

Shiv Chhatrapati Shikshan Sanstha's
Rajarshi Shahu Mahavidyalaya, Latur

Empowered Autonomous Institution



**Structure and Curriculum of Four-Year Multidisciplinary
Degree (Honors/Research) Programme with Multiple
Entry and Exit option**

Undergraduate Programme of Science and Technology

B.Sc. (Honors) in Computer Science

Board of Studies

in

Computer Science

Rajarshi Shahu Mahavidyalaya, Latur

Empowered Autonomous Institution

[UG IV Year]

w.e.f. June, 2026

(In Accordance with NEP-2020)

Academic Year 2026-27

Review Statement

The NEP Cell reviewed the Curriculum of **B.Sc. (Honors/Research) in Computer Science** Programme to be effective from the **Academic Year 2026-27**. It was found that, the structure is as per the NEP-2020 guidelines of Govt. of Maharashtra.

Date: 11/04/2026

Place: Latur

NEP Cell

Rajarshi Shahu Mahavidyalaya, Latur
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शिवश्यामजी
शिक्षण संस्था
लातूर

॥ आरोग्यं तमसो ज्योतिः ॥

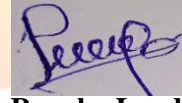
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CERTIFICATE

I hereby certify that the documents attached are the Bonafide copies of the Curriculum of **B.Sc. (Honors) in Computer Science** Programme to be effective from the **Academic Year 2026-27**.

Date: 11/04/2026

Place: Latur



(Dr Renuka Londhe)

Chairperson

Board of Studies in Computer Science
Rajarshi Shahu Mahavidyalaya, Latur
Empowered Autonomous Institution

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**Shiv Chhatrapati Shikshan Sanstha's
Rajarshi Shahu Mahavidyalaya, Latur**

**Empowered Autonomous Institution
Members of Board of Studies in the Subject Computer Science
Under the Faculty of Science and Technology
Department of Computer Science**

Sr. No.	Name	Designation	In position
1	Dr. Renuka Londhe, Assistant Professor, Rajarshi Shahu Mahavidyalaya, Latur Empowered Autonomous Institution	Chairman	HoD
2	Dr. M. H. Kondekar, Dean, Marathwada Institute of Technology. CIDCO Aurangabad Email: mahendra.kondekar@mit.asia Mob. 9822118755	Member	Academic Council Nominee
3	Dr. Shriram Dagadu Raut, Dept. of Computer Science, School of Computational Sciences Punyashlok Ahilyadevi Holkar Solapur University, Solapur-Pune Highway, Kegaon, Solapur	Member	Academic Council Nominee
4	Dr. Shrikant G. Jadhav, HoD, Department of Computer Science, Yeshwant Mahavidyalaya, Nanded Email: jadhavsg.ymn@gmail.com Mob. 9423140192	Member	University Nominee
5	Mr. Avinash Jadhav, Director, Mind Craft software solutions, Pune Email: avijadhav@gmail.com Mob. 9028818356	Member	Industry areas
6	Dr. Santosh Shrikhande, Assistant Professor, School of Technology, SRTMU, Sub Center, Peth, Latur Email: santoshshrikhande@gmail.com Mob.9765223939	Member	College Alumni
7	Prof. Dr. Poorna Shankar, Professor and Dean, Indira College of Engineering and Management Pune, Email: poornashankar@indiraem.ac.in Mob. 8237816742	Member	Expert for special courses

Sr. No.	Name	Designation	In position
8	Ms. Suchitra Sonwane, Assistant Professor, Rajarshi Shahu Mahavidyalaya, Latur Empowered Autonomous Institution	Member	Faculty Member
9	Mr. Arun Shinde, Assistant Professor, Rajarshi Shahu Mahavidyalaya, Latur Empowered Autonomous Institution	Member	Faculty Member
10	Ms. Sunita Jadhav, Assistant Professor, Rajarshi Shahu Mahavidyalaya, Latur Empowered Autonomous Institution	Member	Faculty Member
11	Ms. Humera Maniyar, Assistant Professor, Rajarshi Shahu Mahavidyalaya, Latur Empowered Autonomous Institution	Member	Faculty Member
12	Ms. Pooja Latoria, Assistant Professor, Rajarshi Shahu Mahavidyalaya, Latur Empowered Autonomous Institution	Member	Faculty Member
13	Mr. Mahesh Katambe, Assistant Professor, Rajarshi Shahu Mahavidyalaya, Latur Empowered Autonomous Institution	Member	Faculty Member
14	Ms. Swati Sandur, Assistant Professor, Rajarshi Shahu Mahavidyalaya, Latur Empowered Autonomous Institution	Member	Faculty Member

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From the Desk of the Chairperson...

With the tremendous growth of IoT, Data Science, Artificial Intelligence, and Machine Learning technologies over the past ten years, computers have been influencing the future of humanity. Any student taking B.Sc. (Computer Science) program should be able to understand the philosophy, architecture, and mathematics behind the technologies that advance our modern society. The ever-growing discipline of computer science has strong connections to other disciplines. Many problems in science, engineering, health care, business, and other areas can be solved effectively with computers, but finding a solution requires both computer science expertise and knowledge of the particular domain. Computer science has a wide range of specialties. These include Computer Programming, Software Systems, Graphics, Artificial Intelligence, Mathematical and Statistical Analysis, Data Science, Computational Science, and Software Engineering.

A real genuine attempt has been made while designing the new curriculum of four-year B.Sc. (Computer Science) program under NEP-2020 by Board of Studies in Computer Science of Rajarshi Shahu Mahavidyalaya, Latur (Autonomous) with an aim to develop the core competence in computing and problem solving amongst its graduates. After successful completion of B.Sc. (Computer Science), students can fetch employment directly in companies as programmer, Web Developer, Software Engineer, Network Administrator, Data Scientist, or AI/ML personnel.

The curriculum focuses on building theoretical foundations in Computer Science to enable its students to think critically when challenged with different and new problems. It includes the learner-centric features of NEP-2020 including Multiple Entry and Multiple Exit, Employability, Flexibility to Choose, Multidisciplinary, Research, Advance Courses, etc.

The BoS in Computer Science believe that any student taking B.Sc. (Computer Science) program will get very strong foundation and exposure to basics, advanced and emerging trends of the subject. The curriculum makes it easier to understand the principles of computer science and offers a platform for the development of abilities like programming, networking, and database management. It also emphasizes the ethics of creating and using new technologies by making compelling arguments in favor of secure computing, user privacy protection, and green computing. The curriculum prepares the students for a career in Software industry and also inspires them towards further studies and research opportunities.

We sincerely thank all of the experts who provided their insightful comments and recommendations in order to improve the contents; we have made every effort to take each of them into consideration.

(Dr Renuka R Londhe)
Chairperson
Board of Studies in Computer Science



**Shiv Chhatrapati Shikshan Sanstha's
Rajarshi Shahu Mahavidyalaya, Latur**

**Empowered Autonomous Institution
Faculty of Science and Technology
Department of Computer Science**

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Faculty of Science and Technology

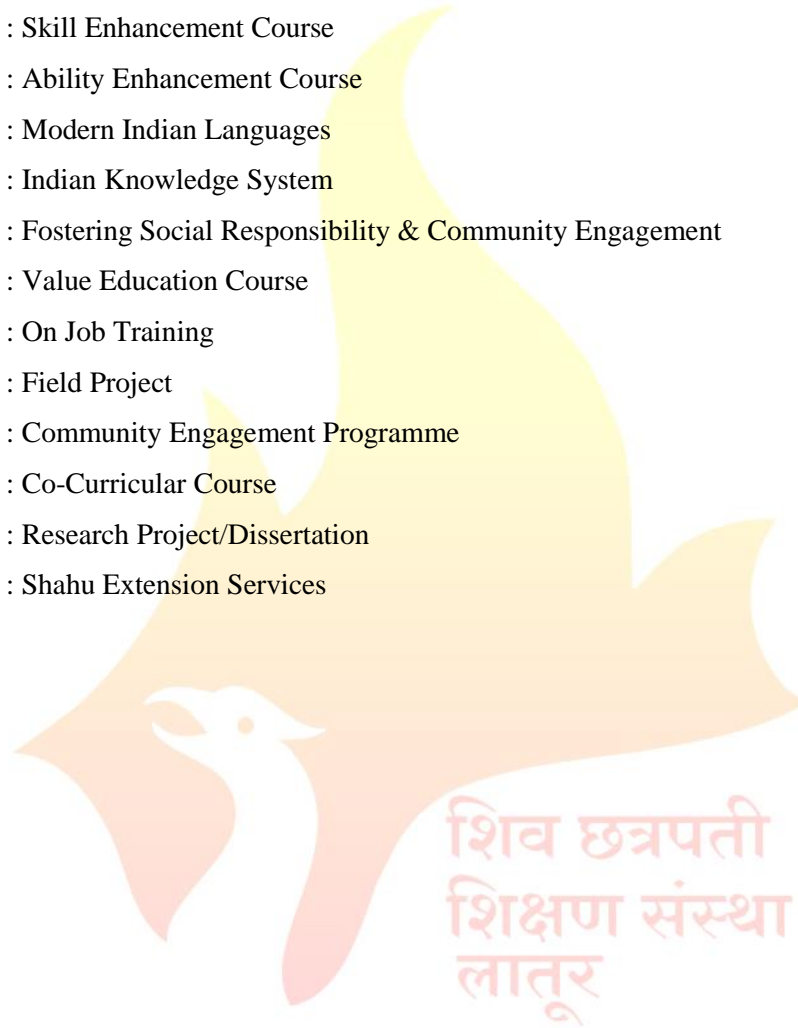
Department of Computer Science

**Structure for Four Year Multidisciplinary UG Degree Programme in Computer Science Multiple
Entry and Exit (In accordance with NEP-2020)**

Year & Level	Sem	Major		Minor	GE/OE	VSC/SEC (VSEC)	AEC/VEC	OJT, FP, CEP, RP	Credit per Sem.	Cum./Cr. per exit
		DSC	DSE							
1	2	3		4	5	6	7	8	9	10
IV 6.0	VII	DSC-XIII: 03 Cr. DSC-XIV: 03 Cr. DSC-XV: 03 Cr. DSC-XVI: 02 Cr. DSCLC-XIII 1Cr DSCLC-XIV 1Cr DSCLC-XV 1Cr	DSE- III:03 Cr. DSELC- III 1Cr	RMC: 04 Cr.					22	176 Cr. UG Hons. Degree
	VIII	DSC-XVII: 03 Cr. DSC-XVIII: 03 Cr. DSC-XIX: 03 Cr. DSC-XX: 02 Cr. DSCLC-I 1Cr DSCLC-II 1Cr DSCLC-III 1Cr	DSE- IV:03 Cr. DSELC- IV 1Cr				OJT/FP- II: 04 Cr.	22		
	Cum. Cr.	28	08	04	-			04	44	

Abbreviations:

1. DSC : Discipline Specific Core (Major)
2. DSE : Discipline Specific Elective (Major)
3. DSM : Discipline Specific Minor
4. GE/OE : Generic/Open Elective
5. VSEC : Vocational Skill and Skill Enhancement Course
6. VSC : Vocational Skill Course
7. SEC : Skill Enhancement Course
8. AEC : Ability Enhancement Course
9. MIL : Modern Indian Languages
10. IKS : Indian Knowledge System
11. FSRCE : Fostering Social Responsibility & Community Engagement
12. VEC : Value Education Course
13. OJT : On Job Training
14. FP : Field Project
15. CEP : Community Engagement Programme
16. CC : Co-Curricular Course
17. RP : Research Project/Dissertation
18. SES : Shahu Extension Services



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**Empowered Autonomous Institution
Faculty of Science and Technology
Department of Computer Science
B.Sc. (Honors) in Computer Science**

Year & Level	Semester	Course Code	Course Title	Credits	No. of Hrs.	
IV 6.0	VII	401COS7101 (DSC-XIII)	Design and Analysis of Algorithm	03	45	
		Lab Course	Lab Course	01	30	
		401COS7102 (DSC-XIV)	Computer System Architecture	03	45	
		Lab Course	Lab Course	01	30	
		401COS7103 (DSC-XV)	Object Oriented Programming	03	45	
		Lab Course	Lab Course			
		401COS7104 (DSC-XVI)	Syllabus of Preparation of NET/SET Examination-I	02	30	
		401COS7201 (DSE-III)	Mobile Application Development Using OR Computer Graphics	03	45	
		Lab Course	Lab Course	01	30	
		401COS7301 (RMC)	Research Methodology	04	60	
	Total Credits				22	
	VIII		401COS8101 (DSC-XVII)	Adv. DBMS	03	45
			Lab Course	Lab Course	01	30
			401COS8102 (DSC-XVIII)	Compiler design	03	45
			Lab Course	Lab Course	01	30
			401COS8103 (DSC-XIX)	Web Programming	03	45
			Lab Course	Lab Course	01	30
			401COS8104 (DSC-XX)	Preparation of NET/SET Examination-II	02	30
			401COS8201 (DSE-IV)	Internet Of Things OR Information Security	03	45
			Lab Course	Lab Course	01	30
			401COS8301 (RMC)	Field Project /Dissertation	04	60
	Total Credits				22	
Total Credits (Semester VII & VIII)				44		



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Programme Outcomes (POs) for B.Sc. Programme	
PO No.	Upon completion of this programme the students will be able to:
PO1	Disciplinary Knowledge and Computing Fundamentals: Apply the knowledge of mathematics, science, and computing fundamentals to understand and solve complex problems in computer science and related domains
PO2	Problem Analysis and System Design: Identify, formulate, and analyze complex real-world problems to design, implement, and evaluate efficient algorithms, systems, and applications considering scalability and usability
PO3	Modern Tool Usage and Technical Skills: Select, adapt, and apply appropriate modern techniques, resources, and IT tools (including programming environments, prediction, and modeling tools) to complex computing activities
PO4	Research, Innovation, and Exploration: Utilize research-based knowledge and methods-including design of experiments, data analysis, and interpretation of information-to provide valid conclusions, innovative solutions, and develop a research ethos
PO5	Professional Ethics and Cyber Security: Understand and commit to professional ethics, cyber regulations, and responsibilities, ensuring information security, data privacy, and safe computing practices in digital environments
PO6	Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, demonstrating collaboration skills in multidisciplinary settings
PO7	Communication and Project Management: Communicate effectively with the computing community and society at large, write effective reports, and apply software engineering and project management principles to software development
PO8	Life-long Learning and Adaptation: Recognize the need for, and possess the preparation and ability to engage in independent and life-long learning to adapt to emerging technologies and technological changes



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Programme Specific Outcomes (PSOs) for B.Sc. Computer Science (Honors/Research)	
PSO No.	Upon completion of this programme the students will be able to:
PSO1	Software & Application Development: Design, develop, and deploy secure and responsive software applications across Web, Mobile, and Desktop platforms using modern languages (C, Java, Python, Kotlin, ASP.NET) and standard Software Engineering practices
PSO2	Data Engineering and Artificial Intelligence: Apply concepts of Data Science, Machine Learning, Pattern Recognition, and Database Management (RDBMS, Adv. DBMS, DBA) to extract insights, optimize data architectures, and build intelligent predictive models
PSO3	Core Computing and Algorithmic Design: Apply fundamental principles of Computer System Architecture, Operating Systems, Compiler Design, and Design and Analysis of Algorithms to optimize computational efficiency and solve complex logical problems
PSO4	Network, Cloud, and IoT Infrastructures: Design, configure, and maintain robust computer networks, Cloud Computing environments, and Internet of Things (IoT) ecosystems, ensuring effective device connectivity, virtualization, and data security
PSO5	Advanced Technologies and Visual Computing: Implement advanced computing techniques in specialized technical areas such as Digital Image Processing, Computer Graphics, and Information Security to solve domain-specific challenges
PSO6	Research Aptitude and Professional Readiness: Cultivate research acumen through Research Methodology and project work, integrating historical insights (like Indian Mathematics) with modern tech, and demonstrating readiness for industry roles, competitive exams (NET/SET preparation), and higher education

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Semester VII

शिव छत्रपती
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**Empowered Autonomous Institution
Faculty of Science & Technology
Department of Computer Science
UG IV Sem VII**

Course Type : DSC XIII

Course Title : Design and Analysis of Algorithm

Course Code : 401COS7101

Credits : 03

Max. Marks: 75

Lectures: 45 Hrs.

