GOVERNMENT COLLEGE (A) RAJAHMUDNRY

DEPARTMENT OF COMPUTER SCIENCE

BOARD OF STUDIES

B.Sc (Honours) Computer Science

ESTD - 1853

2025-26

Preface

The **Board of Studies (BoS) meeting of the Department of Computer Science** is convened on **15 September 2025** to deliberate on the curriculum revamping of undergraduate single-major programs. This initiative is undertaken in response to **stakeholder feedback** and **emerging industry requirements**, and in alignment with the **Government of Andhra Pradesh's directives** and the **National Education Policy (NEP)–2020**, which emphasize the need for modern, skill-oriented, and industry-relevant curricula.

In preparation for this revision, the Department of Computer Science has carried out a **comprehensive review of the existing curriculum**. Valuable feedback was gathered from students, alumni, faculty, and industry experts, highlighting the need to:

☐ Update course content, Introduce **market-oriented courses**,

☐ Integrate **internship training**, and

☐ Offer advanced subjects such as **Data Science, Artificial Intelligence, Digital Forensics, and Full Stack Development**.

Based on these inputs, the Department has redesigned **restructured programs** - **B.Sc. Computer Science (Honors)** and **B.Sc. Artificial Intelligence (Honors)** - that balances **core Computer Science courses** with **applied skill-oriented tracks**. The Major programs span eight semesters with multiple entry and multiple exit options, beginning with a foundation in Computer Science and programming (C, Java, Python), backend technologies (DBMS, DoD), and progressing into advanced tracks:

☐ **B.Sc. Computer Science (Honors)** - Skill Elective Tracks in V & VI semesters:

▪ *Track A*: Full Stack Development

▪ *Track B*: Data Science

☐ **B.Sc. Artificial Intelligence (Honors)** - Skill Elective Tracks in V & VI semesters:

▪ *Track A*: Natural Language Processing

▪ *Track B*: Data Engineering

▪ *Track C*: Automation & Robotics

In addition, the Department is offering **Minor Programs** in **Computer Science, Computer Applications, and Data Science** for students from other disciplines (spanning III to VI semesters). These programs provide non-major students with exposure to both fundamentals and applied aspects of Computer Science, enabling **vertical academic mobility** and multi-disciplinary learning.

Further, the Department has taken the initiative to **inculcate Artificial Intelligence skills**

across the college by introducing **mandatory Skill Enhancement Courses (SECs)** in the I and II semesters for all students, irrespective of stream:

☐ *Fundamentals of Artificial* Intelligence

☐ *Applications of Artificial Intelligence (Discipline-Specific)*

The revised curriculum is carefully designed to provide a strong theoretical foundation, hands-on practical skills, exposure to interdisciplinary applications, and pathways for higher studies, competitive examinations, and industry careers.

This meeting is intended to **present, deliberate, and seek approval** for the revised curriculum structure of both Major and Minor programs in Computer Science, ensuring that it meets academic standards, addresses industry requirements, and enhances future career prospects of students.

Suneel Kumar Duvvuri

Chairman-Board of Studies

Department of Computer Science

Proceedings of the Principal, Government College (Autonomous), Rajahmundry
Present: Dr. Ramachandra R.K, M.Sc., Ph.D.

Rc. No. 24/GCRJY /UG-BoS/ 2025-26 dt. 04.09.2025

Sub: Government College (A), Rajamahendravaram- UG Boards of Studies (BoS)-
   Nomination of Members – Orders issued.
Ref: 1. UGC Guidelines of for Autonomous Colleges-2023.
   2. Proc.No.ANUR/DAA/2025, dated 30-08-2025 of the Vice-Chancellor, ANUR
   ****

Order

The Principal, Government College (Autonomous) Rajahmundry is pleased to nominate the following members to UG Board of Studies to frame the syllabus of **Computer Science and Applications subject** in all the semesters duly following the norms of the UGC regulations for the Autonomous colleges 2023.

S. No	Name	Designation
1	Dr. Suneel Kumar Duvvuri	Chairman
2	All Faculty members in the department	Member
3	Sri G. Vijayadeep, Lecturer in Computer Science, SRR & CVR Govt. College (A), Vijayawada	Subject Expert
4	Sri Kavuri Sridhar, Asst. Professor & TPO, Dept. of Computer Science, PB Siddhartha College of Arts & Science, Vijayawada	Subject Expert
5	Dr. V. Persis, ANUR	University Nominee
6	Sri Maddikonda Satya Sai Srinivasa Kishore, Cloud Analyst , WIPRO	Expert from Corporate Sector
7	Sri P. Bharat Kumar, Java Developer, Wipro	Alumnus

The above members are requested to attend the BoS meeting in September 2025 and share their valuable views, and suggestions on the following functionaries.

a) Prepare syllabi for the subject keeping in view the objectives of the college, interest of the stake holders and National requirement for consideration and approval of the IQAC and Academic Council

b) Suggest methodologies for innovative teaching and evaluation techniques

c) Suggest the panel of names to the Academic Council for appointment of Examiners

d) Coordinate research, teaching, extension and other activities in the department of the College.

e) Suggest CLO, PLO, PI and subject experts to develop question bank in compliance with Bloom's Taxonomy.

The above said members are requested to bestow their services for the successful organization of the event.

PRINCIPAL
GOVERNMENT COLLEGE (AUTONOMOUS)
RAJAHMUNDRY

Government College Autonomous, Rajahmundry
Department of Computer Science
Board of Studies for the Undergraduate Programs
Academic Year 2025-2026
Composition of Board of Studies

Chairman	Dr. Suneel Kumar Duvvuri, In-charge of the Department, Department of Computer Science Government College (A), Rajahmundry.
University Nominee	Dr. V Persis Associate Professor Department of Computer Science and Engineering University College of Engineering, Adikavi Nannaya University, Rajahmundry
Subject Expert	Sri G. Vijayadeep, Lecturer in Computer Science, SRR & CVR Govt. College (A), Vijayawada
Subject Expert	Sri Kavuri Sridhar, Asst. Professor & TPO, Dept. of Computer Science, PB Siddhartha College of Arts & Science, Vijayawada
Expert from Industry	Sri Maddikonda Satya Sai Srinivasa Kishore, Cloud Analyst , WIPRO Pvt Ltd.,
Alumnus	Sri P Bharat Kumar (Undergraduate Student of 2019-22) Java Developer, WIPRO Pvt Ltd.,
Members	
Smt U Sandhya Rani	Faculty Member
Mr Devaraju Hanumanthu	Faculty Member
Sri P. Narasinga Rao	Faculty Member
Sri. D. Seetha Ramulu	Faculty Member
Kum S.Jaya Lakshmi	Faculty Member
Smt Ch.Sujatha	Faculty Member
Smt B.BalaParameswari	Faculty Member

Government College Autonomous, Rajahmundry
Department of Computer Science
Board of Studies for the Undergraduate Programs
Academic Year 2025-2026

In pursuance of the Government of Andhra Pradesh's directions to revamp undergraduate single-major programs, and in alignment with the NEP–2020 guidelines, the Department of Computer Science has revised its curriculum framework.

In 2023–24, the department introduced **single-major programs** in place of three-major degree programs. Based on the feedback received from students, evaluators, and subject experts, the curricular framework has been further strengthened this year.

The present revision incorporates feedback from students, alumni, faculty, and industry experts, with a focus on:

Strengthening the Theoretical Foundation,

Promoting Skill Enhancement through Skill Enhancement Courses (SECs) on *Foundations of Artificial Intelligence* and *Applications of Artificial Intelligence* for all students across the college irrespective of stream,

Introducing Subject-Specific Skill Enhancement Course Tracks to deepen discipline knowledge and practical exposure.

Accordingly, the Department has restructured the **B.Sc. (Honors)-Computer Science (Major)** and **B.Sc.(Honors) Artificial Intelligence (Major)** programs, and designed **Minor programs** in **Computer Science, Computer Applications, and Data Science** for students of other disciplines.

The revised syllabi, course distribution, and elective options are placed before the Board of Studies for discussion and approval.

Agenda Items

1. Approval of the New Curricular Framework for the Academic Year 2025–26.
2. Curriculum design for B.Sc. (Honors) - Computer Science and B.Sc. (Honors)- Artificial Intelligence) as per revised curriculum framework effective from 2025–26.
3. Formulation of Course Objectives and Course Learning Outcomes (CLOs).
4. Approval of semester-wise curriculum for III, IV, V, VII, and VIII Semesters (B.Sc. Honors - CS, AI) effective from 2023–24.
5. Introduction of Minor Programs in Computer Science, Data Science, and Computer Applications as per revised curriculum framework effective from 2025–26 (for Non-Computer Science Students).

