internship (After IV Semester)

Environmental Studies (V Semester)

PART – V: Compulsory Extension Services

A Student shall be awarded one credit for compulsory extension service. A student must enroll in NSS / NCC / Sports & Games / Citizen Consumer Club / Enviro Club or any other service organization in the College and should put in compulsory minimum attendance of 40 hours, which shall be duly certified by the Principal of the College. If a student lacks 40 hours compulsory minimum attendance in the extension services in any Semester, s/he shall have to compensate the same, during the subsequent Semesters.

10. COURSE STRUCTURE

The Computer Science programme consists of 16 Core courses with 3–4 credits each, 4 Allied courses and 3 elective courses with 4–5 credits each, 4 Ability Enhancement Skill courses with two credits each, 2 Non-Major Elective courses with two credits each, 2 Life Skill courses (Value Education and EVS) with two credits each, 1 Self-study course with 2 credits and a domain specific IKS course with 1 credit. Internship is a compulsory component with 2 credits and Project is a compulsory core course with 4 credits for all the UG & PG programmes. Extension activity is a compulsory component with 1 credit.

Consolidated Credit Structure for all the 3 years

Course component		No. of Courses	Credits
Part I	Language	4	12
Part II	English	4	12
Part III	Core	16	64
	Allied	4	16
	Elective	3	14
Part IV	NME	2	4
	Ability Enhancement Skills	4	8
	EVS	1	2
	Value Education	1	2
	Internship	1	2
	Self-study course	1	2
	IKS	1	1
Part V	Extension activity	1	1
Total		**43**	**140**

Credit Distribution for Each Semester:

Semester I		Subject	Credit	Hrs. / Week	Marks		Total
Course Component					Internals	Externals	
Part I	Language	Language – I	3	6	50	50	100
Part II	English	English – I	3	4	50	50	100
Part III	Core – I	Programming in C with LINUX	4	5	50	50	100
	Core – II	Practical–I: Programming in C with LINUX	4	4	50	50	100
	Allied – I	Allied Mathematics	4	5	50	50	100
Part IV	Non Major Elective – I	Basic Tamil – I / Advanced Tamil – I / Practical: Digital Literacy using Google Applications	2	2	50	50	100
	Life Skill – I	Value Education	2	2	50	50	100
	Ability Enhancement Skills – I	Communication skills and Personality Development skills	2	2	50	50	100
Total			**24**	**30**			

Semester II		Subject	Credit	Hrs. / Week	Marks		Total
Course Component					Internals	Externals	
Part I	Language	Language – II	3	6	50	50	100
Part II	English	English – II	3	4	50	50	100
Part III	Core – III	Object Oriented Programming using Java	4	6	50	50	100
	Core – IV	Practical–II: Object Oriented Programming using Java	4	4	50	50	100
	Allied – II	Statistics	4	6	50	50	100
Part IV	Non Major Elective – II	Basic Tamil – II / Advanced Tamil – II / Digital Literacy: Navigating Digital World	2	2	50	50	100
	Ability Enhancement Skills – II	Foundations of quantitative aptitude	2	2	50	50	100
Total			**22**	**30**			

Semester III		Subject	Credit	Hrs. / Week	Marks		Total
Course Component					Internals	Externals	
Part I	Language	Language – III	3	6	50	50	100
Part II	English	English – III	3	4	50	50	100
Part III	Core – V	Python Programming and Data Structures	4	6	50	50	100
	Core – VI	Practical–III: Python Programming and Data Structures	4	6	50	50	100
	Allied – III	Advanced Statistics	4	6	50	50	100
Part IV	Ability Enhancement Skills – III	Practical: Introduction to UI / UX using Figma	2	2	50	50	100
	Self–Study (Compulsory) Course	Indian Heritage and Knowledge System / Contemporary World and Sustainable Development	2	–	–	100	100
Total			**22**	**30**			

Semester IV		Subject	Credit	Hrs. / Week	Marks		Total
Course Component					Internals	Externals	
Part I	Language	Language – IV	3	6	50	50	100
Part II	English	English – IV	3	4	50	50	100
Part III	Core – VII	Full Stack Technology	4	6	50	50	100
	Core – VIII	Practical–IV: Full Stack Technology	4	5	50	50	100
	Allied – IV	Operations Research	4	6	50	50	100
Part IV	Indian Knowledge Systems	Indian Knowledge System with Artificial Intelligence	1	1	50	50	100
	Ability Enhancement Skills – IV	Resume Writing and Interview skills	2	2	50	50	100
Total			**21**	**30**			

Semester V		Subject	Credit	Hrs. / Week	Marks		Total
Course Component					Internals	Externals	
Part III	Core – IX	Operating Systems	4	6	50	50	100
	Core – X	Data Science and Machine Learning	4	6	50	50	100
	Core – XI	Practical–V: Data Science and Machine Learning	4	5	50	50	100
	Elective–I IDE (Inter–Disciplinary Elective)	Practical: Internet and its Applications	4	5	50	50	100
	Elective – II	Practical–VI: Platform Engineering / Data Communication and Networking / Big Data Analytics	5	6	50	50	100
Part IV	Life Skill – II	Environmental Studies	2	2	–	–	–
	Internship	Internship	2	–	–	–	–
Total			**25**	**30**			

Semester VI		Subject	Credit	Hrs. / Week	Marks		Total
Course Component					Internals	Externals	
Part III	Core – XII	Software Engineering and Testing	4	5	50	50	100
	Core – XIII	Artificial Intelligence	4	6	50	50	100
	Core – XIV	Mobile Application Development	4	5	50	50	100
	Core – XV	Practical–VII: Mobile Application Development with Android	4	4	50	50	100
	Core – XVI	Project	4	4	50	50	100
	Elective – III	Cloud Computing / Internet of Things and its Applications / Cyber Security	5	6	50	50	100
Part IV	Extension Activity	Participation in NSS / NCC, etc.	1	–	–	–	–
Total			**26**	**30**			
Total Credits			**140**				

****** Programmes can choose one extra core course(optional) if they give four credit to allied courses***

11. EXAMINATION

Continuous Internal Assessment (CIA) will be for 50 percent and End Semester Examination (ESE) will be for 50 percent. The CIA marks for the two credit courses (NME, EVS, Value Education and Ability Enhancement skill courses) and one credit course on Indian Knowledge System coming under Part IV, shall be awarded based on the nature of the course or at the course instructor's discretion (Assignment/project/presentation). The mode of examination for IKS will be conducted through CIA with 5 out of 10 questions carrying 20 marks each.

Continuous Internal Assessment (CIA)

Every semester will have a mid-semester examination which will be conducted on completion of 45 working days in each semester. A Model exam for three hours duration will be conducted on completion of 85 working days in each semester. For the courses coming under Part IV, ESE will be conducted in MCQ pattern. Internship credits will be given in semester V after verification of documents by the respective Heads.

The schedule for these tests is as follows:

CIA	Schedule	Syllabus Coverage
Mid Semester Examination	After **45** working days of the Semester	50%
Model Examination	After **85** working days of the Semester	100%

The components for the CIA (Theory & Practical) are as follows:

Continuous Internal Assessment – Components			
Assessment Type	**Nature**	**Maximum Marks**	**Weightage**
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment			5
Workbook / recordbook / notebook			5
Class activity 1			5
Class activity 2			5
Class activity 3			5
Attendance	Marks will be given based on the attendance percentage of respective course		5
Total			50

The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed)

1) Quiz with MCQ
2) Case-Study analysis
3) Debate
4) Seminar/ Presentation
5) Peer/Self-Assessment
6) Role play
7) Scrap book
8) Monograph
9) Puzzle
10) Group Discussion
11) Group activity
12) Surprise class tests

A record of all such assessment procedures will be maintained by the department and is open for clarification. Students will have the right to appeal to the Principal in case of glaring disparities in marking. CIA marks for practical subjects will be awarded by the respective faculty based on the performance of the student in the model practical examination, observation notebook, submission of record books, regularity and attendance for the practical classes. The attendance particulars for practical classes will be maintained by the concerned faculty.

The marks for attendance will be awarded as per the following:

Percentage of General Attendance	Marks Awarded
90 – 100	5
75 – 89	4
60 – 74	3
< 60	0

End Semester Examinations (ESE)

After the completion of a minimum of 90 working days each semester, the End Semester Examinations will be conducted. Examinations for all UG and PG programmes will be held for all courses in November/December and April/May. Practical examinations will be conducted only during the end of the odd / even semester before, during or after the commencement of the theory exam. The schedule for ESE Practicals will be notified by the Controller of Examinations in consultation with the Dean Academics.

Mode of Evaluation

METHODS OF EVALUATION		
Internal Evaluation	Mid Sem Exam (10)	50 Marks
	Model Exam (10)	
	Assignment (10)	
	Class activity (15)	
	Attendance (5)	
External Evaluation	End Semester Examination	50 Marks
Total		**100 Marks**

Method of Assessment

Remembering (K1)	● The lowest level of questions requires students to recall information from the course content ● Knowledge questions usually require students to identify information in the textbook. ● Suggested Keywords: **Choose, Define, Find, How, Label, List, Match, Name, Omit, Recall, Relate, Select, Show, Spell, Tell, What, When, Where, Which, Who, Why**
Understanding (K2)	● Understanding off acts and ideas by comprehending organizing, comparing, translating, interpolating and interpreting in their own words. ● The questions go beyond simple recall and require students to combined at altogether. ● Suggested Keywords: **Classify, Compare, Contrast, Demonstrate, Explain, Extend, Illustrate, Infer, Interpret, Outline, Relate, Rephrase, Show, Summarize, Translate**
Application (K3)	● Students have to solve problems by using / applying a concept learned in the classroom. ● Students must use their knowledge to determine a exact response. ● Suggested Keywords: **Apply, Build, Choose, Construct, Develop, Experiment with, Identify, Interview, Make use of, Model, Organize, Plan, Select, Solve, Utilize**
Analyze (K4)	● Analyzing the question is one that asks the students to breakdown something into its component parts. ● Analyzing requires students to identify reasons causes or motives and reach conclusions or generalizations. ● Suggested Keywords: **Analyze, Assume, Categorize, Classify, Compare, Conclusion, Contrast, Discover, Dissect, Distinguish, Divide, Examine, Function, Inference, Inspect, List, Motive, Relationships, Simplify, Survey, Take part in, Test for, Theme**
Evaluate (K5)	● Evaluation requires an individual to make judgment on something. ● Questions to be asked to judge the value of an idea, a character , a work of art, or a solution to a problem. ● Students are engaged in decision-making and problem–solving. ● Evaluation questions do not have single right answers. ● Suggested Keywords: **Agree, Appraise, Assess, Award, Choose, compare, Conclude, Criteria, Criticize, Decide, Deduct, Defend, Determine, Disprove, Estimate, Evaluate, Explain, Importance, Influence, Interpret, Judge, Justify, Mark, Measure, Opinion, Perceive, Prioritize, Prove, Rate, Recommend, Rule on, Select, Support, Value**
Create (K6)	● The questions of this category challenge students to get engaged in creative and original thinking. ● Developing original ideas and problem-solving skills ● Suggested Keywords: **Adapt, Build, Change, Choose, Combine, Compile, Compose, Construct, Create, Delete, Design, Develop, Discuss, Elaborate, Estimate, Formulate, Happen, Imagine, Improve, Invent, Make up, Maximize, Minimize, Modify, Original, Originate, Plan, Predict, Propose, Solution, Solve, Suppose, Test, Theory**

SEMESTER I

PROGRAMME: B.Sc. COMPUTER SCIENCE	**BATCH: 2026 – 2029**
PART: III	**COURSE COMPONENT: CORE – I**
COURSE NAME: PROGRAMMING IN C WITH LINUX	**COURSE CODE: 26UCSC301**
SEMESTER: I	**MARKS: 100**
CREDITS: 4	**TOTAL HOURS: 75**
THEORY	

COURSE OBJECTIVE:

The objective of this course is to provide a comprehensive understanding of C programming fundamentals, data structures, file handling, and pointers, along with exposure to Linux operating system command and shell scripting

COURSE OUTCOMES:

1. Recall C fundamentals: data types, variables, and operators.
2. Create control structures and functions in C programs.
3. Apply arrays, pointers, and file handling in C.
4. Execute Linux commands for file and disk management.
5. Develop shell scripts to automate Linux tasks.

UNIT I **(15 Hours)**

C Fundamentals: Character set - Identifiers and Keywords - Data Types - Constants - Variables - Declarations - Expressions - Statements - Operators: Arithmetic, Unary, Relational and Logical, Assignment and Conditional.

UNIT II **(15 Hours)**

Data input-output functions—Simple C programs - Flow of control - if, if- else, while, do-while, for loops and nested control structures - switch, break and continue and go-to statements - comma operator.

Functions: Definition - Passing arguments - Recursion. Storage Classes - automatic, external, static, register variables - Library functions.

UNIT III **(15 Hours)**

Arrays - Defining and Processing - Passing arrays to functions – multi-dimensional arrays - Arrays and String. Structures - User defined data types – Unions.

Pointers - Declarations - Passing pointers to Functions - Operation in Pointers - Pointer and Arrays - Arrays of Pointers - Files: Creating, Processing, Opening and Closing a data file.

UNIT IV **(15 Hours)**

Introduction to Linux: Structure of file system, creating and viewing files using cat, cd, ls, cp, md, rm, mkdir, rmdir, pwd, more, less, file comparisons – cmp and comm., view files, disk related commands, checking disk free spaces, chmod with its options, cal, date, who, tty, lp and stty.

UNIT V **(15 Hours)**

Filters and pipes: head, tail, wc, pr, cut, paste, sort, unique, grep, egrep, fgrep, tee. The process: shell process, parent and children, process status, changing process priority with nice, premature termination of process, mathematical commands – bc, expr, factor, units.

PRESCRIBED BOOKS:

1. Richard Petersen, "Linux: The Complete Reference," Sixth Edition, McGraw Hill Education, 2017.

2. Yashavant Kanetkar Let Us C: Authentic Guide to C Programming Language 19th Edition - 2023.

REFERENCE BOOKS:

1. Ed Herbert Schildt— "The Complete Reference" 4th Edition McGraw-Hill by 2000.
2. E. Balagurusamy ., "Programming in ANSI C" 9th Edition by McGraw Hill 2024.
3. Daniel J. Barrett., "Linux Pocket Guide: Essential Commands"4th Edition O'Reilly Media by 2022.
4. Mark G., "A Practical Guide to Linux Commands, Editors, and Shell Programming" 4th Edition Sobell by Prentice Hall, 2017.

E-LEARNING RESOURCES:

1. http://www.cprogramming.com/
2. http://www.richardclegg.org/previous/ccourse/
3. https://www.studytonight.com/c/programs/
4. https://www.cprogramming.com/tutorial/computersciencetheory/stackcode.html
5. https://www.javatpoint.com/linux-tutorial

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	*Answer any 10 out of 12 questions (each in 50 words)*	*1-12*	*3*	*30*
B	*Answer any 5 out of 7 questions (each in 300 words)*	*13-19*	*6*	*30*
C	*Answer any 4 out of 6 questions (each in 1200 words)*	*20-25*	*10*	*40*
TOTAL MARKS				**100**

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	2	2	1
II	2	2	1
III	3	1	2
IV	3	1	1
V	2	1	1
TOTAL	**12**	**7**	**6**
	SECTION A – 12	**SECTION B – 7**	**SECTION C – 6**

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	2	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
Ave.	**3**	**3**	**2.8**	**3**	**3**

PO- PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	POs, PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Recall C fundamentals: data types, variables, and operators.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO2	Create control structures and functions in C programs.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO3	Apply arrays, pointers, and file handling in C.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO4	Execute Linux commands for file and disk management.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO5	Develop shell scripts to automate Linux tasks.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5

K1= Remember, K2= Understand, K3= Apply, K4=Analyze, K5= Evaluate, K6= Create

Continuous Internal Assessment – Components			
Assessment Type	**Nature**	**Maximum Marks**	**Weightage**
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Written assignment on Course Related Topics	10	5
Workbook / recordbook / notebook	Handwritten Notes	10	5
Class activity 1	Quiz with MCQ	10	5
Class activity 2	Seminar / Presentation	10	5
Class activity 3	Surprise Class Tests	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50

The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed)

1. *Quiz with MCQ*
2. *Seminar / Presentation*
3. *Peer/Self-Assessment*
4. *Puzzle*
5. *Group Discussion*
6. *Group Activity*
7. *Surprise Class Tests*
8. *Case-Study Analysis*

PROGRAMME: B.Sc. COMPUTER SCIENCE	BATCH: 2026 – 2029
PART: III	COURSE COMPONENT: CORE II
COURSE NAME: PRACTICAL-I: PROGRAMMING IN C WITH LINUX	COURSE CODE: 26UCSC302P
SEMESTER: I	MARKS: 100
CREDITS: 4	TOTAL HOURS: 60
PRACTICAL	

COURSE OBJECTIVE:

The objective of this course is to develop proficiency in C programming with Linux by implementing fundamental programming constructs, data structures, and shell scripting, while gaining hands-on experience with essential Linux commands and system utilities.

COURSE OUTCOMES:

1. Apply decision-making constructs to solve basic C programs.
2. Develop C programs using loops and repetition.
3. Compose C functions for arithmetic computations.
4. Develop C programs for string and array processing.
5. Develop C programs integrating Linux system commands.

PROGRAMS

(10 HOURS)

1. Write a program to add, subtract, multiply, and divide two numbers. (Arithmetic operation).
2. Write a program to check if a number is even or odd. (if-else)
3. Write a program to find the largest of three numbers. (using if-else, logical &&)

(10 HOURS)

4. Write a program to find the maximum and minimum of n numbers. (using for- statement)
5. Write a program to check for Armstrong numbers. (while loop)

(10 HOURS)

6. Write a program to Implement a Structure for Student Information (Using Arrays of Structures)
7. Write a program to Swap Two Numbers Using Pointers
8. Write a program to arrange a set of numbers in ascending order. (1DArray).

Linux programs **(15 HOURS)**

9. Write a C program to check whether a string is a palindrome or not.(String)
10. Write a C program to print the Fibonacci series using a function.
    a) Usage of the following commands: ls, pwd, tty, cat, who, who am I, rm, mkdir, rmdir, touch, cd.
    b) Usage of the following commands: cat (append), cat (concatenate), mv, cp, man, date.

11. a) Usage of the following command: chmod.

    b) Usage of the following commands: head, tail, wc, pr, cut, paste, sort, unique.

(15 HOURS)

12. Usage of the following commands: grep, egrep, fgrep, tee.

13. Usage of the following commands: process status, changing process priority with nice.

14. Write a shell script to modify the "cal" command to display calendars of the specified months.

PSO – CO MAPPING

	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	2	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
Ave.	**3**	**3**	**3**	**2.8**	**3**

PO-PSO-CO-QUESTION PAPER MAPPING

CO No.	**COURSE OUTCOME**	**PSOs ADDRESSED**	**COGNITIVE LEVEL (K1 to K6)**
CO1	Apply decision-making constructs to solve basic C programs.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO2	Develop C programs using loops and repetition.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO3	Compose C functions for arithmetic computations.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO4	Develop C programs for string and array processing.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO5	Develop C programs integrating Linux system commands	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5

K1=Remember, K2=Understand, K3=Apply, K4=Analyze, K5=Evaluate, K6=Create

Continuous Internal Assessment – Components			
Assessment Type	**Nature**	**Maximum Marks**	**Weightage**
Mid-Semester Examination	Practical examination with programming/problem-solving tasks for 90 minutes	50	10
Model Examination	Practical examination with programming/problem-solving tasks for 180 minutes	100	10
Assignment	Assignment based on experimental concepts	10	5
Workbook /record book/ notebook	Handwritten record of experiments, observations, results, and conclusions	10	5
Class activity 1	Debugging Test	10	5
Class activity 2	Problem-Solving Exercise	10	5
Class activity 3	Quiz with MCQ	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50

The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed)

1. *Quiz with MCQ*
2. *Seminar / Presentation*
3. *Peer/Self-Assessment*
4. *Puzzle*
5. *Group Discussion*
6. *Group activity*
7. *Surprise class tests*
8. *Case-Study Analysis*

PROGRAMME: B.Sc.(CS), BCA, B.Sc.(IT)	**BATCH: 2026 – 2029**
PART: III	**COURSE COMPONENT: ALLIED – I**
COURSE NAME: ALLIED MATHEMATICS	**COURSE CODE: 26UCSC3A1**
SEMESTER: I	**MARKS:100**
CREDITS: 4	**TOTAL HOURS: 75**
THEORY AND PROBLEMS	

COURSE OBJECTIVE:

To improve basics in mathematical and analytical skills.

COURSE OUTCOMES:

1. Demonstrate the properties of matrices and determine Eigen values and Eigen vectors using Cayley–Hamilton theorem.
2. Apply finite difference operators and interpolation techniques such as Newton's forward,backward, and Lagrange interpolation formulae for numerical analysis.
3. Expand trigonometric functions and apply hyperbolic and inverse hyperbolic functions in mathematical problem solving.
4. Analyze functions using differentiation techniques, Jacobians, and maxima and minima of functions of two variables.
5. Solve second order differential equations with constant coefficients involving exponential, trigonometric, and polynomial functions.

UNIT I (18 Hours)

Matrices: Symmetric matrix, skew symmetric matrix, Hermitian matrix, skew Hermitian matrix, orthogonal matrix, unitary matrix, Cayley-Hamilton theorem (statement), eigen values and eigen vectors.

Chapter 4, Section 4.1-4.1.6,4.5,4.5.2

UNIT II (18 Hours)

Finite Differences: Interpolation, Operators Δ, ∇and E, difference tables, Interpolation formulae: Newton's forward and backward interpolation formulae for equal intervals, Lagrange's interpolation formula.

Chapter 5

UNIT III (18 Hours)

Trigonometry: Expansion of $\text{Sin}^n\theta$, $\text{Cos}^n\theta$, $\text{Sin}^m\theta\ \text{Cos}^n\theta$, expansion of $\text{Sin}n\theta$ and $\text{Cos}n\theta$, expansions of sin θ, cos $\theta$and tan θ in a series of powers of "θ", hyperbolic and inverse hyperbolic functions.

Chapter 6, section 6.1,6.2,6.3

UNIT IV (18 Hours)

Differentiation: Basic differentiation, Successive Differentiation, Jacobian, Maxima and Minima of functions of two variables.

Chapter 1, Section 1.1,1.2, 1.3,1.3.1

UNIT V (18 Hours)

Differential Equations: Second order differential equation with constant coefficients, differential equation of the form $(aD^2+bD+c)\ y = e^{ax}\ \phi\ (x)$ where a, b, c are constants, $\phi(x)$ = Sin mx (or) Cos mx (or) x^m.

Chapter 5, Section 5.2, 5.2.1,

PRESCRIBED BOOK:

1. Treatment and content as in "Allied mathematics" – P. Durai Pandian, Dr.S.Udayabaskaran, Volume I & II S.Chand and company limited, Reprint 2018.

REFERENCE BOOKS:

1. Allied Mathematics, S.G.Venkatachalapathy.
2. P. Kandasamy and K. Thilagavathi,Allied Mathematics Volume I and Volume II -- 2004, S.Chand and Co, New Delhi.
3. Ancillary Mathematics Volume 1 and 2 by Balasubramanian & K.G.Subramanian..