Learning Objectives:

- LO1. To analyze performance of algorithms.
- LO2. To choose the appropriate data structure and algorithm design method for a specified application.
- LO3. To solve problems using algorithm design methods such as the greedy method, divide and conquer, dynamic programming, backtracking and branch and bound.
- LO4. To understand & implement tractable and intractable problems

Course Outcomes:

After completion of the course, the student will be able to

- CO1. Learn good principles of algorithm design.
- CO2. Learn how to analyze algorithms and estimate their complexity
- CO3. Implement fundamental data structures.
- CO4. Become accustomed to the description of algorithms in both functional and procedural ways.

Unit No.	Title of Unit & Contents	Hrs.
I	Introduction & Overview of Data Structure	10
	A simple example of design using insertion sort, pseudo code for insertion sort, time complexity. Performance Analysis – Space complexity and Time complexity (posteriori testing, and priori approach), Asymptotic Notations (O , Ω , Θ), Examples on Asymptotic Notations, Polynomial vs. Exponential Algorithms. Average, Best- and Worst-case complexity. Arrays, Linked List, Stack, Queue, Trees & Graphs.	
	Unit Outcomes: UO1. Comprehensive overview of various sorting algorithms, their time and space complexities UO2. performance analysis techniques, asymptotic notations, and data structures like arrays, linked lists, stack, queue, trees, and graphs.	
II	Divide and Conquer Algorithms, Greedy Algorithms	15
	Introduction to Divide and Conquer Algorithms, Binary Search, Finding the Maximum and Minimum, Merge- Sort, Quick sort, Strassen's Matrix Multiplication. Introduction to Greedy Algorithms – Fractional Knapsack problem, Minimum cost spanning trees, Kruskal's Algorithm and Prim's Algorithm, Optimal Merge Patterns, Single-Source Shortest Paths.	
	Unit Outcomes:	

Unit No.	Title of Unit & Contents	Hrs.
	<p>UO1. Comprehensive understanding of various divide and conquer algorithms, sorting techniques, greedy algorithms, and their applications in solving real-world problems.</p> <p>UO2. Readers will gain insights into when and how to apply these algorithms effectively, making informed decisions in algorithm design and optimization.</p>	
III	Dynamic Programming, Back Tracking and Branch & Bound Algorithms	10
	<p>Dynamic Programming Definition – Multistage Graphs, All-pairs shortest paths, Single-Source Shortest Paths, Optimal Binary search Trees, Traveling salesman problem Back tracking and Branch and Bound Algorithms Introduction: 8-Queens Problem, Sum of Subsets problem using Back tracking algorithms. Traveling Salesman problem.</p> <p>Unit Outcomes:</p> <p>UO1. Comprehensive understanding of dynamic programming and its applications to various graph problems</p> <p>UO2. UO 2. Grasp the concepts and apply these algorithms to real-world scenarios effectively.</p>	
IV	Lower bound Theory	10
	<p>Lower bound Theory – A brief introduction to comparison trees, Ordered Searching, Sorting & Selections. Lower bounds through reductions, techniques for algebraic problems. Introduction to NP-hard and NP-Complete Problems</p> <p>Unit Outcomes:</p> <p>UO1. Understand lower bound theory and its applications in various algorithmic problems.</p> <p>UO2. Gain insights into how comparison trees and reduction techniques help establish lower bounds.</p>	



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Learning Recourses:

1. Fundamentals of Computer Algorithms by Horowitz, Sahni, Galgotia Publications, 1996.
2. The Art of Computer Programming, Volume 3 by Donald E. Knuth
3. Sorting and Searching, Second Edition, Pearson Education.
4. Data structures A Pseudocode Approach with C, by Richard F. Gilberg, Behrouz A, Forouzan.
5. Introduction to the Design and Analysis of Algorithms by Anany Levitin
6. Design & Analysis of Algorithms 4Th Edition by Gajendra Sharma
7. Design And Analysis of Algorithms 2021 Edition by Michael T. Goodrich, Roberto Tamassia, Wiley

Internal Examination Pattern:

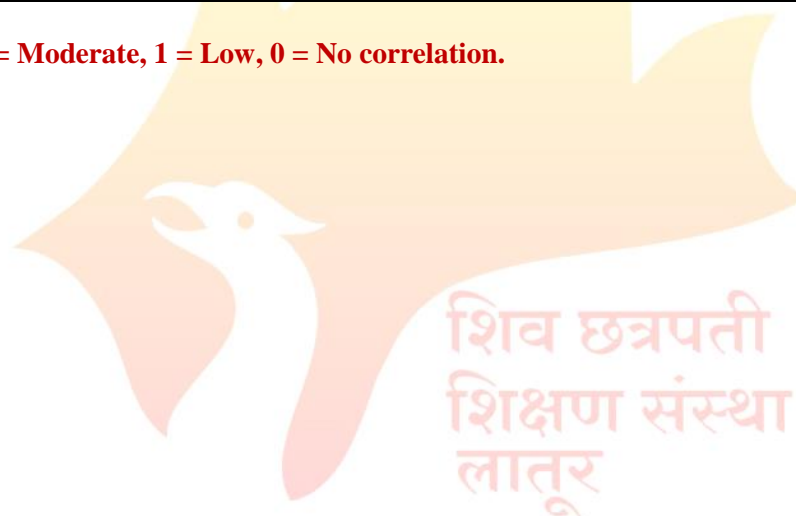
CAT – I: Home Assignment

CAT – II: PPT Presentation/ Open Book Test/ Poster Presentation/ Seminar/ Online Quiz/ Descriptive Test

Mapping of POs, PSOs and COs:

COs/POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	3	2	1	0	0	0	2	2	0	3	0	0	1
CO2	3	3	2	2	0	0	0	2	2	0	3	0	0	1
CO3	2	3	3	1	0	0	0	2	2	0	3	0	0	1
CO4	3	2	2	1	0	0	0	2	1	0	3	0	0	1

Scale: 3 = High, 2 = Moderate, 1 = Low, 0 = No correlation.



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Faculty of Science & Technology
Department of Computer Science
UG IV Sem VII

Course Type : DSC Laboratory Course

Course Title : DSC Laboratory Course-XIII

Course Code : 401COS7105

Credit : 01

Max. Marks: 50

Lectures: 30 Hrs.

Learning Objectives:

- LO 1. Understand the principles and working of the various algorithms.
- LO 2. Learn how to implement the greedy algorithm for job sequencing in Python.
- LO 3. Learn how to implement DFS in Python to explore the nodes of a graph.
- LO 4. Understand the concept of backtracking and its application in solving the 8-queens problem.
- LO 5. Learn how to implement the backtracking algorithm in Python to find valid queen placements.
- LO 6. Gain proficiency in finding the optimal binary search tree using dynamic programming.
- LO 7. Learn how to implement Kruskal's algorithm in Python to generate the minimum cost spanning tree & gain proficiency in finding the minimum cost spanning tree using Kruskal's algorithm.

Course Outcomes:

- CO1. After completion of the course, students will be able to-
- CO2. Demonstrate proficiency in understanding the Quick sort algorithm and its implementation in Python. Analyze the time complexity and performance in sorting a list of integers.
- CO3. Comprehend the Bubble Sort algorithm and its Python implementation. Identify scenarios where it might be suitable for sorting tasks.
- CO4. Implement BFS to explore graphs in a breadth-first manner using Python. Analyze the differences between DFS and BFS and apply them appropriately based on problem requirements

Practical No.	Unit
1	Program in Python to implement Quick sort algorithm for sorting a list of integers in ascending order
2	Program in Python to implement Merge sort algorithm for sorting a list of integers in ascending order.
3	Program in Python to implement Bubble Sort algorithm
4	Program in Python to implement sorting of numbers in ascending and Descending order
5	Program in Python to implement greedy algorithm for job sequencing with deadlines
6	Program in Python to implement the DFS algorithm for a graph

7	Program in Python to implement the BFA algorithm for a graph.
8	Program in Python to implement Binary Search with Divide and conquer approach.
9	Program in Python to multiply matrix using Strassen's matrix multiplication.
10	Program in Python to implement backtracking algorithm for the 8-queens problem.
11	Program in Python to implement the backtracking algorithm for the sum of subsets problem.
12	Program in Python to implements Prim's algorithm to generate minimum cost spanning tree.
13	Program in Python to Kruskal's algorithm to generate minimum cost spanning tree
14	Program in Python to implement Dynamic Programming algorithm for the 0/1 Knapsack problem.
15	Program in Python to implement Dynamic Programming algorithm for the Optimal Binary Search Tree Problem

Learning Recourses:

1. Fundamentals of Computer Algorithms by Horowitz, Sahni, Galgotia Publications, 1996.
2. The Art of Computer Programming, Volume 3 by Donald E. Knuth
3. Sorting and Searching, Second Edition, Pearson Education.
4. Data structures A Pseudocode Approach with C, by Richard F. Gilberg, Behrouz A, Forouzan.
5. Introduction to the Design and Analysis of Algorithms by Anany Levitin
6. Design & Analysis of Algorithms 4Th Edition by Gajendra Sharma
7. Design And Analysis of Algorithms 2021 Edition by Michael T. Goodrich, Roberto Tamassia, Wiley

Internal Examination Pattern:

CAT – I: Record Book Submission

CAT – II: Overall performance in the regular practical

Mapping of POs, PSOs and COs:

COs/POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	3	2	1	0	0	0	2	2	0	3	0	0	1
CO2	3	3	2	2	0	0	0	2	2	0	3	0	0	1
CO3	2	3	3	1	0	0	0	2	2	0	3	0	0	1
CO4	3	2	2	1	0	0	0	2	1	0	3	0	0	1

Scale: 3 = High, 2 = Moderate, 1 = Low, 0 = No correlation.



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UG IV Sem VII**

Course Type : DSC XIV

Course Title : Computer System Architecture

Course Code : 401COS7102

Credits : 03

Max. Marks: 75

Lectures: 45 Hrs.

Learning Objectives:

- LO1. Understand the principles and working of the various algorithms.
- LO2. Learn how to implement the greedy algorithm for job sequencing in Python.
- LO3. Learn how to implement DFS in Python to explore the nodes of a graph.
- LO4. Understand the concept of backtracking and its application in solving the 8-queens problem.

Course Outcomes:

After completion of the course, the student will be able to

- CO1. Demonstrate proficiency in understanding the Quick sort algorithm and its implementation in Python. Analyze the time complexity and performance in sorting a list of integers.
- CO2. Comprehend the Bubble Sort algorithm and its Python implementation. Identify scenarios where it might be suitable for sorting tasks.
- CO3. Implement BFS to explore graphs in a breadth-first manner using Python. Analyze the differences between DFS and BFS and apply them appropriately based on problem requirements
- CO4. Understand Strassen's matrix multiplication algorithm and its implementation in Python. Compare the efficiency of Strassen's algorithm with traditional matrix multiplication

Unit No.	Title of Unit & Contents	Hrs.
I	Design Methodology and Processor Design	15
	Introduction to Design Methodology, The Gate Level- Combinational circuits, Sequential circuits, The Register level - Register level components, design methods The Processor level - components, design techniques Queuing models. Introduction to Processor Design, Instruction sets, Fixed Point Arithmetic, ALU Design.	
	Unit Outcomes: UO1. Learners will develop a solid foundation in digital circuit and processor design methodologies. UO2. Additionally, learners will be capable of making informed decisions in selecting appropriate design techniques and components to optimize the performance and efficiency of digital systems and processors.	
II	Control Design and Memory Organization	10
	General model of control unit, Hardwired control unit, Micro programmed control unit, Micro-programmed Computers. Memory Technology - Memory Device Characteristics, Random Access Memories, Serial Access Memories.	

Unit No.	Title of Unit & Contents	Hrs.
	Virtual Memory - Memory Hierarchies, Main Memory Allocation, Segments, Pages & Files. High Speed Memories- Interleaved memories, Caches and Associative memories. Unit Outcomes: UO3. Learners will develop a solid foundation in digital circuit and processor design methodologies. UO4. Additionally, learners will be capable of making informed decisions in selecting appropriate design techniques and components to optimize the performance and efficiency of digital systems and processors.	
III	Introduction to Microprocessor 8085	10
	Introduction to Microprocessor 8085, Instruction Cycle, Timing Diagram, RISC and CISC processors. Instruction set- Instruction and data formats, addressing modes, Intel 8085 Instructions, Assembly Language Programming. Unit Outcomes: UO1. Learners will develop a strong foundation in microprocessor architecture and programming. UO2. Additionally, learners will be able to compare different microprocessor architectures and understand the trade-offs between RISC and CISC designs.	
IV	Introduction to Other Microprocessors & Peripheral Devices	10
	Features of Intel 8086, Architecture of Intel 8086, Functional Pin Diagram of Intel 8086, Addressing Modes of Intel 8086, Instruction Set of Intel 8086, Assembly Language Programming of 8086, Introduction to 80386 Microprocessor, Features of 80386, Architecture of 80386. Address space partitioning, memory & I/O Interfacing, Interfacing Devices & I/O Devices. Unit Outcomes: UO1. Learners will develop a comprehensive understanding of the Intel 8086 and 80386 microprocessors, including their architecture, instruction set, and memory interfacing. UO2. Additionally, learners will understand the key features and advantages of the Intel 8086 and 80386 microprocessors, making informed decisions in selecting the appropriate processor for specific computing requirements.	