6. Pedagogical Approaches and Skill Orientation with emphasis on experiential learning, project-based learning, and ICT-enabled teaching.
7. Model Question Papers and Identification of Paper Setters.
8. Evaluation and Assessment Reforms in line with NEP-2020 guidelines.
9. Academic Activities of the Department planned for the Academic Year 2025-26.
10. Any Other Items with the Permission of the Chair.

Suneel Kumar Duvvuri
Chairman-Board of Studies
Department of Computer Science

Government College Autonomous, Rajahmundry
Department of Computer Science
Board of Studies for the Undergraduate Programs
Academic Year 2025-2026
Minutes and Resolutions of the Meeting

Chairperson: Dr. Suneel Kumar Duvvuri, Head of the Department of Computer Science

Members Present:

1. Dr. V. Persis – Associate Professor, Department of Computer Science and Engineering, Adikavi Nannaya University, Rajahmahendravaram – ***University Nominee***

2. Sri G. Vijayadeep – Lecturer, Department of Computer Science, SRR & CVR Govt. College (A), Vijayawada – ***Subject Expert***

3. Sri Kavuri Sridhar – Assistant Professor, Department of Computer Computer Science, PB Siddhardha College of Arts & Science, Vijayawada – ***Subject Expert***

4. Sri Maddikonda Satya Sai Srinivasa Kishore – Cloud Analyst, WIPRO Pvt. Ltd – ***Industrial Expert***

5. Smt U. Sandhya Rani – Lecturer, Department of Computer Science– ***Faculty Member***

6. Sri Devaraju Hanumanthu – Lecturer, Department of Computer Science– ***Faculty Member***

7. Sri P. Narasinga Rao – Lecturer, Department of Computer Science– ***Faculty Member***

8. Sri D. Seetha Ramulu – Lecturer, Department of Computer Science– ***Faculty Member***

9. Ms. S. Jaya Lakshmi – Lecturer, Department of Computer Science– ***Faculty Member***

10. Smt Ch. Sujatha – Lecturer, Department of Computer Science– ***Faculty Member***

11. Smt B. Bala Parameswari – Lecturer, Department of Computer Science– ***Faculty Member***

12. Sri P. Bharat Kumar – Java Developer, WIPRO Pvt Ltd. – ***Alumnus***

The members of the Board of Studies convened on 15 September 2025 at the Department of Computer Science & Applications under the Chairmanship of Suneel Kumar Duvvuri, Lecturer In-charge. The meeting commenced promptly at 10:00 AM, with the primary purpose of addressing the various items listed on the agenda for discussion.

1. Approval of the New Curricular Framework for the Academic Year 2025-26.

2. Curriculum design for B.Sc. (Honors) - Computer Science and B.Sc. (Honors)- Artificial Intelligence) as per revised curriculum framework effective from 2025-26.

3. Formulation of Course Objectives and Course Learning Outcomes (CLOs).

4. Approval of semester-wise curriculum for III, IV, V, VII, and VIII Semesters (B.Sc. Honors - Computer Science, Artificial Intelligence Programs) effective from 2023-24.

5. Introduction of Minor Programs in Computer Science, Data Science, and Computer Applications as per revised curriculum framework effective from 2025–26 (for Non-Computer Science Students).

6. Pedagogical Approaches and Skill Orientation with emphasis on experiential learning, project-based learning, and ICT-enabled teaching.

7. Model Question Papers and Identification of Paper Setters.

8. Evaluation and Assessment Reforms in line with NEP-2020 guidelines.

9. Academic Activities of the Department planned for the Academic Year 2025-26.

10. Any Other Items with the Permission of the Chair.

At the outset, Dr. Suneel Kumar Duvvuri, Chairman of the Board, extended a cordial welcome to all members and acknowledged their presence. He then introduced each member of the board, setting a collegial and collaborative tone for the meeting.

In his opening remarks, Dr. Suneel Kumar outlined the Undergraduate and Postgraduate programs currently offered by the Department of Computer Science under the single-major system. He highlighted the importance of the present curriculum revision, stressing the necessity of aligning the programs with the **National Education Policy (NEP)–2020** and the reform measures proposed by the Andhra Pradesh State Council of Higher Education (APSCHE). He further apprised the members that these reforms have been duly endorsed and adopted by the Affiliating University, Adikavi Nanayya University, Rajahmahendravaram.

To formally commence the proceedings, Dr. Suneel Kuanr Duvvuri placed before the board the Draft Board of Studies (BoS) document, inviting deliberations and collective insights on the agenda items.

The following Members Attended the Meeting on **15 September 2025**

S.No.	Name	Designation	Signature
1	Dr. V. Persis	University Nominee	
2	Sri G. Vijayadeep	Subject Expert	
3	Sri Kavuri Sridhar	Subject Expert	
4	Sri Maddikonda Satya Sai Srinivasa Kishore	Industrial Expert	
5	Smt U Sandhya Rani	Faculty Member	
6	Sri. Devaraju Hanumanthu	Faculty Member	
7	Sri. P. Narasinga Rao	Faculty Member	
8	Sri. D. Seetha Ramulu	Faculty Member	
9	Ms. S.Jaya Lakshmi	Faculty Member	
10	Smt Ch.Sujatha	Faculty Member	
11	Smt B.BalaParameswari	Faculty Member	
12	Sri P. Bharat Kumar	Alumnus	

Suneel Kumar Duvvuri

Chairman-Board of Studies

Department of Computer Science

B.Sc. (Honors) Computer Science

Program Specific Outcomes (PSOs)

After completion of the program, the student is able to

PSO1: Problem Solving Proficiency: Proficiently analyze intricate problems, identify requirements, and implement efficient algorithms using appropriate programming languages.

PSO2: Expert Software Development: Expertly design software, architect systems, and develop solutions with an emphasis on scalability, user experience, and best practices.

PSO3: Specialized Knowledge Application: Apply specialized knowledge in areas such as AI, data science, cyber security, contributing to practical problem-solving and innovative solutions.

PSO4: Effective Communication and Collaboration: Communicate technical concepts effectively and collaborate proficiently within multidisciplinary teams, demonstrating leadership and teamwork skills.

Curriculum Framework for B.Sc (Honours) from A.Y. 2025-26 Major+Minor with CSP & 6th sem Internship

Semester	Major (4 Cr) C	H (T+P)	Cr	Minor (4 Cr) C	H (T+P)	Cr	AECC (3 Cr) C	H (T+P)	Cr	Multi Disciplinary (2 Cr) C	H (T+P)	Cr	Skill Enhancement Courses (4Cr/2Cr) C	H (T+P)	Cr	OOTC C	H (T+P)	Cr	(VAC) IKS# Env. Edn* (2 Cr) C	H (T+P)	Cr	Total C	H (T+P)	Cr
Sem 1	2	6+4	8				2	8	6				1	4+2	4							5	24	18
Sem 2	2	6+4	8				2	8	6	1	2	2	1	4+2	4				1#	2	0	7	28	20
Community Service Project of a minimum of 80 hours with 1 Credits. Student is eligible for Exit Option-1 with the award of Certificate in respective discipline																								1
Sem 3	3	9+6	12	1	3+2	4	2	8	6	1	2	2	1	2	2							8	32	26
Sem 4	3	9+6	12	1	3+2	4				1	2	2	1	2	2							6	24	20
Sem 5	1+2	3+2 6+4	12	2	6+4	8													1*	2	2	6	27	22
Sem 6	2	6+4	8	2	6+4	8																4	20	16
Internship/Apprenticeship/OJT a minimum of 180 hours (8 weeks) with 3 Credits. Student is eligible for Exit Option-2 with the award of Degree in respective discipline																								3
Total	**15**		**60**	**6**		**24**	**6**		**18**	**3**		**6**	**4**		**12**				**1+1**		**2**	**36**		**126**
Sem 7	3	9+6	12										2	6+4	8	1	2	2	1#	2	0	7	29	22
Sem 8	3	9+6	12										2	6+4	8	1	2	2	1#	2	0	7	29	22
4-YR	**21**		**84**	**6**		**24**	**6**		**18**	**3**		**6**	**8**		**28**	**2**		**4**	**4**		**2**	**50**		**170**

C	Courses		H	Hours		Cr	Credits		OOTC	Open Online Transdisciplinary
#	Indian Knowledge Systems - Audit Course				*		Environ Edn			