E - LEARNING RESOURCES:

1. https://ia801306.us.archive.org/5/items/MIT18.01JF07/ocw-18.01-f07-lec11_300k.mp4
2. https://nptel.ac.in/courses/111107107
3. https://nptel.ac.in/courses/111106146

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	Answer any 10 out of 12 questions	1 – 12	3	30
B	Answer any 5 out of 7 questions	13 – 19	6	30
C	Answer any 4 out of 6 questions	20 – 25	10	40
TOTAL MARKS				**100**

BREAK UP OF QUESTIONS FOR THEORY AND PROBLEMS

UNITS	SECTION A		SECTION B		SECTION C	
	THEORY	PROBLEM	THEORY	PROBLEM	THEORY	PROBLEM
I	1	1	-	1	-	1
II	1	1	-	1	-	1
III	-	2	-	1	-	1
IV	-	2	-	1	-	1
V	-	2	-	1	-	1
Any Unit	-	2	-	2	-	1
TOTAL	**2**	**10**	**-**	**7**	**-**	**6**
SECTION A – 12			**SECTION B - 7**		**SECTION C - 6**	

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	**2**	**3**	**2**	**2**	**3**
CO 2	**3**	**2**	**2**	**3**	**2**
CO 3	**3**	**2**	**3**	**3**	**2**
CO 4	**2**	**3**	**2**	**2**	**3**
CO 5	**2**	**3**	**3**	**3**	**2**
Ave.	**2.4**	**2.6**	**2.4**	**2.6**	**2.4**

PO-PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	PO'sPSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Recall the basic concepts of matrices, finite difference, trigonometry, basic differentiation and differential equations.	1-5	K1
CO2	Understand the types of Matrices, interpolation of unknown values, expansion of trigonometric functions, higher order derivatives, solving differential equations	1-5	K1, K2
CO3	Apply operations of matrix to find eigen value, interpolation formula, expansion of sine series, Jacobian function and complimentary functions.	1-5	K3
CO4	Analyze the verification of Cayley-Hamilton, interpolation for equal intervals, hyperbolic functions, particular solutions.	1-5	K3, K4
C O5	Evaluate inverse using Cayley-Hamilton, interpolation for unequal intervals, inverse hyperbolic, maximum and minimum of a function, general solution for differential equations.	1-5	K4, K5

K1= Remember, K2= Understand, K3= Apply, K4=Analyze, K5= Evaluate, K6= Create

Continuous Internal Assessment - Components			
Assessment Type	**Nature**	**Maximum Marks**	**Weightage**
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Content -3, Presentation - 2	5	5
Workbook/recordbook/ notebook	Neatness & Presentation - 3, Regularity – 2	5	5
Class activity 1	Quiz with MCQ (Correct Answers - 3, Speed - 2) / Rapid Fire (Quick Response - 3, Accuracy - 2) / Concept Mapping (Understanding of Concept - 3, Logical Connections - 2) / Others	5	5
Class activity 2	Group Discussion (Subject Knowledge - 3, Communication Skills - 2) / Case Study (Application of Concepts - 3, Problem Solving Ability - 2) Discussion/Debate (Content Knowledge - 3, Argument Strength - 2) / Others	5	5
Class activity 3	Learn about any one country of your choice. Scrap book (Idea Generation - 3, Sharing with Class - 2) / Role Play (Creativity and Expression - 3, Team Coordination - 2) / Puzzle (Logical Thinking - 3, Speed - 2) / Others	5	5
Attendance	Marks will be given based on the attendance percentage of respective course		5
Total			50

The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed)

1) Quiz with MCQ
2) Case-Study analysis
3) Debate
4) Seminar/ Presentation
5) Peer/Self-Assessment
6) Role play
7) Scrap book
8) Monograph
9) Puzzle
10) Group Discussion
11) Group activity
12) Surprise class tests

PROGRAMME: B.SC. COMPUTER SCIENCE	BATCH: 2026 -2029
PART: IV	COURSE COMPONENT: NON-MAJOR ELECTIVE I
COURSE NAME: PRACTICAL – DIGITAL LITERACY USING GOOGLE APPLICATIONS	COURSE CODE: 26UNME4A058
SEMESTER: I	MARKS: 100
CREDITS: 2	TOTAL HOURS: 30
PRACTICAL	

COURSE OBJECTIVE:

To develop proficiency in Google Workspace applications and practical skills in cloud-based tools for effective digital communication, collaboration, and content management.

COURSE OUTCOMES:

1. Understand the fundamentals of Internet and Web concepts.
2. Explain the usage of internet concepts and analyze its components.
3. Identify and apply the online information resources.
4. Inspect and utilize the appropriate Google Apps for education effectively.
5. Describe Presentation design principles and create digital content.

PROGRAMS **(6 HOURS)**

1. Create a basic resume using a word processor and upload it to any job or internship portal.
2. Create a one-page story in the mother tongue by using the voice recognition facility of Google Docs.
3. Writing a blog posts that contain images and hyperlinks to other websites using Google Docs.

(6 HOURS)

4. Create a meeting using Google calendar and share the meeting ID with the attendees. Transfer the ownership to the Manager once the meeting ID is generated.
5. Create a label and upload bulk contacts using the import option in Google Contacts.
6. Create a Google classroom and invite all your friends through email ID. Post study material in Google classroom using Google drive. Create a separate folder for every subject and upload all unit wise E-Content Materials.

(6 HOURS)

7. Create and share a folder in Google Drive using the 'share a link' option and set the permission to access that folder by your friends only.
8. Create a registration form for your Department Seminar or Conference using Google Forms.
9. Create a question paper with multiple-choice types of questions for a subject of your choice, using Google Forms.

(6 HOURS)

10. Create a Google form with a minimum of 25 questions to conduct a quiz and generate a certificate after submission.
11. Create a meet using Google Calendar and record the meet using Google Meet.
12. Create a student marksheet table using Google Sheets with appropriate formatting.

(6 HOURS)

13. Create a table and insert a chart using Google Sheets and share the same with your friends.
14. Prepare slideshow containing mini-textbooks/personal art/writing portfolios
15. Prepare a slideshow to create an animated story and share the same with your friends.

PSO – CO MAPPING

	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO 5**
CO 1	3	3	2	3	3
CO 2	3	3	3	2	2
CO 3	3	3	3	2	3
CO 4	3	3	3	3	2
CO 5	3	2	3	3	3
Ave.	**3**	**2.8**	**2.8**	**2.6**	**2.6**

PO- PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	POs,PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Understand the fundamentals of Internet and Web concepts.	PO1 to PO5, PSO1 to PSO5	K2
CO2	Explain the usage of internet concepts and analyze its components.	PO1 to PO5, PSO1 to PSO5	K2, K4
CO3	Identify and apply the online information resources.	PO1 to PO5, PSO1 to PSO5	K3
CO4	Inspect and utilize the appropriate Google Apps for education effectively.	PO1 to PO5, PSO1 to PSO5	K3, K4
CO5	Describe Presentation design principles and create digital content.	PO1 to PO5, PSO1 to PSO5	K2, K3

K1=Remember, K2=Understand, K3=Apply, K4=Analyze, K5=Evaluate, K6=Create

Continuous Internal Assessment – Components			
Assessment Type	**Nature**	**Maximum Marks**	**Weightage**
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Assignment based on experimental concepts	10	5
Workbook/recordbook/ notebook	Handwritten record of experiments, observations, results, and conclusions	10	5
Class activity 1	Hands-on Skill Assessment	10	5
Class activity 2	Group Activity	10	5
Class activity 3	Online Certification	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50

The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed)

1. *Quiz with MCQ*
2. *Seminar / Presentation*
3. *Peer/Self-Assessment*
4. *Puzzle*
5. *Group Discussion*
6. *Group activity*
7. *Surprise class tests*
8. *Case-Study Analysis*

PROGRAMME: ALL UG	BATCH: 2026 – 2029
PART: IV	COURSE COMPONENT: LIFE SKILL – I
COURSE NAME: VALUE EDUCATION	COURSE CODE: 26UVED401
SEMESTER: I	MARKS:100
CREDITS: 2	TOTAL HOURS: 30
THEORY	

COURSE OBJECTIVE:

To inculcate human values, ethical principles, social responsibility, and awareness of responsible technology use for holistic personal and societal development.

COURSE OUTCOMES:

On completion of the course, the students will be able to:

1. Recall core value systems and their relevance to real-life situations and ethical decision-making in personal and social contexts.
2. Describe the role of culture and civilization in shaping individual and collective identities.
3. List salient values for life such as forgiveness, sacrifice, self-esteem, teamwork, and creative thinking.
4. Describe the role of human rights, social values, and ethical use of Artificial Intelligence in addressing contemporary social issues.
5. Recall the teachings of Guru Nanak Dev Ji and describe their connection to values and sustainable living.

UNIT I: EDUCATION AND VALUES

Definition, Concept, Classification, Theory, Criteria and Sources of values Aims and objectives of value education Role and Need for value education in the contemporary society, Role of education in transformation of values in society Role of parents, teachers, society, peer group and mass media in fostering values

UNIT II: VALUE EDUCATION AND PERSONAL DEVELOPMENT

Human Values: Truthfulness, Sacrifice, Sincerity, Self-Control, Altruism, Scientific Vision, relevancy of human values to good life. Character Formation towards Positive Personality

Modern challenges of adolescents: emotions and behavior Self-analysis and introspection: sensitization towards gender equality, differently abled, Respect for - age, experience, maturity, family members, neighbors, strangers, etc.

UNIT III: HUMAN RIGHTS AND MARGINALIZED PEOPLE

Concept of Human Rights – Principles of human rights – human rights and Indian constitution – Rights of Women and children – violence against women – Rights of marginalized People – like women, children, minorities, transgender, differently abled etc. Social Issues and Communal Harmony Social issues – causes and magnitude - alcoholism, drug addiction, poverty, unemployment – communal harmony –concept –religion and its place in public domain –secular civil society

UNIT IV: VALUE EDUCATION TOWARDS NATIONAL AND GLOBAL DEVELOPMENT

Constitutional Values: (Sovereign, Democracy, Socialism, Secularism, Equality, Justice, Liberty, Freedom, Fraternity)
Social Values: (Pity and Probity, Self-Control, Universal Brotherhood).
Professional Values: (Knowledge Thirst, Sincerity in Profession, Regularity, Punctuality, Faith).
Religious and Moral Values: (Tolerance, Wisdom, character).
Aesthetic Values: (Love and Appreciation of literature, fine arts)
Environmental Ethical Values, National Integration and international understanding.
Need for Humanistic values for espousing peace in society.
Conflict of cross-cultural influences, cross-border education.
Emerging Technologies and Human Values: (Ethical and responsible use of Artificial Intelligence, digital citizenship, privacy, academic integrity and technology for social good).

UNIT V:

Guru Nanak Devji's Teachings
Relevance of Guru Nanak Devji's teachings' relevance to Modern Society
The Guru Granth Sahib
The five Ks, Values and beliefs
Rights and freedom (Right of equality, Right to Education, Right to Justice, Rights of women, Freedom of religion, Freedom of culture, Freedom of assembly, Freedom of speech), Empowerment of women, Concept of Langar, Eminent Sikh personalities

REFERENCE BOOKS:

1. Dr. Abdul Kalam. My Journey-Transforming Dreams into Actions. Rupa Publications, 2013.
2. Steven R Covey, 8th Habit of Effective People (From Effectiveness to Greatness), Free Press, New York, 2005.
3. Prem Singh, G.J. (2004). 'Towards Value Based Education', University News. Vol. 42 (45): P.11-12.
4. V.R. Krishna Iyer. Dialectics & Dynamics of Human Rights in India (Tagore Law Lectures) The Yesterday, Today and Tomorrow, Eastern Law House (1999, Reprint 2018)
5. http://www.ncert.nic.in/rightside/links/pdf/framework/english/nf2005.pdf
6. Saptarsi Goswami, Amit Kumar Das and Amlan Chakrabarti, AI for Everyone: A Beginner's Handbook for Artificial Intelligence (AI), Pearson India Education Services Pvt. Ltd., First Edition, 2024. ISBN: 978-9361590832.

QUESTION PAPER PATTERN: MCQ

SOFT SKILLS: COMMON TO ALL	BATCH: 2026- 2029
PART: IV	COURSE COMPONENT: ABILITY ENHANCEMENT SKILLS-I
COURSE NAME: COMMUNICATION SKILLS AND PERSONALITY DEVELOPMENT SKILLS	COURSE CODE: 26USKL401
SEMESTER: I	MARKS:100
CREDITS: 2	TOTAL HOURS: 30
THEORY	

COURSE OBJECTIVE

To build communication skills for personal and professional development.

COURSE OUTCOMES

1. Demonstrate the ability to actively listen to others, understand diverse perspectives, and paraphrase key points accurately, enhancing their comprehension skills in various personal and professional contexts.
2. Articulate thoughts, ideas, and information clearly and concisely, using appropriate language and structure to convey messages effectively in both written and verbal communication
3. Develop confidence in expressing opinions, asserting boundaries, and advocating for themselves and others, leading to enhanced self-assurance and effectiveness in interpersonal and group communication.
4. Demonstrate their communication style and approach based on the audience, context, and purpose of communication, fostering flexibility and versatility in interacting with diverse individuals and groups.
5. Acquire techniques for resolving conflicts, managing disagreements, and negotiating mutually beneficial outcomes through effective communication strategies, promoting constructive problem-solving and collaboration in personal and professional settings.

UNIT I TYPES OF COMMUNICATION (6 Hours)

Verbal Communication – Nonverbal Communication – Visual Communication – Written Communication – Interpersonal Communication – Group Communication – Mass Communication – Digital Communication – Barriers – Language – Cultural – Psychological – Semantic – Technological Barriers.

UNIT II ETIQUETTE & ETHICAL PRACTICES IN COMMUNICATION (6 Hours)

Active Listening – Respectful Language – Clarity and Conciseness – Truthfulness – Professionalism – Tone – Timeliness – Constructive Feedback – Confidentiality – Cultural Sensitivity – Emotional Intelligence – Social Intelligence – Social Etiquettes – Accountability.

UNIT III SELF ACTUALIZATION (6 Hours)

SWOC Analysis- Self Regulation-Self Evaluation, Self-Monitoring, Self- Criticism, Self-Motivation, Self-awareness and Reflection.

UNIT IV LEADERSHIP AND TEAMWORK (6 Hours)

Leadership Skills: Leadership styles – Goal-setting and decision-making – Motivation and influence – Team Dynamics: Team building activities – Conflict resolution – Collaborative problem-solving

UNIT V STRESS AND TIME MANAGEMENT (6 Hours)

Definition of Stress, Types of Stress, Symptoms of Stress, Stress coping ability, Stress Inoculation Training, Time Management and Work-Life Balance: Self-discipline Goal-setting

RECOMMENDED TEXTBOOKS

1. Goleman, Daniel (2006) *Emotional Intelligence*, Bantam Books
2. Linden, Wolfgang (2004) *Stress Management- From Basic Science to Better Practice-* University of British Columbia, Vancouver, Canada.
3. Hasson, Gill (2012) *Brilliant Communication Skills*. Great Britain: Pearson Education.
4. Monippally, Matthukutty, M. *Business Communication Strategies*. New Delhi: Tata McGraw- Hill Publishing Company Ltd., 2001.
5. Raman, Meenakshi & Sangeetha Sharma (2011*) Communication Skills*, Oxford University Press.

REFERENCE BOOKS

1. N.Krishnaswamy *Current English for College* (1st Edition) - Trinity Press
2. Wood, Julia T (2015) *Interpersonal Communication: Everyday Encounters* 8th Edition, Cengage Learning.

E-LEARNING RESOURCES

1. http://www.albion.com/netiquette/corerules.html
2. http://www.englishdaily626.com/c-errors.php
3. https://www.helpguide.org/articles/relationships-communication/nonverbal- communication.htm
4. https://www.communicationtheory.org/verbal-vs-non-verbal-communication-with- examples/
5. https://letstalkscience.ca/educational-resources/backgrounders/digital-citizenship-ethics
6. https://www.switchboard.app/learn/article/teamwork-leadership-skills

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

Section	Question Component	Numbers	Marks	Total
A	Answer any 5 out of 7 questions (answer in 50 words)	1-7	2	**10**
B	Answer any 4 out of 6 questions (answer in 300 words)	8-13	5	**20**
C	Answer any two Internal (Choice)	14-15	10	**20**
	Internal & Viva Voce		50	**50**

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	2	2	----
II	2	1	1
III	1	1	1
IV	1	1	1
V	1	1	1
TOTAL	**7**	**6**	**4**
	SECTION A – 7	**SECTION B – 6**	**SECTION C – 4**

SEMESTER II

PROGRAMME: B.Sc. COMPUTER SCIENCE	BATCH: 2026 – 2029
PART: III	COURSE COMPONENT: CORE – III
COURSE NAME: OBJECT ORIENTED PROGRAMMING USING JAVA	COURSE CODE: 26UCSC303
SEMESTER: II	MARKS: 100
CREDITS: 4	TOTAL HOURS: 90
THEORY	

COURSE OBJECTIVE:

To understand the Object-Oriented Programming features and the core concepts of Java Programming language.

COURSE OUTCOMES:

1. Recall the structure and execution model of Java.
2. Design Java programs using OOP and arrays.
3. Exhibit inheritance, packages, and interfaces in Java.
4. Evaluate exception handling and file I/O in Java.
5. Develop GUI applications using Swing and AWT.

UNIT I (12 HOURS)

Introduction to OOPS: Paradigms of Programming Languages – Basic concepts of Object-Oriented Programming – Procedure Oriented Programming vs. Object Oriented Programming – Benefits & Application of OOPs.

Introduction to Java: History – Java features – Java Environment – JDK API – Types of Java program – Creating and Executing a Java program – Java Tokens – Java Virtual Machine (JVM) – Command Line Arguments – Comments in Java program.

UNIT II (18 HOURS)

Java Programming Elements: Constants – Variables – Data types – Scope of variables – Type casting – Operators: Special operators – Expressions – Evaluation of Expressions. Decision making and branching statements – Looping statements – break – labelled loop – continue Statement.

Arrays in Java: One Dimensional Array – Creating an array – Array processing – Multidimensional Arrays.

Class and objects: Defining a class – Methods – Creating objects – Accessing class members – Constructors – Method overloading – Static members – Nesting of Methods – this keyword.

UNIT III (22 HOURS)

Inheritance: Definition – types of inheritance – Overriding methods – Final variables and methods – Final classes – Final methods – Abstract methods and classes – Visibility Control.

Packages: Java API Packages – System Packages – Naming Conventions – Creating & Accessing a Package – Adding Class to a Package – Hiding Classes

Interfaces: Defining interface – Extending interface – Implementing Interface – Accessing interface variables. Strings: String Array – String Methods – String Buffer Class.

UNIT IV **(20 HOURS)**

Exception Handling: Limitations of Error handling – Advantages of Exception Handling – Types of Errors – Basics of Exception Handling – try block – throwing an exception – catching an exception – finally statement.

Multithreading: Creating Threads – Life of a Thread –Defining & Running Thread – Thread Methods – Thread Priority – Synchronization – Implementing Runnable interface – Thread Scheduling.

I/O Streams: File – Streams – Advantages – The stream classes – Byte streams – Character streams.

UNIT V **(18 HOURS)**

The AWT class hierarchy – Swing: Introduction to Swing – Hierarchy of swing components. Containers – Top level containers – JFrame – JWindow – JDialog – JPanel – JButton – JToggleButton – JCheckBox – JRadioButton – JLabel – JTextField – JTextArea –JList – JComboBox – JScrollPane

Event Handling: Events – Event sources – Event Listeners – Event Delegation Model (EDM) – Handling Mouse and Keyboard Events – Layout Managers – Menus.

Introduction to JApplet: Applet Life cycle – Creating & Executing a JApplet – Applet tag in HTML

Graphics Class: Drawing and filling lines – Rectangles – Polygon – Circles – Font and Color classes.

PRESCRIBED BOOKS:

1. Herbert Schildt, "Java: The Complete Reference", TataMcGraw Hill, 12th Edition.

REFERENCE BOOKS:

1. E. Balagurusamy, "Programming with Java", Tata McGraw Hill, 7th Edition.
2. Sagayaraj, Denis, Karthick and Gajalakshmi, "Java Programming for Core and Advanced Learners", Universities Press (INDIA) Private Limited 2018.
3. Gary Cornell, "Core Java 2 Volume I – Fundamentals", Addison Wesley.
4. Head First Java, O'Rielly Publications, Y. Daniel Liang, Introduction to Java Programming, 7th Edition, Pearson Education India.

E-LEARNING RESOURCES:

1. https://NPTEL.ac.in/courses/106105191/
2. https://www.mooc-list.com/tags/java-programming
3. https://docs.oracle.com/javase/tutorial/ https://www.geeksforgeeks.org/java/
4. https://www.w3schools.com/java/

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	*Answer any 10 out of 12 questions (each in 50 words)*	*1-12*	*3*	*30*
B	*Answer any 5 out of 7 questions (each in 300 words)*	*13-19*	*6*	*30*
C	*Answer any 4 out of 6 questions (each in 1200 words)*	*20-25*	*10*	*40*
TOTAL MARKS				**100**

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	2	2	1
II	3	2	1
III	2	1	2
IV	3	1	1
V	2	1	1
TOTAL	**12**	**7**	**6**
	SECTION A – 12	**SECTION B – 7**	**SECTION C – 6**

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	3	2	3	3
CO 2	3	2	3	3	2
CO 3	3	3	3	2	2
CO 4	3	2	3	2	3
CO 5	3	3	2	2	3
Ave.	3	2.6	2.6	2.4	2.6

PO- PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	POs, PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Recall the structure and execution model of Java.	PSO1 to PSO5 PO1 to PO5	K1, K2, K3, K4, K5
CO2	Design Java programs using OOP and arrays.	PSO1 to PSO5 PO1 to PO5	K1, K2, K3, K4, K5
CO3	Exhibit inheritance, packages, and interfaces in Java.	PSO1 to PSO5 PO1 to PO5	K1, K2, K3, K4, K5
CO4	Evaluate exception handling and file I/O in Java.	PSO1 to PSO5 PO1 to PO5	K1, K2, K3, K4, K5
CO5	Develop GUI applications using Swing and AWT.	PSO1 to PSO5 PO1 to PO5	K1, K2, K3, K4, K5

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

Continuous Internal Assessment – Components			
Assessment Type	**Nature**	**Maximum Marks**	**Weightage**
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 Minutes	100	10
Assignment	Written assignment on Course Related Topics	10	5
Workbook / record book / notebook	Handwritten Notes	10	5
Class activity 1	Quiz with MCQ	10	5
Class activity 2	Seminar / Presentation	10	5
Class activity 3	Surprise Class Tests	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50

The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed)

1. *Quiz (MCQ / Objective Test)*
2. *Practical Lab Exercises*
3. *Hands-on Skill Assessment*
4. *Seminar / Presentation*
5. *Group Activity / Collaborative Task*
6. *Peer / Self-Assessment*
7. *Case Study / Scenario-Based Task*
8. *Surprise Practical Test*

PROGRAMME: B.Sc. COMPUTER SCIENCE	**BATCH: 2026 – 2029**
PART: III	**COURSE COMPONENT: CORE – IV**
COURSE NAME: PRACTICAL II: OBJECT ORIENTED PROGRAMMING USING JAVA	**COURSE CODE: 26UCSC304P**
SEMESTER: II	**MARKS:100**
CREDITS: 4	**TOTAL HOURS: 60**
PRACTICAL	

COURSE OBJECTIVE:

Familiarize yourself with the Java programming concepts through execution of programs.

COURSE OUTCOMES:

1. Execute basic Java programming constructs hands-on.
2. Apply classes and strings to Java programming problems.
3. Design Java programs using packages and exception handling.
4. Develop Java applications with multithreading and file handling.
5. Create a GUI application using Applet and Swing.

LIST OF PROGRAMS: **(15 Hours)**

1. Write a menu-driven Java program using switch statement to
   (a) Swap two numbers
   (b) Check whether the given number is prime.

2. Write a Java program to search an element in the given array using linear search.

3. Write a Java program to perform matrix addition.

4. Write a Java program to perform matrix multiplication.

(15 Hours)

5. Write a Java program to print the student grade sheet using class and object.

6. Write a Java program to demonstrate constructors.

7. Write a Java program to demonstrate inheritance.

8. Write a Java program to demonstrate method overloading.

(15 Hours)

9. Write a Java program to demonstrate method overriding.

10. Write a Java program to demonstrate packages.

11. Write a Java program to demonstrate interfaces.

12. Write a Java program to demonstrate Exception Handling.

(15 Hours)

13. Write a Java program to demonstrate Threads.

14. Write a Java program to copy the contents of one file to another file.

15. Write a Java Applet program using Swing components and a Layout Manager.

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	3	2	3	2
CO 2	3	3	2	3	2
CO 3	3	3	3	2	3
CO 4	2	3	3	3	3
CO 5	3	2	3	3	3
Ave.	2.8	2.8	2.6	2.8	2.6

PO-PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	POs.PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Execute basic Java programming constructs hands-on.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO2	Apply classes and strings to Java programming problems.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO3	Design Java programs using packages and exception handling.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO4	Develop Java applications with multithreading and file handling.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO5	Create a GUI application using Applet and Swing.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

Continuous Internal Assessment – Components			
Assessment Type	**Nature**	**Maximum Marks**	**Weightage**
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Assignment based on experimental concepts	10	5
Workbook/recordbook/ notebook	Handwritten record of experiments, observations, results, and conclusions	10	5
Class activity 1	Hands-on Skill Assessment	10	5
Class activity 2	Group Activity	10	5
Class activity 3	Online Certification	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50

The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed)

1. *Quiz with MCQ*
2. *Seminar / Presentation*
3. *Peer/Self-Assessment*
4. *Puzzle*
5. *Group Discussion*
6. *Group activity*
7. *Surprise class tests*
8. *Case-Study Analysis*

PROGRAMME: B.Sc.(CS), BCA, B.Sc.(IT)	BATCH: 2026 – 2029
PART: III	COURSE COMPONENT: ALLIED – II
COURSE NAME: STATISTICS	COURSE CODE: 26UCSC3A2
SEMESTER: II	MARKS:100
CREDITS: 4	TOTAL HOURS: 90
THEORY AND PROBLEMS	

COURSE OBJECTIVE:

Understand about data and use various statistical techniques to measure and compare the relation between data points.