Learning Recourses:

1. Computer Architecture & Organization -John. P. Hayes (MGH II Edition)
2. Fundamentals of Microprocessors & Microcomputers - Badri Ram (Dhanpat Rai Publications (P) Ltd. Fourth Revised & Enlarged Edition)
3. Computer System Architecture by Mano M Morris
4. Computer System Architecture & Organization by Sps Saini
5. Computer Organization & Architecture by Dr. Lalit K. Arora & Dr. Anjali Arora

Internal Examination Pattern:

CAT – I: Home Assignment

CAT – II: PPT Presentation/ Open Book Test/ Poster Presentation/ Seminar/ Online Quiz/ Descriptive Test

Mapping of POs, PSOs and COs:

COs/POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	0	0	0	0	2	0	0	3	1	0	1
CO2	3	2	1	0	0	0	0	2	0	0	3	1	0	1
CO3	3	2	2	0	0	0	0	2	0	0	3	1	0	1
CO4	3	2	1	0	0	0	0	2	0	0	3	1	0	1

Scale: 3 = High, 2 = Moderate, 1 = Low, 0 = No correlation.



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Rajarshi Shahu Mahavidyalaya,
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**Shiv Chhatrapati Shikshan Sanstha's
Rajarshi Shahu Mahavidyalaya, Latur**

**Empowered Autonomous Institution
Faculty of Science & Technology
Department of Computer Science
UG IV Sem VII**

Course Type : DSC Laboratory Course

Course Title : DSC Laboratory Course-XIV

Course Code : 401COS7106

Credit : 01

Max. Marks: 50

Lectures: 30 Hrs.

Learning Objectives

- LO1. To explore derived gates like NAND, NOR, and XNOR and their logical behavior.
- LO2. To create and validate truth table for a multiplexer with multiple inputs and a single output through logic simulations or practical experimentation.
- LO3. To acquire the basic knowledge of microprocessor and application to understand electronics circuits.
- LO4. To Understand the concept of a demultiplexer and its function in data distribution. Create a truth table for a demultiplexer with a single input and multiple outputs.
- LO5. To Gain proficiency in programming in Assembly Language for the 8086 Microprocessor & implement algorithms for addition and subtraction of 8-bit and 16-bit numbers in Assembly Language.
- LO6. To Understand the concept of a lookup table and its usage in computing square values & implement an ALP that utilizes a lookup table to find the square of a number.

Course Outcomes:

After completion of the course, students will be able to-

- CO1. Learners will develop practical skills in digital logic, microprocessor programming, and problem-solving using Assembly Language for the 8086 microprocessors.
- CO2. Additionally, learners will gain insights into the logical behavior of digital components and their applications in computer arithmetic and data manipulation.
- CO3. Implement algorithms to find the smallest and largest numbers in an array using the 8086 microprocessors.
- CO4. Understand the working principles of multiplexers and demultiplexers. Create and verify truth tables for multiplexer and demultiplexer operations.

Practical No.	Unit
1	To perform and verify the truth tables of basic gates and derived gates
2	To perform and verify the truth table of half adder and half subtractor
3	To perform and verify the truth table of multiplexer
4	To perform and verify the truth table of demultiplexer
5	To perform and verify the truth table of encoder
6	To perform and verify the truth table of decoder
7	Write an ALP for addition & subtraction of two 8-bit ,16-bit numbers
8	Write an ALP for multiplication & division of two 8-bit ,16-bit numbers
9	Write an ALP to find smallest & largest number from array for 8086
10	Write an ALP to find square from lookup table

11	Write an ALP to find one's complement & two's complement of 8-bit number & 16-bit number.
12	Write an ALP to shift an 8-bit number left by one bit.
13	Write an ALP to shift an 8-bit number left by two bits
14	Write an ALP to find square root of a number
15	Write an ALP to find multibyte addition.

Learning Recourses:

1. Computer Architecture & Organization -John. P. Hayes (MGH II Edition)
2. Fundamentals of Microprocessors & Microcomputers - Badri Ram (Dhanpat Rai Publications (P) Ltd. Fourth Revised & Enlarged Edition)
3. Computer System Architecture by Mano M Morris
4. Computer System Architecture & Organization by Sps Saini
5. Computer Organization & Architecture by Dr. Lalit K. Arora & Dr. Anjali Arora

Internal Examination Pattern:

CAT – I: Record Book Submission

CAT – II: Overall performance in the regular practical

Mapping of POs, PSOs and COs:

COs/POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	1	0	0	0	0	2	0	0	3	1	0	1
CO2	3	2	1	0	0	0	0	2	0	0	3	1	0	1
CO3	3	2	2	0	0	0	0	2	0	0	3	1	0	1
CO4	3	2	1	0	0	0	0	2	0	0	3	1	0	1

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**Empowered Autonomous Institution
Faculty of Science & Technology
Department of Computer Science
UG IV Sem VII**

Course Type : DSC XV

Course Title : Object Oriented Programming

Course Code : 401COS7103

Credits : 03

Max. Marks: 75

Lectures: 45 Hrs.

Learning Objectives:

- LO1. To understand how to write program in Python
- LO2. To learn how to use lists, tuples, and dictionaries in Python programs
- LO3. To learn how to build and package Python modules for reusability
- LO4. To learn how to design object-oriented programs with Python classes.
- LO5. To learn how to read and write files in Python
- LO6. To implement inheritance, exception handling & RegEx in Python
- LO7. To learn create GUI application using Python

Course Outcomes:

After completion of the course, students will be able to-

- CO1. Implement programming skills in core Python.
- CO2. Apply Object Oriented Skills in Python.
- CO3. Design & develop application with Graphical User Interfaces in Python
- CO4. Use the ability to handle exceptions, write regular expression & database applications in Python

Unit No.	Title of Unit & Contents	Hrs.
I	Introduction & Working with Python	10
	Installation and Working with Python , Understanding Python variables, Python Shell, Python IDLE, Different Python IDEs (VS-Code, Py-charm, Sub-lime text etc). Python Data types, Python Operators, Python blocks, Control & looping Statements Built in methods/functions on: String, List, Tuples, Dictionary Functions, Modules in Python, organizing Python projects into modules, importing own module as well as external modules, Understanding Packages, Powerful Lambda function in Python, Modules: The from ... import statement, A module's name, Making your own modules, The dir function, packages. Brief Tour of the Standard Library: math, date time, turtle, NumPy, SciPy, Panda.	
	Unit Outcome: UO 1. Learners will develop a strong foundation in Python. UO 2. Additionally, learners will learn how to organize Python projects into modules and packages for better code organization and reusability.	
II	OOPs Concept, & File Handling in Python	10
	Concept of class-object/instance, Constructor & its types, Destructor in Python, Types of Variables: Instance Variable, Class Variables, Static Variables, Types of Methods: Instance Method, Class Method, Static Method, Passing Members of One class to Another Class, inner class.	

Unit No.	Title of Unit & Contents	Hrs.
	<p>Inheritance: Single, Multiple, Multilevel, Hierarchical, Hybrid, Python Constructor in Inheritance, Constructor/ Method Overriding, Method Overloading, Operator Overloading</p> <p>Abstract Classes & Interfaces: Abstract Method & Class, Interfaces in Python, Abstract Class Vs Interface</p> <p>File Handling in Python: Types of Files, Reading, Writing Files using Python, With Statement.</p> <p>Understanding read functions, read (), readline() and readlines(), Understanding write functions, write() and writelines(), Manipulating file pointer using seek, Programming using file operations.</p> <p>Unit Outcome: UO 1. Understand the OOPs concepts Using Python. UO 2. Explain the file handling using Python</p>	
III	Graphical User Interface in Python	10
	<p>GUI in Python, The Root Window, Fonts and Colors, Working with Containers, Canvas, Frame, Widgets, Button Widgets, arranging widgets in the Frame, Label, Widget, Message Widget, Text Widget, Scrollbar Widget, CheckButton Widget, RadioButton Widget, Entry Widget, Spinbox Widget, ListBox widget, Menu Widget, Creating Tables</p> <p>Unit Outcomes: UO 1. Implementing GUI programming in Python. UO 2. Writing & executing program using Frames, Widgets, Buttons, Label, Message widgets radio button etc..</p>	
IV	Python Regular Expression, Exception Handling & Database Interaction	15
	<p>Powerful pattern matching and searching, Power of pattern searching using regex in Python, Real time parsing of networking or system data using regex, Password, email, URL validation using regular expression, Pattern finding programs using regular expression, Exception Handling: Avoiding code break using exception handling, Safe guarding file operation using exception handling, Handling and helping developer with error code, Programming using Exception handling. Database Connection: SQL Database connection using Python, Creating and searching tables, Reading and storing config information on database, Programming using database connections.</p> <p>Unit Outcome: UO 1. Using pattern matching & searching using Regex. UO 2. Connecting MySQL database with Python to access table data</p>	

Learning Resources:

1. Core Python Programming- Dr. R Nageswara Rao (Dreamtech Press)
2. Learning Python- Mark Lutz, O'Reilly, 5th edition.
3. Starting Out with Python plus My Programming Lab- Tony Gaddis, Pearson
4. Python: The Complete Reference by Martin C. Brown
5. Python Programming : Using Problem Solving Approach by Reema Thareja
6. Programming In Python 3 A Complete Introduction To The Python Language by Mark Summerfield
7. <https://www.w3schools.com/python>
8. <https://www.python.org/community/>

Internal Examination Pattern:

CAT – I: Home Assignment

CAT – II: PPT Presentation/ Open Book Test/ Poster Presentation/ Seminar/ Online Quiz/ Descriptive Test

Mapping of POs, PSOs and COs:

COs/POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	2	3	3	0	0	0	0	2	3	2	1	0	0	1
CO2	2	3	3	0	0	0	0	2	3	2	1	0	0	1
CO3	1	3	3	0	0	0	0	2	3	0	1	0	0	1
CO4	2	3	3	1	0	0	0	2	3	2	1	0	0	1

Scale: 3 = High, 2 = Moderate, 1 = Low, 0 = No correlation.



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**Empowered Autonomous Institution
Faculty of Science & Technology
Department of Computer Science
UG IV Sem VII**

Course Type : DSC Laboratory Course

Course Title : DSC Laboratory Course XV

Course Code : 601COS1107

Credits : 03

Max. Marks: 50

Lectures: 30 Hrs.

Learning Objectives:

- LO1. To understand how to write program in Python
- LO2. To learn how to use lists, tuples, and dictionaries in Python programs
- LO3. To learn how to build and package Python modules for reusability
- LO4. To learn how to design object-oriented programs with Python classes.
- LO5. To learn how to read and write files in Python
- LO6. To implement inheritance, exception handling & RegEx in Python
- LO7. To learn create GUI application using Python

Course Outcomes:

After completion of the course, students will be able to-

- CO1. Implement programming skills in core Python.
- CO2. Apply Object Oriented Skills in Python.
- CO3. Design & develop application with Graphical User Interfaces in Python
- CO4. Use the ability to handle exceptions, write regular expression & database applications in Python

Practical No.	Unit
1	Study of Datatypes in Python
2	Study of Control /Looping statements
3	Study of Functions in Python (Variables-Local Global, Type of Arguments)
4	Study of Modules & Packages
5	Study of Lambda Function
6	Study of List & Dictionary Manipulation (List, Dictionary Methods)
7	Study of Constructor, Destructor in Python (Simple Class & Object, Constructor & its types, Destructor)
8	Study of types of variables & methods in class
9	Study of Inheritance & its types
10	Study of Constructor & Method Overriding
11	Study of Method & Operator Overloading
12	Study of Database Connectivity Testing MySQL Database connection & Creating Cursor Create Database, Tables & Insert, Read records from it Update, Delete Records from MySQL Database using Python Parameterized Query
13	Any Five Program To implement GUI using tkinter

Learning Resources:

1. Core Python Programming- Dr. R Nageswara Rao (Dreamtech Press)
2. Learning Python- Mark Lutz, O'Reilly, 5th edition.
3. Starting Out with Python plus My Programming Lab- Tony Gaddis, Pearson
4. Python: The Complete Reference by Martin C. Brown
5. Python Programming : Using Problem Solving Approach by Reema Thareja
6. Programming In Python 3 A Complete Introduction To The Python Language by Mark Summerfield
7. <https://www.w3schools.com/python>
8. <https://www.python.org/community/>

Internal Examination Pattern:

CAT – I: Record Book Submission

CAT – II: Overall performance in the regular practical

Mapping of POs, PSOs and COs:

COs/POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	2	3	3	0	0	0	0	2	3	2	1	0	0	1
CO2	2	3	3	0	0	0	0	2	3	2	1	0	0	1
CO3	1	3	3	0	0	0	0	2	3	0	1	0	0	1
CO4	2	3	3	1	0	0	0	2	3	2	1	0	0	1

Scale: 3 = High, 2 = Moderate, 1 = Low, 0 = No correlation.

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**Shiv Chhatrapati Shikshan Sanstha's
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**Empowered Autonomous Institution
Faculty of Science & Technology
Department of Computer Science
UG IV Sem VII**

Course Type : DSC-XVI

Course Title : Syllabus of Preparation of NET/SET Examination-I

Course Code : 401COS7104

Credits : 02

Max. Marks: 50

Lectures: 30 Hrs.

Learning Objectives:

LO 1. To understand how to write program in Python

Course Outcomes:

After completion of the course, students will be able to-

CO 1. exceptions, write regular expression & database applications in Python

Internal Examination Pattern:

CAT – I: Home Assignment

CAT – II: PPT Presentation/ Open Book Test/ Poster Presentation/ Seminar/ Online Quiz/ Descriptive Test

Mapping of POs, PSOs and COs:

COs/POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1														
CO2														
CO3														
CO4														

Scale: 3 = High, 2 = Moderate, 1 = Low, 0 = No correlation.

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Rajarshi Shahu Mahavidyalaya,
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**Shiv Chhatrapati Shikshan Sanstha's
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**Empowered Autonomous Institution
Faculty of Science & Technology
Department of Computer Science
UG IV Sem VII**

Course Type : DSE-III (A)

Course Title : Mobile Application Development

Course Code : 401COS7201A

Credits : 03

Max. Marks: 75

Lectures: 45 Hrs.