	CURRICULAR FRAMEWORK B.Sc HONOURS FROM THE A.Y. 2025-26							
	(Major + Minor with CSP & VI Semester Internship)							
	1st Year - Semester I							
Sl.No	**Category**	**Course No**	**No. of Hours**		**Total No. of Hours**	**No. of Credits**		**Total No. of Credits**
			Theory	**Practical**		**Theory**	**Practical**	
1	Major - Core	I	3	2	5	3	1	4
2	Major - Core	II	3	2	5	3	1	4
3	Minor	0	0	0	0	0	0	0
4	AECC - English	I	4	0	4	3	0	3
5	AECC - MIL (Telugu/Hindi/ Sanskrit)	I	4	0	4	3	0	3
6	Multidisciplinary Course	0	0	0	0	0	0	0
7	Skill Enhancement Course (SEC) **Fundamentals of Artificial Intelligence**	I	4	2*	6	4	0	4
End of Semester I of 1st Year		**5**	**18**	**6**	**24**	**16**	**2**	**18**
	1st Year - Semester II							
1	Major - Core	III	3	2	5	3	1	4
2	Major - Core	IV	3	2	5	3	1	4
3	Minor	0	0	0	0	0	0	0
4	English	II	4	0	4	3	0	3
5	MIL (Telugu/Hindi/ Sanskrit)	II	4	0	4	3	0	3
6	Multidisciplinary Course	I	2	0	2	2	0	2
7	Skill Enhancement Course (SEC) **Application of Artificial Intelligence (Discipline Specific)**	II	4	2*	6	4	0	4
8	Indian Knowledge System	I	2	0	2	0	0	0

9	Community Service Project (minimum of 80 hours with 1 Credit)							1
End of Semester II of 1st Year		7	22	6	28	18	3	21
2nd Year - Semester III								
1	Major - Core	VI	3	2	5	3	1	4
2	Major - Core	VII	3	2	5	3	1	4
3	Major - Core	VIII	3	2	5	3	1	4
4	Minor	I	3	2	5	3	1	4
5	AECC (Creative Writing/Business Writing in English)	III	4	0	4	3	0	3
6	AECC (Creative Writing/Journalistic Writing in MIL - Telugu/Hindi/ Sanskrit)	III	4	0	4	3	0	3
7	Multidisciplinary Course	II	2	0	2	2	0	2
8	Skill Enhancement Course (SEC) Design Thinking/Problem Solving / Others	III	2	0	2	2	0	2
End of Semester III of 2nd Year		8	24	8	32	22	4	26
2nd Year - Semester IV								
1	Major - Core	IX	3	2	5	3	1	4
2	Major - Core	X	3	2	5	3	1	4
3	Major - Core	XI	3	2	5	3	1	4
4	Minor	II	3	2	5	3	1	4
5	Multidisciplinary Course	IV	2	0	2	2	0	2
6	Skill Enhancement Course (SEC) Design	IV	2	0	2	2	0	2

	Thinking/Problem Solving / Others							
End of Semester IV of 2nd Year		6	16	8	24	16	4	20
3rd Year - Semester V								
1	Major - Core	V	3	2	5	3	1	4
2	Major - Elective	XII	3	2	5	3	1	4
3	Major - Elective	XIII	3	2	5	3	1	4
4	Minor	III	3	2	5	3	1	4
5	Minor	IV	3	2	5	3	1	4
6	Environmental Education	I	2	0	2	2	0	2
End of Semester V of 3rd Year		6	17	10	27	17	5	22
3rd Year - Semester VI								
1	Major - Elective	XIV	3	2	5	3	1	4
2	Major - Elective	XV	3	2	5	3	1	4
3	Minor	VII	3	2	5	3	1	4
4	Minor	VIII	3	2	5	3	1	4
5	Semester Internship (minimum of 180 hours with 3 Credits)							3
End of Semester VI of 3rd Year		4	12	8	20	12	7	19

Courses - Credit Distribution

Component	Distribution	Credits
Major	11 Core Courses × 4 Credits = 44 4 Skill Courses × 4 Credits = 16	60
Minor	6 Courses × 4 Credits	24
AECC (Languages)	English: 3 Courses × 3 Credits = 9 MIL: 3 Courses × 3 Credits = 9	18
Multidisciplinary Courses	3 Courses × 2 Credits	6
Skill Enhancement Courses (SECs)	AI: 2 Courses × 4 Credits = 8 Others: 2 Courses × 2 Credits = 4	12
Value Added Course	Environmental Education = 2	2
CSP + Internship	–	4
Total	–	**126**

B.Sc. (Honors) Computer Science

Sl. No	Semester	Course Code & Course Title	CIA	SEE	Hours/week			
					L	T	P	C
1	I	**CS-101:** Computer Fundamentals and Office Automation	50	50	3	-	-	3
		CS-101P: Computer Fundamentals and Office Automation Lab	-	50	-	-	2	1
2		**CS-102:** Problem Solving Using C	50	50	3	-	-	3
		CS-102P: Problem Solving Using C Lab	-	50	-	-	2	1
3	II	**CS-201:** Data Structures using C	50	50	3	-	-	3
		CS-201P: Data Structures using C Lab	-	50	-	-	2	1
4		**CS-202:** Digital Logic Design	50	50	3	-	-	3
		CS-202P: Digital Logic Design Lab	-	50	-	-	2	1
5	III	**CS-301:** OOPS Through JAVA	50	50	3	-	-	3
		CS-301P: OOPS Through JAVA Lab	-	50	-	-	2	1
6		**CS-302:** Database Management System	50	50	3	-	-	3
		CS-302P: Database Management System Lab	-	50	-	-	2	1
7		**CS-303:** Computer Organization	50	50	3	-	-	3
		CS-303P: Computer Organization Lab	-	50	-	-	2	1
8	IV	**CS-401:** Operating Systems	50	50	3	-	-	3
		CS-401P: Operating Systems Lab	-	50	-	-	2	1
9		**CS-402:** Computer Networks	50	50	3	-	-	3
		CS-402P: Computer Networks Lab	-	50	-	-	2	1
10		**CS-403:** Python Programming	50	50	3	-	-	3
		CS-403P: Python Programming Lab	-	50	-	-	2	1
11	V	**CS-501:** Software Engineering	50	50	3	-	-	3

		CS-501P: Software Engineering Lab	-	50	-	-	2	1
SEA:Skill Elective Track A (Full Stack Web Development)								
12	V - Track A	*CS-502SEA1*:Web Interface Design Technologies	50	50	3	-	-	3
		CS-502SEA1P:Web Interface Design Technologies Lab	-	50	-	-	2	1
13		*CS-503SEA2*:Web Application Development using PHP & MySQL	50	50	3	-	-	3
		CS-503SEA2P:Web Application Development using PHP & MySQL Lab	-	50	-	-	2	1
14	VI- Track A	*CS-601SEA3:* Mobile Application Development	50	50	3	-	-	3
		CS-601SEA3P:Mobile Application Development Lab	-	50	-	-	2	1
15		*CS-602SEA4*:MERN Stack	50	50	3	-	-	3
		CS-602:SEA4P: MERN Stack Lab	-	50	-	-	2	1
SEB:Skill Elective Track B (Data Science)								
16	V - Track B	*CS-502SEB1*:Data Science with R	50	50	3	-	-	3
		CS-502SEB1P: Data Science with R Lab	-	50	-	-	2	1
17		*CS-503SEB2*:Python for Data Science	50	50	3	-	-	3
		CS-503SEB2P: Python for Data Science Lab	-	50	-	-	2	1
18	VI - Track B	*CS-601SEB3*:Data Visualization Tools	50	50	3	-	-	3
		CS-601SEB3P:Data Visualization Tools Lab	-	50	-	-	2	1
19		*CS-602SEB4*:Machine Learning	50	50	3	-	-	3
		CS-602SEB4P: Machine Learning Lab	-	50	-	-	2	1

C12, C13, C14, and C15 (2 courses in Semester V and 2 in Semester VI) must be selected from the same track.

The student must choose **only one track – either Track A or Track B – and continue with the same track** across both semesters.

Government College Autonomous, Rajahmundry
Department of Computer Science
Board of Studies for the Undergraduate Programs
Academic Year 2025-2026
Scheme of Valuation for Practical Examinations

S. No.	Description	Odd Semester (Internal Practical)	Even Semester (External Practical)
1	Record Maintenance*	10	10
2	Viva-Voce	10	10
3	Problem Solving / Programming / Experiment/ Procedure Explanation (Algorithm/Flowchart if Any)	15	15
4	Lab Performance / Execution & Output	15	15
	Total	50 Marks	50 Marks

*Award of Marks for Record Maintenance

S. No.	Number of Practicals Recorded	Marks Awarded
1	10 Practicals and Above	10
2	8 Practicals	8
3	6 Practicals	6
4	5 Practicals	5
5	Less than 5	0

- Odd Semesters (Internal): Conducted by the concerned faculty (course teacher). One additional examiner will be nominated by the Department Incharge.
- Even Semesters (External): Conducted jointly by an External Examiner (from another college/university) and the concerned faculty (as Internal Examiner).