COURSE OUTCOMES:

1. Demonstrate the fundamentals of statistics and represent statistical data using graphical methods such as bar charts, pie diagrams, histograms, frequency polygons, and ogives.
2. Analyze measures of central tendency including mean, median, mode, quartiles, deciles, percentiles, and relationships among arithmetic mean, geometric mean, and harmonic mean.
3. Examine measures of dispersion such as range, mean deviation, quartile deviation, standard deviation, coefficient of variation, interquartile deviation, and mean absolute deviation.
4. Analyze correlation and regression techniques including Karl Pearson's coefficient, Spearman's rank correlation, and linear regression equations for statistical interpretation.
5. Apply probability concepts, axioms, independent events, addition and multiplication theorems, and Bayes' theorem in solving statistical problems.

UNIT I **(18 Hours)**

Introduction to statistics: Definition, Characteristics, Graphical Representation of data: Bar charts, Pie Diagrams, Histograms, Frequency polygon, Ogives.
Volume I: Chapter 1, Chapter 6

UNIT II **(18 Hours)**

Measures of Central Tendency: Mean, Median, Mode, graphical location of median, quartiles, deciles, percentiles, relation among arithmetic mean, geometric mean and harmonic mean.
Volume I: Chapter 7

UNIT III **(18 Hours)**

Measures of Dispersion: Range, Mean deviation, Quartile deviation, Standard deviation, Coefficient of variation, Inter quartile deviation, Mean Absolute deviation.
Volume I: Chapter 8

UNIT IV **(18 Hours)**

Correlation and Regression: Correlation: Meaning, Applications, types of degree of correlation, Scatter diagram, Karl Pearson's Coefficient of Correlation, Spearman's Rank Correlation. Regression: Meaning, uses, Difference between correlation and regression, linear regression equations.
Volume I : Chapter 10 and Chapter 11

UNIT V **(18 Hours)**

Probability: Basic probability, axioms of probability, independent events, Addition and Multiplication theorem (Statement only), Baye's theorem
Volume II : Chapter 1

PRESCRIBED BOOK:

1. Treatment and content as in "Statistical Methods" – S.P. Gutpa,Sultan Chand & Sons 45th Edition(2017)

REFERENCE BOOKS:

1. New Mathematical statistics - Sanjay Arora &Bansilal (2002), Meerat Publications, New Delhi
2. Fundamentals of Mathematical Statistics - Gupta,S.C. and Kapoor, V.K.(2000): 10/e, Sultan Chand & Sons
3. Basic Statistics - 3/Agarwal .B.L (1996): e ,New Age International(P) Ltd.,
4. Statistics for Business and Economics - Hooda.R.P.(2003): 3/e, MacMillan.

E - LEARNING RESOURCES:

1. https://www.digimat.in/nptel/courses/video/110107114/L01.html
2. https://ocw.mit.edu/courses/14-30-introduction-to-statistical-method-in-economics-spring-2006/
3. www.e-booksdirectory.com
4. www.bookboon.com/en/statistics-andmathematics-ebooks

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	Answer any 10 out of 12 questions	1 - 12	3	30
B	Answer any 5 out of 7 questions	13 - 19	6	30
C	Answer any 4 out of 6 questions	20 - 25	10	40
TOTAL MARKS				**100**

BREAK UP OF QUESTIONS FOR THEORY AND PROBLEMS

UNITS	SECTION A		SECTION B		SECTION C	
	THEORY	PROBLEM	THEORY	PROBLEM	THEORY	PROBLEM
I	2	-	-	1	-	1
II	1	1	-	1	-	1
III	-	2	-	1	-	1
IV	1	1	-	1	-	1
V	1	1	-	1	-	1
Any Unit	-	2	-	2	-	1
TOTAL	5	7	-	7	-	6
SECTION A – 12			**SECTION B - 7**		**SECTION C - 6**	

PO – CO MAPPING

CO	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	2	2
CO2	3	3	2	2	2
CO3	2	2	3	2	2
CO4	2	3	3	2	2
CO5	2	3	3	3	2
Average	**2.4**	**2.6**	**2.6**	**2.2**	**2.0**

PSO – CO MAPPING

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	2	2
CO2	3	3	2	2	2
CO3	2	2	3	2	2
CO4	2	3	3	2	2
CO5	2	3	3	3	2
Average	**2.4**	**2.6**	**2.6**	**2.2**	**2.0**

PO – PSO – CO QUESTION PAPER MAPPING

CO No:	COURSE OUTCOMES	POs & PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Demonstrate the properties of matrices and determine eigen values and eigen vectors using Cayley–Hamilton theorem.	PSO 1, PSO 2, PSO 3, PSO 4, PSO 5	K1, K2, K3, K4, K5
CO2	Apply finite difference operators and interpolation techniques such as Newton's forward, backward, and Lagrange interpolation formulae for numerical analysis	PSO 1, PSO 2, PSO 3, PSO 4, PSO 5	K1, K2, K3, K4, K5
CO3	Expand trigonometric functions and apply hyperbolic and inverse hyperbolic functions in mathematical problem solving.	PSO 1, PSO 2, PSO 3, PSO 4, PSO 5	K1, K2, K3, K4, K5
CO4	Analyze functions using differentiation techniques, Jacobians, and maxima and minima of functions of two variables	PSO 1, PSO 2, PSO 3, PSO 4, PSO 5	K1, K2, K3, K4, K5
CO5	Solve second order differential equations with constant coefficients involving exponential, trigonometric, and polynomial functions.	PSO 1, PSO 2, PSO 3, PSO 4, PSO 5	K1, K2, K3, K4, K5

K1= Remember, K2= Understand, K3= Apply, K4=Analyze, K5= Evaluate, K6= Create

Continuous Internal Assessment - Components			
Assessment Type	**Nature**	**Maximum Marks**	**Weightage**
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Content -3, Presentation - 2	5	5
Workbook / recordbook / notebook	Neatness & Presentation - 3, Regularity – 2	5	5
Class activity 1	Quiz with MCQ (Correct Answers - 3, Speed - 2) / Rapid Fire (Quick Response - 3, Accuracy - 2) / Concept Mapping (Understanding of Concept - 3, Logical Connections - 2) / Others	5	5
Class activity 2	Group Discussion (Subject Knowledge - 3, Communication Skills - 2) / Case Study (Application of Concepts - 3, Problem Solving Ability - 2) Discussion/Debate (Content Knowledge - 3, Argument Strength - 2) / Others	5	5
Class activity 3	Learn about any one country of your choice. Scrap book (Idea Generation - 3, Sharing with Class - 2) / Role Play (Creativity and Expression - 3, Team Coordination - 2) / Puzzle (Logical Thinking - 3, Speed - 2) / Others	5	5
Attendance	Marks will be given based on the attendance percentage of respective course		5
Total			50

The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed)

1) Quiz with MCQ
2) Case-Study analysis
3) Debate
4) Seminar/ Presentation
5) Peer/Self-Assessment
6) Role play
7) Scrap book
8) Monograph
9) Puzzle
10) Group Discussion
11) Group activity
12) Surprise class tests

PROGRAMME: Open to all Programmes except B.Sc. COMPUTER SCIENCE	BATCH: 2026 – 2029
PART: IV	COURSE COMPONENT: NON-MAJOR ELECTIVE -II
COURSE NAME: DIGITAL LITERACY: NAVIGATING DIGITAL WORLD	COURSE CODE: 26UNME4B058
SEMESTER: II	MARKS:100
CREDITS: 2	TOTAL HOURS: 30
THEORY	

COURSE OBJECTIVE:

To equip students with the knowledge and skills of digital society and to engage students with digital technologies in their personal and professional lives.

COURSE OUTCOMES:

1. Examine the functions of computers, computer hardware, and file management.
2. Manage to store and share files in the cloud.
3. Design graphics and presentations using Content creation tools.
4. Identify and prevent cyber security threats and phishing attempts.
5. Acquire Physical and Mental health by practicing proper strategies.

UNIT I **(6 HOURS)**

Basics of Computing: Hardware Vs Software – Operating System: Windows, MacOS, Linux - Introduction to File Management.

UNIT II **(6 HOURS)**

Online File Storage and Sharing: Google Drive Uploading, Organizing and Sharing Files and Folders – Best Practices for file Organization and Share Permissions.

UNIT III **(6 HOURS)**

Visual Content Creation Tools: Canva – Designing graphics, Presentations and Social media Posts- Design principles for creating Visually appealing Content.

UNIT IV **(6 HOURS)**

Digital Security: Cyber security threats and Vulnerabilities – Password management and best Practices- Recognizing Phishing scams and malware.

UNIT V **(6 HOURS)**

Digital Wellness: Managing Screen time and Digital distractions – Mental health Considerations in the digital age.

PRESCRIBED BOOKS:

1. Fundamentals of Information Technology – Alexis Leon, Mathews Leon.
2. Introduction to Cyber Security: Guide to the World of Cyber Security – Anand Shinde.

REFERENCE BOOKS:

1. Fundamental of Computers – V. Rajaraman.
2. Cybersecurity Fundamentals: Best Security Practices - Bruce Brown.

E-LEARNING RESOURCES:

1. https://www-mooc--list-com.webpkgcache.com/doc/-/s/www.mooc-list.com/tags/digital-literacy
2. https://www.mooc4dev.org/DigiLitMOOC
3. https://www.javatpoint.com/computer-fundamentals-tutorial
4. https://www.javatpoint.com/ict-tools

QUESTION PAPER PATTERN: MULTIPLE CHOICE QUESTIONS

Continuous Internal Assessment – Components			
Assessment Type	**Nature**	**Maximum Marks**	**Weightage**
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Written assignment on Course Related Topics	10	5
Workbook/recordbook/ notebook	Handwritten Notes	10	5
Class activity 1	Quiz with MCQ	10	5
Class activity 2	Seminar / Presentation	10	5
Class activity 3	Group Activity	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50

The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed)

1. *Quiz (MCQ / Objective Test)*
2. *Practical Lab Exercises*
3. *Hands-on Skill Assessment*
4. *Seminar / Presentation*
5. *Group Activity / Collaborative Task*
6. *Peer / Self-Assessment*
7. *Case Study / Scenario-Based Task*
8. *Surprise Practical Test*

PROGRAMME: ALL UG	BATCH: 2026 – 2029
PART: IV	COURSE COMPONENT: ABILITY ENHANCEMENT SKILLS – II
COURSE NAME: FOUNDATIONS OF QUANTITATIVE APTITUDE	COURSE CODE: 26USKL402
SEMESTER: II	MARKS:100
CREDITS: 2	TOTAL HOURS: 30
THEORY AND PROBLEMS	

COURSE OBJECTIVE

Develop learners' problem-solving skills and critical thinking abilities in the context of recruitment aptitude tests.

COURSE OUTCOME

1. Apply the concepts of number systems, divisibility rules, and number series to solve numerical problems.
2. Compute HCF and LCM of numbers using prime factorization method.
3. Apply percentage concepts to solve problems involving profit, loss, cost price, and selling price.
4. Compare simple interest and compound interest to solve financial problems.
5. Interpret data from tables and graphs to draw meaningful conclusions.

UNIT I: Number system and Number series (6 HOURS)

Numbers: Numbers and their classification, test for divisibility of numbers, General properties of divisibility, division and remainder, remainder rules.

Number Series: Number series, three steps to solve a problem on series, two-line number series, sum rules on natural numbers.

UNIT II: HCF and LCM of Numbers (6 HOURS)

Factors, Multiples, Principal of Prime factorization, Highest Common Factor (HCF) and Least Common Multiple (LCM), Product of two numbers, Difference between HCF and LCM.

UNIT III: Percentage, Profit and Loss (6 HOURS)

Percentage: Introduction, fraction to rate percent, rate percent to fraction, rate percent of a number, express a given quantity as a percentage of another given quantity, convert a percentage into decimals and convert a decimal into percentage.

Profit and Loss: Gain/Loss and % gain and % loss, relation among Cost price, Sale price, Gain/Loss and % gain and % loss.

UNIT IV: Simple Interest and Compound Interest **(6 HOURS)**

Simple Interest: Definition, effect of change of *P, R and T* on Simple Interest, amount.

Compound Interest: Introduction, conversion period, basic formula, to find the Principal / Rate / Time, Difference between Simple Interest and Compound Interest.

UNIT V: Data interpretation **(6 HOURS)**

Tabulation, Bar Graphs, Pie Charts, Line Graphs, average.

PRESCRIBED BOOK:

1. Quantitative Aptitude by R.S. Agarwal

REFERENCE BOOKS:

1. Quantitative Aptitude by Abhijit Guha, Fourth Edition.
2. Quantitative Aptitude by Ramandeep Singh.

E - LEARNING RESOURCES:

1. https://byjus.com/maths/numeralsystem/#:~:text=crore%20is%207.,International%20Numeral
   %20System,8%20%E2%80%93%20Ones
2. https://byjus.com/maths/hcf-and-lcm/
3. https://byjus.com/maths/profit-loss-percentage/
4. https://www.vedantu.com/jee-main/maths-difference-between-simple-interest-and compound-interest
5. https://sites.utexas.edu/sos/guided/descriptive/descriptivec/frequency/

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	Multiple Choice Questions: Answer 20 out of 20 questions (each question carries one mark)	1 – 20	20	20
B	Answer any 5 out of 7 questions (each question carries 6 marks)	21 – 27	6	30
TOTAL MARKS				**50**

BREAK UP OF QUESTIONS FOR PROBLEMS

UNITS	SECTION A	SECTION B
I	4	1
II	4	1
III	4	1
IV	4	1
V	4	1
Any Unit	-	2
TOTAL	**20**	**7**

SEMESTER III

PROGRAMME: B.Sc. COMPUTER SCIENCE	BATCH: 2026 – 2029
PART: III	COURSE COMPONENT: CORE – V
COURSE NAME: PYTHON PROGRAMMING AND DATA STRUCTURES	COURSE CODE: 26UCSC305
SEMESTER: III	MARKS:100
CREDITS: 4	TOTAL HOURS:90
THEORY	

COURSE OBJECTIVE:

The course aims to provide a comprehensive understanding of Python programming, including basic syntax, data structures, object-oriented programming, and algorithms, enabling students to implement efficient solutions using various data structures and algorithms like trees, graphs, stacks, and queues.

COURSE OUTCOMES:

1. Recall Python syntax, data types, and control structures.
2. Explain the use of functions, lists, and dictionaries in Python.
3. Apply OOP to design Python classes with inheritance.
4. Design Python programs for stack, queue, and linked list.
5. Evaluate BFS, DFS, and binary tree traversal algorithms.

UNIT I: (15 Hours)

Introduction to Python: Introduction -Python Overview -Comments -Python Identifiers -Reserved Keywords -Variables - Data Types -Operators -Statement and Expression -**Control Statements**: simple if. if..else, if-elif statements -for loop –while loop –else in for and while -break and continue statements -Input and Output Statements in Python

UNIT II: (20 Hours)

Functions: Introduction -Built-in Functions -User Defined Functions -Parameters and Arguments - Function Calls -The return Statement -Python Recursive Function -The Anonymous Functions **Strings and Lists:** Strings: Creating and accessing elements -Traverse, slice and operations- in-built string methods and functions -Lists : Creating and accessing elements- Traverse, slice and operations- in-built string methods and functions

UNIT III: (20 Hours)

Tuples and Dictionaries: Tuples: Creating and accessing elements- Traverse, slice and operations- in-built string methods and functions -Dictionaries: Creating dictionaries and Accessing Values

Classes and Objects: Overview of OOP (Object-Oriented Programming) -Class Definition -Creating Objects -Objects as Arguments -Objects as Return Values - Built-in Class Attributes--Data Encapsulation - Inheritance -Method Overriding

UNIT IV: **(20 Hours)**

Introduction to Data Structure - Arrays: Single and Multi-dimensional Arrays - **Stack:** Implementing stack using array - Recursion - Prefix, Infix and Postfix expressions, Conversion from Infix to Postfix – Postfix evaluation.

Queue: Array implementation of Queue, Circular Queue - Singly Linked List-representation of Stack and Queue as Linked Lists.

UNIT V: **(15 Hours)**

Trees: Introduction - Binary Trees - Binary Search Tree. **Creation and Traversal:** Inorder, Preorder and Postorder. **Graph:** Definition, Types of Graphs, Traversal – Breadth First Search and Depth First Search.

PRESCRIBED BOOKS:

1. Downey,Allen B Think Python 2nd edition 2012, Green Tea Press.
2. Y Daniel Liang, Introduction to Python Programming and Data Structures Third Edition, Pearson publications

REFERENCE BOOKS:

1. Sweigart, Al . Automate the Boring Stuff with Python, 2019, https://automatetheboringstuff.com/
2. Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd. ISBN-13: 978-8126556014, https://ggnindia.dronacharya.info/Downloads/Sub- info/RelatedBook/PYTHON-REFERENCE-BOOK-1.pdf.
3. Sahni S. Data Structures, Algorithms and Applications in C++. New York, NY: McGraw-Hill; 2000.
4. Puntambekar, A. A. (2020). Data Structures: Concepts and Implementation. Amazon Digital Services LLC - KDP Print.

E-**LEARNING RESOURCES:**

1. NPTEL, MOOC and coursera courses on Analysis of algorithms and data structures
2. https://www.w3schools.com/python/
3. https://www.tutorialspoint.com/python/index.htm
4. https://www.geeksforgeeks.org/python-programming-language-tutorial/
5. https://www.javatpoint.com/data-structure-tutorial

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	*Answer any 10 out of 12 questions (each in 50 words)*	*1-12*	*3*	*30*
B	*Answer any 5 out of 7 questions (each in 300 words)*	*13-19*	*6*	*30*
C	*Answer any 4 out of 6 questions (each in 1200 words)*	*20-25*	*10*	*40*
TOTAL MARKS				**100**

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	2	2	1
II	2	1	2
III	3	2	1
IV	3	1	1
V	2	1	1
TOTAL	**12**	**7**	**6**
	SECTION A – 12	**SECTION B – 7**	**SECTION C – 6**

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	3	3	2	3
CO 2	3	3	3	3	2
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
Ave.	3	3	3	2.8	2.8

PO-PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	POs, PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Recall Python syntax, data types, and control structures.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO2	Explain the use of functions, lists, and dictionaries in Python.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO3	Apply OOP to design Python classes with inheritance.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO4	Design Python programs for stack, queue, and linked list.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO5	Evaluate BFS, DFS, and binary tree traversal algorithms.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

Continuous Internal Assessment - Components			
Assessment Type	**Nature**	**Maximum Marks**	**Weightage**
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 Minutes	100	10
Assignment	Written assignment on Course Related Topics	10	5
Workbook / recordbook / notebook	Handwritten Notes	10	5
Class activity 1	Quiz with MCQ	10	5
Class activity 2	Seminar / Presentation	10	5
Class activity 3	Surprise Class Tests	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50

The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed)

1. *Quiz (MCQ / Objective Test)*
2. *Practical Lab Exercises*
3. *Hands-on Skill Assessment*
4. *Seminar / Presentation*
5. *Group Activity / Collaborative Task*
6. *Peer / Self-Assessment*
7. *Case Study / Scenario-Based Task*
8. *Surprise Practical Test*

PROGRAMME: B.Sc. COMPUTER SCIENCE	**BATCH: 2026 – 2029**
PART: III	**COURSE COMPONENT: CORE – VI**
COURSE NAME: PRACTICAL III – PYTHON PROGRAMMING AND DATA STRUCTURES	**COURSE CODE: 26UCSC306P**
SEMESTER: III	**MARKS:100**
CREDITS: 4	**TOTAL HOURS: 90**
PRACTICAL	

COURSE OBJECTIVE:

The course aims to equip students with practical Python programming skills to solve real-world problems involving data manipulation, mathematical operations, algorithm implementation, and data structure operations such as stacks, queues, trees, and graphs.

COURSE OUTCOMES:

1. Apply Python for conversions and string manipulations.
2. Apply recursion for Fibonacci and factorial in Python.
3. Analyze data using Python with strings and lists.
4. Design Python applications for stack and queue operations.
5. Develop Python code for BST and graph traversals.

PROGRAMS:

PYTHON **(50 Hours)**

1. Write a python program to convert the given temperature from Fahrenheit to Celsius and vice versa depending upon the user's choice.
2. Write a python program to prepare mark sheet with grade where grades are assigned based on the score:

Score	Grade
>=80	First Class with distinction
>=60	First Class
>=40	Second Class
<40	Fail

3. Write a python program that finds all prime numbers within a user-defined range.
4. Write a Python function to generate Fibonacci series.
5. Write a python program to find factorial of the given number using a recursive function.
6. Write a python program to count all consonants, vowels and digits from a given string.

7. Write a python program to remove the largest and smallest numbers from a list.
8. Write a program to create a function that takes two numbers as input and returns their sum, difference, product, and quotient as a tuple.
9. Write a python program to get day no and print day name using dictionary.

DATA STRUCTURES **(40 Hours)**

10. Write a python program to implement push and pop algorithms of stack using arrays
11. Write a python program to implement a program to convert infix notation to postfix notation using stack.
12. Write a python program to implement a program to evaluate postfix expression
13. Write a python program to implement enqueue and dequeue operations of queue using arrays
14. Write a python program to implement Binary Search Tree traversals: Preorder, Inorder and Postorder.
15. Write a python program to implement Graph traversals: Depth First Search and Breadth First Search

PSO – CO MAPPING

	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO5**
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	2	3	3	3
CO 4	3	3	2	3	3
CO 5	3	3	3	3	3
Ave.	3	2.8	2.8	3	3

Continuous Internal Assessment – Components			
Assessment Type	**Nature**	**Maximum Marks**	**Weightage**
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Assignment based on experimental concepts	10	5
Workbook/recordbook/ notebook	Handwritten record of experiments, observations, results, and conclusions	10	5
Class activity 1	Hands-on Skill Assessment	10	5
Class activity 2	Group Activity	10	5
Class activity 3	Online Certification	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50

The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed)

1. *Quiz with MCQ*
2. *Seminar / Presentation*
3. *Peer/Self-Assessment*
4. *Puzzle*
5. *Group Discussion*
6. *Group activity*
7. *Surprise class tests*
8. *Case-Study Analysis*

PROGRAMME: B.Sc. COMPUTER SCIENCE	BATCH: 2026 – 2029
PART: III	COURSE COMPONENT: ALLIED III
COURSE NAME: ADVANCED STATISTICS	COURSE CODE: 26UCSC3A3
SEMESTER: III	MARKS:100
CREDITS: 4	TOTAL HOURS: 90
THEORY AND PROBLEMS	

COURSE OBJECTIVE:

Understand about data and use of various statistical techniques.

COURSE OUTCOMES:

1. Demonstrate curve fitting techniques using the principle of least squares to fit straight line, parabola, exponential, and power curves for statistical data analysis.
2. Analyze discrete and continuous random variables, cumulative distribution functions, and mathematical expectations in probabilistic modelling.
3. Interpret statistical hypotheses and perform hypothesis testing using t-test for statistical decision making.
4. Examine statistical data using F-test and Chi-square test to test significance and independence of attributes.
5. Analyze variance using One-way and Two-way ANOVA, Completely Randomized Design (CRD), and Randomized Block Design (RBD) in experimental design problems.