Learning Objectives:

- LO1. To learn Kotlin Programming Language
- LO2. To use Kotlin Programming Language for the development of Android Applications
- LO3. To Learn Kuddo & Nutrilicious Tools for development of Applications
- LO4. Use of DSLs for complex Application Development

Course Outcomes:

After completion of the course, students will be able to-

- CO1. Describe the basic concepts and principles to develop the mobile application.
- CO2. Develop the Android Applications using Kotlin Programming Language.
- CO3. Use Kuddo & Nutrilicious tool for the development of Android App
- CO4. Develop the complex Application Development

Unit No.	Title of Unit & Contents	Hrs.
I	Learning & Diving into Kotlin	11
	Introducing Kotlin, Diving into Kotlin- Variables & datatypes, Conditional Code, Loops & Ranges, Functions, Null Safety m Equality Checks, Exception Handling, Purpose of Functional programming, Functions, Working with Collections, Scoping Functions, Lazy Sequences. Unit Outcome: UO 1. Understand features and benefits of Kotlin as a modern programming language, Declare and initialize different types of variables and constants in Kotlin, use data types, operators, and expressions to manipulate data in Kotlin UO 2. Apply conditional statements and loops to control the flow of execution in Kotlin, Define and invoke functions with parameters and return values in Kotlin, handle null values and exceptions using Kotlin's null safety and try-catch-finally features, Understand the purpose and principles of functional programming in Kotlin.	
II	Object Orientation in Kotlin & Interoperability with JAVA	11
	Classes & Object Instantiation, Properties, Method, Primary & Secondary Constructors, Inheritance & Overriding rules, Type Checking & Casting, Visibilities, Data classes, Enumerations, Objects & Companions, Generics. Interoperability with JAVA – Using JAVA Code from Kotlin, Using Kotlin Code from JAVA, Best Practices for Interoperability.	

Unit No.	Title of Unit & Contents	Hrs.
	Unit Outcome: UO 1. Understand the concept of classes and objects in Kotlin and how to create and use them. UO 2. Implement inheritance and polymorphism in Kotlin and override the methods and properties of a superclass.	
III	Android App Development with Kotlin: Kudoo App, Nutrilicious	13
	Setting up Kotlin for Android, using Kotlin in Android Studio, Autogenerated Gradle Configuration, adapting your Gradle Configuration using Annotation Processors, Converting java code to Kotlin. Kudoo , a To Do List App: Creating the project, Adding the RecyclerView, adding a Room Data Base, using a View Model, Integrating LiveData, Adding New To-Do Items, Enabling Checking off To Do items. Nutrilicious : Setting up the Project, Adding RecyclerView to the home screen, Fetching Data from the USDA nutrition API, Mapping JSON Data to Domain Classes, Introducing ViewModel for Search, letting users search Foods, Store user's favorite foods in room database,	
	Unit Outcomes: UO 1. Set up and use Kotlin for Android development in Android Studio and understand the Gradle configuration. UO 2. Create a To Do List app using Kotlin, RecyclerView, Room, ViewModel, and LiveData,	
IV	Kotlin DSLs and Migrating to Kotlin	10
	Introducing DSLs, creating a DSL in Kotlin, DSL for Android Layouts with Anko, DSL for Gradle Build Scripts On Software Migrations, Leading the Change, Partial or Full Migration, where to start, Tool Support.	
	Unit Outcome: UO 1. Create and use DSLs in Kotlin using features such as infix notation, extension functions, lambdas with receivers, and type-safe builders. UO 2. Use Gradle, a build automation tool that supports Kotlin as a DSL, to configure and manage projects using Kotlin..	

Learning Resources:

1. Android Application Development (With Kitkat Support), Black Book by Pradeep Kothari
2. Learn To Program With Kotlin From The Basics To Projects With Text And Image Processing by Lavers
3. Programming Android with Kotlin: Achieving Structured Concurrency with Coroutines by Pierre-Olivier Laurence
4. Android Application Development with Kotlin Paperback by Hardik Trivedi
5. Android Programming with Kotlin for Beginners: Build Android apps starting from zero programming experience with the new Kotlin programming language by John Horton
6. <https://www.w3schools.com/KOTLIN/index.php>
7. <https://kotlinlang.org/community/>

Internal Examination Pattern:

CAT – I: Home Assignment

CAT – II: PPT Presentation/ Open Book Test/ Poster Presentation/ Seminar/ Online Quiz/ Descriptive Test

Mapping of POs, PSOs and COs:

COs/POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
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CO2	2	3	3	0	0	0	0	2	3	0	0	1	0	1
CO3	1	3	3	1	0	0	0	2	3	0	0	1	0	1
CO4	2	3	3	2	0	0	0	2	3	0	0	1	0	2

Scale: 3 = High, 2 = Moderate, 1 = Low, 0 = No correlation.**॥ आरोह तमसो ज्योतिः ॥****Rajarshi Shahu Mahavidyalaya,
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**Empowered Autonomous Institution
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Department of Computer Science
UG IV Sem VII**

Course Type : DSE Lab Course
Course Title : DSE Lab Course-III A
Course Code : 401COS7202A
Credits : 03 Max. Marks: 50 Lectures: 30 Hrs.

Learning Objectives:

- LO 1. To learn Kotlin Programming Language
- LO 2. To use Kotlin Programming Language for the development of Android Applications
- LO 3. To Learn Kuddo & Nutrilicious Tools for development of Applications
- LO 4. Use of DSLs for complex Application Development

Course Outcomes:

After completion of the course, students will be able to-

- CO 1. Describe the basic concepts and principles to develop the mobile application.
- CO 2. Develop the Android Applications using Kotlin Programming Language.
- CO 3. Use Kuddo & Nutrilicious tool for the development of Android App
- CO 4. Develop the complex Application Development

Practical No.	Unit
1	Implement the program of mutable and read only variables
2	Implement the program of Conditional statement in Kotlin and Construct Looping statements in Kotlin (While & For Loop)
3	Declaring and calling a simple and extension function in Kotlin
4	Implement the Nullable and Non nullable types and accessing members of nullable variables in Kotlin
5	Implement exception handling using try, catch, finally block
6	Implement the program of Inheritance and Data class in Kotlin
7	Implement the program of classes and objects in Kotlin and also implement the program of constructors in Kotlin (Primary and Secondary)
8	Create a Kuddo App – To do List in Android Studio
9	Create a Nutrilicious App – in Android Studio
10	Create Anko Layouts over hard Layouts using Kotlin in Android Studio
11	Create Weather forecasting application using Kotlin in Android Studio
12	Create a paint and calculator application using Kotlin in android studio
13	Create Quiz Application using Kotlin in Android Studio
14	Build a planet app using Kotlin in Android Studio
15	Create a chatting Application using Kotlin in Android Studio

Learning Resources:

1. Android Application Development (With Kitkat Support), Black Book by Pradeep Kothari
2. Learn To Program With Kotlin From The Basics To Projects With Text And Image Processing by Lavers
3. Programming Android with Kotlin: Achieving Structured Concurrency with Coroutines by Pierre-Olivier Laurence

4. Android Application Development with Kotlin Paperback by Hardik Trived
5. Android Programming with Kotlin for Beginners: Build Android apps starting from zero programming experience with the new Kotlin programming language by John Horton
6. <https://www.w3schools.com/KOTLIN/index.php>

Internal Examination Pattern:

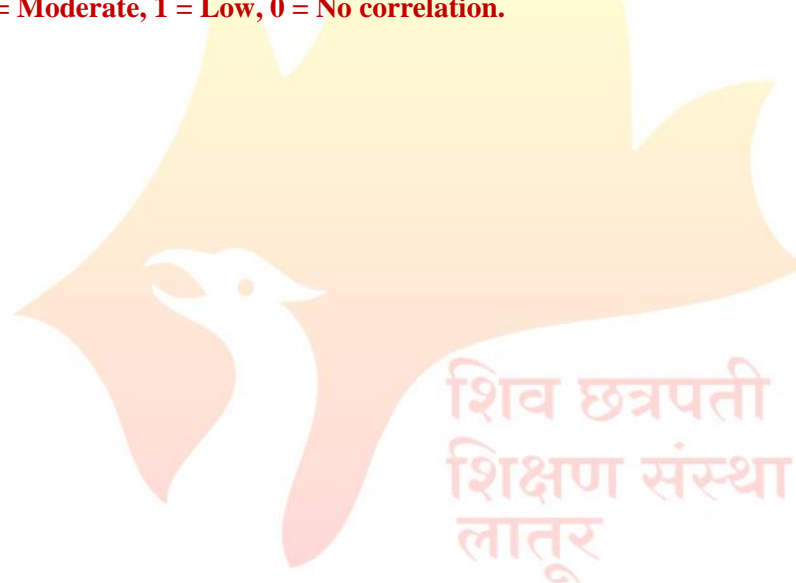
CAT – I: Record Book Submission

CAT – II: Overall performance in the regular practical

Mapping of POs, PSOs and COs:

COs/POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	2	2	3	0	0	0	0	2	3	0	0	1	0	1
CO2	2	3	3	0	0	0	0	2	3	0	0	1	0	1
CO3	1	3	3	1	0	0	0	2	3	0	0	1	0	1
CO4	2	3	3	2	0	0	0	2	3	0	0	1	0	2

Scale: 3 = High, 2 = Moderate, 1 = Low, 0 = No correlation.



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Department of Computer Science
UG IV Sem VII**

Course Type : DSE-III (B)

Course Title : Computer Graphics

Course Code : 401COS7201B

Credits : 03

Max. Marks: 75

Lectures: 45 Hrs.

Learning Objectives:

- LO1. To learn the fundamentals of 3D graphics pipeline, 3D transformation, camera manipulation, lighting, texture mapping, frame buffer operations, etc.
- LO2. To understand Graphics Processing Unit, shaders and shader programming.
- LO3. To get familiar with fundamentals of 3D modeling and animation.

Course Outcomes:

After completion of the course, students will be able to-

- CO1. Comprehend the various computer graphics hardware and display technologies
- CO2. Implement the 2D and 3D viewing techniques
- CO3. Utilize various 2D and 3D objects transformation techniques
- CO4. Apply illumination models, color models, and visible surface detection methods to create realistic surface rendering and shading effect

Unit No.	Title of Unit & Contents	Hrs.
I	Introduction to Computer Graphics	10
	A survey of computer graphics: Computer Aided Design, Presentation graphics, Computer Art, Entertainment, Education and training, Visualization, Image processing, Graphical User Interfaces. Overview of graphics Systems: Video display devices, Raster Scan Displays, Random Scan Displays, Input devices, Hard-copy devices, Graphics software. Output Primitives: Points and Lines, Line drawing Algorithms (DDA and Bradenham's Line algorithm), Mid-point circle algorithm, Ellipse generating algorithms, Filled-Area Primitives. Attributes of Output Primitives: Line Attributes, Curve Attributes, Color and Grayscale Levels, Area-Fill Attributes and Character Attributes, Bundled attributes and anti-aliasing.	
	Unit Outcome: UO 1. Describe the applications and benefits of computer graphics in various domains. UO 2. Explain the components and functions of a graphics system, such as video display devices, raster scan displays, random scan displays, input devices, hard-copy devices, graphics software, etc.	
II	Transformation and Clipping	15
	Two-dimensional geometric Transformation: Basic Transformation (Translation, Rotation, Scaling), Matrix representation and Homogenous Coordination, Composite Transformation, Reflection Shear, Transformation between coordinate systems, two-dimensional viewing: The Viewing Pipeline, viewing coordinate reference frame, window to view port coordinate transformation,	

Unit No.	Title of Unit & Contents	Hrs.
	<p>Line Clipping: (Cohen-Sutherland & Liang-Barsky algorithm) and Polygon Clipping (Sutherland-Hodgeman Algorithm).</p> <p>Unit Outcome:</p> <p>UO 1. Apply different geometric transformations, such as translation, rotation, scaling, reflection, and shear, to manipulate two-dimensional objects and shapes.</p> <p>UO 2. Transform between different coordinate systems, such as world, device, and normalized coordinates, using appropriate transformation matrices.</p>	
III	Three-Dimensional Graphics	10
	<p>Three-dimensional object Representation: Polygon Surfaces, Quadratic Surfaces, Spline Representation, Bezier Curves and Surfaces, B-Spline Curves and Surfaces, Fractal Geometry Methods: Fractal Generation Procedures, Classification of Fractals, Fractal Dimension, Geometric Construction of Deterministic Self Similar Fractals, Self-Squaring fractals. Three Dimensional Geometric and Modeling Transformations: Translation, Rotation, Scaling, Reflections, Shears, Composite Transformations, Modeling and coordinate Transformations.</p> <p>Three-dimensional Viewing: Viewing Pipeline, Viewing Coordinates, Projections (Parallel and Perspective) Clipping.</p> <p>Unit Outcomes:</p> <p>UO 1. Represent and manipulate three-dimensional objects using various methods.</p> <p>UO 2. Apply different geometric and modeling transformations, such as translation, rotation, scaling, reflection, shear, composite transformations, modeling and coordinate transformations, etc.</p>	
IV	Illumination and Color Models	10
	<p>Visible Surface Detection Methods: Classification of Visible-Surface Detection Algorithms, Back-Face Detection, Depth-Buffer Method, A-Buffer Method, Scan line and Depth Sorting,</p> <p>Illumination Models and Surface-Rendering Methods: Basic Illumination Models, Displaying Light Intensities, Halftone Patterns and Dithering Techniques. Polygon- Rendering Methods (Ground Shading, Phong Shading). Light sources – basic illumination models–half tone patterns and dithering techniques;</p> <p>Properties of light–Standard primaries and chromaticity diagram;</p> <p>Intuitive colour concepts–RGB colour model–YIQ colour model–CMY colour model–HSV colour model–HLS colour model;</p> <p>Colour selection.</p> <p>Unit Outcome:</p> <p>UO 1. Implement various visible surface detection methods, such as back-face detection, depth-buffer method, A-buffer method, scan line and depth sorting, etc., and classify them based on their advantages and disadvantages.</p> <p>UO 2. Apply different illumination models and surface-rendering methods, such as basic illumination models, displaying light intensities, halftone patterns and dithering techniques, polygon-rendering methods etc., to create realistic and smooth shading effects on the surfaces.</p>	

Learning Resources:

1. Computer Graphics (Principles and Practice) by Foley, vanDam, Feiner and Hughes, Addison Wesley (Indian Edition).
2. Computer Graphics by D Hearn and PM Baker, Prentice Hall of India (Indian Edition).
3. Procedural Elements for Computer Graphics by D F Rogers, McGrawHill (Indian Edition).
4. Interactive Computer Graphics, A top-down approach with OpenGL by Edward Angele, Addison Wesley.