Government College Autonomous, Rajahmundry
Department of Computer Science
Board of Studies for the Undergraduate Programs
Academic Year 2025-2026
List of Examiners and Paper Setters

S. No	Name of the Lecturer/ Reader/ Professor	Papers	College	City
1	Prof P Suresh Varma	ALL	Dept of CSE, AKNU	Rajahmundry
2	Dr V Persis	ALL	Dept of CSE, AKNU	Rajahmundry
3	Dr M Kamala Kumari	ALL	Dept of CSE, AKNU	Rajahmundry
4	Dr P Venkateswara Rao	ALL	Dept of CSE, AKNU	Rajahmundry
5	Dr D. Latha	ALL	Dept of CSE, AKNU	Rajahmundry
6	Dr B. Kezia Rani	ALL	Dept of CSE, AKNU	Rajahmundry
7	R V Satyanarayana	ALL	GDC (P R) Kakinada	Kakinada
8	G Balavenkata Padmanadh	ALL	GDC Mummidivaram	Mummidivaram
9	Dr N Sridhar	ALL	GDC Srikakulam	Srikakulam
10	E Jyothikiranmayi	ALL	SCIM GDC Tanuku	Tanuku
11	Rebba Ashok Kumar	ALL	SCIM GDC Tanuku	Tanuku
12	Smt M Rajini	ALL	GDC Ravulapalem	Ravulapalem
13	Dr K Satya Rajesh	ALL	GDC Bantumalli	Bantumalli
14	Vijayadeep Gummadi	ALL	GDC (SRR & CVR)	Vijayawada
15	Bharat Kumar	ALL	GDC (SRR & CVR)	Vijayawada
16	M. Arun Kumar	ALL	GDC Kovvur	Kovvur
17	Smt N Swarnajyothi	ALL	GDC Kaikaluru	Kaikaluru
18	U Sarala	ALL	GDC Avanigadda A	Avanigadda
19	Dr A Sivaprasad	ALL	GDC Tekkali	Tekkali
20	I Srilakshmi	ALL	GDC (A) Tuni	Tuni
21	Sri B Raghuram	ALL	GDC Seethampeta	Seethampeta
22	Sri B Srinivas	ALL	GDC (M) Srikakulam	Srikakulam
23	Dr K V Sobha Rani	ALL	GDC Ramachandrapuram	Ramachandrapuram
24	R Venakata Phani Kumar	ALL	GDC Perumallapuram	Perumallapuram
25	G Satya Suneetha	ALL	GDC Kovvuru	Kovvuru
26	Dr. U Subhashini	ALL	GDC Ravulapalem	Ravulapalem
27	B Hemaraju	ALL	GDC Tekkali	Tekkali
28	P Jyothi	ALL	GDC Pathapatnam	Pathapatnam
29	S Vani Kumari	ALL	GDC (W) Srikakulam	Srikakulam
30	Simma Madhavi Latha	ALL	GDC (W) Srikakulam	Srikakulam

Semester-I

CS-101: Computer Fundamentals and Office Automation

Semester: I	L-T-P: 3-0-0	Credits:03

Course Objectives

1. **Understand foundational computing concepts**, including number systems, the evolution of computers, block diagrams, and generational progress.
2. **Develop knowledge of computer architecture**, focusing on system organization and networking fundamentals.
3. **Acquire practical skills in document creation**, formatting, and digital presentations using word processing tools.
4. **Gain proficiency in spreadsheet operations**, such as data entry, formulas, functions, and charting techniques.
5. **Introduce data visualization and basic modelling principles**, fostering analytical thinking in structuring and interpreting data sets.

Course Outcomes

1. At the End of the Course, The Students will be able to **explain different number systems**, the historical evolution of computers, and identify key components in a block diagram.
2. Learners will demonstrate **basic blocks of a computer and fundamental networking knowledge.**
3. Learners will create professional-level documents and **design visually appealing presentations** using word processing software and presentation software.
4. Learners will manipulate data within spreadsheets, apply formulas, and **generate accurate summaries and visualizations.**
5. Learners will apply data modelling techniques to **analyze, organize, and represent data effectively** in various scenarios.

Unit 1. Number Systems, Evolution , Block Diagram and Generations:

Number Systems: Binary, Decimal, Octal, Hexadecimal; conversions between number systems.

Evolution of Computers: History from early mechanical devices to modern-day systems.

Block Diagram of a Computer: Components like Input Unit, Output Unit, Memory, CPU (ALU + CU).

Generations of Computers: First to Fifth Generation – technologies, characteristics, examples.

Unit 2. Basic organization and N/W fundamentals:

Computer Organization: Functional components – Input/Output devices, Storage types, Memory hierarchy.

Types of Computers: Micro, Mini, Mainframe, and Supercomputers.

Networking Fundamentals: Definition, need for networks, types (LAN, WAN, MAN), topology (Star, Ring, Bus).

Internet Basics: IP Address, Domain Name, Web Browser, Email, WWW.

Unit 3. Word Processing and presentations:

Word Processing Basics: Using MS Word/Google Docs – formatting, styles, tables, mail merge.

Presentation Tools: Using PowerPoint/Google Slides – slide design, animations, transitions.

Applications: Creating resumes, reports, brochures, and presentations.

Keyboard Shortcuts

Unit 4. Spreadsheet Basics:

Spreadsheet Concepts: Understanding rows, columns, cells in tools like MS Excel/Google Sheets, cell referencing.

Functions and Formulae: SUM, AVERAGE, IF, COUNT.

Charts and Graphs: Creating visual representations

Data Handling: Sorting, filtering, conditional formatting.

Text Functions: LEFT, RIGHT, MID, LEN, TRIM, CONCAT, TEXTJOIN

Advanced Functions: **Logical**: IF, AND, OR, IFERROR, **Lookup**: VLOOKUP, HLOOKUP, XLOOKUP, INDEX, MATCH

Unit 5. Data Analysis and Visualization:

Conditional Formatting: Custom rules, Color scales, Icon sets, Data bars

Data Analysis Tools: Pivot Tables and Pivot Charts, Data Validation (Drop-downs, Input Messages, Error Alerts), What-If Analysis: Goal Seek, Scenario Manager, Data Tables

Charts and Dashboards: Creating Interactive Dashboards, Using slicers with Pivot Tables,Combo Charts and Sparklines

Productivity Tips: Using Named Ranges, Freeze Panes, Split View

Textbooks:

1. **Fundamentals of Computers,** Reema Thareja, Oxford University Press, Second Edition
2. **Fundamentals of Computers**, V. Rajaraman – PHI Learning
3. **Introduction to Computers** by Peter Norton – McGraw Hill

4. **Microsoft Office 365 In Practice** by Randy Nordell – McGraw Hill Education

References:

1. **Excel 2021 Bible** by Michael Alexander, Richard Kusleika – Wiley
2. **Networking All-in-One For Dummies** by Doug Lowe – Wiley
3. **Microsoft Official Docs and Training**: https://learn.microsoft.com
4. **Google Workspace Learning Center**: https://support.google.com/a/users/

Activities:

Outcome: At the End of the Course, The Students will be able to **explain different number systems**, the historical evolution of computers, and identify key components in a block diagram.

Activity: Create a digital poster or infographic comparing number systems (binary, decimal, octal, hexadecimal) and illustrating the timeline of computer generations with key innovations.

Evaluation Method: Rubric-based assessment of the poster presentation on a 10-point scale focusing on:

- Accuracy of number system conversions
- Correct identification of block diagram components
- Visual organization and creativity

Outcome: Learners will demonstrate **basic blocks of a computer and fundamental networking knowledge.**

Activity: Design a concept map showing the internal architecture of a computer and types of networks (LAN, WAN, MAN), including devices and topologies.

Evaluation Method: Checklist-based peer review and instructor validation:

- Completeness of the map
- Correctness of networking concepts
- Use of appropriate terminology
- Logical flow and structure of the map

Outcome: Learners will create professional-level documents and **design visually appealing presentations** using word processing software and presentation software.

Activity: Prepare a formal report (e.g., project proposal) in a word processor and present it using a slide deck with transitions, embedded media, and design elements.