UNIT I **(18 Hours)**

Curve fitting: Principle of least squares, fitting of straight line, parabola, exponential and power curve.

UNIT II **(18 Hours)**

Random Variables and Expectation: Discrete Random Variable, Continuous Random Variable, Cumulative Distribution, Properties of Distribution function. Definition of Mathematical Expectation and problems.

UNIT III **(18 Hours)**

Hypothesis: Meaning, types, standard hypothesis, null and alternative hypothesis, simple and composite hypothesis, type I and type II error, Testing of hypothesis: t- test.

UNIT IV **(18 Hours)**

F-Test, Chi Square Test, Test of Independence of Attributes.

UNIT V **(18 Hours)**

Analysis of Variance: One – Way Classification, Two – Way Classification. Design of Experiment: Completely Randomized Design and Randomized Block Design.

PRESCRIBED BOOKS:

1. Mathematical Statistics - by P. R. Vittal Margham Publications, 1st edition 2002.

REFERENCE BOOKS:

1. Statistical Methods - S.P.Gupta, Sultan Chand & Sons 45th Edition(2017).
2. New Mathematical statistics - Sanjay Arora & Bansilal (2002), Meerat Publications, New Delhi.
3. Fundamentals of Mathematical Statistics - Gupta,S.C. and Kapoor, V.K.(2000): 10/e, Sultan Chand & Sons.

E - LEARNING RESOURCES:

1. https://archive.nptel.ac.in/courses/103/106/103106120/
2. https://www.youtube.com/watch?v=ZfbWC4rqIiE
3. https://ocw.mit.edu/courses/9-07-statistics-for-brain-and-cognitive-science-fall 2016/8fa39994fa6b066d23c68c78f0923531_MIT9_07F16_lec12.pdf
4. https://mathisfunforum.com/viewtopic.php?id=28219

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	Answer any 10 out of 12 questions	1 – 12	3	30
B	Answer any 5 out of 7 questions	13 – 19	6	30
C	Answer any 4 out of 6 questions	20 – 25	10	40
TOTAL MARKS				**100**

BREAK UP OF QUESTIONS FOR THEORY

UNITS	SECTION A	SECTION B	SECTION C
I	2	1	1
II	2	1	1
III	2	1	1
IV	2	1	1
V	2	1	1
Any Unit	2	2	1
TOTAL	12	**7**	6
SECTION A – 12		**SECTION B - 7**	**SECTION C - 6**

PO – CO MAPPING

CO	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	2	2
CO2	3	3	2	2	2
CO3	2	3	3	2	2
CO4	2	3	3	2	2
CO5	2	3	3	3	2
Average	**2.4**	**2.8**	**2.6**	**2.2**	**2.0**

PSO – CO MAPPING

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	2	2
CO2	3	3	2	2	2
CO3	2	3	3	2	2
CO4	2	3	3	2	2
CO5	2	3	3	3	2
Average	**2.4**	**2.8**	**2.6**	**2.2**	**2.0**

PO – PSO – CO QUESTION PAPER MAPPING

CO No:	COURSE OUTCOMES	POs & PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Demonstrate curve fitting techniques using the principle of least squares to fit straight line, parabola, exponential, and power curves for statistical data analysis.	PSO 1, PSO 2, PSO 3, PSO 4, PSO 5	K1, K2, K3, K4, K5
CO2	Analyze discrete and continuous random variables, cumulative distribution functions, and mathematical expectations in probabilistic modelling.	PSO 1, PSO 2, PSO 3, PSO 4, PSO 5	K1, K2, K3, K4, K5
CO3	Interpret statistical hypotheses and perform hypothesis testing using t-test for statistical decision making.	PSO 1, PSO 2, PSO 3, PSO 4, PSO 5	K1, K2, K3, K4, K5
CO4	Examine statistical data using F-test and Chi-square test to test significance and independence of attributes.	PSO 1, PSO 2, PSO 3, PSO 4, PSO 5	K1, K2, K3, K4, K5
CO5	Analyze variance using One-way and Two-way ANOVA, Completely Randomized Design (CRD), and Randomized Block Design (RBD) in experimental design problems.	PSO 1, PSO 2, PSO 3, PSO 4, PSO 5	K1, K2, K3, K4, K5

K1= Remember, K2= Understand, K3= Apply, K4=Analyze, K5= Evaluate, K6= Create

Continuous Internal Assessment - Components			
Assessment Type	**Nature**	**Maximum Marks**	**Weightage**
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Content -3, Presentation - 2	5	5
Workbook/recordbook/ notebook	Neatness & Presentation - 3, Regularity – 2	5	5
Class activity 1	Quiz with MCQ (Correct Answers - 3, Speed - 2) / Rapid Fire (Quick Response - 3, Accuracy - 2) / Concept Mapping (Understanding of Concept - 3, Logical Connections - 2) / Others	5	5
Class activity 2	Group Discussion (Subject Knowledge - 3, Communication Skills - 2) / Case Study (Application of Concepts - 3, Problem Solving Ability - 2) Discussion/Debate (Content Knowledge - 3, Argument Strength - 2) / Others	5	5
Class activity 3	Learn about any one country of your choice. Scrap book (Idea Generation - 3, Sharing with Class - 2) / Role Play (Creativity and Expression - 3, Team Coordination - 2) / Puzzle (Logical Thinking - 3, Speed - 2) / Others	5	5
Attendance	Marks will be given based on the attendance percentage of respective course		5
Total			50

The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed)

1) Quiz with MCQ
2) Case-Study analysis
3) Debate
4) Seminar/ Presentation
5) Peer/Self-Assessment
6) Role play
7) Scrap book
8) Monograph
9) Puzzle
10) Group Discussion
11) Group activity
12) Surprise class tests

PROGRAMME: B.Sc. COMPUTER SCIENCE	BATCH: 2026 – 2029
PART: IV	COURSE COMPONENT: ABILITY ENHANCEMENT SKILL – III
COURSE NAME: PRACTICAL: INTRODUCTION TO UI / UX USING FIGMA	COURSE CODE: 26USKL410
SEMESTER: III	MARKS:100
CREDITS: 2	TOTAL HOURS: 30

COURSE OBJECTIVE:

This course aims to provide students with a comprehensive understanding of User Interface (UI) and User Experience (UX) design principles and equip them with practical skills in Figma — the industry-standard collaborative design tool.

COURSE OUTCOMES:

1. Define key UI/UX concepts, articulate the difference between UI / User Experience, and recall core usability principles and the Human-Centered Design (HCD) process.
2. Construct low-fidelity wireframes and information architectures using Figma tools and layout grids.
3. Analyze visual design principles such as typography, color theory, and Gestalt theory to evaluate and deconstruct existing UI designs.
4. Evaluate high-fidelity interactive prototypes through structured usability testing, and refine designs based on iterative feedback.
5. Design and deliver a complete, end-to-end UI/UX project from research to prototype, demonstrating proficiency in Figma collaboration, and professional design presentation skills.

UNIT I **(6 HOURS)**

Foundations of UI/UX Design: Introduction to UI and UX: Definitions, Differences, and Interdependencies – History and Evolution of User Interface Design – User-Centered Design (UCD) Principles and Design Thinking Process – Overview of the Design Process: Empathize, Define, Ideate, Prototype, Test – Introduction to Figma: Interface Tour, Workspace Setup, and Account Configuration – Figma Basics: Frames, Artboards, Shapes, Text, Colors, and Auto Layout Fundamentals.

UNIT II **(6 HOURS)**

Research, Wireframing & Information Architecture: UX Research Methods: User Interviews, Surveys, Contextual Inquiry – Personas, Empathy Maps, and User Journey Mapping – Information Architecture: Site Maps, Card Sorting, Navigation Patterns – Low-Fidelity Wireframing Concepts and Best Practices – Creating Wireframes in Figma: Grids, Layout Guides, and Component Placement – Responsive Design Principles: Mobile-First Approach and Breakpoints.

UNIT III **(6 HOURS)**

Visual Design Principles & Figma Components: Visual Design Fundamentals: Typography, Color Theory, Contrast, and Hierarchy – Gestalt Principles and their Application in UI Design – Design Systems: Atoms, Molecules, Organisms (Atomic Design Methoology) – Figma Components: Creating Master Components, Instances, and Variants – Styles in Figma: Color Styles, Text Styles, and Effect Styles – Icons, Imagery, and Illustrations: Sourcing and Integrating in Figma.

UNIT IV **(6 HOURS)**

Prototyping, Interaction Design & Usability Testing: Interaction Design Concepts: Affordances, Feedback, Micro-interactions – High-Fidelity Prototyping in Figma: Connections, Flows, and Transitions – Advanced Prototype Interactions: Overlays, Scroll Behavior, and Smart Animate – Usability Testing: Planning, Conducting, and Analyzing Test Results – Accessibility in UI/UX: WCAG Guidelines, Inclusive Design Principles – Iterative Design: Incorporating User Feedback and Design Critique Methods.

UNIT V **(6 HOURS)**

Collaboration, Handoff & Real-World Projects: Figma Collaboration Features: Real-Time Editing, Comments, and Multiplayer Design – Developer Handoff: Inspect Panel, CSS Properties, Asset Export in Figma – Figma Plugins and Integrations: Useful Plugins for Productivity and Creativity – Mobile App UI Design: Platform Guidelines (Material Design & Apple HIG) – Case Study: End-to-End UI/UX Project (Research → Wireframe → Prototype → Test).

REFERENCE BOOKS

1. Steve Krug, Don't Make Me Think, Revisited, New Riders, 3rd Ed., 2014.
2. Jeff Johnson, Designing with the Mind in Mind, Morgan Kaufmann, 3rd Ed., 2021.
3. Aarron Walter, Designing for Emotion, A Book Apart, 2nd Ed., 2020.
4. Alan Cooper et al, About Face: The Essentials of Interaction Design, Wiley, 4th Ed., 2014.
5. Brad Frost, Atomic Design, Brad Frost Web, 2016.
6. Frank Spillers & Chauncey Wilson, Usability Testing Essentials, Morgan Kaufmann, 2nd Ed., 2021.

E-LEARNING RESOURCES

1. https://help.figma.com/hc/en-us/categories/360002051613
2. https://grow.google/certificates/ux-design/
3. https://www.nngroup.com/articles/
4. https://www.interaction-design.org/
5. https://www.youtube.com/c/Figmadesign
6. https://dribbble.com
7. https://behance.net

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	3	2	3	2
CO 2	3	3	2	2	2
CO 3	2	3	3	2	3
CO 4	3	2	2	3	2
CO 5	2	2	2	2	2
Ave.	**2.6**	**2.6**	**2.2**	**2.4**	**2.2**

PO-PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	POs, PSOs ADDRESSED	COGNITIVE LEVEL (K1 TO K6)
CO1	Define key UI/UX concepts, articulate the difference between UI / User Experience, and recall core usability principles and the Human-Centered Design (HCD) process.	PO1 to PO5, PSO1 to PSO5	K1 to K6
CO2	Construct low-fidelity wireframes and information architectures using Figma tools and layout grids.	PO1 to PO5, PSO1 to PSO5	K1 to K6
CO3	Analyze visual design principles such as typography, color theory, and Gestalt theory to evaluate and deconstruct existing UI designs.	PO1 to PO5, PSO1 to PSO5	K1 to K6
CO4	Evaluate high-fidelity interactive prototypes through structured usability testing, and refine designs based on iterative feedback.	PO1 to PO5, PSO1 to PSO5	K1 to K6
CO5	Design and deliver a complete, end-to-end UI/UX project from research to prototype, demonstrating proficiency in Figma collaboration, and professional design presentation skills.	PO1 to PO5, PSO1 to PSO5	K1 to K6

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

Continuous Internal Assessment – Components			
Assessment Type	**Nature**	**Maximum Marks**	**Weightage**
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Assignment based on experimental concepts	10	5
Workbook/recordbook/ notebook	Handwritten record of experiments, observations, results, and conclusions	10	5
Class activity 1	Hands-on Skill Assessment	10	5
Class activity 2	Group Activity	10	5
Class activity 3	Online Certification	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50

The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed)

1. *Quiz with MCQ*
2. *Seminar / Presentation*
3. *Peer/Self-Assessment*
4. *Puzzle*
5. *Group Discussion*
6. *Group activity*
7. *Surprise class tests*
8. *Case-Study Analysis*

PROGRAMME: COMMON TO ALL	**BATCH: 2026-2029**
PART: IV	**COURSE COMPONENT: SELF-STUDY**
COURSE NAME: INDIAN HERITAGE AND KNOWLEDGE SYSTEM	**COURSE CODE: 26USSP401**
SEMESTER: III	**MARKS:100**
CREDITS: 2	**TOTAL HOURS: SELF-STUDY**
THEORY	

COURSE DESCRIPTION:

Delving into Indian Heritage, this course focuses on South Indian cultures and ancient knowledge like Yoga, Ayurveda, and Siddha, shaping the Nation's identity.

COURSE OBJECTIVES:

Analyzing Indian heritage's impact on national identity, South India's culture, and holistic traditions like Yoga, Ayurveda, Siddha, Jyotish, and Natya Shastra.

COURSE OUTCOMES:

1. Recall the key features of Indian heritage and its role in shaping cultural identity.
2. Identify the artistic, architectural, and literary achievements of South India and other regions.
3. List traditional practices preserved through folklore across India.
4. Recall the principles of ancient Indian sciences related to physical, mental, and spiritual well-being.
5. Describe the connections between spiritual, medicinal, and artistic elements in Indian heritage.

COURSE STRUCTURE:

UNIT 1: INTRODUCTION TO INDIAN HERITAGE

- **Concept of Heritage:** Definition, the importance of studying heritage, and its diverse forms.
- **Cultural Landscape of India:** Overview of major cultural zones in India, with a focus on South India.

Key Concepts: Cultural heritage, diversity, tangible heritage (e.g., monuments), intangible heritage (e.g., traditions, practices).

UNIT 2: CULTURAL TAPESTRY OF SOUTH INDIA

- **Literature:** The classical Tamil literature of *Sangam poetry,* the epic Kannada works like the *"Kuvempu Ramayana,"* the Telugu compositions of *Annamacharya,* and the poetic Malayalam works of Kerala's rich literary tradition.
- **Painting:** The intricate gold leaf work of *Tanjore* painting, the intricate patterns of *Mysore* painting, hand-painting or block-printing of Kalamkari.
- **Theatre:** The ancient art form of *Koothu* and the elaborate dance-dramas of *Bhagavata Mela* in Tamil Nadu, and the colourful folk theatre of *Yakshagana* in Karnataka.
- **UNESCO Indian Heritage Sites:** *Great Living Chola Temples* artistry, *Hampi*- Virupaksha Temple and the Vijaya Vittala Temple, *Mahabalipuram*- a treasure trove of Pallava art, *Mysore Palace*-Indo-Saracenic architecture, *Periyar National Park*- Western Ghats, *Kanchipuram*-City of Thousand Temples

UNIT 3: TAMIL NADU FOLKLORES

- Origins and Significance: Historical background of Tamil Nadu folklore and its cultural significance.
- Folk Dances: Exploration of traditional Tamil folk dances like Karakattam, Kolattam, and Kummi.
- **Folk Music:** Overview of folk music traditions in Tamil Nadu, including *Parai Attam and Villu Paatu.*
- **Rituals and Festivals:** Understanding the role of folklore in Tamil Nadu's rituals and festivals- *Pongal and Jallikattu.*

Key Concepts: Karakattam, Kolattam, Parai Attam, Villu Paatu, Tamil folk tales, cultural rituals.

UNIT 4: UNVEILING THE KNOWLEDGE SYSTEMS

- **Cultural Landscape of India:** Overview of major cultural zones in India, with a focus on South India.
- **Yoga:** Exploring the various aspects of Yoga - its philosophy, Eight Limbs, practices (e.g., Asanas, Pranayama), and benefits for physical and mental well-being.
- **Ayurveda:** Understanding the core principles of Ayurveda - its focus on holistic health, diagnosis, and treatment methods.

Key Concepts: Yoga philosophy, Asanas, Pranayama, Tridosha theory (Ayurveda), Doshas (Vata, Pitta, Kapha), Panchakarma, herbal medicine, Ayurvedic lifestyle.

UNIT 5: SIDDHA TRADITION AND OTHER KNOWLEDGE SYSTEMS

- **Siddha Tradition:** Origins, philosophy, medicinal practices, and spiritual aspects.
- **Other Important Knowledge Systems:** Jyotish Shastra (Indian astrology), Natya Shastra (Treatise on performing arts).

Key Concepts: Siddha literature, alchemy, and spirituality in Siddha tradition. Pancha Boothas (Siddha), herbal remedies, Planetary influences, elements of classical Indian dance and music, and aesthetics in Natya Shastra.

QUESTION PAPER PATTERN: MCQ

PROGRAMME: COMMON TO ALL	**BATCH: 2026 – 2029**
PART: IV	**COURSE COMPONENT: SELF-STUDY**
COURSE NAME: CONTEMPORARY WORLD AND SUSTAINABLE DEVELOPMENT	**COURSE CODE: 26USSP402**
SEMESTER: III	**MARKS:100**
CREDITS: 2	**TOTAL HOURS: SELF-STUDY**
THEORY	

COURSE OVERVIEW:

Delving into global dynamics, this course highlights Asia and India's pivotal role in achieving global sustainability objectives.

COURSE OBJECTIVES:

Exploring global challenges, Asian politics, conflict resolution, sustainability, and India's SDG efforts, with a focus on Tamil Nadu.

COURSE OUTCOMES:

1. Identify the key actors and institutions that shape the contemporary world order.
2. Describe the political, economic, and security challenges in major Asian regions.
3. Recall the causes and human impact of recent wars and conflicts.
4. Describe the principles of sustainable development and their relevance at local, national and global levels.
5. Identify India's contributions to the SDGs through Tamil Nadu's programs.

COURSE STRUCTURE:

UNIT 1: GLOBAL GOVERNANCE AND INSTITUTIONS

- **State & Non-State Actors:** Definition, types (nation-states, failed states), functions.

  Key Actors: International states, Intergovernmental organizations (IGOs), nongovernmental organizations (NGOs), multinational corporations (MNCs).

- **United Nations (UN):** Structure, key organs (General Assembly, Security Council), functions, WB, & others.

  Key Concepts: United Nations General Assembly, United Nations Security Council.

- **Regional Organizations:** European Union (EU), African Union (AU), North Atlantic Treaty Organization (NATO).

  Key Concepts: European Union Commission, African Union Commission, North Atlantic Treaty Organization.

- **International Law and Treaties:** Significance, role in addressing global challenges.

  Key Concepts: International Court of Justice, International Criminal Court, Geneva Conventions.

UNIT 2: CONTEMPORARY ASIA

Major Geographical Regions

- **Middle East:** Characterized by rich oil reserves, Complex political dynamics, and ongoing conflicts.

  Key countries: Iran, Iraq, Israel, Saudi Arabia, Syria, Turkey

- **Southeast Asia:** Rapid economic growth, Challenges- maritime security and environmental degradation.

  Key countries: Indonesia, Malaysia, Philippines, Singapore, Thailand, Vietnam

- **Far East:** Major economic powerhouses and Potential flashpoints.

  Key countries: China, Japan, North Korea, South Korea

- **Rise of China:** Political-South China Sea, Territorial disputes and Competition for Resources. Economic- China's Belt and Road Initiative (BRI)

- **Major Economic Centers: Singapore-** Global financial hub, **Hong Kong-** Special Administrative Region of China, **United Arab Emirates (UAE)-** Diversified economy driven by oil and gas, tourism, and trade.

Regional Organizations:

- Association of Southeast Asian Nations (ASEAN)
- South Asian Association for Regional Cooperation (SAARC)
- Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC)
- Asia-Pacific Economic Cooperation (APEC)
- Shanghai Cooperation Organization (SCO)

UNIT 3: RECENT WARS OF THE WORLD

- **Syrian Civil War (2011-present):** Bashar al-Assad regime, Syrian opposition groups, ISIS.

  Key Concepts: Origins of the conflict, humanitarian crisis, foreign intervention, refugee crisis.

- **Yemeni Civil War (2015-present):** Houthi rebels, Yemeni government, Saudi-led coalition.

  Key Concepts: Proxy war dynamics, humanitarian crisis, role of Iran and Saudi Arabia, UN peace efforts.

- **Ukraine Conflict (2014-present)**: Ukrainian government, Russian-backed separatists, Russia.

  Key Concepts: Annexation of Crimea, Donbas region conflict, Minsk agreements, NATO-Russia tensions.

- **Ethiopia Civil War (2020-present):** Ethiopian government, Tigray People's Liberation Front (TPLF), Eritrean forces.

  Key Concepts: Tigray conflict, humanitarian crisis, regional implications, efforts for ceasefire and peace talks.

- **Nagorno-Karabakh War (2020):** Armenia, Azerbaijan, Russia.

  Key Concepts: Conflict over Nagorno-Karabakh region, ceasefire agreement, role of Turkey, peace negotiations.

- **Myanmar Civil War (2021-present):** Myanmar military (Tatmadaw), ethnic armed groups, and Civilian resistance.

  Key Concepts: Coup aftermath, Rohingya crisis, ethnic conflicts, ASEAN mediation efforts.

UNIT 4: SUSTAINABLE DEVELOPMENT GOALS

- **Definition of Sustainable Development:** Balancing economic, social, and environmental needs.

  Key Concepts: United Nations Development Programme (UNDP), World Wildlife Fund (WWF), Sustainable Development Solutions Network (SDSN).

- **UN Sustainable Development Goals (SDGs):** Overview, targets.

  Key Concepts: United Nations, national governments, NGOs, private sector.

- **Challenges and Opportunities:** Achieving sustainability, global cooperation.

  Key Concepts: United Nations, national governments, civil society organizations, multinational corporations.

UNIT 5: INDIA'S ROLE IN ACHIEVING SUSTAINABLE DEVELOPMENT GOALS (SDGS) WITH TAMIL NADU INITIATIVES

Addressing Basic Needs:

- **Goal 1: No Poverty**
  - National Rural Employment Guarantee Act (NREGA)
  - Kalaignar Kanchi Thalaiyalar Scheme
  - Ungal Thozhil Udhayanam (UTOY)
- **Goal 2: Zero Hunger**
  - National Food Security Act (NFSA)
  - Nutritious Noon Meal Programme
  - Annadhanam Scheme
  - Amma Unavagam
- **Goal 3: Good Health and Well-being**
  - National Health Mission (NHM)
  - Health Insurance of Tamil Nadu
  - Chief Minister's Comprehensive Health Insurance Scheme
  - Maruthuva Mitri
  - Amma Mini Clinics

Ensuring Essential Services:

- **Goal 4: Quality Education**
  - Sarva Shiksha Abhiyan (SSA)
  - Rashtriya Madhyamik Shiksha Abhiyan (RMSA)
  - Namakkal District Library Scheme
  - Pudhumai Penn Scheme under Higher Education Assurance Scheme (HEAS
  - Free Coaching for Competitive Exams
- **Goal 6: Clean Water and Sanitation**
  - Swachh Bharat Mission (Clean India Mission)
  - National Rural Drinking Water Programme (NRDWP)
  - Jal Jeevan Mission Tamil Nadu
  - Namakku Naathey Scheme
  - Kudimaramathu Scheme
- **Goal 7: Affordable and Clean Energy**
  - National Solar Mission
  - Tamil Nadu Solar Energy Policy
  - Green House Scheme

Building Sustainable Communities:

- **Goal 11: Sustainable Cities and Communities**
  - Smart Cities Mission
  - Atal Mission for Rejuvenation and Urban Transformation (AMRUT)
  - Adi Dravidar Housing Scheme

- **Goal 13: Climate Action**
  - National Action Plan on Climate Change (NAPCC)
  - International Solar Alliance
  - Tamil Nadu Wind Energy Policy 2019

- **Goal 17: Partnerships for the Goals**
  - Development Assistance Programmes (DAPs)
  - International Development Cooperation (IDC)

QUESTION PAPER PATTERN: MCQ

SEMESTER IV

PROGRAMME: B.Sc., COMPUTER SCIENCE	**BATCH: 2026 – 2029**
PART: III	**COURSE COMPONENT: CORE – VII**
COURSE NAME: FULL STACK TECHNOLOGY	**COURSE CODE: 26UCSC307**
SEMESTER: IV	**MARKS: 100**
CREDITS: 4	**TOTAL HOURS: 90**
THEORY	

COURSE OBJECTIVE:

To understand the basic concepts of front-end programming languages and back-end database management to develop interactive, client-server web applications.