Internal Examination Pattern:

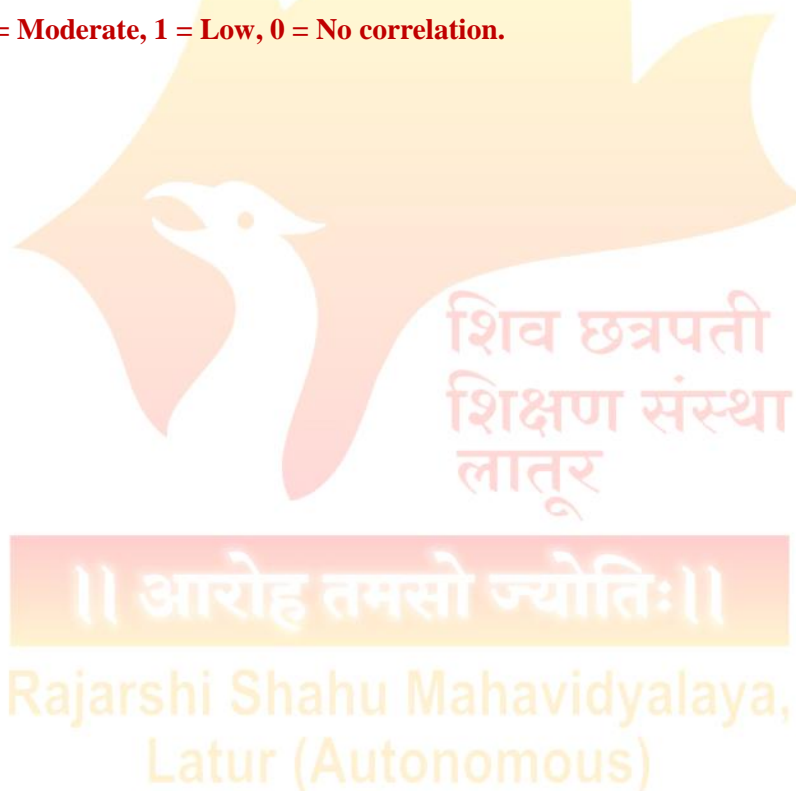
CAT – I: Home Assignment

CAT – II: PPT Presentation/ Open Book Test/ Poster Presentation/ Seminar/ Online Quiz/ Descriptive Test

Mapping of POs, PSOs and COs:

COs/POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	0	0	0	0	2	2	0	2	0	3	1
CO2	2	3	3	0	0	0	0	2	2	0	2	0	3	1
CO3	3	3	3	0	0	0	0	2	2	0	2	0	3	1
CO4	3	3	3	0	0	0	0	2	2	0	2	0	3	1

Scale: 3 = High, 2 = Moderate, 1 = Low, 0 = No correlation.





**Shiv Chhatrapati Shikshan Sanstha's
Rajarshi Shahu Mahavidyalaya, Latur**

**Empowered Autonomous Institution
Faculty of Science & Technology
Department of Computer Science
UG IV Sem VII**

Course Type : DSE Lab Course

Course Title : DSE Lab Course-IIIB

Course Code : 401COS7202B

Credits : 01

Max. Marks: 50

Lectures: 30 Hrs.

Learning Objectives:

- LO1. To learn the fundamentals of 3D graphics pipeline, 3D transformation, camera manipulation, lighting, texture mapping, frame buffer operations, etc.
- LO2. To understand Graphics Processing Unit, shaders and shader programming.
- LO3. To get familiar with fundamentals of 3D modeling and animation.

Course Outcomes:

After completion of the course, students will be able to-

- CO1. Comprehend the various computer graphics hardware and display technologies
- CO2. Implement the 2D and 3D viewing techniques
- CO3. Utilize various 2D and 3D objects transformation techniques
- CO4. Apply illumination models, color models, and visible surface detection methods to create realistic surface rendering and shading effect

Practical No.	Unit
1	Program to demonstrate line(), circle(), rectangle(), ellipse().
2	Program to demonstrate setlinestyle()and setfillstyle().
3	Program to draw the emoji faces.
4	Program to draw a car.
5	Program to implement DDA algorithm.
6	Program to implement Bresenham's integer line drawing algorithm.
7	Program to implement Bresenham's General line drawing algorithm.
8	Program to implement Translation Transformation
9	Program to implement Scaling Transformation.
10	Program to implement Rotation Transformation

Learning Resources:

1. Computer Graphics (Principles and Practice) by Foley, vanDam, Feiner and Hughes, Addison Wesley (Indian Edition).
2. Computer Graphics by D Hearn and PM Baker, Prentice Hall of India (Indian Edition).
3. Procedural Elements for Computer Graphics by D F Rogers, McGrawHill (Indian Edition).
4. Interactive Computer Graphics, A top-down approach with OpenGL by Edward Angele, Addison Wesley.

Internal Examination Pattern:

CAT – I: Record Book Submission

CAT – II: Overall performance in the regular practical

Mapping of POs, PSOs and COs:

COs/POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	2	0	0	0	0	2	2	0	2	0	3	1
CO2	2	3	3	0	0	0	0	2	2	0	2	0	3	1
CO3	3	3	3	0	0	0	0	2	2	0	2	0	3	1
CO4	3	3	3	0	0	0	0	2	2	0	2	0	3	1

Scale: 3 = High, 2 = Moderate, 1 = Low, 0 = No correlation.



॥ आरोग्यं तमसो ज्योतिः ॥

Rajarshi Shahu Mahavidyalaya,
Latur (Autonomous)



**Shiv Chhatrapati Shikshan Sanstha's
Rajarshi Shahu Mahavidyalaya, Latur**

**Empowered Autonomous Institution
Faculty of Science & Technology
Department of Computer Science
UG IV Sem VII**

Course Type : RMC

Course Title : Research Methodology

Course Code : 401COS7301

Credits : 04

Max. Marks: 100

Lectures: 60 Hrs.

Learning Objectives:

- LO1. To enable to student to understand and work methods and concepts related Research.
- LO2. To enable the student to develop research proposal and to work with research problem.
- LO3. To develop broad comprehension of research area.

Course Outcomes:

After completion of the course, the student will be able to-

- CO1. Examine the basic aspects of Research methods
- CO2. Apply and integrate the basic concepts Collection and analysis of data.
- CO3. Know the of report writing and evaluation methods.
- CO4. Examine the plagiarism by using various apps.

Unit No.	Title of Unit & Contents	Hrs.
I	Introduction and Methods of Research	15
	<ol style="list-style-type: none">1. Meaning of Research, Objectives of Research, Types of Research,2. Research Approaches, Significance of Research, Research Methods Versus Methodology, Research and Scientific Methods,3. Research Processes, Criteria for Good Research4. Research Problem, Selecting the Problem, Necessity of Defining the Problem, Techniques Involved in Defining a Problem	
	Unit Outcome: UO1. Examine the basic aspects of Research methods	
II	Research Design and Sampling	15
	<ol style="list-style-type: none">1. Meaning and Need for Research Design, Features of A Good Design.2. Important Concepts Relating to Research Design: Dependent and Independent Variables, Extraneous Variables, Control, Research Hypothesis, Experimental and Non-Experimental Hypothesis –Testing Research, Experimental and Control Group3. Different Research Designs: Research Design in Case of Exploratory Research Studies, Research Design in Case of Hypothesis- Testing Research Studies, Basic Principles of Experimental Designs, Important Experimental Designs	

	4. Sampling Design, Steps in Sample Design, Criteria of Selecting a Sampling Procedure, Characteristics of A Good Sample Design, Different Types of Sample Design	
	Unit Outcome: UO1. Apply and integrate the basic concepts Collection and analysis of data.	
III	Data Collection and Data Processing	15
	1. Measurements in Research, Measurement Scales, Sources of Errors in Measurement. 2. Collection of Primary Data: Observation Method, Interview Method, Through Questionnaires, Through Schedules, Difference Between Questionnaire and Schedule 3. Collection of Secondary Data, Selection of Appropriate Methods for Data Collection, Case Study Method 4. Data Processing, Processing Operations: Editing, Coding, Classification, Tabulation, Graphical Representation, Types of Analysis, Statistical Tools and Techniques of Data Analysis-Measures of Central Tendency, Dispersion.	
	Unit Outcome: UO1. Know the of report writing and evaluation methods	
IV	Report Writing and Evaluations	15
	1. Principles of Report Writing and Guide Lines According to Style Manuals. 2. Writing and Presentation of Preliminary, Main Body and Reference Section of Report. 3. Evaluation of Research Report. 4. Methods to Search Required Information Effectively, Reference Management Software Like Zotero/ Mendeley, Software for Paper Formatting Like Latex/ MS Office. 5. Software for Detection of Plagiarism.	
	Unit Outcome: UO1. Examine the plagiarism by using various apps.	

Learning Recourses:

1. Bajpai S. R. (1975) Methods of Social Survey and Research, Kitabghar, Kanpur.
2. Hans Raj (1988) Theory and Practice in Social Research, Surjeet Publication, Kolhapur.
3. Krishnaswami O. R. (1988) Methodology of Research in Social Science, Himalaya Pub. House.
4. Sadhu, Singh, Research Methodology in Social Science Bhandarkar, Research Methodology
5. Kothari, C. R. (2005) Quantitative Technique, New Delhi, Vikas Publication House.
6. Gautam, N. C. (2004) Development of Research tools, New Delhi, Shree Publishers.
7. Gupta, Santosh (2005) Research Methodology and Statistical Techniques, Deep and Deep Publications.
8. Chandra A. and Sexena T. P. (2000) Style Manual, New Delhi, Metropolitan Book Comp. Ltd.
9. Shukla, J. J. (1999) Theories of Knowledge, Ahmadabad, Karnavati Publication.
10. Bhattacharya, D. K. (2004) Research Methodology, New Delhi, Excel Books.
11. Brymann, Alan and Carmer, D. (1995) Qualitative data analysis for social scientist, New York, Routledge Publication.
12. Best J. W. and Khan J. V. (2005) Research in Education New Delhi, Prentice Hall India.

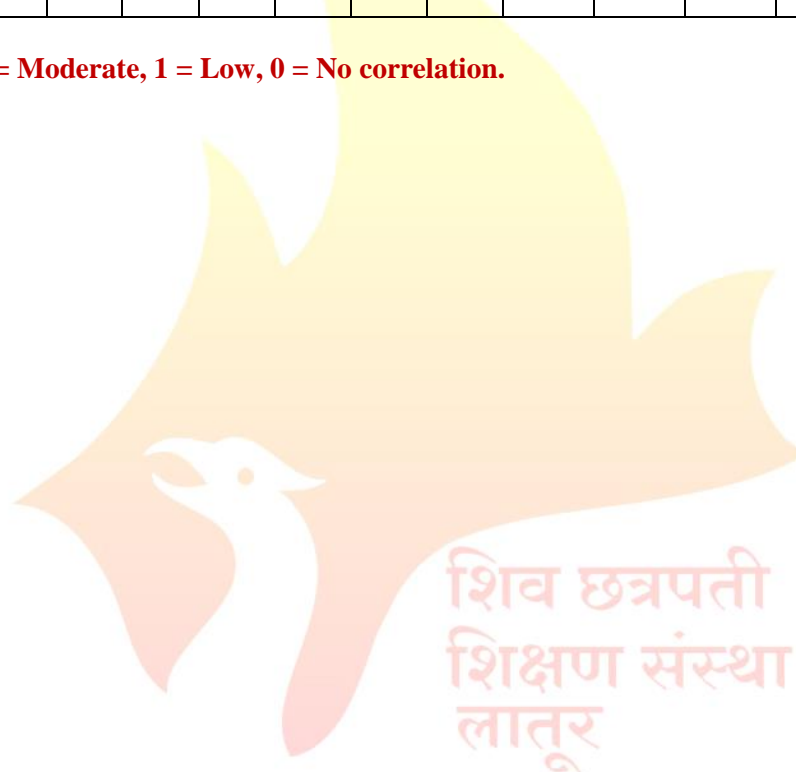
Internal Examination Pattern:

CAT – I: Home Assignment

CAT – II: PPT Presentation/ Open Book Test/ Poster Presentation/ Seminar/ Online Quiz/ Descriptive Test

Mapping of POs, PSOs and COs:

COs/POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	1	2	0	3	0	0	2	2	0	0	0	0	0	3
CO2	1	2	2	3	1	0	2	2	0	2	0	0	0	3
CO3	1	1	2	3	0	1	3	2	0	0	0	0	0	3
CO4	1	1	2	2	3	0	1	2	0	0	0	0	0	3

Scale: 3 = High, 2 = Moderate, 1 = Low, 0 = No correlation.**॥ आरोह तमसो ज्योतिः ॥****Rajarshi Shahu Mahavidyalaya,
Latur (Autonomous)**

Semester VIII

शिव छत्रपती
शिक्षण संस्था
लातूर

॥ आर्योह तमसो ज्योतिः ॥

Rajarshi Shahu Mahavidyalaya,
Latur (Autonomous)



**Shiv Chhatrapati Shikshan Sanstha's
Rajarshi Shahu Mahavidyalaya, Latur**

**Empowered Autonomous Institution
Faculty of Science & Technology
Department of Computer Science
UG IV Sem VIII**

Course Type : DSC-XVII

Course Title : Advanced DBMS

Course Code : 401COS8101

Credits : 03

Max. Marks: 75

Lectures: 45 Hrs.

Learning Objectives:

- LO1. To impart the concepts of Centralized, Parallel and Distributed Databases.
- LO2. To familiarize with Query transformation and optimization ideas
- LO3. To educate on distributed database transaction management principles
- LO4. To discuss the concurrency control concepts in distributed systems
- LO5. To familiarize the basics concepts of reliability and inconsistency problems of distributed database systems

Course Outcomes:

After completion of the course, students will be able to-

- CO1. Solve transforming a global query into local query using optimizing techniques.
- CO2. Summarize the distributed transaction management principles.
- CO3. Explain various distributed concurrency control techniques.
- CO4. Evaluate the Non-blocking Commitment Protocols

Unit No.	Title of Unit & Contents	Hrs.
I	Relational Databases	10
	Structure of Relational Database, Database Schema, Keys, Schema Diagrams, Relational Operations, Relational Algebra, Tuple Relational Calculus, Domain Relational Calculus. Overview of the design Process, Entity Relationship Model, Intraradical states, Removing Redundant attributes in entity sets, E-R Diagram, Entity Relationship Design Issues Intermediate and Advanced SQL	
	Unit Outcome: UO 1. Understand the relational database concepts - Tuple Relational Calculus, Domain Relational Calculus UO 2. Study of the components used Entity relational model	
II	Query Processing and Optimization	08
	Measures of Query Cost, Selection Operation, Sorting, Join Operations, Other Operations Transformation of Relational Expressions, Estimating statistics of expression results, choice of evaluation plan, Materialized views, advanced topics in Query optimization	
	Unit Outcome: UO 1. Discussing Measures of Query Cost, Selection Operation, Sorting, Join Operations, Other Operations UO 2. Understanding Query Evaluation & query optimization.	

Unit No.	Title of Unit & Contents	Hrs.
III	Transaction Management and Concurrency Control	12
	Transaction concept, simple transaction model, Storage Structure, Transaction Atomicity and durability, Transaction isolation, Serializability, Transaction isolation and atomicity, Transaction isolation level and implementation, Transactions as SQL Statements Lock based Protocol, Deadlock handling, Time stamp-based protocol, Validation based protocol	
	Unit Outcomes: UO 1. Implementing database transactions UO 2. Using various lock-based protocol, deadlock handling protocols	
IV	System Architecture	15
	Data base system architecture-centralized and client server architecture, Server system architecture, Parallel System and distributed systems I/O Parallelism, interquery Parallelism, Intraquery Parallelism, Intraoperation Parallelism, Interoperation Parallelism Homogeneous and Heterogeneous databases, Distributed data storage, Distributed transactions, commit protocols, Concurrency control and distributed databases, Distributed query processing	
	Unit Outcome: UO 1. Discuss various types of databases. UO 2. Understand Centralized , distributed & parallel databases & Query processing techniques.	