Evaluation Method: Performance-based evaluation using a 10-point scoring scale:

- Formatting and structure of the document
- Presentation aesthetics and clarity
- Communication skills during presentation

Outcome: Learners will manipulate data within spreadsheets, apply formulas, and **generate accurate summaries and visualizations.**

Activity: Analyze a dataset (e.g., student scores or sales data) using spreadsheet software. Apply formulas (SUM, AVERAGE, IF, VLOOKUP) and create relevant charts.

Evaluation Method: Practical test with a rubric:

- Correct use of formulas
- Accuracy of data summaries

Outcome: Learners will apply data modelling techniques to **analyze, organize, and represent data effectively** in various scenarios.

Activity: Prepare an interactive dashboard for a given data set using EXCEL.

Evaluation Method: Evaluation of the dashboard on a 10-point scoring scale:

- Presentation aesthetics and clarity
- Interactiveness
- Communication skills during presentation

CS-101P: Computer fundamentals and Office Automation Lab

Semester: I	L-T-P: 0-0-2	Credits:01

List of Experiments:

1. Demonstration of Assembling and Dessembling of Computer Systems.

2. Identify and prepare notes on the type of Network topology of your institution.

3. Prepare your resume in Word.

4. Using Word, write a letter to your higher official seeking 10-days leave.

5. Prepare a presentation that contains text, audio and video.

6. Using a spreadsheet, prepare your class Time Table.

7. Using a Spreadsheet, calculate the Gross and Net salary of employees(Min 5) considering all the allowances.

8. Generate the class-wise and subject-wise results for a class of 20 students. Also generate the highest and lowest marks in each subject.

9. Using IF, AND, OR, and IFERROR to Automate Grade Evaluation.

    a. Create a table of student scores in different subjects.

    b. Use IF to assign grades (A/B/C/Fail).

    c. Use IFERROR to handle missing scores or invalid data.

10. *Employee Database Search Using VLOOKUP, HLOOKUP, XLOOKUP, INDEX, and MATCH*

    a. Create a database of employees (Name, ID, Department, Salary).

    b. Implement VLOOKUP to search by employee ID.

    c. Use HLOOKUP to extract department heads by role.

    d. Apply XLOOKUP for more flexible searches.

    e. Use INDEX + MATCH as an alternative to VLOOKUP.

11. Sales Report Analysis Using Pivot Tables and Charts

    a. Use a dataset of product sales (Product, Region, Date, Quantity, Revenue).

    b. Create Pivot Tables to summarize data by region/product.

    c. Insert Pivot Charts for visual analysis (e.g., bar, line).

    d. Add slicers to make the dashboard interactive.

12. Designing a Data Entry Form with Drop-downs and Input Rules

    a. Create a student registration form.

    b. Add drop-down lists for course selection using Data Validation.

    c. Add input messages to guide users.

    d. Add error alerts for wrong entries.

13. Monthly Budget Planning using Goal Seek and Scenario Manager

    a. Create a simple personal budget (income, expenses, savings).

      b.   Use Goal Seek to determine income needed to save a desired amount.

      c.   Use Scenario Manager to compare different budgeting scenarios (best/ worst/ realistic case).

      d.   Create a one-variable Data Table to analyze how different expenses affect savings.

14. Dashboard Creation Using Combo Charts, Sparklines & Slicers

      a.   Use existing sales or attendance data.

      b.   Insert combo charts (e.g., column + line).

      c.   Add sparklines to show trends.

      d.   Use slicers with Pivot Tables to control dashboard elements.

      e.   Finalize and format for interactivity.

CLO-PLO Mapping

CLO\PLO	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10
CLO 1	3	1	-	-	-	-	-	-	1	-
CLO 2	3	-	-	1	-	-	-	-	1	-
CLO 3	2	-	-	3	-	-	3	-	-	-
CLO 4	3	2	1	3	-	-	2	-	-	-
CLO 5	3	3	2	3	-	-	1	-	1	-

(3 = High, 2 = Moderate, 1 = Low, 0 = Not mapped)

Blue Print of Question Paper

S.NO	QUESTIONS	UNITS OF THE SYLLABUS	MARKS
1	Question1 or Question2	UNIT-I	7
2	Question3 or Question4	UNIT-II	7
3	Question5 or Question6	UNIT-III	7
4	Question7 or Question8	UNIT-IV	7
4	Question9 or Question10	UNIT-V	7
5	Question 11, 12, 13, 14, 15,16, 17, 18 Short answers (Five out of Eight should be answered, each question is of 3 Marks)	Covers All Five Units of the Syllabus	5x3=15
		Total	50

GOVERNMENT AUTONOMOUS COLLEGE, RAJAHMUNDRY
B.Sc.(Honours) Computer Science
Semester: I
CS-101: Computer Fundamentals and Office Automation
Model Question Paper

Time: 2 ½ Hours   Max. Marks: 50 M

Section – A				
Answer ALL Questions. Each Question Carries 7 Marks **5 X 7 = 35**				
Question	**BL**	**CLO**	**PLO**	**PI**
1. Explain the block diagram of a computer with components. **OR** 2. Discuss the evolution of computers from 1st to 5th generation.	2	1	1	1.1.2 / 1.1.3
3. Explain different network topologies with diagrams. **OR** 4. Discuss the role of IP addresses and domain names in Internet communication.	2 / 3	2	2	2.1.2 / 2.1.3
5. Demonstrate the steps in creating a table in MS Word. **OR** 6. How do you design a professional presentation with transitions and animations?	3	3	4	4.1.2 / 4.1.3
7. Explain different chart types in MS Excel with examples. **OR** 8. Illustrate the use of logical functions (IF, AND, OR) with examples.	3	4	2	2.1.4 / 2.1.5
9. Explain the creation of dashboards using Pivot tables and slicers. **OR** 10. Describe the use of Goal Seek and Scenario Manager for data analysis.	4	5	2 / 3	2.1.6 / 3.1.1
Section – B				
Answer any FIVE Questions. Each Question Carries 3 Marks **5 X 3 = 15**				
11. Convert 456 (Decimal) into Binary and Hexadecimal.	1	1	1	1.1.1
12. Differentiate Microcomputers and Supercomputers.	2	2	1	1.1.3
13. Write short notes on LAN and WAN.	1	2	2	2.1.1
14. List any three features of MS Word for creating documents.	1	3	4	4.1.1
15. Explain the purpose of animations in presentations.	2	3	4	4.1.2
16. What is VLOOKUP? Give an example.	2	4	2	2.1.3
17. Define Pivot Table in spreadsheets.	1	5	2	2.1.4
18. What are conditional formatting rules in Excel? Give one example.	2	5	2	2.1.5

CS-102: Problem Solving using C

Semester: I	L-T-P: 3-0-0	Credits:03

Course Objectives:

1. Understand the fundamentals of computer programming, Apply structured problem-solving approaches using algorithms, flowcharts, and C programming constructs.
2. Develop efficient logic using decision-making, loop, and jump control statements.
3. Utilize derived data types like arrays and strings for modular program design.
4. Design and implement modular solutions using functions, recursive logic, pointer operations, and dynamic memory management.
5. Handle complex data structures including structures, unions, and text file operations.

Course Outcomes:

At the end of the course, students will be able to:

1. Understand basic computing concepts, programming paradigms and write structured C programs.
2. Apply control flow statements to solve logical and repetitive tasks in C.
3. Implement arrays and string operations to manage and manipulate data efficiently.
4. Design modular code using functions, recursion, and appropriate parameter passing.
5. Utilize pointers and memory operations for effective data handling. Demonstrate competence in dynamic memory allocation and text file processing.

Unit 1. Introduction to computer programming:

Introduction, Types of software, Compiler and interpreter, Concepts of Machine level, Assembly level and high-level programming, Flowcharts and Algorithms, Fundamentals of C: History of C, Features of C, C Tokens-variables and keywords and identifiers, constants and Data types, Rules for constructing variable names, Operators, Structure of C program, Input /output statements in C-Formatted and Unformatted I/O

Unit 2. Control statements:

Decision making statements: if, if else, else if ladder, switch statements. Loop control statements: while loop, for loop and do-while loop. Jump Control statements: break,continue and goto.

Unit 3. Derived data types in C:

Arrays: One Dimensional arrays - Declaration, Initialization and Memory representation; Two Dimensional arrays -Declaration, Initialization and Memory representation. Strings: Declaring & Initializing string variables; String handling functions, Character handling functions

Unit 4. Functions:

Pointers: Pointer data type, Pointer declaration, initialization, accessing values using pointers. Pointer arithmetic, Pointers and arrays.

Function Prototype, definition and calling. Return statement. Nesting of functions. Categories of functions. Recursion (Basic Concept only). Parameter Passing by address & by value. Local and Global variables. Storage classes: automatic, external, static and register.