COURSE OUTCOMES:

1. Develop web pages using HTML5 and CSS3.
2. Develop dynamic web pages using JavaScript and DOM.
3. Create backend scripts using Node.js.
4. Apply normalization to design relational database schemas.
5. Perform CRUD operations using MySQL with Node.js.

UNIT I **(16 HOURS)**

Introduction to HTML5: Introduction – Headings – Linking – Images – Special Characters and Horizontal Rules – Lists – Tables – Forms – Internal Linking – Meta Elements – HTML5 Form Input Types – Input and Datalist Elements and Autocomplete Attribute – Page Structure Elements.

Introduction to Cascading Style Sheets (CSS3): Introduction – Inline Styles – Embedded Style Sheets – Conflicting Styles – Linking External Style Sheets – Positioning Elements – Backgrounds – Box Model and Text Flow – Drop-Down Menus – Text Shadows – Rounded Corners – Color – Box Shadows – Image Borders – Animation – Transitions and Transformations.

UNIT II **(16 HOURS)**

JavaScript: Introduction to Scripting – Data Types – Variables – Operators – Control and Looping Structures – Functions – Arrays – Objects – Math Object – String Object – Date Object – Boolean and Number Object – Document Object – Document Object Model – Form Validations.

UNIT III **(18 HOURS)**

Introduction to Node.js: Overview – Features & Advantages of Node.js – Node.js Process Model – Working with REPL – Node.js Console – Modules – Node Package Manager – Creating Web Server – File Systems – Debugging Node.js Application.

UNIT IV **(20 HOURS)**

Relational Databases: Purpose of Database System – Views of Data – Data Models – Database System Architecture – Introduction to Relational Databases – Relational Model – Keys – Entity-Relationship Model – E-R Diagrams – Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms – Dependency Preservation – Boyce/Codd Normal Form.

UNIT V **(20 HOURS)**

Introduction to MySQL: Database Design – Data Types – Managing Databases and Tables – Implementing Keys & Constraints – Creating Databases – Creating Tables – Altering Tables – Deleting Databases and Tables – Inserting, Updating and Deleting Data – Querying with SQL Select – Aggregate Functions – Having and Group By Clause – Joining Tables.

Accessing MySQL from Node.js: Connect to MySQL – Performing MySQL Operations using Node.js.

PRESCRIBED BOOKS:

1. Internet & World Wide Web – How to Program, Paul Deitel, Harvey Deitel, Abbey Deitel, Fifth Edition, Pearson Education, 2012. (HTML5, CSS, JavaScript)
2. NodeJS Guidebook, Dhruti Shah, BPB Publications, 2018.
3. Silberschatz, A., Korth, H., & Sudarshan, S. (2019). Database System Concepts (7th ed.). McGraw-Hill.
4. Murach, J. (2023). Murach's MySQL (4th edition). Mike Murach & Associates.

REFERENCE BOOKS:

1. HTML & CSS: The Complete Reference, Thomas A. Powell, Fifth Edition, The McGraw-Hill Companies, Inc., 2010.
2. Web Technologies: A Computer Science Perspective, Jeffrey C. Jackson, Pearson Education, 2011.
3. Web Programming with HTML, XHTML, and CSS, Jon Duckett, Second Edition, Wiley Publishing Inc.
4. Learning Node, Shelly Powers, First Edition, O'Reilly, 2012.
5. Elmasri, R., & Navathe, S. B. (2016). Fundamentals of Database Systems (7th ed.). Pearson.

E-LEARNING RESOURCES:

1. W3Schools – HTML Tutorial: https://www.w3schools.com/html/
2. W3Schools – CSS Tutorial: https://www.w3schools.com/css/
3. JavaScript Guide – MDN Web Docs: https://developer.mozilla.org/en-US/docs/Web/JavaScript/Guide
4. TutorialsPoint – Node.js Tutorial: https://www.tutorialspoint.com/nodejs/
5. GeeksforGeeks – MySQL Tutorial: https://www.geeksforgeeks.org/mysql-tutorial/

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	*Answer any 10 out of 12 questions (each in 50 words)*	*1-12*	*3*	*30*
B	*Answer any 5 out of 7 Questions (each in 300 words)*	*13-19*	*6*	*30*
C	*Answer any 4 out of 6 Questions (each in 1200 words)*	*20-25*	*10*	*40*
TOTAL MARKS				**100**

BREAKUP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	2	2	1
II	2	2	1
III	3	1	2
IV	3	1	1
V	2	1	1
TOTAL	**12**	**7**	**6**
	SECTION A – 12	**SECTION B – 7**	**SECTION C – 6**

PSO - CO MAPPING

	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	2	3
CO 5	3	3	3	2	3
Ave.	**3**	**3**	**3**	**2.6**	**3**

PO- PSO–CO QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	POs, PSOs ADDRESSED	COGNITIVE LEVEL (K1to K6)
CO1	Develop web pages using HTML5 and CSS3.	PO1 to PO5, PSO1 to PSO5	K1, K2
CO2	Develop dynamic web pages using JavaScript and DOM.	PO1 to PO5, PSO1 to PSO5	K3
CO3	Create backend scripts using Node.js.	PO1 to PO5, PSO1 to PSO5	K3, K4
CO4	Apply normalization to design relational database schemas.	PO1 to PO5, PSO1 to PSO5	K4, K5
CO5	Perform CRUD operations using MySQL with Node.js.	PO1 to PO5, PSO1 to PSO5	K5, K6

K1=Remember, K2=Understand, K3=Apply, K4=Analyse, K5=Evaluate, K6=Create

Continuous Internal Assessment – Components			
Assessment Type	**Nature**	**Maximum Marks**	**Weightage**
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Written assignment on Course Related Topics	10	5
Workbook/ recordbook/notebook	Handwritten Notes	10	5
Class activity 1	Quiz with MCQ	10	5
Class activity 2	Seminar / Presentation	10	5
Class activity 3	Surprise Class Tests	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50

The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed)

1. *Quiz (MCQ / Objective Test)*
2. *Practical Lab Exercises*
3. *Hands-on Skill Assessment*
4. *Seminar / Presentation*
5. *Group Activity / Collaborative Task*
6. *Peer / Self-Assessment*
7. *Case Study / Scenario-Based Task*
8. *Surprise Practical Test*

PROGRAMME: B.Sc., COMPUTER SCIENCE	BATCH: 2026 – 2029
PART: III	COURSE COMPONENT: CORE – VIII
COURSE NAME: PRACTICAL IV – FULL STACK TECHNOLOGY	COURSE CODE: 26UCSC308P
SEMESTER: IV	MARKS: 100
CREDITS: 4	TOTAL HOURS: 75
PRACTICAL	

COURSE OBJECTIVE:

To design and develop interactive web applications using HTML5, CSS3, JavaScript, Node.js, and MySQL.

COURSE OUTCOMES:

1. Design static and dynamic web pages using HTML5.
2. Apply CSS3 styling and animations to web pages.
3. Develop interactive web pages with JavaScript validation.
4. Construct server-side applications using Node.js.
5. Implement a full-stack application using Node.js and MySQL.

HTML5 **(15 HOURS)**

1. Create a web page to illustrate headings, text formatting, and list tags.
2. Develop a web page to display tables, frames, and links.
3. Create a web page to display images, audio, and video files.

CSS3 **(15 HOURS)**

4. Create a web page with all types of CSS.
5. Design a web page using different CSS properties like border, background, text, font, and color.
6. Design a web page using CSS with animation, transitions, and transformations.

JAVASCRIPT **(15 HOURS)**

7. Demonstrate predefined methods of string and math objects available in JavaScript.
8. Create a registration form and perform validation.
9. Write a JavaScript program using DOM manipulation.

NODE.JS **(15 HOURS)**

10. Create a simple "Hello, World!" server using Node.js.
11. Write a program to illustrate file systems in Node.js.
12. Write a Node.js program using the REPL environment.

NODE.JS & MYSQL **(15 HOURS)**

13. Write a Node.js program to establish a connection with a MySQL database.
14. Write a Node.js program to perform CRUD (Create, Read, Update, Delete) operations using MySQL.
15. Develop a web application that integrates HTML, CSS, JavaScript, Node.js, and MySQL to store and retrieve user information dynamically.

PSO - CO MAPPING

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	3	3
CO2	3	3	3	3	2
CO3	3	3	3	3	3
CO4	3	3	3	3	2
CO5	3	3	3	3	3
Ave.	**3**	**3**	**3**	**3**	**2.6**

PO- PSO–CO QUESTION PAPER MAPPING

CO No:	**COURSE OUTCOME**	**POs, PSOs ADDRESSED**	**COGNITIVE LEVEL (K1 to K6)**
CO1	Design static and dynamic web pages using HTML5.	PO1 to PO5, PSO1 to PSO5	K2, K3
CO2	Apply CSS3 styling and animations to web pages.	PO1 to PO5, PSO1 to PSO5	K2, K3
CO3	Develop interactive web pages with JavaScript validation.	PO1 to PO5, PSO1 to PSO5	K3, K4
CO4	Construct server-side applications using Node.js.	PO1 to PO5, PSO1 to PSO5	K4, K5
CO5	Implement a full-stack application using Node.js and MySQL.	PO1 to PO5, PSO1 to PSO5	K5, K6

K1=Remember, K2=Understand, K3=Apply, K4=Analyse, K5=Evaluate, K6=Create

Continuous Internal Assessment – Components			
Assessment Type	**Nature**	**Maximum Marks**	**Weightage**
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Assignment based on experimental concepts	10	5
Workbook/recordbook/ notebook	Handwritten record of experiments, observations, results, and conclusions	10	5
Class activity 1	Hands-on Skill Assessment	10	5
Class activity 2	Group Activity	10	5
Class activity 3	Online Certification	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50

The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed)

1. *Quiz with MCQ*
2. *Seminar / Presentation*
3. *Peer/Self-Assessment*
4. *Puzzle*
5. *Group Discussion*
6. *Group activity*
7. *Surprise class tests*
8. *Case-Study Analysis*

PROGRAMME: B.Sc. (CS), BCA, B.Sc.(IT), B.Sc.(DA)	BATCH: 2026 – 2029
PART: III	COURSE COMPONENT: ALLIED – IV
COURSE NAME: OPERATIONS RESEARCH	COURSE CODE: 26UCSC3A4
SEMESTER: IV	MARKS:100
CREDITS: 4	TOTAL HOURS: 90
THEORY AND PROBLEMS	

COURSE OBJECTIVE:

On completion of this course student will be able to use the mathematical knowledge in optimal use of resources.

COURSE OUTCOMES:

1. Formulate and solve Linear Programming Problems using graphical methods for optimization applications.
2. Analyze and solve Transportation Problems using North West Corner Method, Least Cost Method, and Vogel's Approximation Method.
3. Apply Assignment Problem techniques to obtain optimal solutions for balanced and unbalanced models.
4. Analyze sequencing problems involving jobs and machines to determine optimal processing sequences.
5. Apply Network Analysis techniques such as PERT and CPM for project planning, scheduling, and control.

UNIT I **(18 HOURS)**

Linear Programming Problem: Introduction, Requirements for a Linear Programming Problem, Assumptions in Linear Programming Models, Applications of Linear Programming Method, Areas of Application of Linear Programming, Formulation of Linear Programming Problems. Graphical Method of Solutions, Some exceptional cases.

Chapter 1 & 2.

UNIT II **(18 HOURS)**

Transportation Problem: Definitions of the Transportation problem, Formulation and Solution of Transportation Models: Basic feasible solution by North West Corner Method, Least Cost Method, Vogel's Approximation Method. without degeneracy. Unbalanced Transportation Problem, Maximization Problem.

Chapter 7.

UNIT III **(18 HOURS)**

Assignment Problem: Definition of the Assignment problem, Formulation and Solution of the Assignment models, Unbalanced Assignment Problem, Maximization Problem.

Chapter 8.

UNIT IV **(18 HOURS)**

Sequencing Problem: n jobs through two machines, n jobs through three machines, two jobs through m machines, n jobs through m machines.

Chapter 14.

UNIT V **(18 HOURS)**

Network Analysis: Introduction, planning, scheduling, control, basic technologies, rules for constructing a project network, network construction, Program Evaluation Review Techniques (PERT),Critical Path Method (CPM). (no crashing).

Chapter 15

PRESCRIBED BOOK:

1. Resource Management Techniques- Sundaresan, K.S.Ganapathy Subramanian, K.Ganesan, A.R.Publications.

REFERENCE BOOKS:

1. Operations Research - Kandiswarup, P.K.Gupta, Man Mohan, S.Chand & Sons Education Publications,NewDelhi,12thRevised edition.
2. Operations Research Principles and Problems - S. Dharani Venkata Krishnan,Keerthi publishing house PVT Ltd
3. Operations Research - Prem Kumar Gupta &D. S. Hira, 7th Revised Edition, S. Chand & Company Ltd., 2014

E - LEARNING RESOURCES

1. https://nptel.ac.in/courses/110106062
2. https://maa.org/press/maa-reviews/operations-research-problems
3. https://ocw.mit.edu/courses/15-053-optimization-methods-in-management-science-spring-2013/resources/mit15_053s13_lec2/

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	Answer any 10 out of 12 questions	1 - 12	3	30
B	Answer any 5 out of 7 Questions	13 - 19	6	30
C	Answer any 4 out of 6 Questions	20 - 25	10	40
TOTAL MARKS				**100**

BREAK UP OF QUESTIONS FOR THEORY AND PROBLEMS

UNITS	SECTION A		SECTION B		SECTION C	
	THEORY	PROBLEM	THEORY	PROBLEM	THEORY	PROBLEM
I	1	1	-	1	-	1
II	1	1	-	1	-	1
III	1	1	-	1	-	1
IV	1	1	-	1	-	1
V	1	1	-	1	-	1
Any Unit	-	2	1	1	-	1
TOTAL	5	7	1	6	-	6
SECTION A – 12			**SECTION B - 7**		**SECTION C - 6**	

PO – CO MAPPING

CO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	2	2
CO2	2	3	3	2	2
CO3	2	3	3	2	3
CO4	2	3	3	3	3
CO5	3	3	3	3	2
Average	**2.4**	**3.0**	**2.8**	**2.4**	**2.4**

PSO – CO MAPPING

CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	2	2
CO2	2	3	2	2	2
CO3	2	3	3	2	3
CO4	2	2	3	3	3
CO5	3	3	3	3	2
Average	**2.4**	**2.6**	**2.6**	**2.4**	**2.4**

PO – PSO – CO QUESTION PAPER MAPPING

CO No:	COURSE OUTCOMES	POs & PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Formulate and solve Linear Programming Problems using graphical methods for optimization applications.	PSO 1, PSO 2, PSO 3, PSO 4, PSO 5	K1, K2, K3, K4, K5
CO2	Analyze and solve Transportation Problems using North West Corner Method, Least Cost Method, and Vogel's Approximation Method.	PSO 1, PSO 2, PSO 3, PSO 4, PSO 5	K1, K2, K3, K4, K5
CO3	Apply Assignment Problem techniques to obtain optimal solutions for balanced and unbalanced models.	PSO 1, PSO 2, PSO 3, PSO 4, PSO 5	K1, K2, K3, K4, K5
CO4	Analyze sequencing problems involving jobs and machines to determine optimal processing sequences.	PSO 1, PSO 2, PSO 3, PSO 4, PSO 5	K1, K2, K3, K4, K5
CO5	Apply Network Analysis techniques such as PERT and CPM for project planning, scheduling, and control.	PSO 1, PSO 2, PSO 3, PSO 4, PSO 5	K1, K2, K3, K4, K5

K1= Remember, K2= Understand, K3= Apply, K4=Analyze, K5= Evaluate, K6= Create

Continuous Internal Assessment - Components			
Assessment Type	**Nature**	**Maximum Marks**	**Weightage**
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Content -3, Presentation - 2	5	5
Workbook/recordbook/ notebook	Neatness & Presentation - 3, Regularity – 2	5	5
Class activity 1	Quiz with MCQ (Correct Answers - 3, Speed - 2) / Rapid Fire (Quick Response - 3, Accuracy - 2) / Concept Mapping (Understanding of Concept - 3, Logical Connections - 2) / Others	5	5
Class activity 2	Group Discussion (Subject Knowledge - 3, Communication Skills - 2) / Case Study (Application of Concepts - 3, Problem Solving Ability - 2) Discussion/Debate (Content Knowledge - 3, Argument Strength - 2) / Others	5	5
Class activity 3	Learn about any one country of your choice. Scrap book (Idea Generation - 3, Sharing with Class - 2) / Role Play (Creativity and Expression - 3, Team Coordination - 2) / Puzzle (Logical Thinking - 3, Speed - 2) / Others	5	5
Attendance	Marks will be given based on the attendance percentage of respective course		5
Total			50

The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed)

1) Quiz with MCQ
2) Case-Study analysis
3) Debate
4) Seminar/ Presentation
5) Peer/Self-Assessment
6) Role play
7) Scrap book
8) Monograph
9) Puzzle
10) Group Discussion
11) Group activity
12) Surprise class tests

PROGRAMME: B.Sc., COMPUTER SCIENCE	**BATCH: 2026 – 2029**
PART: IV	**COURSE COMPONENT: INDIAN KNOWLEDGE SYSTEM**
COURSE NAME: INDIAN KNOWLEDGE SYSTEM WITH ARTIFICIAL INTELLIGENCE	**COURSE CODE: 26UIKS409**
SEMESTER: IV	**MARKS: 100**
CREDITS: 1	**TOTAL HOURS: 15**

COURSE OBJECTIVE

Provide a concise understanding of Indian Knowledge Systems and AI, focusing on foundations, ethics, and interdisciplinary applications.

COURSE OUTCOMES

1. Explain Indian Knowledge Systems and their relevance to modern technology.
2. Analyze AI concepts and compare them with Indian logical frameworks.
3. Evaluate the integration of IKS and AI in real-world applications.

UNIT I INTRODUCTION TO INDIAN TRADITIONAL KNOWLEDGE (5 HOURS)

Concept, scope, and significance of Indian Traditional Knowledge (ITK) Concept and scope of Indian Knowledge Systems - Sources of IKS: Vedas, Upanishads, Puranas, Manuscripts, inscriptions, oral traditions - Major knowledge domains in IKS : Ayurveda, Yoga, Siddha , Mathematics, Astronomy, Architecture, Linguistics - Indian scientific and logical traditions: Nyaya, Vaisheshika, Sankhya - Relevance of IKS in the modern digital and technological era.

UNIT II ARTIFICIAL INTELLIGENCE – CONCEPTS & INDIAN PERSPECTIVES (5 HOURS)

Introduction to Artificial Intelligence: Definition, history, and applications - Core AI concepts: Machine Learning, Deep Learning, Natural Language Processing (NLP) - Data, knowledge representation, and reasoning - Indian logical frameworks and cognition: Comparison of Indian logic with modern AI reasoning - Ethical AI and Indian philosophical perspectives: Dharma, ethics, and responsible AI.

UNIT III INTEGRATION OF IKS AND AI APPLICATIONS (5 HOURS)

Digitization of Indian Knowledge using AI: Manuscript digitization, OCR for Indian scripts, Knowledge extraction. AI applications in traditional knowledge systems: AI in Ayurveda diagnosis and drug discovery, AI in Yoga and wellness analytics, AI in agriculture and traditional farming knowledge. Knowledge databases and digital repositories: Traditional Knowledge Digital Library (TKDL) – role and importance. Challenges and future scope of IKS with AI: Preservation, authenticity, bias, and ethics, Research and innovation opportunities.

RECOMMENDED TEXTBOOKS

1. Kapoor, Kapil, Indian Knowledge Systems, D.K. Printworld, 2017.
2. Russell, Stuart and Norvig, Peter, Artificial Intelligence: A Modern Approach, 4th Edition, Pearson Education, New Delhi, 2021.
3. Chatterjee, Satischandra and Datta, Dhirendramohan, An Introduction to Indian Philosophy, University of Calcutta Press, Kolkata, 2016.

REFERENCE BOOKS

1. Plofker, Kim, Mathematics in India, Princeton University Press, Princeton, 2009.
2. Vagbhata, Ashtanga Hridayam (Selected English Translations), Chaukhambha Publications, Varanasi, 2014.
3. Bishop, Christopher M., Pattern Recognition and Machine Learning, Springer, New York, 2006.
4. Brachman, Ronald J. and Levesque, Hector J., Knowledge Representation and Reasoning, Morgan Kaufmann Publishers, San Francisco, 2004.
5. CSIR, Government of India, Traditional Knowledge Digital Library (TKDL): Documentation and Reports, Council of Scientific and Industrial Research, New Delhi, 2018.

E-LEARNING RESOURCES

1. https://www.tkdl.res.in
2. https://www.namami.gov.in
3. https://www.dli.gov.in
4. https://www.unesco.org/en/digital-heritage
5. https://indianculture.gov.in

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	**ESSAY** ANSWER ANY 5 OUT OF 10 QUESTIONS **(EACH IN 1200 WORDS)**	1-10	20	**100**

BREAK UP OF QUESTIONS

Section	Units	No. of Questions	
		Theory	Problems
A	Unit-1	2	
	Unit-2	2	
	Unit-3	2	
	Unit-4	2	
	Unit-5	2	

SOFT SKILLS: COMMON TO ALL	BATCH: 2026 – 2029
PART: IV	COURSE COMPONENT: ABILITY ENHANCEMENT SKILL – IV
COURSE NAME: RESUME WRITING AND INTERVIEW SKILLS	COURSE CODE: 26USKL405
SEMESTER: IV	MARKS:100
CREDITS: 2	TOTAL HOURS: 30
THEORY	

COURSE OBJECTIVE:

To equip the students to acquire the relevant skills for better employability.

COURSE OUTCOMES:

On completion of the course, the students will be able to:

1. Prepare professional resumes, CVs, biodata and covering letters suitable for job applications.
2. Apprise the fundamental concepts, purpose and characteristics of job interviews.
3. Identify various types of interviews and their expectations in recruitment processes.
4. Apply interview techniques and strategies to effectively handle different stages of the interview process.
5. Demonstrate employability skills such as communication, personality development, time management, and presentation skills for career readiness.

UNIT I: Preparing Biodata / CV / Resume (6 Hours)

Essential characteristics of a job application – Difference between Biodata, CV, Resume – Covering letter – Tips to draft an application

UNIT II: Introduction to Interview Skills (6 Hours)

Definition – Meaning – Concept of interview – Purpose – Objectives of interview – Characteristic features of job interviews

UNIT III: Types of Interview (6 Hours)

Traditional one-to-one job interview – Panel interview – Behavioural interview – Group interview – Phone interview – Preliminary interview – Patterned interview – Depth interview – Stress interview – Exit interview – Interview through tele and video conferencing

UNIT IV: Interviews – Techniques and Strategies (6 Hours)

Preparing for the interview process – Before the interview – During the interview – After the interview – Tips to ace an interview – Commonly asked interview questions – Do's and Don'ts – Reasons for rejection.

UNIT V: Leveraging Employability Skills (6 Hours)

Personality Development – Organizational skills – Time Management – Stress Management – Effective Communication Skills – Reasoning Ability – Verbal Ability – Group Discussion – Technical skills – Presentation skills

PRESCRIBED TEXTBOOKS

1. Monipally, Matthukutty M. (2017) *Business Communication: From Principles to Practice*
2. Peter, Francis. (2012) *Soft Skills and Professional Communication*. New Delhi: Tata McGraw Hill.