Learning Resources:

1. Database system Concepts, Abrahan Silberschatz, Henry F. Korth, S. Sudarshan, Mc Graw Hills Publication
2. An Introduction to Database Systems, Bipin C. Desai, Galgotia Publications
3. Advanced Database Management Systems (PB) by Yogesh Sharma
4. Fundamentals of Database System by Elmasri Ramez
5. Understanding MySQL Internals: Discovering and Improving a Great Database by Sasha Pachev
6. Learning MySQL: Get a Handle on Your Data by Vinicius M. Grippa
7. <https://www.w3schools.com/MySQL/default.asp>

Internal Examination Pattern:

CAT – I: Home Assignment

CAT – II: PPT Presentation/ Open Book Test/ Poster Presentation/ Seminar/ Online Quiz/ Descriptive Test

Mapping of POs, PSOs and COs:

COs/POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	3	3	0	0	0	0	2	0	3	2	0	0	2
CO2	3	2	3	0	1	0	0	2	0	3	2	2	0	2
CO3	3	2	3	0	1	0	0	2	0	3	2	2	0	2
CO4	3	2	3	1	1	0	0	2	0	3	2	2	0	2

Scale: 3 = High, 2 = Moderate, 1 = Low, 0 = No correlation.



**Shiv Chhatrapati Shikshan Sanstha's
Rajarshi Shahu Mahavidyalaya, Latur**

**Empowered Autonomous Institution
Faculty of Science & Technology
Department of Computer Science
UG IV Sem VIII**

Course Type : DSC Laboratory Course

Course Title : DSC Laboratory Course XVI

Course Code :

Credits : 01

Max. Marks: 50

Lectures: 30 Hrs.

Learning Objectives:

- LO1. To impart the concepts of Distributed and Centralized Databases.
- LO2. To enable with the principles of Query transformation and Optimization techniques.
- LO3. To nurture with precepts of transaction management in distributed database.
- LO4. To discuss the concurrency control concepts in distributed systems.
- LO5. To familiarize the basics concepts of reliability and inconsistency problems of distributed database systems

Course Outcomes:

After completion of the course, students will be able to-

- CO1. Solve transforming a global query into local query using optimizing techniques.
- CO2. Summarize the distributed transaction management principles.
- CO3. Explain various distributed concurrency control techniques.
- CO4. Evaluate the Non-blocking Commitment Protocols

Practical No.	Unit
1	Introduction SQL-SQL*Plus a. My SQL Installation b. Types of SQL Commands c. Various Data Types d. Database & Tables Creation e. Key Constrains-Normalization f. Update, Delete, Alter , Rename g. where, In, not in, like, not like, distinct, is null, is not null
2	Working with sorting, grouping & Aggregate functions a. Order by Clause b. Group by Clause, Having Clause c. Single Row Functions: character, number, date etc. d. Multi-row Functions
3	Working with Table Join a. Cartesian Product b. ANSI Style c. Using Clause d. Theta Join e. Outer Join- Left, Right, Full Outer Join f. Self-join g. Set Operators – Union, Intersect, Minus
4	Working with Views in Oracle 10g

Practical No.	Unit
5	Programs on PL/SQL Block in ORACLE 10g a. Simple PL/SQL Block b. Looping in PL/SQL Block c. Exception Handling in PL/SQL
6	Programs on Trigger, Procedure, Cursor in Oracle 10g a. Row Triggers and Statement Triggers b. Before and After Triggers c. Instead Of Triggers d. Implicit cursors e. Explicit cursors f. Procedures –In, Out, In Out
7	Working with Database Transactions in MySQL/ORACLE/ PostgreSQL a. Set transaction b. Begin transaction c. End transaction d. Commit, Rollback, Savepoint
8	Program on Distributed Transactions in PostgreSQL

Learning Resources:

1. Database system Concepts, Abrahan Silberschatz, Henry F. Korth, S. Sudarshan, Mc Graw Hills Publication
2. An Introduction to Database Systems, Bipin C. Desai, Galgotia Publications
3. Advanced Database Management Systems (PB) by Yogesh Sharma
4. Fundamentals of Database System by Elmasri Ramez
5. Understanding MySQL Internals: Discovering and Improving a Great Database by Sasha Pachev
6. Learning MySQL: Get a Handle on Your Data by Vinicius M. Grippa
7. <https://www.w3schools.com/MySQL/default.asp>

Internal Examination Pattern:

CAT – I: Record Book Submission

CAT – II: Overall performance in the regular practical

Mapping of POs, PSOs and COs:

COs/POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	3	3	0	0	0	0	2	0	3	2	0	0	2
CO2	3	2	3	0	1	0	0	2	0	3	2	2	0	2
CO3	3	2	3	0	1	0	0	2	0	3	2	2	0	2
CO4	3	2	3	1	1	0	0	2	0	3	2	2	0	2

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**Shiv Chhatrapati Shikshan Sanstha's
Rajarshi Shahu Mahavidyalaya, Latur**

**Empowered Autonomous Institution
Faculty of Science & Technology
Department of Computer Science
UG IV Sem VIII**

Course Type : DSC-XVIII

Course Title : Compiler Design

Course Code : 401COS8102

Credits : 03

Max. Marks: 75

Lectures: 45 Hrs.

Learning Objectives:

- LO 1. To get working knowledge of the MMC phases of compilation, like lexical analysis, parsing, semantic analysis and code generation.
- LO 2. To use the formal attributed grammars for specifying the syntax and semantics of programming languages
- LO 3. To understand the structure of a compiler, and how the source and target languages influence various choices in the design
- LO 4. To learn and use tools for compiler construction

Course Outcomes:

Upon successful completion of the course, students will be able to:

- CO 1. Solve problem of parsing and compiling.
- CO 2. Design and develop simple compiler.
- CO 3. Use compiler tools in basic, concurrent, distributed and embedded environments.
- CO 4. Generate and optimize the code.

Unit No.	Title of Unit & Contents	Hrs.
I	Introduction to Compilers and Lexical Analysis	12
	Compilers and Translators, The Structure of Compiler, Lexical Analysis, Syntax Analysis, Intermediate Code generation, Optimization, Code Generation, Bookkeeping, Error Handling, Compiler writing Tools, Programming Language Basics: Definition, The lexical and Syntactic structure of a language, data elements, data structures, operators, assignment, statements, program units, data environments, parameter transmission, storage management. Lexical Analysis: Role of Lexical Analyzer, A simple approach to the design of Lexical Analyzers, Regular Expressions, Finite Automata, from regular expressions to finite automata, Minimizing the number of states of a DFA, A language specifying lexical analyzers, Implementation of a lexical analyzer, The scanner generator as Swiss army knife.	
	Unit Outcomes: UO 1. Gain a deep understanding of the structure and components of a compiler. UO 2. Analyze the structure of the source code based on a formal grammar.	
II	Syntax Analysis and Parsing Techniques	11
	Context free grammars, Derivations and Parse Trees, Capabilities of Role of Context free grammars, Parser, shift reduce parsing, Operator Precedence Parsing, top-down parsing, Predictive parsers – Computation of FIRST & FOLLOW functions and	

Unit No.	Title of Unit & Contents	Hrs.
	<p>construction of parsing table, LR parsers, the canonical collection of LR (O) items, Constructing LALR parser tables, Using Ambiguous Grammars, An Automatic parser Generator, Implementation of LR parsing tables, Constructing LALR sets of items</p> <p>Unit Outcomes: UO 1. Gain a thorough understanding of context-free grammars and their role in specifying the syntax of programming languages. UO 2. Learn about different parsing techniques, including shift-reduce parsing, operator precedence parsing, and top-down parsing</p>	
III	Syntax Directed Translation and Symbol Table	11
	<p>Syntax-Directed Translation schemes, Implementation of syntax-directed translators, Intermediate code, Postfix notations, parser trees and syntax trees, three address codes – Quadruples and triples, indirect triples, Translation of assignment statements, Boolean expressions, Statements that alter the flow of control, Postfix translations, Translation with a top down parser. Symbol Tables: The Contents of Symbol Table, Data Structures for a Symbol Tables, Representing scope information</p> <p>Unit Outcomes: UO 1. Gain practical experience in implementing syntax-directed translators. UO 2. Acquire the skills about intermediate code representations and their role in translating high-level programming languages to machine code.</p>	
IV	Code Optimization and Code Generation	11
	<p>The principal sources of optimization, loop optimization - Basic blocks, flow graphs, loops, code motion, induction variables, The DAG representation of basic blocks- Application of DAGs, Value Numbers and Algebraic Laws, Global Data Flow Analysis-Data Flow equations, Solving Data Flow equations. Object programs: the environment of code, generator, run-time addresses for names, Problems in code generation, A machine model, a simple code generator, Register allocation and assignments, Code generation from DAG's, Peephole optimization. Introduction to Errors, Lexical Phase Errors, Syntactic Phase Errors, Semantic Phase Errors</p> <p>Unit Outcomes: UO 1. Learn about loop optimization techniques, including code motion, induction variable elimination, and loop unrolling. UO 2. To gain knowledge of basic blocks and flow graphs, and understand their role in analyzing and optimizing code</p>	

Learning Resources:

1. Principles of Compiler Design - Alfred V. Aho, Jeffrey D. Ullman (Narosa Publishing House)
2. Compiler Construction – Principles & Practices D. M. Dhamdhare,
3. Compilers Principles, Techniques and Tools Alfred V. Aho Second Edition (Pearson Education)
4. Compilers: Principles, Techniques, and Tools by Alfred V. Aho, Monica S. Lam, Ravi Sethi, and Jeffrey D. Ullman
5. Engineering a Compiler by Keith D. Cooper and Linda Torczon
6. Parsing Techniques: A Practical Guide by Dick Grune and Ceriel J.H. Jacobs
7. Modern Compiler Implementation in C by Andrew W. Appel

8. Compiler Design in C by Allen I. Holub
9. Introduction to the Theory of Computation by Michael Sipser
10. Advanced Compiler Design and Implementation by Steven Muchnick

Internal Examination Pattern:

CAT – I: Home Assignment

CAT – II: PPT Presentation/ Open Book Test/ Poster Presentation/ Seminar/ Online Quiz/ Descriptive Test

Mapping of POs, PSOs and COs:

COs/POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
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CO3	2	2	3	0	0	0	0	2	2	0	3	0	0	2
CO4	3	3	2	1	0	0	0	2	2	0	3	0	0	2

Scale: 3 = High, 2 = Moderate, 1 = Low, 0 = No correlation.





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Rajarshi Shahu Mahavidyalaya, Latur**

**Empowered Autonomous Institution
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Department of Computer Science
UG IV Sem VIII**

Course Type : DSC Lab Course

Course Title : DSC Lab Course- XVII

Course Code : 401COS8106

Credit : 01

Max. Marks: 50

Lectures: 30 Hrs.

Learning Objectives:

- LO1. To get working knowledge of the MMC phases of compilation, like lexical analysis, parsing, semantic analysis and code generation.
- LO2. To use the formal attributed grammars for specifying the syntax and semantics of programming languages
- LO3. To understand the structure of a compiler, and how the source and target languages influence various choices in the design
- LO4. To learn and use tools for compiler construction.

Course Outcomes:

Upon successful completion of the course, students will be able to:

- CO1. Solve problem of parsing and compiling.
- CO2. Design and develop simple compiler.
- CO3. Use compiler tools in basic, concurrent, distributed and embedded environments.
- CO4. Generate and optimize the code.

Practical No.	Experiment
1	Tokenizing a file using C.
2	2 Implementation of Lexical Analyzer using Lex Tool.
3	3 Study the LEX and YACC tool and evaluate an arithmetic expression with parentheses, unary and binary operators using Flex and Yacc (Calculator).
5	4 Using JFLAP, create a DFA from a given regular expression.
6	5 Create LL (1) parse table for a given CFG and hence Simulate LL (1) Parsing
7	Using JFLAP create SLR (1) parse table for a given grammar. Simulate parsing and output the parse tree proper format.
8	Write functions to find FIRST and follow of all the variables.
9	Read a regular expression in its standard form and find out an ϵ -NFA from it. Need to postfix form. Scan a string and check whether the string matches against the

10	given regular expression or not
11	Design predictive parser for the given language.
12	Convert the BNF rules into YACC form and write code to generate abstract syntax tree.

Learning Resources:

1. Principles of Compiler Design - Alfred V. Aho, Jeffrey D. Ullman (Narosa Publishing House)
2. Compiler Construction – Principles & Practices D. M. Dhamdhare,
3. Compilers Principles, Techniques and Tools Alfred V. Aho Second Edition (Pearson Education)
4. Compilers: Principles, Techniques, and Tools by Alfred V. Aho, Monica S. Lam, Ravi Sethi, and Jeffrey D. Ullman
5. Engineering a Compiler by Keith D. Cooper and Linda Torczon
6. Parsing Techniques: A Practical Guide by Dick Grune and Criel J.H. Jacobs
7. Modern Compiler Implementation in C by Andrew W. Appel
8. Compiler Design in C by Allen I. Holub
9. Introduction to the Theory of Computation by Michael Sipser
10. Advanced Compiler Design and Implementation by Steven Muchnick

Internal Examination Pattern:

CAT – I: Record Book Submission

CAT – II: Overall performance in the regular practical

Mapping of POs, PSOs and COs:

COs/POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	3	2	0	0	0	0	2	1	0	3	0	0	1
CO2	2	3	3	1	0	0	0	2	2	0	3	0	0	2
CO3	2	2	3	0	0	0	0	2	2	0	3	0	0	2
CO4	3	3	2	1	0	0	0	2	2	0	3	0	0	2

Scale: 3 = High, 2 = Moderate, 1 = Low, 0 = No correlation.

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Rajarshi Shahu Mahavidyalaya,
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Shiv Chhatrapati Shikshan Sanstha's
Rajarshi Shahu Mahavidyalaya, Latur
 Empowered Autonomous Institution
 Faculty of Science & Technology
 Department of Computer Science
 UG IV Sem VIII

Course Type : DSC-XIX

Course Title : Web Programming

Course Code : 401COS8103

Credits : 03

Max. Marks: 75

Lectures: 45 Hrs.

Learning Objectives:

- LO1. ASP.NET helps students to create their own web applications.
- LO2. To design & develop static and dynamic websites.
- LO3. To develop web application with validation controls
- LO4. To train the students in creating dynamic web pages using ASP.NET.
- LO5. To facilitate the students, develop real time applications using database.