Unit 5. Dynamic Memory Management:

Introduction, Functions-malloc, calloc, realloc, free Structures: Basics of structure, structure members, accessing structure members, nested structures, array of structures, structure and functions, structures and pointers. Unions - Union definition; difference between Structures and Unions. Working with text files - modes: opening, reading, writing and closing text files.

Text Books:
1. Programming in ANSI C, E. Balagurusamy, Tata McGraw Hill, 6 th Edn,
2. Computer fundamentals and programming in C, Reema Theraja, Oxford University Press

Reference Books:
1. Let us C, Y Kanetkar, BPB publications
2. Head First C: A Brain-Friendly Guide, David Griffiths, Dawn Griffiths

Activities:

Outcome: Understand basic computing concepts, programming paradigms and write structured C programs.

Activity: Create a concept map of computing fundamentals and programming paradigms (procedural, structured, object-oriented). Then, they write a structured C program (e.g., a calculator or student grade system) using proper syntax, indentation, and modular design.

Evaluation Method: Rubric-based Code Review & Viva to check the

- ○ The correctness of the concept map
- ○ Correct use of structure (main + functions)
- ○ Identification of paradigm used
- ○ Code readability and documentation

Outcome: Apply control flow statements to solve logical and repetitive tasks in C.

Activity: Implement a program that solves a logic puzzle (e.g., number guessing game, pattern generation, or prime number finder) using if, switch, for, while, and do-while.

Evaluation Method: Automated Test Cases + Peer Review to check the

- ○ Correct use of control statements
- ○ Logical correctness of output
- ○ Efficiency and edge case handling
- ○ Peer feedback on clarity and logic

Outcome: Implement arrays and string operations to manage and manipulate data efficiently.

Activity: Build a program that stores and arranges student marks in ascending and descending order using arrays and performs string operations like concatenation, comparing, and formatting names.

Evaluation Method: Functional Demonstration + Code Walkthrough to check the

- ○ Correct array and string usage
- ○ Memory efficiency
- ○ Handling of invalid inputs
- ○ Explanation of sorting/searching logic

Activity:

- **Recursive Problem Solver**

   Students write a modular program to solve a recursive problem (e.g., factorial, Fibonacci, or Tower of Hanoi) using functions with parameters and return values.

Evaluation Method:

- **Code Trace + Written Quiz**
  - ○ Correct function decomposition
  - ○ Proper parameter passing (by value/reference)
  - ○ Recursion depth and base case handling
  - ○ Quiz on tracing recursive calls

Outcome: Utilize pointers and memory operations for effective data handling. Demonstrate competence in dynamic memory allocation and text file processing.

Activity: Create a program that dynamically stores user input (e.g., survey responses) using pointers and writes/reads the data to/from a text file.

Evaluation Method: Memory Debugging + File I/O Assessment to check the

- ○ Proper use of malloc, calloc, realloc, and free
- ○ Pointer arithmetic and dereferencing
- ○ File creation, reading, writing, and error handling
- ○ Use of tools like Valgrind or manual memory trace (Optional for Unix flavours)

CS-102P: Problem Solving using C Lab

Semester: I	L-T-P: 0-0-2	Credits:01

List of Experiments:

1. Write a program to check whether the given number is Armstrong or not.
2. Write a program to find the sum of individual digits of a positive integer.
3. Write a program to generate the first n terms of the Fibonacci sequence.
4. Write a program to find both the largest and smallest number in a list of integer values
5. Write a program to demonstrate change in parameter values while swapping two integer variables using Call by Value & Call by Address
6. Write a program to perform various string operations.
7. Write a program to search an element in a given list of values.
8. Write a program that uses functions to add two matrices.
9. Write a program to calculate factorial of given integer value using recursive functions
10. Write a program for multiplication of two N X N matrices.
11. Write a program to sort a given list of integers in ascending order.
12. Write a program to calculate the salaries of all employees using Employee (ID, Name, Designation, Basic Pay, DA, HRA, Gross Salary, Deduction, Net Salary) structure.
    a. DA is 30 % of Basic Pay
    b. HRA is 15% of Basic Pay
    c. Deduction is 10% of (Basic Pay + DA)
    d. Gross Salary = Basic Pay + DA+ HRA
    e. Net Salary = Gross Salary - Deduction
13. Write a program to read / write the data from / to a file.
14. Write a program to reverse the contents of a file and store in another file.
15. Write a program to create Book (ISBN,Title, Author, Price, Pages, Publisher)structure and store book details in a file and perform the following operations
    a. Add book details
    b. Search a book details for a given ISBN and display book details, if available
    c. Update a book details using ISBN
    d. Delete book details for a given ISBN and display list of remaining Books

CLO-PLO Mapping

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CLO 3	3	2	1	1	-	-	-	-	-	-
CLO 4	3	2	2	-	-	1	-	-	-	-
CLO 5	3	2	3	1	-	-	-	-	1	-

(3 = High, 2 = Moderate, 1 = Low, 0 = Not mapped)

Blue Print of Question Paper

S.NO	QUESTIONS	UNITS OF THE SYLLABUS	MARKS
1	Question1 or Question2	UNIT-I	7
2	Question3 or Question4	UNIT-II	7
3	Question5 or Question6	UNIT-III	7
4	Question7 or Question8	UNIT-IV	7
4	Question9 or Question10	UNIT-V	7
5	Question 11, 12, 13, 14, 15,16, 17, 18 Short answers (Five out of Eight should be answered, each question is of 3 Marks)	Covers All Five Units of the Syllabus	5x3=15
		Total	**50**

GOVERNMENT AUTONOMOUS COLLEGE, RAJAHMUNDRY
B.Sc.(Honours) Computer Science
Semester: I
CS-102: Problem Solving Using C
Model Question Paper

Time: 2 ½ Hours   Max. Marks: 50 M

Section – A				
Answer ALL Questions. Each Question Carries 7 Marks **5 X 7 = 35**				
Question	**BL**	**CLO**	**PLO**	**PI**
1. Explain the fundamental components of a C program with suitable examples. **OR** 2. Discuss the difference between compiler and interpreter with examples.	2	1	1	1.1.2 / 1.1.3
3. Write a C program to find the largest of three numbers using if-else. **OR** 4. Explain the working of switch statement with a sample program.	3	2	2	2.1.2 / 2.1.3
5. Explain 1D and 2D arrays in C with memory representation. **OR** 6. Write a C program to demonstrate string handling functions	3	3	4	3.1.2 / 3.1.3
7. How does parameter passing differ by value and by address? **OR** 8. Explain pointers with arrays. Write a program to display elements using pointers.	3/4	4	2	2.1.4 / 2.1.5
9. Explain dynamic memory allocation functions with syntax and examples. **OR** 10. Differentiate between Structures and Unions with examples.	4	5	2 / 3	2.1.6 / 3.1.1
Section – B				
Answer any FIVE Questions. Each Question Carries 3 Marks **5 X 3 = 15**				
11. Define Flowchart. Draw a simple flowchart to find the sum of two numbers.	1	1	1	1.1.1
12. List the different types of C tokens with examples.	2	1	1	1.1.3
13. Differentiate between while, do-while, and for loops.	2	2	2	2.1.1
14. Write a C program to demonstrate the use of break and continue.	3	2	2	2.1.2
15. Write short notes on array of strings..	2	3	3	3.1.1
16. Explain different storage classes in C with examples.	2	4	2	2.1.3
17. Write a program to open a file in write mode and store student names.	3	5	2	2.1.4
18. Write a short note on nested structures with an example.	2	5	3	3.1.1

Semester II

CS-201: Data Structures using C

Semester: II	L-T-P: 3-0-0	Credits:03

Course Objectives:

1. Understand fundamental concepts of algorithms and data structures with focus on complexity analysis and abstract data types.
2. Explore various types of linked lists and their dynamic memory representations and operations.
3. Analyze and implement linear data structures, such as stacks and queues, and examine their real-world applications.
4. Apply sorting and searching algorithms, understanding their performance implications and optimization strategies.
5. Design and manipulate hierarchical and graph-based structures, applying traversal algorithms and understanding their practical uses in computing.

Course Outcomes:

Learners will be able to:

1. Explain algorithm characteristics, time and space complexity, and asymptotic notations with clarity.
2. Implement and analyze different types of linked lists, including insertion, deletion, and traversal operations.
3. Develop stack and queue data structures using arrays and linked lists, and apply them in expression evaluation.
4. Apply efficient searching and sorting algorithms to solve computational problems and evaluate performance trade-offs.
5. Construct and traverse tree and graph structures, using them to solve problems like shortest path and spanning trees.