REFERENCE BOOKS

1. Higgins, Jessica JD (2018)*10 Skills for Effective Business Communication: Practical Strategies from the World's Greatest Leaders*
2. Nicholas, Sonji (2023) *Interviewing: Preparation, Types, Techniques, and Questions, Pressbooks*
3. Storey, James (2016) *The Art of The Interview: The Perfect Answers to Every Interview Question*

E-LEARNING RESOURCES

1. https://careermobilityoffice.cs.ny.gov/cmo/documents/Resume%20&%20Interviewing%20Handout.pdf
2. https://edu.gcfglobal.org/en/interviewingskills/interview-etiquette/1/
3. https://findjobhub.com/en/types-of-interviews
4. https://egyankosh.ac.in/bitstream/123456789/23411/1/Unit-2.pdf
5. https://bharatskills.gov.in/pdf/E_Books/CTS/ES/English/ES_Part_1_62%20hour_English.pdf
6. https://bharatskills.gov.in/pdf/E_Books/CTS/ES/English/ES_Part2_58hour_English.pdf

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

Section	Question Component	Numbers	Marks	Total
A	Answer any 5 out of 7 questions (answer in 50 words)	1-7	2	**10**
B	Answer any 4 out of 6 questions (answer in 300 words)	8-13	5	**20**
C	Answer any two Internal (Choice)	14-15	10	**20**
	Internal & Viva Voce		50	**50**

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	2	2	----
II	2	1	1
III	1	1	1
IV	1	1	1
V	1	1	1
TOTAL	**7**	**6**	**4**
	SECTION A – 7	**SECTION B – 6**	**SECTION C – 4**

SEMESTER V

PROGRAMME: B.Sc. COMPUTER SCIENCE	BATCH: 2026 – 2029
PART: III	COURSE COMPONENT: CORE – IX
COURSE NAME: OPERATING SYSTEMS	COURSE CODE: 26UCSC309
SEMESTER: V	MARKS:100
CREDITS: 4	TOTAL HOURS:90
THEORY	

COURSE OBJECTIVE:

Students will familiarize on the general structure of an operating system and case study is also provided.

COURSE OUTCOME:

1. Explain operating system goals, structure, and services.
2. Implement CPU scheduling and process synchronization mechanisms.
3. Analyse deadlock prevention and recovery strategies.
4. Evaluate paging, segmentation, and fragmentation techniques.
5. Analyse solutions for virtual memory and file systems.

UNIT I: (18 Hours)

Introduction: Views –Goals – OS Structure –Components – Services - System Design and Implementation. Process Management: Process - Process Scheduling – Cooperating Process – Threads – Inter process Communication.

UNIT II: (18 Hours)

CPU Scheduling: CPU Schedulers – Scheduling criteria – Scheduling Algorithms - Process Synchronization: Critical-Section problem - Synchronization Hardware – Semaphores – Classic Problems of Synchronization – Critical Region.

UNIT III: (18 Hours)

Deadlock: Characterization – Methods for handling Deadlocks – Prevention, Avoidance, and Detection of Deadlock - Recovery from deadlock. Secondary Storage Structures: Protection – Goals- Domain Access matrix.

UNIT IV: (18 Hours)

Memory Management: Address Binding – Dynamic Loading and Linking – Overlays – Logical and Physical Address Space - Contiguous Allocation – Internal & External Fragmentation. Non-Contiguous Allocation: Paging and Segmentation schemes – Implementation – Sharing - Fragmentation.

UNIT V: (18 Hours)

Virtual Memory: Demand Paging – Page Replacement - Page Replacement Algorithms – Thrashing. File System: Concepts – Access methods – Directory Structure –Protection Consistency Semantics. File System Structures – Allocation methods – Free Space Management.

PRESCRIBED BOOKS:

1. Silberschatz A., Galvin P.B., Gange,.2012, Operating System Principles, Tenth Edition, John Wiley &Sons.

REFERENCE BOOKS:

1. H.M. Deitel ,2004, An Introduction to Operating System, - Third Edition, Addison Wesley Pearson Publication

WEBSITES FOR REFERENCES:

1. https://www.geeksforgeeks.org/types-of-operating-systems/
2. https://www.tutorialspoint.com/operating_system/index.htm
3. http://www.ics.uci.edu/~ics143/lectures.html
4. http://williamstallings.com/Extras/OS-Notes/notes.h

WEBSITES FOR ONLINE COURSES:

1. https://www.coursera.org/courses?query=operating%20system
2. https://alison.com/course/introduction-to-operating-systems
3. Swayam& MOOC courses titled Operating system

QUESTION PAPER PATTERN:

Section	Question Component	Numbers	Marks	Total
A	Answer any 10 out of 12	1-12	3	30
B	Answer any 5 out of 7	13-19	6	30
C	Answer any 4 out of 6	20-25	10	40
TOTAL MARKS				**100**

DISTRIBUTION OF QUESTIONS:

Section	Unit	No. of Questions	
		Theory	Problems
Section A	Unit – 1	2	
	Unit – 2	3	
	Unit – 3	3	
	Unit – 4	2	
	Unit – 5	2	
Section B	Unit – 1	1	
	Unit – 2	2	
	Unit – 3	1	
	Unit – 4	2	
	Unit – 5	1	
Section C	Unit – 1	1	
	Unit – 2	1	
	Unit – 3	2	
	Unit – 4	1	
	Unit – 5	1	

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	3	2	3	2
CO 2	2	3	2	2	2
CO 3	3	3	3	2	3
CO 4	2	2	3	3	3
CO 5	3	3	3	3	3
Ave.	**2.6**	**2.8**	**2.6**	**2.6**	**2.6**

PO- PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	POs, PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Explain operating system goals, structure, and services.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO2	Implement CPU scheduling and process synchronization mechanisms.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO3	Analyse deadlock prevention and recovery strategies.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO4	Evaluate paging, segmentation, and fragmentation techniques.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO5	Analyse solutions for virtual memory and file systems.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

Continuous Internal Assessment – Components			
Assessment Type	**Nature**	**Maximum Marks**	**Weightage**
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Written assignment on Course Related Topics	10	5
Workbook/recordbook/ notebook	Handwritten Notes	10	5
Class activity 1	Quiz with MCQ	10	5
Class activity 2	Seminar / Presentation	10	5
Class activity 3	Surprise Class Tests	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50

The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed)

1. *Quiz (MCQ / Objective Test)*
2. *Practical Lab Exercises*
3. *Hands-on Skill Assessment*
4. *Seminar / Presentation*
5. *Group Activity / Collaborative Task*
6. *Peer / Self-Assessment*
7. *Case Study / Scenario-Based Task*
8. *Surprise Practical Test*

PROGRAMME: B.Sc. COMPUTER SCIENCE	BATCH: 2026 – 2029
PART: III	COURSE COMPONENT: CORE – X
COURSE NAME: DATA SCIENCE AND MACHINE LEARNING	COURSE CODE: 26UCSC310
SEMESTER: V	MARKS:100
CREDITS: 4	TOTAL HOURS:90
THEORY	

COURSE OBJECTIVE:

To introduce the fundamental concepts of Machine Learning and Data Science, enabling students to develop models and analyze data efficiently.

COURSE OUTCOMES:

1. Explain data science scope and key ML tools.
2. Apply preprocessing and visualization using Matplotlib.
3. Analyse ML types and the ML workflow
4. Create models using regression, KNN, SVM, and Naïve Bayes.
5. Evaluate model performance using cross-validation and tuning.

UNIT I (18 HOURS)

Introduction to Data Science and Machine Learning: Definition and scope of Data Science – Overview of Machine Learning - Relationship between Data Science and Machine Learning. Core Concepts and Terminology: Types of Data and Data Sources - Data Types - Programming and Tool Ecosystem: Essential Programming Languages - Key Libraries and Tools.

UNIT II (18 HOURS)

Data Preparation and Visualization: Data Preprocessing: Handling Missing Data, Removing Duplicates, and inconsistencies – Identifying and Treating Outliers – Feature Engineering: Feature selection and Dimensionality reduction - Data Visualization: Matplotlib and Seaborn.

UNIT III (18 HOURS)

Introduction to Machine Learning: Definition and scope of Machine Learning · Types of Machine Learning: Supervised · Unsupervised · Reinforcement Learning · Machine Learning Workflow and applications · Machine Learning Ecosystem.

UNIT IV (18 HOURS)

Supervised Learning Algorithms: Regression: Linear Regression – Polynomial Regression - Classification: Logistic Regression, Naïve Bayes classifier, K-Nearest Neighbors (KNN), Support Vector Machines.

UNIT V (18 HOURS)

Model Evaluation and Optimization: Performance Metrics: Accuracy, Precision, Recall, F1 Score, Confusion Matrix- Model Validation: Overfitting and Underfitting, Cross-Validation: K-Fold Cross-Validation - Model Selection and Optimization: Bias-Variance Trade-off, Hyper parameter Tuning.

PRESCRIBED BOOKS:

1. Levene, M., & Harris, M. (2025). Just enough data science and machine learning: Essential tools and techniques. Addison Wesley.
2. Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, “Machine Learning”, First Edition, Pearson Education 2018.
3. Davy Cielen, Arno D.B. Meysman, Mohamed Ali, “Introducing Data Science”, manning publications 2016.

REFERENCE BOOKS:

1. AurélienGéron, “Hands-on Machine Learning with Scikit-Learn”, Keras and,O’Reilly Media, Inc. 2017.
2. EthemAlpaydin, Introduction to Machine Learning, 2nd Edition, the MIT Press, 2009.
3. Tom M. Mitchell, “Machine Learning”, McGraw-Hill Education, 2017.
4. Mevin P. Murphy, "Machine Learning: A Probabilistic Perspective" by The MIT Press, 2012. Roger Peng, “The Art of Data Science”, lulu.com 2016.
5. Murtaza Haider, “Getting Started with Data Science–Making Sense of Data with Analytics”, IBMpress, E-book.
6. Davy Cielen, Arno D.B. Meysman, Mohamed Ali, “Introducing Data Science: Big Data,Machine Learning,and More, Using Python Tools”,Dreamtech Press 2016.
7. Jean,H.(2023). Data science, Certybox Education.
8. Pierson,L.(2021). Data science for dummies, John Wiley & Sons.

E-LEARNING RESOURCES:

1. https://www.geeksforgeeks.org/machin learning -an-introduction/
2. https://www.javatpoint.com/machine-learning
3. https://www.simplilearn.com
4. https://www.ibm.com/in-en/topics/data-science
5. https://www.mygreatlearning.com/blog/what-is-data-science/

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	*Answer any 10 out of 12 Questions (each in 50 words)*	*1-12*	*3*	*30*
B	*Answer any 5 out of 7 Questions (each in 300 words)*	*13-19*	*6*	*30*
C	*Answer any 4 out of 6 Questions (each in 1200 words)*	*20-25*	*10*	*40*
TOTAL MARKS				**100**

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	2	2	1
II	2	2	1
III	3	1	2
IV	3	1	1
V	2	1	1
TOTAL	12	7	6
SECTION A – 12		**SECTION B – 7**	**SECTION C – 6**

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	3	2	3	3
CO 2	3	2	2	2	3
CO 3	3	3	2	2	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
Ave.	**3**	**2.8**	**2.6**	**2.6**	**3**

PO-PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	POs, PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Explain data science scope and key ML tools.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO2	Apply preprocessing and visualization using Matplotlib.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO3	Analyse ML types and the ML workflow.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO4	Create models using regression, KNN, SVM, and Naïve Bayes.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO5	Evaluate model performance using cross-validation and tuning.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

Continuous Internal Assessment – Components			
Assessment Type	**Nature**	**Maximum Marks**	**Weightage**
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Written assignment on Course Related Topics	10	5
Workbook / recordbook/ notebook	Handwritten Notes	10	5
Class activity 1	Quiz with MCQ	10	5
Class activity 2	Seminar / Presentation	10	5
Class activity 3	Surprise Class Tests	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50

The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed)

1. *Quiz (MCQ / Objective Test)*
2. *Practical Lab Exercises*
3. *Hands-on Skill Assessment*
4. *Seminar / Presentation*
5. *Group Activity / Collaborative Task*
6. *Peer / Self-Assessment*
7. *Case Study / Scenario-Based Task*
8. *Surprise Practical Test*

PROGRAMME: B.Sc. COMPUTER SCIENCE	BATCH: 2026 – 2029
PART: III	COURSE COMPONENT: CORE – XI
COURSE NAME: PRACTICAL V – DATA SCIENCE AND MACHINE LEARNING	COURSE CODE: 26UCSC311P
SEMESTER: V	MARKS:100
CREDITS: 4	TOTAL HOURS: 75
PRACTICAL	

COURSE OBJECTIVE:

To provide hands-on experience in data preprocessing, data visualization, and implementing machine learning models using essential libraries.

COURSE OUTCOMES:

1. Execute data cleaning and encoding on structured datasets.
2. Exhibit feature transformation and missing value imputation.
3. Create data visualizations using plots and histograms.
4. Assess KNN and Naïve Bayes using F1-score and confusion matrix.
5. Examine and manipulate datasets from CSV and web sources.

PROGRAMS:

DATA HANDLING & PREPROCESSING (15 HOURS)

1. Write a program to get the number of observations, missing values, and perform categorical data encoding for a given dataset.
2. Develop a program to retrieve missing values and handle the same in a dataset.
3. Write a Python script to pre-process text data by converting text into numerical features.
4. Write a program to load and explore datasets from CSV and Excel files using Pandas.
5. Write a program to load data from a CSV file into a DataFrame and print its shape, data types, number of rows-columns, feature names, and description.

DATA VISUALIZATION & EXPLORATION (15 HOURS)

6. Write a program to visualize a dataset using Matplotlib or Seaborn by plotting scatter plots, bar charts, box plots, and histograms.
7. Create a program to visualize time series data using line plots, area plots.
8. Develop a Pandas program to load a dataset, clean the data by handling missing values, and perform basic data exploration tasks (e.g., checking for duplicates and summary statistics).

MACHINE LEARNING MODELS **(15 HOURS)**

9. Write a program to perform K-Nearest Neighbors (KNN) classification and evaluate its performance using accuracy, precision, recall, and F1-score.
10. Implement a Naïve Bayes classifier and demonstrate its application on a dataset. Evaluate its performance using a confusion matrix and classification report.

DATA RETRIEVAL & PROCESSING **(15 HOURS)**

11. Write a program to read data from the web and store it in a DataFrame.
12. Read data from a text file using Pandas.

ADVANCED DATA HANDLING **(15 HOURS)**

13. Work with Pandas DataFrames to filter, group, and summarize data.
14. Develop a program to apply feature transformation techniques on structured datasets.

PSO – CO MAPPING

	PSO 1	**PSO 2**	**PSO 3**	**PSO 4**	**PSO5**
CO 1	3	3	2	3	2
CO 2	3	3	3	3	3
CO 3	2	3	3	3	3
CO 4	3	2	3	3	3
CO 5	3	3	2	2	3
Ave.	**2.8**	**2.8**	**2.6**	**2.6**	**2.8**

PO- PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	POs, PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Execute data cleaning and encoding on structured datasets.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO2	Exhibit feature transformation and missing value imputation.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO3	Create data visualizations using plots and histograms.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5, K6
CO4	Assess KNN and Naïve Bayes using F1-score and confusion matrix.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5, K6
CO5	Examine and manipulate datasets from CSV and web sources.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

Continuous Internal Assessment – Components			
Assessment Type	**Nature**	**Maximum Marks**	**Weightage**
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Assignment based on experimental concepts	10	5
Workbook/recordbook/ notebook	Handwritten record of experiments, observations, results, and conclusions	10	5
Class activity 1	Hands-on Skill Assessment	10	5
Class activity 2	Group Activity	10	5
Class activity 3	Online Certification	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50

The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed)

1. *Quiz with MCQ*
2. *Seminar / Presentation*
3. *Peer/Self-Assessment*
4. *Puzzle*
5. *Group Discussion*
6. *Group activity*
7. *Surprise class tests*
8. *Case-Study Analysis*

PROGRAMME: Open to all Programmes except B.Sc. COMPUTER SCIENCE	**BATCH: 2026 – 2029**
PART: III	**COURSE COMPONENT: ELECTIVE I INTER-DISCIPLINARY ELECTIVE**
COURSE NAME: PRACTICAL: INTERNET AND ITS APPLICATIONS	**COURSE CODE: 26UCSC3E1P**
SEMESTER: V	**MARKS:100**
CREDITS: 4	**TOTAL HOURS: 75**
PRACTICAL	

COURSE OBJECTIVE:

To understand and design simple websites using the basic HTML tags, TABLE tags, FRAMES and forms, World Wide Web, Web Browsers to develop websites, creating E-mails, Sending and receiving mails.

COURSE OUTCOMES:

1. Design web pages with different text formats.
2. Create web pages with background and foreground images.
3. Build web pages with tables.
4. Design applications to view more than one web page in a single window using frame tag.
5. Develop Simple websites.

UNIT I: (5 Hours)

Introduction to Computers: Programming Language types History of Internet Personal Computers History of World Wide Web

UNIT II: (5 Hours)

Web Browsers -Internet Explorer - connecting to Internet Features of Internet explorer-Searching the Internet -online help and tutorials-File Transmission Protocol (FTP) Browser settings.

UNIT III: (5 Hours)

Attaching a file, Electronic mail creating an E-mail id sending and Receiving mails attaching a file- Instance messaging - other web browsers.

UNIT IV: (5 Hours)

Introduction to HTML Tags for Document structure (HTML, Head, and Body Tag). Headings paragraph(<p> tag) – Font style elements: (bold, italic, strike, font) - line breaks-headers - Linking- Images- lists – table – Frames – Forms: Input.

UNIT V: **(5 Hours)**

E-marketing consumer tracking Electronic advertising search engine-CRM-credit card payments Digital cash and e-wallets micro payments-smart card.

PRESCRIBED BOOKS:

1. Internet and World Wide Web Third edition H.M.Deitel, P.J. Deitel and A.B.Goldberg- PHI

REFERENCE BOOKS:

1. The Internet -Complete Reference Harley Hahn, Tata McGraw Hill

PRACTICAL (15 Hours)

HTML Basics **(15 Hours)**

1. Illustrate body and pre-tags.
2. Create an HTML document with the following formatting options:
   - Bold
   - Italics
   - Underline
   - Headings (Using H1 to H6 heading styles)
   - Font (Type, Size, and Color)
3. Create a webpage to demonstrate font variation.
4. Illustrate Ordered list tag.
5. Illustrate unordered list tag.

Working with Images & Links **(15 Hours)**

6. Illustrate the image tag.
7. Write a program to set background image using the body tag.
8. Create an HTML document that implements both Internal linking and external linking.
9. Illustrate Table tag.
10. Illustrate Frame tag.

Forms & Email **(10 Hours)**

11. Create a form using HTML with the following types of controls:
    - Text Box
    - Option/radio buttons
    - Checkboxes
    - Reset and Submit buttons
12. Creating an E-mail ID, sending and receiving mail with attachment, CC, BCC.
13. Design mark sheet using HTML tags.

Project Work **(10 Hours)**

14. Create Guru Nanak College Website using HTML tags.
15. Design a website to submit your resume.

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	3	2	3	2
CO 2	2	3	2	2	2
CO 3	3	3	3	2	3
CO 4	2	2	3	3	3
CO 5	3	3	3	3	3
Ave.	**2.6**	**2.8**	**2.6**	**2.6**	**2.6**

PO-PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	POs, PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Configure the Android Studio environment.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO2	Create Android interfaces with GUI components and layouts.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO3	Develop apps with graphics, database, and notifications.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO4	Build Android apps with multithreading and GPS services.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5, K6
CO5	Construct and test mobile applications integrating Android components.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

Continuous Internal Assessment – Components			
Assessment Type	**Nature**	**Maximum Marks**	**Weightage**
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Assignment based on experimental concepts	10	5
Workbook/recordbook/ notebook	Handwritten record of experiments, observations, results, and conclusions	10	5
Class activity 1	Hands-on Skill Assessment	10	5
Class activity 2	Group Activity	10	5
Class activity 3	Online Certification	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50

The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed)

1. *Quiz with MCQ*
2. *Seminar / Presentation*
3. *Peer/Self-Assessment*
4. *Puzzle*
5. *Group Discussion*
6. *Group activity*
7. *Surprise class tests*
8. *Case-Study Analysis*

PROGRAMME: B.C.A, B.Sc. (CS), B.Sc. (IT), B.Sc. (DA)	**BATCH: 2026 – 2029**
PART: III	**COURSE COMPONENT: ELECTIVE – II**
COURSE NAME: PRACTICAL – VI: PLATFORM ENGINEERING	**COURSE CODE: 26UBCA3E2P**
SEMESTER: V	**MARKS:100**
CREDITS: 5	**TOTAL HOURS:90**
PRACTICAL	

COURSE OBJECTIVE

Exclusive Training for the industry-related programs.

COURSE OUTCOMES

1. Deploying programs for IT Infrastructure.
2. Windows Server Administration support for Clients.
3. Unix Administration with RHEL.
4. Understanding Virtualization in Project Environment
5. Learning ITIL Process Management

LIST OF PROGRAMS

(30 HOURS)

1. IT- Infrastructure
2. Windows Administration
3. Windows AD Administration
4. Unix Administration

(30 HOURS)

5. Virtualization Concepts
6. Cloud Deployment
7. RDBMS - Database Administration

(30 HOURS)

8. Backup, Restoration & Monitoring
9. Middleware Components
10. ITIL Process
11. Perform End to End Case Study.

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	3	2	3	2
CO 2	3	3	2	3	2
CO 3	3	3	3	2	3
CO 4	2	3	3	3	3
CO 5	3	2	3	3	3
Ave.	**2.8**	**2.8**	**2.6**	**2.8**	**2.6**

PO-PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Deploying programs for IT Infrastructure	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO2	Windows Server Administration support for Clients.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO3	Unix Administration with RHEL	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5, K6
CO4	Understanding Virtualization in Project Environment	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5, K6
CO5	Learning ITIL Process Management	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

Continuous Internal Assessment – Components			
Assessment Type	**Nature**	**Maximum Marks**	**Weightage**
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Assignment based on experimental concepts	10	5
Workbook/recordbook/ notebook	Handwritten record of experiments, observations, results, and conclusions	10	5
Class activity 1	Hands-on Skill Assessment	10	5
Class activity 2	Group Activity	10	5
Class activity 3	Online Certification	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50

The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed)

1. *Quiz with MCQ*
2. *Seminar / Presentation*
3. *Peer/Self-Assessment*
4. *Puzzle*
5. *Group Discussion*
6. *Group activity*
7. *Surprise class tests*
8. *Case-Study Analysis*

PROGRAMME: B.Sc., COMPUTER SCIENCE	**BATCH: 2026 – 2029**
PART: III	**COURSE COMPONENT: ELECTIVE – II**
COURSE NAME: DATA COMMUNICATION AND NETWORKING	**COURSE CODE: 26UCSC3E4**
SEMESTER: V	**MARKS:100**
CREDITS: 5	**TOTAL HOURS:90**
THEORY	

COURSE OBJECTIVE:

Demonstrate understanding about various data communication transmission media, interface and Modulation techniques and to understand the various protocols, topologies, layers and configurations.

COURSE OUTCOME:

1. Recall digital data types in a big data environment.
2. Apply big data analytics concepts and significance.
3. Apply NoSQL techniques using Cassandra.
4. Analyse Hadoop architecture and components.
5. Design data processing solutions using Hadoop MapReduce.

UNIT I: **(15 Hours)**

Introduction to Data Communication, Network, Protocols and Standards - Line Configuration - Topology - Transmission mode - Classification of Network - OSI Model - Layers of OSI Model.

UNIT II: **(15 Hours)**

Parallel and Serial Transmission - DTE/DCE/ such as EIA-449, EIA-530, EIA-202 and X.21interface-Interface standards - Modems -Guided Media - Unguided Media - Performance -Types of Error -Error Detection - Error Corrections.

UNIT III: **(18 Hours)**

Multiplexing - Types of Multiplexing - Multiplexing Application - Telephone system - Project 802 - Ethernet - Token Bus - Token Ring - FDDI - IEEE 802.6 - SMDS - Circuit Switching - Packet Switching - Message switching - Connection Oriented and Connectionless services.

UNIT IV: **(21 Hours)**

Repeaters - Bridges - Routers - Gateway - Routing algorithms: Distance Vector, link State, path vector Routing, Multicast Routing - TCP/IP Network, Transport Layer of TCP/IP: TCP, TCP Services, TCP Features - Application Layers of TCP/IP: Namespace, DNS, Distribution of Namespace, DNS in the Internet, Resolution, DNS messages, Types of Records, Registers, Dynamics DNS, Encapsulation- World Wide Web: Architecture, Client, Server, URL, Cookies. Web document: Static Document, Dynamic Document, activeDocument.