Course Outcomes:

After completion of this course, students will be able to

- CO1. Develop web pages using HTML, CSS and JavaScript.
- CO2. Create a Web form with server controls.
- CO3. Separate page code from content by using code-behind pages, page controls, and components.
- CO4. Display dynamic data from a data source by using Microsoft ADO.NET and data binding.

Unit No.	Title of Unit & Contents	Hrs.
I	Introduction to Web Technology & Asp.net	10
	Web Support Languages, Types of .net Application: web, Desktop, Mobile, Role of Web Browser and Web Server Understanding HTTP, LAN, WAN, Client side and Server-side Scripting, Introduction to Ajax and WCF, Introduction to .net, .net Framework, Installing visual studio.net, Asp Vs Asp.net, Asp.net Web page life cycle, Asp.net Web form, Directive Unit Outcome: UO 1. Gain knowledge of the role of web browsers and web servers in the context of web applications, and understand how they interact with each other using HTTP protocols. UO 2. Differentiate client-side and server-side scripting, and learn how to use them effectively in web development	
II	Asp.net Applications, CSS and Themes	10
	Creating Asp.net Web Application, Auto Post back property, HTML controls Vs Web controls, Code Window & Design Window, Server-Side controls, Exception Handling, what is CSS? Types of CSS, Theme, Name skin within a Theme. Unit Outcome: UO 1. Create an ASP.NET web application using Visual Studio.NET, including setting up a project, adding pages, and configuring the necessary settings.	

Unit No.	Title of Unit & Contents	Hrs.
	UO 2. Differentiate between HTML controls and web controls in ASP.NET, and understand the advantages of using web controls for server-side processing.	
III	Syntax Directed Translation and Symbol Table	15
	Redirecting Options: Response.Redirect, Server.Transfer, Cross Page Post back, Passing Values between pages, Introduction to Master Page, Content Place Holder and Content tags, Accessing Controls of Master page in Content page, Master page with Menus.	
	Unit Outcomes: UO 1. Use the Response.Redirect method in ASP.NET to redirect users to a different page within the application. UO 2. Understand the concept of master pages in ASP.NET and how they can be used to create consistent layouts across multiple pages	
IV	User Controls, Validation, State Management and Web Services	10
	Creating User Control, Required Field Validator, Compare Validator, Range Validator, Regular Expression Validator, Custom Validator, Query String, State Management, Hidden Field, Cookies, Session, Creating Web Services, Web Methods, Database Oriented Asp.net, ADO.NET data access, Data Binding, Web Application with Grid View, Data List, Data Grid, Repeater.	
	Unit Outcome: UO 1. Create user controls in ASP.NET and understand how to use them in their web applications. UO 2. Gain an understanding of how to pass values between pages using query strings in ASP.NET .	

Learning Resources:

1. ASP.NET the Complete Reference: Matthew Macdonald
2. Mastering Asp.net, BPB Publication, Russel.
3. Asp.net 4.0 Black Book

Internal Examination Pattern:

CAT – I: Home Assignment

CAT – II: PPT Presentation/ Open Book Test/ Poster Presentation/ Seminar/ Online Quiz/ Descriptive Test

Mapping of POs, PSOs and COs:

COs/POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	2	3	3	0	0	0	0	2	3	0	1	2	0	1
CO2	2	3	3	0	0	0	0	2	3	0	1	2	0	1
CO3	2	2	3	0	0	0	0	2	3	0	1	2	0	1
CO4	2	3	3	0	0	0	0	2	3	2	1	2	0	1

Scale: 3 = High, 2 = Moderate, 1 = Low, 0 = No correlation.



**Shiv Chhatrapati Shikshan Sanstha's
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**Empowered Autonomous Institution
Faculty of Science & Technology
Department of Computer Science
UG IV Sem VIII**

Course Type : DSC Lab Course

Course Title : DSC Lab Course Lab Course XVIII

Course Code : 601COS2106

Credits : 03

Max. Marks: 50

Lectures: 30 Hrs.

Learning Objectives:

- LO1. ASP.NET helps students to create their own web applications.
- LO2. To design & develop static and dynamic websites.
- LO3. To develop web application with validation controls
- LO4. To train the students in creating dynamic web pages using ASP.NET.
- LO5. To facilitate the students, develop real time applications using database.

Course Outcomes:

After completion of this course, students will be able to

- CO1. Develop web pages using HTML, CSS and JavaScript.
- CO2. Create a Web form with server controls.
- CO3. Separate page code from content by using code-behind pages, page controls, and components.
- CO4. Display dynamic data from a data source by using Microsoft ADO.NET and data binding.

Practical No.	Unit
1	Introduction and Installation of Visual Studio.
2	Program for variables declaration and operators in Asp.net.
3	Program for Decision Making, Loops and Function in Asp.net.
4	Program to demonstrate Label, TextBox, Button Control.
5	Program to demonstrate ListBox, ComboBox Control.
6	Program to demonstrate Dropdown list and Calendar Control.
7	Program to design a Masterpage.
8	Program for embedding CSS in Asp.net.
9	Program to demonstrate Exception Handling in Asp.Net.
10	Program to demonstrate Compare validator, Required Filed Validator.
11	Program to demonstrate Range Validator and Custom Validator.
12	Program on Cookies.
13	Program on Session.
14	Program to demonstrate View State and Query String.
15.	Database Connectivity.

Learning Resources:

- 1. ASP.NET the Complete Reference: Matthew Macdonald
- 2. Mastering Asp.net, BPB Publication, Russel.
- 3. Asp.net 4.0 Black Book

Internal Examination Pattern:

CAT – I: Record Book Submission

CAT – II: Overall performance in the regular practical

Mapping of POs, PSOs and COs:

COs/POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	2	3	3	0	0	0	0	2	3	0	1	2	0	1
CO2	2	3	3	0	0	0	0	2	3	0	1	2	0	1
CO3	2	2	3	0	0	0	0	2	3	0	1	2	0	1
CO4	2	3	3	0	0	0	0	2	3	2	1	2	0	1

Scale: 3 = High, 2 = Moderate, 1 = Low, 0 = No correlation.



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**Empowered Autonomous Institution
Faculty of Science & Technology
Department of Computer Science
UG IV Sem VIII**

Course Type : DSC-XVI

Course Title : Syllabus of Preparation of NET/SET Examination-II

Course Code : 401COS7104

Credits : 02

Max. Marks: 50

Lectures: 30 Hrs.

Learning Objectives:

LO1. To understand how to write program in Python

Course Outcomes:

After completion of the course, students will be able to-

CO1. exceptions, write regular expression & database applications in Python

Internal Examination Pattern:

CAT – I: Home Assignment

CAT – II: PPT Presentation/ Open Book Test/ Poster Presentation/ Seminar/ Online Quiz/ Descriptive Test

Mapping of POs, PSOs and COs:

COs/POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1														
CO2														
CO3														
CO4														

Scale: 3 = High, 2 = Moderate, 1 = Low, 0 = No correlation.

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Rajarshi Shahu Mahavidyalaya,
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**Shiv Chhatrapati Shikshan Sanstha's
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**Empowered Autonomous Institution
Faculty of Science & Technology
Department of Computer Science
UG IV Sem VIII**

Course Type : DSE-IVA

Course Title : Internet of Things

Course Code : 401COS8201A

Credits : 03

Max. Marks: 75

Lectures: 45 Hrs.

Learning Objectives:

- LO1. To introduce the concepts of Internet of Things.
- LO2. To impart the knowledge on IoT application areas.
- LO3. To introduce the IoT business process models, design technology for Connected Devices.
- LO4. To enable the students, learn the effective usage of device connectivity and web connectivity models

Course Outcomes:

Upon successful completion of the course, students will be able to:

- CO1. Demonstrate the need of IoT in the computing world.
- CO2. Identify the Business Process models of IoT.
- CO3. Analyze the data storage and acquisition mechanisms for real time applications.
- CO4. Design IoT based prototypes

Unit No.	Title of Unit & Contents	Hrs.
I	Introduction Internet of Things	12
	Definition and characteristics of IoT. Sensing, Actuation, Networking basics, Sensor Network. Physical Design of IoT, Things in IoT, IoT Protocols Logical Design of IoT- IoT functional blocks, IoT communication models, IoT enabling Technologies- Wireless sensor networks, cloud computing, big data analytics, communication protocols, embedded systems IoT Levels and deployment templates- IoT Level1 to IoT Level6.	
	Unit Outcomes: UO 1. Define and describe the concept of IoT, including its characteristics and components. UO 2. Learn about networking basics in the context of IoT, including different types of networks and their use in connecting IoT devices	
II	Domain Specific IoTs and IOT vs M2M	11
	Introduction: Home automation- Smart lighting, smart appliances, intrusion detection, smoke or gas detectors Cities-Smart parking, smart lighting, smart roads, structural help monitoring, surveillance, emergency response Environment-Weather monitoring, Air pollution monitoring, forest fire detection, river flood detection Retail- Inventory management, smart payments, smart vending machines Logistics-Route generation and scheduling, fleet tracking, ship monitoring, remote vehicle	

	<p>diagnostic Agriculture- smart irrigation, green house control Industry- machine diagnostic, prognosis, indoor air quality monitoring Health and Lifestyle. IOT vs M2M: - M2M, Difference between IoT and M2M, Difference between SDN and NFV for IoT- software defined networking and network function virtualization, IoT Code generator. An emerging industrial structure for IoT, Use case example.</p> <p>Unit Outcomes: UO1. Identify and describe different applications of IoT in home automation, including smart lighting, smart appliances, intrusion detection, and smoke or gas detectors. UO2. Learn about the role of IoT in environmental monitoring, including applications in weather monitoring, air pollution monitoring, forest fire detection, and river flood detection.</p>	
III	IoT Design Methodology	11
	<p>Purpose and requirement specification, Process specification, Domain model specification Information model specification, Service specification, IoT level specification, Functional View specification, Operational View specification Device and component integration, Application Development with Python, Case Study on IoT System for weather monitoring.</p> <p>Unit Outcomes: UO1. Define the purpose and requirements of an IoT system, and use appropriate methods and tools to elicit, analyse, validate, and document them. UO2. To identify the domain entities and relationships of an IoT system, and use appropriate methods and tools to model, verify, and refine the domain model.</p>	
IV	Developing IoT Solutions.	11
	<p>What is an IoT Device? Raspberry Pi Interfaces, Programming Raspberry Pi with Python, Other IoT Devices, IoT Physical Servers on Cloud Offering, Amazon Web Services for IoT, Case studies- Home Automation, Cities, Environment, Agriculture.</p> <p>Unit Outcomes: UO1. Use Raspberry Pi as an IoT device, and interface it with various sensors, actuators, and peripherals using GPIO pins, I2C, SPI, UART, etc. UO2. To understand the role and benefits of cloud computing for IoT systems, and use various cloud services and platforms to host IoT physical servers.</p>	

Learning Resources:

1. Internet of Things (A hands on approach) - Vijay Madiseti and Arshdeep Bagha
2. Designing the Internet of Things - Adrian McEwen & Hakim Cassimally.
3. Rethinking the Internet of Things - A scalable approach to connecting everything – Francis Dacosta.

Internal Examination Pattern:

CAT – I: Home Assignment

CAT – II: PPT Presentation/ Open Book Test/ Poster Presentation/ Seminar/ Online Quiz/ Descriptive Test

Mapping of POs, PSOs and COs:

COs/POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	2	2	2	0	0	0	0	2	1	0	0	3	0	1
CO2	2	2	2	0	0	0	0	2	1	0	0	3	0	1
CO3	3	3	3	0	0	0	0	2	2	0	0	3	0	2
CO4	2	3	3	2	0	0	1	2	3	0	0	3	0	2

Scale: 3 = High, 2 = Moderate, 1 = Low, 0 = No correlation.



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Rajarshi Shahu Mahavidyalaya,
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**Shiv Chhatrapati Shikshan Sanstha's
Rajarshi Shahu Mahavidyalaya, Latur**

**Empowered Autonomous Institution
Faculty of Science & Technology
Department of Computer Science
UG IV Sem VIII**

Course Type : DSE Lab Course

Course Title : DSE Lab Course-IVA

Course Code : 401COS8202A

Credit : 01

Max. Marks: 50

Lectures: 30 Hrs.

Learning Objectives:

- LO1. To introduce the concepts of Internet of Things.
- LO2. To impart the knowledge on IoT application areas.
- LO3. To introduce the IoT business process models, design technology for Connected Devices.
- LO4. To enable the students, learn the effective usage of device connectivity and web connectivity models

Course Outcomes:

After completion of this course, students will be able to

- CO1. Demonstrate the need of IoT in the computing world.
- CO2. Identify the Business Process models of IoT.
- CO3. Analyze the data storage and acquisition mechanisms for real time applications.
- CO4. Design IoT based prototypes.

Practical No.	Experiment
1	Install Virtual box and Raspberry Pi to perform actions of Raspberry Pi.
2	Starting Raspbian OS, familiarizing with raspberry pi components and Interface,
3	connecting to ethernet, monitor, USB.
4	Displaying different LED patterns with Raspberry Pi.
5	Displaying Time over 4-Digit 7-Segment Display using Raspberry Pi.
6	Control Raspberry Pi via Telegram Messenger.
7	Setting up Wireless Access Point using Raspberry Pi.
8	Fingerprint Sensor interfacing with Raspberry Pi.
9	GPS Module Interfacing with Raspberry Pi.
10	Visitor Monitoring with Raspberry Pi and Pi camera
11	RFID interfacing with Raspberry Pi.
12	Building Google Assistant with Raspberry Pi.

13	Installing windows 10 IoT core on Raspberry Pi.
14	Light on LED through Python Program using Raspberry Pi
15	Get input from switches and switch on corresponding LEDs controlling on LEDs

Learning Resources:

1. Internet of Things (A hands on approach) - Vijay Madiseti and Arshdeep Bagha
2. Designing the Internet of Things - Adrian McEwen & Hakim Cassimally.
3. Rethinking the Internet of Things - A scalable approach to connecting everything – Francis Dacosta.

Internal Examination Pattern:

CAT – I: Record Book Submission

CAT – II: Overall performance in the regular practical

Mapping of POs, PSOs and COs:

COs/POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	2	2	2	0	0	0	0	2	1	0	0	3	0	1
CO2	2	2	2	0	0	0	0	2	1	0	0	3	0	1
CO3	3	3	3	0	0	0	0	2	2	0	0	3	0	2
CO4	2	3	3	2	0	0	1	2	3	0	0	3	0	2

Scale: 3 = High, 2 = Moderate, 1 = Low, 0 = No correlation.

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Rajarshi Shahu Mahavidyalaya,
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**Shiv Chhatrapati Shikshan Sanstha's
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**Empowered Autonomous Institution
Faculty of Science & Technology
Department of Computer Science
UG IV Sem VIII**

Course Type : DSE IV (B)

Course Title : Information Security

Course Code : 401COS8201B

Credits : 03

Max. Marks: 75

Lectures: 45 Hrs.