Unit 1. Basic Concepts:

Algorithm: Definition and characteristics, Complexity analysis: Space Complexity, Time Complexity, Asymptotic Notations.

Introduction to Data structures: Definition, Types of Data structures, Abstract Data Types (ADT), Introduction to Linked Lists, Representation of linked lists in Memory, Comparison between Linked List and Array.

Unit 2. Linked Lists:

Types of Linked Lists - Singly Linked list, Doubly Linked list, Circularly Singly Linked list, Circularly Doubly Linked list; Implementation of Single Linked List ADT: Creating a List, Traversing a linked list, Searching in linked list, Insertion and deletion into linked list (At first Node, Specified Position, Last node).

Unit 3. Stacks and Queues:

Introduction to stack ADT, Implementation of stacks using array and Linked List, Application of stacks - Polish Notations - Converting Infix to Post Fix Notation - Evaluation of Post Fix Notation.
Queues: Introduction to Queue ADT, Implementation of Queues using array and Linked List, Application of Queues Types of Queues- Circular Queues, De-queues, Priority Queue, Heaps.

Unit 4. Searching and Sorting:

Linear or Sequential Search, Binary Search, Hashing and collision resolution.
Sorting: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort and Merge Sort

Unit 5. Trees and Graphs:

Tree Terminology, Binary Tree Representation, Traversal techniques, Expression Tree, Binary Search Tree- Definition, Operations on a Binary Search Tree: Creation, Search, Insertion & deletion.
Graphs: Introduction to Graphs, Terminology, Representation (Adjacency Matrix, Adjacency List), Traversal of Graphs (DFS, BFS), Applications of Graphs, Concept of Shortest Path Problems, Concept of Minimum Cost Spanning Tree

Textbooks:
1. Data Structures Using C, Balagurusamy E. Tata MCGraw Hill
2. Data Structures using C, Reema Thareja, Third Edition, Oxford University Press

Reference Books:
1. Data Structures, Lipschutz, Schaum's Outline Series, Tata Mcgraw-hill
2. Data Structures Using C, Ch. Vijay Kumar, Pen Press International

Activities:

Outcome: Explain algorithm characteristics, time and space complexity, and asymptotic notations with clarity

Activity: Create a comparative chart of algorithms with different notations related to time and space complexities.

Evaluation Method: Rubric-based assessment of the chart for correctness, clarity, and depth of explanation on a 10-point scale.

Outcome: Implement and analyze different types of linked lists, including insertion, deletion, and traversal operations

Activity: Code a menu-driven program in C to implement single linked lists with all basic operations.

Evaluation Method: Practical lab assessment with test cases and Viva-style questioning to explain pointer manipulation.

Outcome: Develop stack and queue data structures using arrays and linked lists, and apply them in expression evaluation

Activity: Build a program to convert infix expressions to postfix and evaluate them using stacks; Implement queues using both arrays and linked lists with enqueue/dequeue operations.

Evaluation Method: Code review and execution of programs for sample cases and evaluation based on correctness and efficiency.

Outcome: Apply efficient searching and sorting algorithms to solve computational problems and evaluate performance trade-offs

Activity: Implement and compare sorting algorithms (e.g., selection sort and bubble sort) and searching algorithms (e.g., Linear vs. Binary Search) on datasets of varying sizes. Record number of swaps and iterations for preparing a chart to assimilate the results.

Evaluation Method: Performance report with graphs and analysis. Oral presentation or peer review discussing trade-offs and algorithm selection rationale.

Outcome: Construct and traverse tree and graph structures, using them to solve problems like shortest path and spanning trees

Activity: Implement binary trees and graphs using adjacency lists/matrices.

Evaluation Method: Lab demo with sample inputs and visual output (e.g., tree traversal order, graph paths).

CS-201P: Data Structures using C Lab

Semester: II	L-T-P: 0-0-2	Credits:01

List of Experiments

1. Write a program to read 'N' numbers of elements into an array and also perform the following operation on an array

    a. Add an element at the beginning of an array

    b. Insert an element at given index of array

    c. Update an element using a values and index

    d. Delete an existing element

2. Write a program to implement Single Linked List with insertion, deletion and traversal operations

3. Write a program to implement Doubly Linked List with insertion, deletion and traversal operations

4. Write a program to implement the Stack operations using Arrays and Linked Lists.

5. Write a program to convert a given infix expression to a postfix expression using stacks.

6. Write a program to implement the Queue operations using Arrays and Linked Lists.

7. Write a program to implement the Circular Queue operations using Arrays.

8. Write a program for Binary Search Tree Traversals

9. Write a program to search an item in a given list using the following Searching Algorithms

    a. Linear Search

    b. Binary Search.

10. Write a program for implementation of the following Sorting Algorithms

    a. Bubble Sort

    b. Insertion Sort

    c. Quick Sort

    d. Merge Sort

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CLO\PLO	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10
CLO 1	3	2	-	-	-	-	1	-	-	-
CLO 2	3	2	1	1	-	-	-	-	-	-
CLO 3	3	2	2	1	-	-	-	-	-	-
CLO 4	3	3	2	1	-	-	-	-	1	-
CLO 5	3	3	3	1	-	-	-	-	1	-

(3 = High, 2 = Moderate, 1 = Low, 0 = Not mapped)

Blue Print of Question Paper

S.NO	QUESTIONS	UNITS OF THE SYLLABUS	MARKS
1	Question1 or Question2	UNIT-I	7
2	Question3 or Question4	UNIT-II	7
3	Question5 or Question6	UNIT-III	7
4	Question7 or Question8	UNIT-IV	7
4	Question9 or Question10	UNIT-V	7
5	Question 11, 12, 13, 14, 15,16, 17, 18 Short answers (Five out of Eight should be answered, each question is of 3 Marks)	Covers All Five Units of the Syllabus	5x3=15
		Total	**50**

Time: 2 ½ Hours   Max. Marks: 50 M

Section – A				
Answer ALL Questions. Each Question Carries 7 Marks **5 X 7 = 35**				
Question	**BL**	**CLO**	**PLO**	**PI**
1. Explain Time and Space complexity in detail. Discuss various Asymptotic Notations (Big O, Big Omega, Big Theta) used for algorithm analysis. **OR** 2. What is an Abstract Data Type (ADT)? Compare and contrast arrays with linked lists, providing scenarios where each is preferable.	2	1	1	1.1.1 / 1.1.3
3. Write a C program to implement a singly linked list with functions for insertion at the beginning, deletion at the end, and display. **OR** 4. Describe doubly linked lists and circular linked lists with suitable diagrams. Explain the process of inserting a node at a specified position in a doubly linked list.	3	2	3	3.1.2 / 3.1.3
5. Explain the procedure to convert the following infix expression to postfix using a stack: (A + B) * C - (D - E) * (F + G). Show the state of the stack and the output at each step. **OR** 6. How can a queue be implemented using a linked list? Write Algorithms for the enqueue and dequeue operations for a linked queue.	3/4	3	2	2.1.2 / 2.1.4
7. Explain the Quick Sort algorithm. Trace the algorithm to sort the following array of elements: [44, 33, 11, 55, 77, 90, 40, 60, 99, 22, 88, 66] **OR** 8. What is hashing? Explain any two collision resolution techniques with suitable examples.	3/4	4	2	2.1.2 / 2.1.5
9. What is a Binary Search Tree (BST)? Create a BST for the following sequence of numbers: 45, 15, 79, 90, 10, 55, 12, 20, 50. Also, show the preorder, inorder, and postorder traversals of the final tree. **OR** 10. Explain Breadth-First Search (BFS) and Depth-First Search (DFS) graph traversal algorithms with an example for each.	4	5	3	3.1.1 / 3.1.4

Section – B				
Answer any FIVE Questions. Each Question Carries 3 Marks **5 X 3 = 15**				
11. Define an algorithm and list its key characteristics.	1	1	1	1.1.1
12. What is the difference between a static and a dynamic data structure?	2	1	1	1.1.3
13. Write a short note on the applications of stacks.	2	3	1	1.1.2
14. What is a circular queue and why is it useful?	2	3	2	2.1.1
15. Differentiate between linear search and binary search.	2	4	2	2.1.3
16. Define the following tree terminologies: root, leaf, sibling, and depth.	1	5	1	1.1.1
17. What is a graph? Explain the adjacency matrix representation of a graph.	2	5	1	1.1.3
18. Write algorithm for Bubble Sort	3	4	4	2.1.3

CS-202: Digital Logic Design

Semester: II	L-T-P: 3-0-0	Credits:03

Course Objectives

1. Introduce the fundamentals of number systems, their conversions, and binary arithmetic operations.
2. Explore digital logic through gates, Boolean algebra, and simplification techniques for logic functions.
3. Develop proficiency in designing basic combinational circuits like adders and subtractors.
4. Equip students with the skills to implement advanced combinational components such as multiplexers, encoders, and decoders.
5. Foster understanding of sequential circuits, flip-flops, counters, and shift registers for system-level design.