UNIT V: **(21 Hours)**

Computer Security Concepts-Security Attacks: Active Attacks, Passive Attacks -Message authentication Codes: message Authentication Requirements, Message Authentication Functions Requirements for message Authentication codes-Electronic mail Security: s/MIME, Domain Keys Identified Mail- IP Security: IP Security Overview, IP Security Policy, Encapsulating Security payload, Combining Security Associations, Internet key Exchange, Cryptographic suits- Firewalls: The Need for Firewalls, Firewall Characteristics, Types of Firewalls, Firewalls Basing, Firewall Location and Configuration.

PRESCRIBED BOOKS

1. Behrouz and Forouzan, 2017, Introduction to Data Communication and Networking, 5th Edition, TMH.
2. William Stallings, Cryptography and Network Security -8th Edition,PHI.
3. Cryptography and Network Security (UPTU), V.S.Bagad, I.A.Dhotre, Technical Publications.

REFERENCE BOOKS:

1. Jean Walrand 1998, Communication Networks (A first Course), Second Edition, WCB/TMH.
2. Behrouz and Forouzan, 2006, Data Communication and Networking, 3rd Edition, TMH.
3. Bruce, Schneider, Applied Cryptography, 2nd Edition, Toha Wiley &Sons,1996.
4. DougalsR.Stinson, Cryptography- Theory and Practice, CRCPress,1995

E-LEARNING RESOURCES:

1. https://www.tutorialspoint.com/data_communication_computer_network/index.html
2. http://examradar.com/communication-networking-summary-1/
3. https://www.guru99.com/data-communication-computer-network-tutorial.html
4. https://onlinecourses.swayam2.ac.in/e-learning/preview/cec19_cs07
5. https://www.coursera.org/learn/data-communication-network-services

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	*Answer any 10 out of 12 questions (each in 50 words)*	*1-12*	*3*	*30*
B	*Answer any 5 out of 7 questions (each in 300 words)*	*13-19*	*6*	*30*
C	*Answer any 4 out of 6 questions (each in 1200 words)*	*20-25*	*10*	*40*
TOTAL MARKS				**100**

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	2	2	1
II	2	1	2
III	3	2	1
IV	3	1	1
V	2	1	1
TOTAL	**12**	**7**	**6**
	SECTION A – 12	**SECTION B – 7**	**SECTION C – 6**

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	3	3	2	3
CO 2	3	3	3	3	2
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
Ave.	3	3	3	2.8	2.8

PO- PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	POs, PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Recall digital data types in a big data environment	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO2	Apply big data analytics concepts and significance.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO3	Apply NoSQL techniques using Cassandra.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO4	Analyse Hadoop architecture and components.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO5	Design data processing solutions using Hadoop MapReduce.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

Continuous Internal Assessment – Components			
Assessment Type	**Nature**	**Maximum Marks**	**Weightage**
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Written assignment on Course Related Topics	10	5
Workbook / recordbook/ notebook	Handwritten Notes	10	5
Class activity 1	Quiz with MCQ	10	5
Class activity 2	Seminar / Presentation	10	5
Class activity 3	Surprise Class Tests	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50

The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed)

1. *Quiz (MCQ / Objective Test)*
2. *Practical Lab Exercises*
3. *Hands-on Skill Assessment*
4. *Seminar / Presentation*
5. *Group Activity / Collaborative Task*
6. *Peer / Self-Assessment*
7. *Case Study / Scenario-Based Task*
8. *Surprise Practical Test*

PROGRAMME: B.Sc. COMPUTER SCIENCE	**BATCH: 2026 – 2029**
PART: III	**COURSE COMPONENT: ELECTIVE – II**
COURSE NAME: BIG DATA ANALYTICS	**COURSE CODE: 26UCSC3E5**
SEMESTER: V	**MARKS:100**
CREDITS: 5	**TOTAL HOURS:90**
THEORY	

COURSE OBJECTIVE

To learn the concepts of big data analytics.

COURSE OUTCOMES

1. Recall digital data types in a big data environment.
2. Apply big data analytics concepts and significance.
3. Apply NoSQL techniques using Cassandra.
4. Analyse Hadoop architecture and components.
5. Design data processing solutions using Hadoop MapReduce.

UNIT I **(18 HOURS)**

Introduction to Big Data: Data, Characteristics of data and Types of digital data: Unstructured, Semi-structured and Structured, Sources of data, Working with unstructured data, Evolution and Definition of big data, Characteristics and Need of big data, Challenges of big data, Data environment versus big data environment.

UNIT II **(18 HOURS)**

Big Data Analytics: Overview of business intelligence, Data science and Analytics, Meaning and Characteristics of big data analytics, Need of big data analytics, Classification of analytics, Challenges to big data analytics, Importance of big data analytics, Basic terminologies in big data environment.

UNIT III **(18 HOURS)**

Databases and Big Data Technology: Introduction to NoSQL, Uses, Features and Types, Need, Advantages, Disadvantages and Application of NoSQL, Overview of NewSQL, Comparing SQL, NoSQL and NewSQL, Introduction of apache cassandra and its needs, Characteristics of Cassandra.

UNIT IV **(18 HOURS)**

Hadoop Foundation for Analytics: History, Needs, Features, Key advantage and Versions of Hadoop, Essential of Hadoop ecosystems, RDBMS versus Hadoop, Key aspects and Components of Hadoop, Hadoop architectures.

UNIT V **(18 HOURS)**

Hadoop MapReduce: Introduction to MapReduce, Processing data with Hadoop using MapReduce, MapReduce application, Data serialization and Working with common serialization formats, Big data serialization formats.

PRESCRIBED BOOKS:

1. Seema Acharya and Subhashini Chellappan, "Big Data and Analytics", Wiley India Pvt. Ltd., 2016.

REFERENCE BOOKS:

1. "Hadoop: The Definitive Guide", Tom White, O'Reilly Media, 2010.
2. "Big Data" by Judith Hurwitz, Alan Nugent, Dr. Fern Halper and Marcia Kaufman, Wiley Publications, 2014.
3. Lars George, "HBase: The Definitive Guide", O'Reilley,2011.
4. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley,2010.
5. Hadoop MapReduce Cookbook, Srinath Perera, Thilina Gunarathne, Packt Publishing Ltd, 2013.

E-LEARNING RESOURCES:

1. https://www.javatpoint.com/what-is-big-data
2. https://www.tutorialspoint.com/big_data_tutorials.htm
3. Hadoop: http://hadoop.apache.org/
4. http://strata.oreilly.com/2010/09/the-smaq-stack-for-big-data.html
5. http://blogs.computerworld.com/18840/big_data_smaq_down_storage_mapreduce_and_query

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

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PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	3	3	3
CO 2	3	2	3	3	2
CO 3	3	3	3	2	2
CO 4	3	3	3	2	3
CO 5	3	3	3	2	3
Ave.	**3**	**2.8**	**3**	**2.4**	**2.6**

PO- PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	POs, PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
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CO3	Apply NoSQL techniques using Cassandra.	PO1 to PO5, PSO1 to PSO5 PO1 to PO5,	K1, K2, K3, K4, K5
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CO5	Design data processing solutions using Hadoop MapReduce.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

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6. *Peer / Self-Assessment*
7. *Case Study / Scenario-Based Task*
8. *Surprise Practical Test*

PROGRAMME: ALL UG	BATCH: 2026 – 2029
PART: IV	COURSE COMPONENT: Life Skill – II
COURSE NAME: ENVIRONMENTAL STUDIES	COURSE CODE: 26UEVS401
SEMESTER: V	MARKS:100
CREDITS: 2	TOTAL HOURS: 30
THEORY	

COURSE OBJECTIVE:

To make students realize the importance of Environmental Studies.

COURSE OUTCOMES:

1. Define the scope and importance of environmental studies and its relevance to sustainable development.
2. Identify different types of natural resources and classify them as renewable, non-renewable, and potentially renewable.
3. Describe the concept of biodiversity and list major conservation strategies.
4. Identify the causes and types of environmental pollution and recall common prevention measures.
5. List basic disaster management plans for common environmental hazards and recall preparedness measures at community level.

UNIT I (6 HOURS)

The Multidisciplinary nature of environmental studies Definition; Scope and importance, Need for public awareness.

UNIT II (6 HOURS)

Natural Resources: Renewable and non-renewable resources: Natural resources and associated problems.

a) Forest resources: Use and Over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water dams benefits and problems.
c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, Case studies.
f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. - Role of an individual in conservation of natural resources. - Equitable use of resources for sustainable lifestyles.

UNIT III **(6 HOURS)**

Ecosystems - Concept of an ecosystem - Structure and function of an ecosystem - Producers, consumers and decomposers - Energy flow in the ecosystem - Ecological succession - Food chains, food webs and ecological pyramids- Introduction, types, characteristic features, structure and function of the following ecosystem: -

a. Forest ecosystem
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

UNIT IV **(6 HOURS)**

Biodiversity and its Conservation

- Introduction-Definition: genetic, species and ecosystem diversity.
- Biogeographical classification of India.
- Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
- Biodiversity at global, National and local levels.
- India as a mega-diversity nation.
- Hot-spots of biodiversity.
- Threats to biodiversity: habital loss, poaching of wildlife, man-wildlife conflicts.
- Endangered and endemic species of India.
- Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT V **(6 HOURS)**

Environmental Pollution: Definition - Causes, effects and control measures of: -

a. Air pollution
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

Solid waste Management: Causes, effects and control measures of urban and industrial wastes. - Role of an individual in prevention of pollution. - Pollution case studies. - Disaster management: floods, earthquake, cyclone and landslides.

QUESTION PAPER PATTERN: MULTIPLE CHOICE QUESTIONS

PROGRAMME: B.Sc. COMPUTER SCIENCE	**BATCH: 2026 – 2029**
PART: IV	**COURSE COMPONENT: INTERNSHIP**
COURSE NAME: INTERNSHIP	**COURSE CODE: 26UINT401**
SEMESTER: V	**MARKS: -**
CREDITS: 2	**TOTAL HOURS: -**
INTERNSHIP	

COURSE OBJECTIVE:

To Facilitate internship for students at software companies or tech startups, offering invaluable real-world experience to apply theoretical knowledge.

COURSE OUTCOMES

1. Apply academic knowledge to real-world IT problems.
2. Develop domain knowledge, multidisciplinary, and professional skills.
3. Gain industry exposure through practical experience.
4. Practice ethical and sustainable computing approaches.
5. Enhance employability skills.

GUIDELINES:

The internship period is specifically designated to span a minimum of 4 weeks and is scheduled to occur during the extended summer break between the fourth and fifth semesters of their academic journey. During this training students are expected to immerse themselves in practical, hands-on learning opportunities, gaining exposure to real-world scenarios, industry practices, and the application of theoretical concepts learned throughout their coursework.

Upon the successful completion of the training program, each student is required to obtain an official internship completion certificate from the organization or company where they undertook their training.

SEMESTER VI

PROGRAMME: B.Sc., COMPUTER SCIENCE	**BATCH: 2026 – 2029**
PART: III	**COURSE COMPONENT: CORE – XII**
COURSE NAME: SOFTWARE ENGINEERING AND TESTING	**COURSE CODE: 26UCSC312**
SEMESTER: VI	**MARKS:100**
CREDITS: 4	**TOTAL HOURS:75**
THEORY	

COURSE OBJECTIVE:

To equip students with foundational skills in software engineering and testing.

COURSE OUTCOMES:

1. Describe software engineering evolution and SDLC models.
2. Build an SRS document using requirement analysis.
3. Examine cohesion, coupling, and DFD-based design.
4. Distinguish black-box and white-box testing methods.
5. Design system testing plans using debugging tools.

UNIT I **(15 HOURS)**

Software Engineering: Introduction – Evolution – Software Development Projects – Emergence of Software Engineering. Software Life Cycle Models: Basic Concepts – Waterfall model – V Model – Prototyping Model – Incremental Development Model – Rapid Application Development (RAD) – Agile Development Model – Scrum – Spiral Model.

UNIT II **(15 HOURS)**

Software Project Management: Complexities – Responsibilities of a Software Project Manager Project Planning – Metrics for Project Size Estimation – Project Estimation Techniques – Empirical Estimation Techniques – Heuristic Techniques - COCOMO Model – Analytical Estimation Techniques.

Requirement Analysis and Specification: Requirement Gathering and Analysis – Software Requirement Specification (SRS) – Users of SRS Document – Characteristics of Good SRS Document – Attributes of Bad SRS Documents – Categories of Customer Requirements – Functional Requirements.

UNIT III **(15 HOURS)**

Software Design: Overview – Characteristics of good software design – Cohesion & Coupling – Layered arrangements of Modules – Approaches to Software Design. Function Oriented Software Design: SA/SD Methodology – Structured Analysis – Data Flow diagrams – Developing the DFD model – Structured Design – Detailed Design – Design Review. Coding: Standards and Guidelines – Code Review – Software Documentation.

UNIT IV **(15 HOURS)**

Software Testing: Introduction – Testing Activities – Unit Testing – Black-Box Testing – Equivalence Class Partitioning – Boundary Value Analysis – White-Box Testing – Statement Coverage – Branch Coverage – Condition Coverage – Condition and Decision Coverage – Multiple Decision Coverage – Path Coverage – McCabe's Cyclomatic Complexity Metric – Data-Flow based Testing – Mutation Testing.

UNIT V **(15 HOURS)**

Debugging: Approaches – Guidelines – Program Analysis Tools – Integration Testing – Testing Object- Oriented Programs – System Testing – Smoke Testing – Performance Testing – Error Seeding – Issues associated with testing.

PRESCRIBED BOOKS:

1. Rajib Mall, Fundamentals of Software Engineering, PHI Learning Pvt. Ltd., 2018, 5th Edition.

REFERENCE BOOKS:

1. Roger S. Pressman, Software Engineering – A Practitioner's Approach, McGraw Hill 2010, 7th Edition.
2. Richard E. Fairley, Software Engineering Concepts, McGraw-Hill edition, 2017, 5th Edition.
3. Pankaj Jalote, An Integrated Approach to Software Engineering, Narosa Publishing House 2011, 3rd Edition.
4. Tsui, F., Karam, O., & Bernal, B, Essentials of software engineering, Jones and Bartlett Learning 2022, 5th Edition.

E-LEARNING RESOURCES:

1. https://pdfrock.com/free-compress-pdf.html (Ebook)
2. https://www.coursera.org/learn/software-engineering-implementation-and-testing
3. https://www.javatpoint.com/software-engineering
4. https://www.tutorialspoint.com/software_engineering/software_engineering_tutorial

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
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TOTAL MARKS				**100**

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	2	2	1
II	2	1	2
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IV	3	1	1
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TOTAL	**12**	**7**	**6**
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PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	2	2
Ave.	3	3	3	2.8	2.8

PO-PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	POs, PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Describe software engineering evolution and SDLC models.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO2	Build an SRS document using requirement analysis.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO3	Examine cohesion, coupling, and DFD-based design.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO4	Distinguish black-box and white-box testing methods.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO5	Design system testing plans using debugging tools.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5

K1= Remember, K2= Understand, K3= Apply, K4=Analyze, K5= Evaluate, K6= Create

Continuous Internal Assessment – Components			
Assessment Type	**Nature**	**Maximum Marks**	**Weightage**
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
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Assignment	Written assignment on Course Related Topics	10	5
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Class activity 1	Quiz with MCQ	10	5
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1. *Quiz (MCQ / Objective Test)*
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PROGRAMME: B.Sc. COMPUTER SCIENCE	BATCH: 2026 – 2029
PART: III	COURSE COMPONENT: CORE XIII
COURSE NAME: ARTIFICIAL INTELLIGENCE	COURSE CODE: 26UCSC313
SEMESTER: VI	MARKS:100
CREDITS: 4	TOTAL HOURS:90
THEORY	

COURSE OBJECTIVE:

To become familiar with basic principles of AI, Heuristic Search Techniques, Game Theory, Knowledge representation and AI applications.

COURSE OUTCOMES:

1. Recall AI foundations, history, and agent concepts.
2. Apply search algorithms to solve AI problems.
3. Compare minimax, alpha-beta pruning, and stochastic games.
4. Evaluate knowledge representation using logic techniques.
5. Design AI solutions using NLP and robotics.

UNIT I **(18 HOURS)**

Artificial Intelligence: Introduction – Foundations of AI - History of AI -Risks and Benefits of AI.

Intelligent Agents: Agents and Environments- The Concept of Rationality - The Nature of Environments - Structure of Agents.

UNIT II **(18 HOURS)**

Solving Problems By Searching: Problem-Solving Agents – Search Algorithms - Uninformed Search Strategies - Breadth First Search – Uniform-cost Search – Depth First Search – Depth-limited and iterative deepening search

Informed (Heuristic) Search Techniques: Greedy Best First Search-A* Search –Memory bounded search - Heuristic Functions.

UNIT III **(18 HOURS)**

Search in Complex Environments: Local Search and Optimization Problems - Hill Climbing - Simulated Annealing- Local Search in Continuous Spaces.

Adversarial Search and Games: Game Theory- Optimal Decisions in Games- The minimax search algorithm - Optimal decisions in multiplayer games-Alpha-Beta Pruning– Move ordering- Heuristic Alpha–Beta Tree Search- Stochastic Games.

UNIT IV **(18 HOURS)**

Knowledge Representation: Logical Agents – Knowledge-Based Agents – Logic - Propositional Logic - First-Order Logic - Syntax and Semantics of First-Order Logic - Forward Chaining - Backward Chaining.

UNIT V **(18 HOURS)**

Applications of AI: Natural Language Processing–Language Models – Grammar – Parsing – Augmented Grammars - Natural Language Tasks - Robotics – Robots – Robot Hardware - Robotic Perception - Planning and Control.

PRESCRIBED BOOKS:

1. S. Russell, P. Norvig, Artificial Intelligence: A Modern Approach, 4th Edition, Pearson Education, 2020.

REFERENCE BOOKS:

1. Vinod Chandra S. S. and Anand Hareendran S. “Artificial Intelligence: Principles and Applications”, 2nd Edition, PHI Learning Pvt Ltd, 2020.
2. Elaine Rich, Kevin Knight, & Shivashankar B Nair, Artificial Intelligence, McGraw Hill, 3rd Edition, 2009.
3. Mishra R. B, Artificial Intelligence, Prentice Hall of India, 2nd Edition, 2011.
4. Prachi Joshi, and Parag Kulkarni, “Artificial Intelligence: Building Intelligent Systems", 2nd Edition, MIT Press, 2012.
5. Dr. Dheeraj Mehrotra, “Basics of Artificial Intelligence & Machine Learning”, Notion Press, 2019.

E-LEARNING RESOURCES:

1. MOOC courses entitled Artificial Intelligence
2. https://in.coursera.org/courses?query=artificial%20intelligence
3. https://www.udemy.com/topic/artificial-intelligence/
4. https://www.geeksforgeeks.org/artificial-intelligence-an-introduction/
5. https://www.tutorialspoint.com/fundamentals_of_science_and_technology/artificial_intelligence.

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Ave.	**3**	**2.8**	**3**	**2.4**	**2.6**

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CO1	Recall AI foundations, history, and agent concepts.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
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Class activity 1	Quiz with MCQ	10	5
Class activity 2	Seminar / Presentation	10	5
Class activity 3	Surprise Class Tests	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50

The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed)

1. *Quiz (MCQ / Objective Test)*
2. *Practical Lab Exercises*
3. *Hands-on Skill Assessment*
4. *Seminar / Presentation*
5. *Group Activity / Collaborative Task*
6. *Peer / Self-Assessment*
7. *Case Study / Scenario-Based Task*
8. *Surprise Practical Test*

PROGRAMME: B.Sc. COMPUTER SCIENCE	**BATCH: 2026 – 2029**
PART: III	**COURSE COMPONENT: CORE – XIV**
COURSE NAME: MOBILE APPLICATION DEVELOPMENT	**COURSE CODE: 26UCSC314**
SEMESTER: VI	**MARKS:100**
CREDITS: 4	**TOTAL HOURS:75**
THEORY	

COURSE OBJECTIVES

To provide students with a comprehensive understanding of mobile application development using the Android platform.

COURSE OUTCOMES

1. Explain core mobile app development concepts.
2. Develop proficiency in setting up the Android environment.
3. Acquire skills to manage Android resources effectively.
4. Design Android UIs using widgets, menus, and adapters.
5. Develop Android apps using SQLite and web APIs.

UNIT-I **(15 HOURS)**

Mobile Application Development Introduction, advantages, difference between mobile application, Web application and Hybrid Application. **Android Operating System**: Introduction, Android Versions with Features, Android Architecture, OHA

UNIT-II **(15 HOURS)**

Android Application Development Environment: Introduction of Android Studio, Android SDK, Android Development Tools, Android Virtual Devices, Directory Structure of Android Application, Activity & Application Life Cycle, Anatomy of Android Application, Android Manifest File.

UNIT-III **(15 HOURS)**

Android Terminologies & Resource handling Terminologies: Context, Activity, Intent, Service, Broadcast Receiver, Fragment Resources: Working with Different Types of Resources Like String, Dimen, Integer, Drawable, Color, Style, Material Design etc.

Animation: Tween Animation and Frame by Frame Animation

UNIT-IV **(15 HOURS)**

UI Widgets: TextView, Button, EditText, CheckBox, RadioButton & RadioGroup, AutoCompleteTextView , Spinner, ImageView, Seekbar, ProgressBar, Dialogs Android Layouts, Menu and Views Layouts: Linear Layout, Absolute Layout, Frame Layout, Relative Layout, Constraint Layout Creation of Layout Programmatically Menu: Option, Context Views: Adapters, ListView, ScrollView, WebView, CardView, RecyclerView

UNIT-V **(15 HOURS)**

Android Storage Techniques: Shared Preferences, Files & Directories, SQLite Database Connectivity & Operations, Sharing Data Between Application Using Content Providers.

Web Application Integration Techniques and Android APIs: Introduction of JSON, JSON Parsing, Networking API, Telephony API, Web API, Building and Publishing Application to Online Application Store

PRESCRIBED BOOKS

1. Head First Android Development (2nd Edition) by David Griffiths and Dawn Griffiths, O'Reilly Media, 2021.
2. Android Programming: The Big Nerd Ranch Guide (5th Edition) by Bill Phillips, Chris Stewart and Kristin Marsicano, Big Nerd Ranch Guides, 2022.
3. Android App Development with Kotlin (2nd Edition) by Donn Felker, Packt Publishing, 2022.

REFERENCE BOOKS

1. Android Cookbook (2nd Edition) by Ian F. Darwin, O'Reilly Media, 2021.
2. Kotlin for Android Developers (2nd Edition) by Antonio Leiva, Leanpub, 2017.
3. Android Studio Arctic Fox Essentials by Neil Smyth, Payload Media, 2021.
4. Learning Android App Development by Wallace Jackson, Apress, 2018.

E-LEARNING RESOURCES:

1. https://developer.android.com
2. https://www.coursera.org
3. https://www.udemy.com
4. https://www.edx.org
5. https://www.youtube.com/@AndroidDevelopers

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	*Answer any 10 out of 12 questions (each in 50 words)*	*1-12*	*3*	*30*
B	*Answer any 5 out of 7 questions (each in 300 words)*	*13-19*	*6*	*30*
C	*Answer any 4 out of 6 questions (each in 1200 words)*	*20-25*	*10*	*40*
TOTAL MARKS				**100**

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	2	1	1
II	2	2	1
III	3	1	2
IV	3	1	1
V	2	2	1
TOTAL	**12**	**7**	**6**
	SECTION A – 12	**SECTION B – 7**	**SECTION C – 6**

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	3	2	3	2
CO 2	2	3	2	2	2
CO 3	3	3	3	2	3
CO 4	2	2	3	3	3
CO 5	3	3	3	3	3
Ave.	**2.6**	**2.8**	**2.6**	**2.6**	**2.6**

PO- PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	POs, PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Explain core mobile app development concepts.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO2	Develop proficiency in setting up the Android environment.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO3	Acquire skills to manage Android resources effectively.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO4	Design Android UIs using widgets, menus, and adapters.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO5	Develop Android apps using SQLite and web APIs.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

Continuous Internal Assessment - Components			
Assessment Type	**Nature**	**Maximum Marks**	**Weightage**
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Written assignment on Course Related Topics	10	5
Workbook / recordbook / notebook	Handwritten Notes	10	5
Class activity 1	Quiz with MCQ	10	5
Class activity 2	Seminar / Presentation	10	5
Class activity 3	Surprise Class Tests	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50

The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed)

1. *Quiz (MCQ / Objective Test)*
2. *Practical Lab Exercises*
3. *Hands-on Skill Assessment*
4. *Seminar / Presentation*
5. *Group Activity / Collaborative Task*
6. *Peer / Self-Assessment*
7. *Case Study / Scenario-Based Task*
8. *Surprise Practical Test*

PROGRAMME: B.Sc. COMPUTER SCIENCE	**BATCH: 2026 – 2029**
PART: III	**COURSE COMPONENT: CORE – XV**
COURSE NAME: PRACTICAL – VII: MOBILE APPLICATION DEVELOPMENT WITH ANDROID	**COURSE CODE: 26UCSC315P**
SEMESTER: VI	**MARKS:100**
CREDITS: 4	**TOTAL HOURS:60**
PRACTICAL	

COURSE OBJECTIVE:

To enable them to develop, test, and deploy Android apps that use core UI components, data storage, device services, and basic networking features.