Learning Objectives:

- LO1. Describe the basic principles of confidentiality, integrity, and availability (CIA) and how they relate to information security
- LO2. Recognize the current trends and challenges in information security, such as cloud computing, cyberattacks, data breaches, etc.
- LO3. Define vulnerability, threat, and risk in the context of information security. Conduct risk assessment and mitigation using appropriate methods and tools
- LO4. Analyze and report the results of the assessments using appropriate formats and tools
Recommend and implement corrective actions based on the findings of the assessment

Course Outcomes:

Upon successful completion of the course, students will be able to:

- CO1. Demonstrate understanding of information security concepts and their organizational relevance.
- CO2. Evaluate current security challenges and apply standards/frameworks for effective protection.
- CO3. Conduct risk assessments, implement mitigation measures, and apply quick fixes for incidents.
- CO4. Apply business continuity planning (BCP), disaster recovery planning (DRP), incident management, segregation of duties, and IT Act 2000 principles.

Unit No.	Title of Unit & Contents	Hrs.
I	UNIT I Introduction	11
	What is Information Security & Why do you need it? –Basics Principles of Confidentiality, Integrity Availability Concepts Policies, procedures, Guidelines, Standards Administrative Measures and Technical Measures, People, Process, Technology	
	Unit Outcomes: UO1. Students will be able to explain the concepts and principles of information security and its importance for the organization and the individual UO2. Apply administrative and technical measures to protect information assets.	
II	UNIT II Current Trends in information Security	12
	Current Trends in information Security, Cloud Computing: benefits and Issues related to info Security Standards available for InfoSec: Cobit, Cadbury, ISO27001, OWASP, OSSTMM, etc.-An Overview, Certifiable Standards: How, What, When, Who	

	<p>Unit Outcomes:</p> <p>UO1. Identify and evaluate the current trends and challenges in information security, such as cloud computing, cyberattacks, data breaches, etc.</p> <p>UO2. Understand the standards and frameworks available for information security, such as COBIT, Cadbury, ISO27001, OWASP, OSSTMM, etc.</p>	
III	UNIT III Threat and Risk	11
	<p>Vulnerability, Threat and Risk, Risk Assessment and Mitigation + Quick fixes, Introduction to BCP/DRP/Incident management, Segregation and Separation of Duties & Roles and responsibilities, IT ACT 2000</p> <p>Unit Outcomes:</p> <p>UO1. Define vulnerability, threat, and risk in the context of information security, and conduct risk assessment and mitigation using appropriate methods and tools.</p> <p>UO2. Implement quick fixes to reduce the impact of information security incidents, and understand the concepts and importance of business continuity planning (BCP).</p>	
IV	UNIT IV assessments for Information Security	11
	<p>Types of assessments for Information Security</p> <ol style="list-style-type: none"> 1. VAPT of Networks 2. Web Application Audits 3. IT assessments or audits 4. Assessment of Network Equipment's 5. Assessment of Security Devices (Web Filtering, Firewalls, IDS/IPS, Routers) 6. Data Center Assessment 7. Security of Application Software 8. SAP Security 9. Desktop Security 10. RDBMS Security 11. BCP/DRP assessments 12. Policy reviews <p>Unit Outcomes:</p> <p>UO1. Perform different types of assessments for information security, such as vulnerability assessment and penetration testing (VAPT) of networks.</p> <p>UO2. Analyze and report the results of the assessments using appropriate formats and tools, such as graphs, charts, tables, reports, etc.</p>	

Learning Resources:

1. Security Engineering: A Guide to Building Dependable Distributed Systems (Hardcover) by Ross J. Anderson
2. The Web Application Hacker's Handbook: Discovering and Exploiting Security Flaws (Paperback) by Dafydd Stuttard

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Latur (Autonomous)

Internal Examination Pattern:

CAT – I: Home Assignment

CAT – II: PPT Presentation/ Open Book Test/ Poster Presentation/ Seminar/ Online Quiz/ Descriptive Test

Mapping of POs, PSOs and COs:

COs/POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	0	0	3	0	0	2	0	0	0	2	3	1
CO2	2	3	2	0	3	0	0	2	0	0	0	2	3	1
CO3	3	3	2	0	3	0	0	2	0	0	0	2	3	1
CO4	2	2	0	0	3	0	2	2	0	0	0	2	3	2

Scale: 3 = High, 2 = Moderate, 1 = Low, 0 = No correlation.

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**Shiv Chhatrapati Shikshan Sanstha's
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**Empowered Autonomous Institution
Faculty of Science & Technology
Department of Computer Science
UG IV Sem VIII**

Course Type : DSE Lab Course

Course Title : DSE Lab Course-IVB

Course Code : 401COS8202B

Credit : 01

Max. Marks: 50

Lectures: 30 Hrs.

Learning Objectives:

- LO1. Explain the core principles of confidentiality, integrity, and availability (CIA) in information security.
- LO2. Identify emerging trends and challenges such as cloud security, cyberattacks, and data breaches.
- LO3. Define vulnerability, threat, and risk; perform risk assessment and apply mitigation strategies.
- LO4. Analyze assessment results, prepare structured reports, and recommend corrective actions.

Course Outcomes:

After completion of the course, students will be able to

- CO1. Demonstrate understanding of information security concepts and their organizational relevance.
- CO2. Evaluate current security challenges and apply standards/frameworks for effective protection.
- CO3. Conduct risk assessments, implement mitigation measures, and apply quick fixes for incidents.
- CO4. Apply business continuity planning (BCP), disaster recovery planning (DRP), incident management, segregation of duties, and IT Act 2000 principles.

Practical No.	Unit
1	Create and analyze a security policy for a given scenario, such as a home network, a small business, or an organization.
2	Implement and test various administrative and technical measures to protect information assets, such as encryption, password management, backup and recovery, antivirus software, firewall, etc.
3	Evaluate the effectiveness of people, process, and technology in information security, and identify the strengths and weaknesses of each component.
4	Explore and compare different cloud computing models and services, such as SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc., and their benefits and issues related to information security.
5	Choose and apply a suitable standard or framework for information security, such as COBIT, Cadbury, ISO27001, OWASP, OSSTMM, etc., for a given scenario or case study.
6	Understand and prepare for the process and benefits of certifying information security standards, such as eligibility criteria, certification steps, costs, benefits, etc.
7	Identify and classify different types of vulnerabilities, threats, and risks in

Practical No.	Unit
	information security, such as malware, phishing, denial-of-service attacks, data breaches, identity theft, etc.
8	Conduct risk assessment and mitigation using appropriate methods and tools, such as risk matrix, risk register, risk treatment plan, etc.
9	Implement quick fixes to reduce the impact of information security incidents, such as isolating infected systems, changing passwords, notifying users or authorities, etc.
10	Understand and apply the concepts and importance of business continuity planning (BCP), disaster recovery planning (DRP), and incident management in information security, using various tools and templates.
11	Apply segregation and separation of duties to prevent unauthorized access and misuse of information in a given scenario or case study.
12	Comply with the IT Act 2000 and its provisions related to information security in a given scenario or case study.
13	Perform different types of assessments for information security using various tools and resources.
14	Analyze and report the results of the assessments using appropriate formats and tools, such as graphs, charts, tables, reports, etc.
15	Recommend and implement corrective actions based on the findings of the assessments, such as patching vulnerabilities, updating configurations, enhancing security policies, etc.

Learning Resources:

1. Security Engineering: A Guide to Building Dependable Distributed Systems (Hardcover) by Ross J. Anderson
2. The Web Application Hacker's Handbook: Discovering and Exploiting Security Flaws (Paperback) by Dafydd Stuttard

Internal Examination Pattern:

CAT – I: Record Book Submission

CAT – II: Overall performance in the regular practical

Mapping of POs, PSOs and COs:

COs/POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
CO1	3	2	0	0	3	0	0	2	0	0	0	2	3	1
CO2	2	3	2	0	3	0	0	2	0	0	0	2	3	1
CO3	3	3	2	0	3	0	0	2	0	0	0	2	3	1
CO4	2	2	0	0	3	0	2	2	0	0	0	2	3	2

Scale: 3 = High, 2 = Moderate, 1 = Low, 0 = No correlation.



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Faculty of Science & Technology
UG IV

Extra Credit Activities

Sr. No.	Course Title	Credits	Hours T/P
1	MOOCs	Min. of 02 credits	Min. of 30 Hrs.
2	Certificate Courses	Min. of 02 credits	Min. of 30 Hrs.
3	IIT Spoken Tutorial Courses	Min. of 02 credits	Min. of 30 Hrs.

Guidelines:

Extra -academic activities

1. All extra credits claimed under this heading will require sufficient academic input/ contribution from the students concerned.
2. Maximum 04 extra credits in each academic year will be allotted.
3. These extra academic activity credits will not be considered for calculation of SGPA/CGPA but will be indicated on the grade card.

Additional Credits for Online Courses:

1. Courses only from SWAYAM and NPTEL platform are eligible for claiming credits.
2. Students should get the consent from the concerned subject Teacher/Mentor/Vice Principal and Principal prior to starting of the course.
3. Students who complete such online courses for additional credits will be examined/verified by the concerned mentor/internal faculty member before awarding credits.
4. Credit allotted to the course by SWAYAM and NPTEL platform will be considered as it is.

Additional Credits for Other Academic Activities:

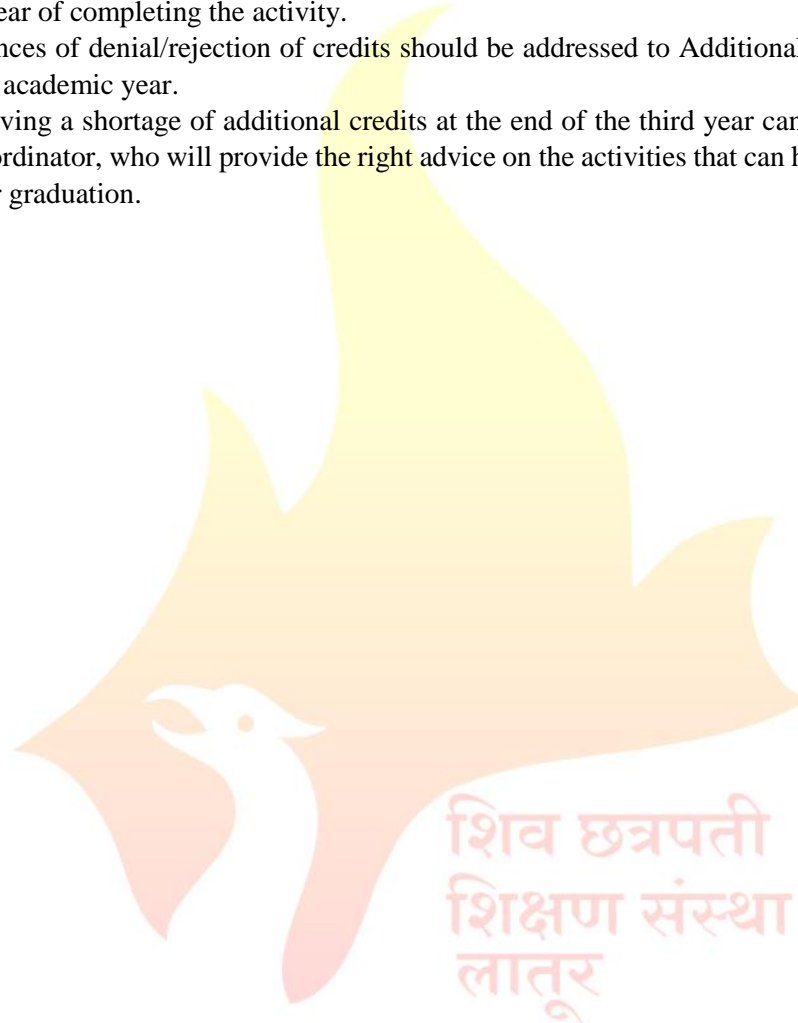
1. One credit for presentation and publication of paper in International/National/State level seminars/workshops.
2. One credit for measurable research work undertaken and field trips amounting to 30 hours of recorded work.
3. One credit for creating models in sponsored exhibitions/other exhibits, which are approved by the concerned department.
4. One credit for any voluntary social service/Nation building exercise which is in collaboration with the outreach center, equivalent to 30 hours
5. All these credits must be approved by the College Committee.

Additional Credits for Certificate Courses:

1. Students can get additional credits (number of credits will depend on the course duration) from certificate courses offered by the college.
2. The student must successfully complete the course. These credits must be approved by the Course Coordinators.
3. Students who undertake summer projects/ internships/ training in institutions of repute through a national selection process, will get 2 credits for each such activity. This must be done under the supervision of the concerned faculty/mentor.

Note:

1. The respective documents should be submitted within 10 days after completion of Semester End Examination.
2. No credits can be granted for organizing or for serving as office bearers/ volunteers for Inter-Class / Associations / Sports / Social Service activities.
3. The office bearers and volunteers may be given a letter of appreciation by the respective staff coordinators. Besides, no credits can be claimed for any services/activities conducted or attended within the college.
4. All claims for the credits by the students should be made and approved by the mentor in the same academic year of completing the activity.
5. Any grievances of denial/rejection of credits should be addressed to Additional Credits Coordinator in the same academic year.
6. Students having a shortage of additional credits at the end of the third year can meet the Additional Credits Coordinator, who will provide the right advice on the activities that can help them earn credits required for graduation.



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Rajarshi Shahu Mahavidyalaya,
Latur (Autonomous)



**Shiv Chhatrapati Shikshan Sanstha's
Rajarshi Shahu Mahavidyalaya, Latur**
Empowered Autonomous Institution
Faculty of Science & Technology

Examination Framework

Theory:

40% Continuous Assessment Tests (CATs) and 60% Semester End Examination (SEE)

Practical:

50% Continuous Assessment Tests (CATs) and 50% Semester End Examination (SEE)

Course	Marks	CAT & Mid Term Theory				CAT Practical		Best Scored CAT & Mid Term	SEE	Total
		Att.	CAT I	Mid Term	CAT II	Att.	CAT			
1	2	3				4		5	6	5 + 6
Research Methodology	100	10	10	20	10	-	-	40	60	100
DSC/DSE	75	05	10	15	10	-	-	30	45	75
Lab Course	50	-	-	-	-	05	20	-	25	50
Field Project	100	10	10	20	10	-	-	40	60	100

Note:

1. All Internal Exams are compulsory
2. Out of 02 CATs best score will be considered
3. Mid Term Exam will be conducted by the Exam Section
4. Mid Term Exam is of Objective nature (MCQ)
5. Semester End Exam is of descriptive in nature (Long & Short Answer)
6. CAT Practical (20 Marks): Lab Journal (Record Book) 10 Marks, Overall Performance 10 Marks.

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