Course Outcomes

At the end of the course, students will be able to:

1. Apply concepts of number systems to perform radix conversions and binary arithmetic using signed and unsigned formats.
2. Simplify logic functions using Boolean algebra, Karnaugh maps, and universal gates.
3. Design and analyze combinational circuits such as half adders, full adders, and subtractors.
4. Construct advanced combinational logic modules, including multiplexers, demultiplexers, encoders, decoders, and their hierarchical versions. Realize complex Boolean functions using combinations of logic modules.
5. Develop and evaluate sequential circuits such as flip-flops, latches, counters, and shift registers.

Unit 1: Number Systems:

Conversion of numbers from one radix to another radix, r's, (r-1)'s complements, signed binary numbers, addition and subtraction of unsigned and signed numbers, weighted and unweighted codes.

Unit 2. Logic Gates and Boolean Algebra:

NOT, AND, OR, universal gates, X-OR and X-NOR gates, Boolean laws and theorems, complement and dual of a logic function, canonical and standard forms, two level realization of logic functions using universal gates, minimizations of logic functions (POS and SOP) using Boolean theorems, K-map (up to four variables), don't care conditions.

Unit 3. Combinational Logic Circuits – 1:

Design of half adder, full adder, half subtractor, full subtractor, ripple adders and subtractors, ripple adder / subtractor.

Unit 4. Combinational Logic Circuits – 2:

Design of decoders, encoders, priority encoder, multiplexers, demultiplexers, higher order decoders, demultiplexers and multiplexers, realization of Boolean functions using decoders, multiplexers.

Unit 5. Sequential Logic Circuits:

Classification of sequential circuits, latch and flip-flop, RS- latch using NAND and NOR Gates, RS, JK, T and D flip-flops, truth tables and excitation tables, conversion of flip- flops, flip-flops with asynchronous inputs (preset and clear). Registers- shift registers, bidirectional shift registers, universal shift register, design of ripple counters, modulus counters.

Text Books:
1. Digital Design, M. Morris Mano, Michael D Ciletti,5th edition, Pearson.
2. Digital Logic Design, K.C. Rao, Ramana, Pen International Press

Reference Books:
1. Digital Electronics and Logic Design, Jaydeep Chakravorty, Universities Press
2. Digital Logic Design, Sonali Singh, BPB Publications

Activities:

Outcome: Apply concepts of number systems to perform radix conversions and binary arithmetic using signed and unsigned formats

Activity: Design a calculator in a spreadsheet or simulation tool (e.g., Logisim) that performs: Decimal ↔ Binary ↔ Hexadecimal conversions and binary arithmetic (addition, subtraction).

Evaluation Method: Rubric-based evaluation on a 10point scale (conversion accuracy, arithmetic correctness)

Outcome: Simplify logic functions using Boolean algebra, Karnaugh maps, and universal gates

Activity: Provide students with complex Boolean expressions and truth tables. Ask them to: Simplify using Boolean laws, Minimize using Karnaugh maps and Implement using only NAND or NOR gates

Evaluation Method: Worksheet submission with step-by-step simplification and evaluation of gate-level implementation using a 10-point scale.

Outcome: Design and analyze combinational circuits such as half adders, full adders, and subtractors

Activity: Build and simulate: Half adder and full adder using logic gates, and half and full subtractor circuits

Evaluation Method: Evaluate the correctness of the circuits for different inputs on a 10-point scale.

Outcome: Construct advanced combinational circuits, including multiplexers, demultiplexers, encoders and decoders.

Activity: Design Multiplexers for function selection, Decoders for control signal generation and Encoders for input compression

Evaluation Method: Project-based evaluation with functional demo and assessments based on a 10-point scale.

Outcome: Develop and evaluate sequential circuits such as flip-flops, latches, counters, and shift registers

Activity: Implement and test SR, JK, D, T flip-flops, asynchronous and synchronous counters using a simulator (E.g. Logisim, Multisim)

Evaluation Method: Lab assessment on a 10-point scale to understand the correctness of the circuit and presentation of the design.

CS-202P: Digital Logic Design Lab

Semester: II	L-T-P: 0-0-2	Credits:01

List of Experiments

The laboratory work can be done by using physical gates and necessary equipment or simulators.

Simulators: https://sourceforge.net/projects/gatesim/ or https://circuitverse.org/ or any free open-source simulator

1. Introduction to digital electronics lab- nomenclature of digital ICs, specifications, study of the data sheet, concept of Vcc and ground, verification of the truth tables of logic gates using TTL ICs.
2. Implementation of the given Boolean functions using logic gates in both SOP and POS forms
3. Realization of basic gates using universal gates.
4. Design and implementation of half and full adder circuits using logic gates.
5. Design and implementation of half and full subtractor circuits using logic gates.
6. Verification of stable tables of RS, JK, T and D flip-flops using NAND gates.
7. Implementation and verification of Decoder and encoder using logic gates.
8. Implementation of 4X1 MUX and DeMUX using logic gates.
9. Implementation of 8X1 MUX using suitable lower order MUX.
10. Implementation of 7-segment decoder circuit.
11. Implementation of 4-bit parallel adder.
12. Design and verification of 4-bit modulus counter.

CLO-PLO Mapping

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CLO 3	3	2	3	1	-	-	-	-	-	-
CLO 4	3	3	3	1	-	-	-	-	-	-
CLO 5	3	3	3	1	-	-	-	-	1	-

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		Total	50

Time: 2 ½ Hours   Max. Marks: 50 M

Section – A				
Answer ALL Questions. Each Question Carries 7 Marks **5 X 7 = 35**				
Question	**BL**	**CLO**	**PLO**	**PI**
1. Explain the procedure for converting a hexadecimal number to a decimal number. Convert $(1AFC)_{16}$ to its decimal, binary, and octal equivalents. **OR** 2. Perform the subtraction $(11010)_2$ - $(10000)_2$ using both 1's complement and 2's complement arithmetic.	3	1	2	2.1.1 / 2.1.3
3. State and prove De Morgan's theorems for three variables using truth tables. Implement the expression $F(A, B, C) = \Sigma m(0, 2, 4, 6, 7)$ using only NAND gates. **OR** 4. Simplify the following Boolean function using a 4-variable K-map and realize the simplified expression using universal gates: $F(W,X,Y,Z) = \Sigma m(0,1,2,4,5,6,8,9,12,13,14)$	3/4	2	3	3.1.2 / 3.1.3
5. Design a full adder circuit using two half adders and an OR gate. Explain its operation with a truth table and logic diagram. **OR** 6. Design a full subtractor and implement it using logic gates. Provide the truth table, logical expressions for difference and borrow, and the final circuit diagram.	4	3	3	3.1.1 / 3.1.4
7. Design a 4-to-1 multiplexer (MUX) using logic gates. Also, show how to implement the Boolean function $F(A,B,C) = \Sigma m(1, 3, 5, 6)$ using an 8-to-1 MUX. **OR** 8. What is an encoder? Design a decimal-to-BCD encoder that takes ten decimal inputs (0-9) and produces the corresponding 4-bit BCD output.	4	4	3	3.1.2 / 3.1.4
9. Explain the working of a JK flip-flop with its logic diagram, truth table, and characteristic equation. How is the race-around condition eliminated? **OR** 10. Design a 3-bit synchronous ripple counter using T flip-flops. Draw the logic diagram and explain its timing diagram.	4	5	3	3.1.1 / 3.1.4
Section – B				
Answer any FIVE Questions. Each Question Carries 3 Marks **5 X 3 = 15**				

Question				
11. Convert the decimal number $(29.25)_{10}$ to its binary equivalent.	2	1	1	1.1.3
12. Define 'canonical form' and 'standard form' of a Boolean expression.	1	2	1	1.1.1
13. Draw the logic symbol and truth table for an X-NOR gate.	1	2	1	1.1.2
14. What is a half adder? Write the logical expressions for its sum and carry.	2	3	2	2.1.1
15. Differentiate between a multiplexer and a demultiplexer.	2	4	2	2.1.3
16. What is the difference between combinational and sequential logic circuits?	2	5	1	1.1.3
17. Explain the difference between a latch and a flip-flop.	2	5	2	2.1.1
18. What is a shift register? List its types.	1	5	1	1.1.2