COURSE OUTCOMES:

1. Configure the Android Studio environment
2. Practice various computing strategies for Python-based solutions to real world problem Create Android interfaces with GUI components and layouts.
3. Develop apps with graphics, database, and notifications.
4. Build Android apps with multithreading and GPS services.
5. Construct and test mobile applications integrating Android components.

PROGRAMS:

(10 HOURS)

1. Write simple program of various IDEs for Android development.
2. Installing and Configuring Android Studio on a Windows System.

(10 HOURS)

3. Develop an application that uses GUI components, Font and Colours
4. Develop an application that uses Layout Managers and event listeners.

(10 HOURS)

5. Write an application that draws basic graphical primitives on the screen
6. Develop an application that makes use of databases.
7. Develop an application that makes use of Notification Manager.

(15 HOURS)

8. Implement an application that uses multi-threading.
9. Develop a native application that uses GPS location information
10. Implement an application that writes data to the SD card.

(15 HOURS)

11. Implement an application that creates an alert upon receiving a message
12. Write a mobile application that makes use of RSS feed
13. Develop a mobile application to send an email.

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	3	2	3	2
CO 2	2	3	2	2	2
CO 3	3	3	3	2	3
CO 4	2	2	3	3	3
CO 5	3	3	3	3	3
Ave.	**2.6**	**2.8**	**2.6**	**2.6**	**2.6**

PO-PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	POs, PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Configure the Android Studio environment.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO2	Create Android interfaces with GUI components and layouts.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO3	Develop apps with graphics, database, and notifications.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO4	Build Android apps with multithreading and GPS services.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5, K6
CO5	Construct and test mobile applications integrating Android components.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

Continuous Internal Assessment – Components			
Assessment Type	**Nature**	**Maximum Marks**	**Weightage**
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Assignment based on experimental concepts	10	5
Workbook/recordbook/ notebook	Handwritten record of experiments, observations, results, and conclusions	10	5
Class activity 1	Hands-on Skill Assessment	10	5
Class activity 2	Group Activity	10	5
Class activity 3	Online Certification	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50

The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed)

1. *Quiz with MCQ*
2. *Seminar / Presentation*
3. *Peer/Self-Assessment*
4. *Puzzle*
5. *Group Discussion*
6. *Group activity*
7. *Surprise class tests*
8. *Case-Study Analysis*

PROGRAMME: B.Sc. COMPUTER SCIENCE	**BATCH: 2026 – 2029**
PART: III	**COURSE COMPONENT: CORE – XVI**
COURSE NAME: PROJECT	**COURSE CODE: 26UCSC316**
SEMESTER: VI	**MARKS:100**
CREDITS: 4	**TOTAL HOURS:60**
PRACTICAL	

COURSE OBJECTIVE:

To demonstrate the ability to analyze requirements, identify challenges, and devise effective solutions to solve real world problems.

COURSE OUTCOMES:

1. Apply domain specific theories, principles, and methodologies to design and execute meaningful projects.
2. Identify complex problems and develop innovative, practical, and multidisciplinary solutions.
3. Demonstrate the ability to conduct research, analyse data, and interpret findings to support informed decision making.
4. Integrate ethical practices, sustainability, and social responsibility into project work, contributing positively to society.
5. Present and document project outcomes, while cultivating adaptability and continuous learning.

GUIDELINES:

- A student is expected to complete planning, analysing, designing and implementing the project in 3 months timeframe.
- Each individual students' contribution is mandatory for internal assessment and to appear for the final viva.

EVALUATION:

Internal assessment will be based on initial project proposal, two reviews and a comprehensive final report of the project.

External assessment will be based on the presentation of the project work and Viva Voce.

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	2
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	2	3	2
Ave.	**3**	**3**	**2.8**	**3**	**2.6**

Continuous Internal Assessment – Components			
Assessment Type	**Nature**	**Maximum Marks**	**Weightage**
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Assignment based on experimental concepts	10	5
Workbook/recordbook/ notebook	Handwritten record of experiments, observations, results, and conclusions	10	5
Class activity 1	Hands-on Skill Assessment	10	5
Class activity 2	Group Activity	10	5
Class activity 3	Online Certification	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50

The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed)

1. *Quiz with MCQ*
2. *Seminar / Presentation*
3. *Peer/Self-Assessment*
4. *Puzzle*
5. *Group Discussion*
6. *Group activity*
7. *Surprise class tests*
8. *Case-Study Analysis*

PROGRAMME: B.Sc. COMPUTER SCIENCE	BATCH: 2026 – 2029
PART: III	COURSE COMPONENT: ELECTIVE – III
COURSE NAME: CLOUD COMPUTING	COURSE CODE: 26UCSC3E3
SEMESTER: VI	MARKS:100
CREDITS: 5	TOTAL HOURS:90
THEORY	

COURSE OBJECTIVE

To provide fundamental knowledge of cloud computing, its architecture, virtualization, storage solutions, security concerns, and cloud-based programming models.

COURSE OUTCOMES

1. Describe cloud concepts, service models, and migration.
2. Interpret cloud architecture and governance frameworks.
3. Classify virtualization types in cloud infrastructure.
4. Assess cloud storage, security, and Hadoop tools.
5. Develop cloud applications using MapReduce and AWS.

UNIT I **(18 HOURS)**

Cloud Computing Foundation: Introduction to Cloud Computing –Characteristics–Pros and cons of Cloud Computing- Move to cloud computing- Types of Cloud- Nature of the Cloud-Technologies in Cloud Computing-Migrating into the Cloud-Seven Step Model-Cloud Infrastructure-Cloud Application Architecture-Cloud Service Models-Cloud Deployment Models. Cloud based services and applications- cloud based concepts and Technologies-Working of Cloud Computing

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UNIT II **(18 HOURS)**

Cloud Computing Architecture: Cloud Life Cycle Model-Role of Cloud Modelling and Architecture- Cloud Modeling and Design Reference Model for Cloud Computing- Developing Holistic Cloud Computing Reference Model-Cloud System Architecture-Cloud Modeling and Designing-Model for Federated Cloud Computing-Cloud Ecosystem Model-Cloud Governance.

UNIT III **(18 HOURS)**

Basics of Virtualization: Types of Virtualization - Implementation Levels of Virtualization - Virtualization Structures - Tools and Mechanisms - Virtualization of CPU, Memory, I/O Devices - Virtual Clusters and Resource management – Virtualization for Data-center Automation - Virtualization Architecture and Software

UNIT IV **(18 HOURS)**

Data Storage and Cloud Computing: Data Storage – Cloud Storage -Cloud Storage from LANs to WANs – Cloud Computing Services: Cloud Services – Cloud Computing at Work Cloud Computing and Security: Risks in Cloud Computing- Data Security in Cloud-Cloud Security Services- Cloud Computing Tools: Tools and Technologies for Cloud – Cloud Mashaps- Apache Hadoop- Cloud Tools

UNIT V **(18 HOURS)**

Parallel and Distributed Programming Paradigms: MapReduce, Twister and Iterative MapReduce – Hadoop Library from Apache – Mapping Applications - Programming Support - Google App Engine, Amazon AWS - Cloud Software Environments -Eucalyptus, Open Nebula, OpenStack, Aneka, CloudSim. Cloud Applications – Moving Applications to the Cloud – Microsoft Cloud Services – Google Cloud Applications – Amazon Cloud Services

PRESCRIBED BOOKS:

1. Cloud Computing – A Practical Approach for Learning and Implementation, A.Srinivasan and J.Suresh, Pearson India Publications 2014.
2. Amazon Web Services in Action, Second Edition, MICHAEL WITTIG ANDREAS WITTIGFOREWORD BY BEN WHALEY MANNING©2019 by Manning Publications

REFERENCE BOOKS:

1. George Reese, “Cloud Application Architectures: Building Applications and Infrastructure in the Cloud” O'Reilly
2. John W. Rittinghouse and James F. Ransome, “Cloud Computing: Implementation, Management, and Security”, CRC Press, 2010
3. Buyya, Vecciola and Selvi, “Mastering Cloud Computing: Foundations and Applications Programming”, Tata McGraw Hill, 2013
4. RajKumar Buyya, James Broberg, Andrzej, “Cloud Computing: Principles and Paradigms”, Wiley India Publications 2011
5. Arshdeep Bahga and Vijay Madisetti, “Cloud Computing – A Hands on Approach”, Universities Press (India) Pvt Ltd. 2014.
6. Kumar Saurabh, “Cloud Computing – insights into New-Era Infrastructure”, Wiley India,2011

E-LEARNING RESOURCES:

1. https://www.simplilearn.com/tutorials/cloud-computing-tutorial/what-is-cloud-computing
2. https://www.tutorialspoint.com/cloud_computing/index.htm
3. https://www.javatpoint.com/introduction-to-cloud-computing
4. https://in.coursera.org/specializations/cloud-computing
5. https://www.edx.org/learn/cloud-computing

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	*Answer any 10 out of 12 questions (each in 50 words)*	*1-12*	*3*	*30*
B	*Answer any 5 out of 7 questions (each in 300 words)*	*13-19*	*6*	*30*
C	*Answer any 4 out of 6 questions (each in 1200 words)*	*20-25*	*10*	*40*
TOTAL MARKS				**100**

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	2	2	1
II	3	2	1
III	2	1	2
IV	3	1	1
V	2	1	1
TOTAL	**12**	**7**	**6**
	SECTION A – 12	**SECTION B - 7**	**SECTION C – 6**

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	3	2	3	3
CO 2	3	2	2	2	3
CO 3	3	3	2	2	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
Ave.	**3**	**2.8**	**2.6**	**2.6**	**3**

PO-PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	POs, PSOs ADDRESSED	COGNITIVE LEVEL (K1 TO K6)
CO1	Describe cloud concepts, service models, and migration.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO2	Interpret cloud architecture and governance frameworks.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO3	Classify virtualization types in cloud infrastructure.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO4	Assess cloud storage, security, and Hadoop tools.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO5	Develop cloud applications using MapReduce and AWS.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

Continuous Internal Assessment - Components			
Assessment Type	**Nature**	**Maximum Marks**	**Weightage**
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Written assignment on Course Related Topics	10	5
Workbook / recordbook / notebook	Handwritten Notes	10	5
Class activity 1	Quiz with MCQ	10	5
Class activity 2	Seminar / Presentation	10	5
Class activity 3	Online Certification	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50

The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed)

1. *Quiz (MCQ / Objective Test)*
2. *Practical Lab Exercises*
3. *Hands-on Skill Assessment*
4. *Seminar / Presentation*
5. *Group Activity / Collaborative Task*
6. *Peer / Self-Assessment*
7. *Case Study / Scenario-Based Task*
8. *Surprise Practical Test*

PROGRAMME: B.Sc. COMPUTER SCIENCE	BATCH: 2026 – 2029
PART: III	COURSE COMPONENT: ELECTIVE – III
COURSE NAME: INTERNET OF THINGS AND ITS APPLICATIONS	COURSE CODE: 26UCSC3E6
SEMESTER: VI	MARKS:100
CREDITS: 5	TOTAL HOURS:90
THEORY	

COURSE OBJECTIVE:

To comprehensively understand IoT fundamentals and applications across industries.

COURSE OUTCOME:

1. Acquire insights of IoT architectures and enabling technologies.
2. Design interconnected systems for various applications in smart environments.
3. Apply wireless technologies for IoT and their protocols.
4. Analyze data handling, analytics, and big data technologies.
5. Demonstrate various IoT applications.

UNIT I **(18 HOURS)**

Fundamentals of IoT: Introduction, Definitions & Characteristics of IoT, IoT Architectures, Physical & Logical Design of IoT, Enabling Technologies in IoT, History of IoT, About Things in IoT, The Identifiers in IoT, About the Internet in IoT, IoT frameworks, IoT and M2M.

UNIT II **(18 HOURS)**

Sensors Networks: Definition, Types of Sensors, Types of Actuators, Examples and Working Development Boards: Arduino IDE and Board Types, RaspberriPi Development Kit, RFID Principles and components, **Wireless Sensor Networks:** History and Context, The node, Connecting nodes, Networking Nodes, WSN and IoT.

UNIT III **(18 HOURS)**

Wireless Technologies for IoT: WPAN Technologies for IoT - IEEE 802.15.4, Zigbee, Z-Wave. IP-Based Protocols for IoT IPv6, 6LowPAN, RPL, REST, AMPQ, CoAP, MQTT.Edge connectivity and protocols.

UNIT IV **(18 HOURS)**

Data Handling & Analytics: Introduction, Bigdata, Types of data, Characteristics of Big data, Data handling Technologies, Flow of data, Data acquisition, Data Storage, Introduction to Hadoop. Introduction to data Analytics, Types of Data analytics, Local Analytics, Cloud analytics and applications.

UNIT V **(18 HOURS)**

Applications of IoT: Home Automation, Smart Cities, Energy, Retail Management, Logistics, Agriculture, Health and Lifestyle, Industrial IoT, Legal challenges, IoT design Ethics, IoT in Environmental Protection.

PRESCRIBED BOOKS:

1. IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, Cisco Press, 2017.
2. Internet of Things – A hands-on approach, Arshdeep Bahga, Vijay Madisetti, Universities Press, 2015.
3. Internet of Things: Architecture, Design Principles And Applications, Rajkamal, McGraw Hill Higher Education.

REFERENCE BOOKS:

1. Daniel Minoli, ― "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications
2. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press.
3. "From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence",Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle and Elsevier, 2014.
4. Dhivya Bala, "ESP8266: Step by Step Tutorial for ESP8266 IoT,Arduino NODEMCU Dev. Kit", 2018.
5. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice", Wiley 2014.

E-LEARNING RESOURCES:

1. https://sites.google.com/view/bscgeeks/internet-of-things
2. http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.html
3. https://kp.kiit.ac.in/wp-content/uploads/2022/01/IOT-Study-materials.pdf
4. ttps://ptgmedia.pearsoncmg.com/images/9781587144561/samplepages/9781587144561_CH08.pdf
5. https://learn.microsoft.com/en-us/azure/iot/iot-introduction

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	*Answer any 10 out of 12 questions (each in 50 words)*	*1-12*	*3*	*30*
B	*Answer any 5 out of 7 questions (each in 300 words)*	*13-19*	*6*	*30*
C	*Answer any 4 out of 6 questions (each in 1200 words)*	*20-25*	*10*	*40*
TOTAL MARKS				**100**

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	2	2	1
II	2	2	1
III	3	1	2
IV	3	1	1
V	2	1	1
TOTAL	**12**	**7**	**6**
	SECTION A – 12	**SECTION B – 7**	**SECTION C - 6**

PSO – CO MAPPING

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	3	2	3	2
CO 2	3	2	3	3	2
CO 3	3	3	3	3	2
CO 4	3	2	3	3	3
CO 5	3	3	2	3	2
Ave.	**3**	**2.6**	**2.6**	**3**	**2.2**

PO-PSO-CO-QUESTION PAPER MAPPING

CO No:	COURSE OUTCOME	POs, PSOs ADDRESSED	COGNITIVE LEVEL (K1 TO K6)
CO1	Acquire insights of IoT architectures and enabling technologies. .	PO1 to PO5, PSO 1 to PSO5	K1, K2, K3, K4, K5
CO2	Design interconnected systems for various applications in smart environments.	PO1 to PO5, PSO 1 to PSO5	K1, K2, K3, K4, K5
CO3	Apply wireless technologies for IoT and their protocols.	PO1 to PO5, PSO 1 to PSO5	K1, K2, K3, K4, K5
CO4	Analyze data handling, analytics, and big data technologies.	PO1 to PO5, PSO 1 to PSO5	K1, K2, K3, K4, K5
CO5	Demonstrate various IoT applications.	PO1 to PO5, PSO 1 to PSO5	K1, K2, K3, K4, K5

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

Continuous Internal Assessment - Components			
Assessment Type	**Nature**	**Maximum Marks**	**Weightage**
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Written assignment on Course Related Topics	10	5
Workbook / recordbook/ notebook	Handwritten Notes	10	5
Class activity 1	Quiz with MCQ	10	5
Class activity 2	Seminar / Presentation	10	5
Class activity 3	Online Certification	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50

The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed)

1. *Quiz (MCQ / Objective Test)*
2. *Practical Lab Exercises*
3. *Hands-on Skill Assessment*
4. *Seminar / Presentation*
5. *Group Activity / Collaborative Task*
6. *Peer / Self-Assessment*
7. *Case Study / Scenario-Based Task*
8. *Surprise Practical Test*

PROGRAMME: B.Sc. COMPUTER SCIENCE	BATCH: 2026 – 2029
PART: III	COURSE COMPONENT: ELECTIVE – III
COURSE NAME: CYBER SECURITY	COURSE CODE: 26UCSC3E7
SEMESTER: VI	MARKS:100
CREDITS: 5	TOTAL HOURS:90
THEORY	

COURSE OBJECTIVE:

The objective of this course is to enable students to understand core concepts, terminology, and legal aspects of cyber security

COURSE OUTCOME:

1. Evaluate fundamental cyber security concepts, theories, and strategies as they apply to real world case studies
2. Understand the principles of cryptography- Encryption
3. Explain technical and non-technical security solutions on different types of cyber systems.
4. Assess risks, vulnerabilities, and threats to sample cyber systems.
5. Identify attributes associated with cyber security professionals Understand of Indian criminal justice system and functioning of various institutions of the criminal justice system.

UNIT I: (14 Hours)

Basics of Cyber Security: Introduction to Cyber Security - Importance and challenges in Cyber Security- Security-Cyber Laws -CFAA, ECPA, HIPAA, COPPA, GDPR-Cyberspace - Cyber threats - Cyber warfare - CIA Triad - Cyber Terrorism- Cyber Security of Critical Infrastructure - Cyber security -Organizational Implications.

UNIT II: (20 Hours)

Vulnerability in cyber space and Security Types of Hackers- Hackers and Crackers - Cyber-Attacks and Vulnerabilities- Malware threats- Sniffing - Gaining Access - Hiding Files - Covering Tracks- Worms - Trojans- Viruses- Backdoors. Vulnerabilities- Overview, Vulnerabilities in Software, System administration, Threat Actors, Attacks, Open Access to Organizational Data, Weak Authentication, Unprotected Broadband communications. Cyber Security Safeguards- Overview, Access control, Audit, Authentication, Biometrics, Cryptography, Deception, Denial of Service Filters, Ethical Hacking, Firewalls, Intrusion Detection Systems, Response, Scanning, Security policy, Threat Management.

UNIT III: **(18 Hours)**

Ethical Hacking and Social Engineering Ethical Hacking Concepts and Scopes- Threats and Attack Vectors - Information Assurance- Threat Modeling- Enterprise Information Security Architecture- Vulnerability Assessment and Penetration Testing- Types of Social Engineering- Insider Attack- Preventing Insider Threats- Social Engineering Targets and Defence Strategies.

UNIT IV: **(20 Hours)**

Cyber Forensics and Auditing Introduction to Cyber Forensics- Computer Equipment and associated storage media- Role of forensics Investigator- Forensics Investigation Process - Collecting Network based Evidence- Writing Computer Forensics Reports - Auditing - Plan an audit against a set of audit criteria- Information Security Management System Management. Introduction to COBIT

UNIT V: (18 Hours)

Architecture of Cyberspce Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Complex Network Architectures, internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security.

PRESCRIBED BOOKS:

1. Donaldson, S., Siegel, S., Williams, C.K., and Aslam, A. (2015). ―Enterprise Cyber security -How to Build a Successful Cyber defense Program against Advanced Threats‖, Apress, 1st Edition.
2. Franke, Don Cyber Security Basics: Protect your organization … (Paperback) Nina Godbole, Sumit Belapure, (2011). ―Cyber Security‖, Willey.
3. Roger Grimes, ―Hacking the Hacker‖, Wiley, 1st Edition, 2017.
4. Yuri Diogenes and Erdal Ozkaya (2018). Cyber security– Attack and Defense Strategies: 2nd Edition Paperback.

REFERENCE BOOKS:

1. Godbole, N., and Belapure, S. (2011). *Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives*, Wiley India Pvt Ltd.
2. Stallings, W. (2017). *Cryptography and Network Security: Principles and Practice*, Pearson Education, 7th Edition.
3. Whitman, M.E., and Mattord, H.J. (2018). *Principles of Information Security*, Cengage Learning, 6th Edition.
4. Grimes, R.A. (2017). *Hacking the Hacker: Learn from the Experts Who Take Down Hackers*, Wiley, 1st Edition.
5. Diogenes, Y., and Ozkaya, E. (2018). *Cybersecurity – Attack and Defense Strategies*, Packt Publishing, 2nd Edition.

E-LEARNING RESOURCES:

1. https://www.netacad.com/courses/cybersecurity/introduction-cybersecurity
2. https://www.cybrary.it/course/cybersecurity-fundamentals/
3. https://portswigger.net/web-security
4. https://www.sans.org/cyberaces/

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	*Answer any 10 out of 12 questions (each in 50 words)*	*1-12*	*3*	*30*
B	*Answer any 5 out of 7 questions (each in 300 words)*	*13-19*	*6*	*30*
C	*Answer any 4 out of 6 questions (each in 1200 words)*	*20-25*	*10*	*40*
TOTAL MARKS				**100**

BREAK UP OF QUESTIONS

UNITS	SECTION A	SECTION B	SECTION C
I	2	2	1
II	2	2	1
III	3	1	2
IV	3	1	1
V	2	1	1
TOTAL	**12**	**7**	**6**
	SECTION A – 12	**SECTION B – 7**	**SECTION C – 6**

PSO-CO MAPPING

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	2
CO2	3	3	2	3	2
CO3	3	3	3	3	2
CO4	2	3	2	3	2
CO5	2	2	3	2	3
Ave.	2.6	2.8	2.4	2.8	2.2

PO-PSO-CO-QUESTION PAPER MAPPING

CO No	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	Evaluate fundamental cyber security concepts, theories, and strategies as applied to real-world case studies.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO2	Understand the principles of cryptography- Encryption	PO1 to PO5, PSO1 to PSO5	K1, K2, K3
CO3	Explain technical and non-technical security solutions on different types of cyber systems.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4
CO4	Assess risks, vulnerabilities, and threats to sample cyber systems.	PO1 to PO5, PSO1 to PSO5	K1, K2, K3, K4, K5
CO5	Identify attributes associated with cyber security professionals Understand of Indian criminal justice system and functioning of various institutions of the criminal justice system.	PO1 to PO5, PSO1 to PSO5	K1, K2, K4

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

Continuous Internal Assessment – Components			
Assessment Type	**Nature**	**Maximum Marks**	**Weightage**
Mid-Semester Examination	Pen and Paper test for 90 minutes	50	10
Model Examination	Written examination for 180 minutes	100	10
Assignment	Written assignment on Course Related Topics	10	5
Workbook/recordbook / notebook	Handwritten Notes	10	5
Class activity 1	Quiz with MCQ	10	5
Class activity 2	Seminar / Presentation	10	5
Class activity 3	Online Certification	10	5
Attendance	Marks will be given based on the attendance percentage of respective course	5	5
Total			50

The Mode of Evaluation for class activity can be based on the following parameters (these are suggestions, the faculty can add more if needed)

1. *Quiz (MCQ / Objective Test)*
2. *Practical Lab Exercises*
3. *Hands-on Skill Assessment*
4. *Seminar / Presentation*
5. *Group Activity / Collaborative Task*
6. *Peer / Self-Assessment*
7. *Case Study / Scenario-Based Task*
8. *Surprise Practical Test*