Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

Empowered Autonomous Institution

Structure and Curriculum of Two-Year Multidisciplinary Degree Programme with Multiple Entry and Exit option

Undergraduate Programme of Science & Technology

M. Sc. in Computer Science

Board of Studies

in

Computer Science

Rajarshi Shahu Mahavidyalaya, Latur

Empowered Autonomous Institution

w.e.f. June, 2026

(In accordance with NEP-2020)

Review Statement

The NEP Cell reviewed the Curriculum of **M.Sc. 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

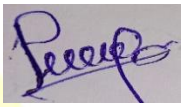
NEP CELL
Rajarshi Shahu Mahavidyalaya, Latur
Empowered Autonomous Institution

CERTIFICATE

I hereby certify that the documents attached are the Bonafide copies of the curriculum of **M. Sc. in Computer Science** Programme to be effective from the **Academic Year 2026-27.**

Date: 11.04.2026

Place: Latur



(Dr. Renuka R Londhe)
Board of Studies in Computer Science
Rajarshi Shahu Mahavidyalaya, Latur
Empowered Autonomous Institution

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

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,	Member	Expert for special courses

Sr. No.	Name	Designation	In position
	Indira College of Engineering and Management Pune, Email: poornashankar@indiraiem.ac.in Mob. 8237816742		
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, Lanar 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 Shaha Mahavidyalaya, Latur Empowered Autonomous Institution	Member	Faculty Member

From the Desk of the Chairperson…

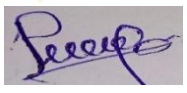
With the tremendous growth of IoT, Data Science, Artificial Intelligence, and Machine Learning technologies over the past ten years, computers have been influencing the future of humanity. Any student taking B.Sc. (Computer Science) program should be able to understand the philosophy, architecture, and 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 Empowered Autonomous Institution 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 Computer Science BoS states that the B.Sc. (Computer Science) Honors & M. Sc. (Computer Science) program gives students a strong foundation and exposure to the basics, advanced, and emerging trends of the subject. The program helps students to comprehend the principles of computer science and enhance skills such as programming, networking, and database management. The program also stresses the ethics of creating and using new technologies by making compelling arguments for secure computing, user privacy protection, and green computing. The program trains students for a career in Software industry and 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)
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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Shiv Chhatrapati Shikshan Sanstha's

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PG Skeleton in Accordance with NEP-2020

Illustrative Credit Distribution Structure for Two Year M.Sc. Degree

Year Level	Sem	Major 24-28 (22-26) per Sem 46-56 for two years		Lab Course	RM	OJT/FP	RP	Cum. Cr	Marks	Degree
		Mandatory	**Elective**		RMC 4Cr	NA	NA	22 Cr		
I 6.0	**I**	Major I 3Cr	MEC I 3Cr	LC-I 1Cr LC-II 1Cr LC-III 1Cr LC-IV 1Cr					Theory: 1Cr=25 M Lab Course: 1Cr=50 M	**PG Diploma (After 03 Year B.Sc. Degree)**
		Major II 3Cr								
		Major III 3Cr								
		Major IV 2 Cr								
	II	Major V 3Cr	MEC II 3Cr	LC-V 1Cr LC-VI 1Cr LC-VII 1Cr LC-VIII 1Cr	NA	OJT-I 4Cr /FPI 4Cr	NA	22 Cr	OJT/FP: 1Cr=25 M	
		Major VI 3Cr								
		Major VII 3Cr								
		Major VIII 2 Cr								
	Total	**Major 22 Cr**	**MEC 06 Cr**	**LC-8 Cr**	**RMC 04Cr**	**OJT/FP 04Cr**	**NA**	**48 Cr**		
Exit Option: PG Diploma with 40 Credits After 03 Year B.Sc. Degree										
II 6.5	**III**	Major VII 3Cr	MEC III 3Cr	LC-IX 1Cr LC-X 1Cr LC-XI 1Cr LC-XII 1Cr	NA	NA	RP-I 4Cr	**20Cr**	RPI & RPII: 1Cr=25 M	**PG Degree (After 03 Year UG Degree)**
		Major VIII 3Cr								
		Major IX 3Cr								
	IV	Major X 3Cr	MEC IV 3Cr	LC-XIII 1Cr LC-XIV 1Cr LC-XV 1Cr LC-XVI 1Cr	NA	NA	RP-II 6Cr	**22Cr**		
		Major XI 3Cr								
		Major XII 3Cr								
	Total	**Major 18 Cr**	**MEC 06 Cr**	**LC-8 Cr**	**NA**	**NA**	**RP 10 Cr**	**42 Cr**		
Cum. Total of I & II Year		**Major 36 Cr**	**MEC 12 Cr**	**LC-16Cr**	**RMC 04 Cr**	**OJT/FP 04Cr**	**RP 10 Cr**	**40+42 =82 Cr**		**86 Credits**
	Exit Option: Two Years 04 Sem. PG Degree with 82 Credits After 03 Year UG Degree									

Abbreviations:

1. MEC : Major Elective Course
2. RMC : Research Methodology Course
3. OJT : On Job Training(Internship/Apprenticeship)
4. FP : Field Project
5. RP : Research Project
6. Cum. Cr : Cumulative Credit

Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

Empowered Autonomous Institution

PG First Year

1. Courses and Credits: Sem-I

Sr. No.	Course Type	Course Code	Credits	Marks	Hours L/P
1	MSC-I	601COS1101	03	75	45
2	MSC-II	601COS1102	03	75	45
3	MSC-III	601COS1103	03	75	45
4	MSC-IV	601COS1104	02	50	30
5	MSE-I	601COS1201	03	75	45
6	RMC	601RMC1501	04	100	45
7	Lab Course-I	601COS1105	01	50	30
8	Lab Course-II	601COS1106	01	50	30
9	Lab Course-III	601COS1107	01	50	30
10	Lab Course-IV	601COS1202	01	50	30

Sem-II

Sr. No.	Course Type	Course Code	Credits	Marks	Hours L/P
1	MSC-V	601COS2101	03	75	45
2	MSC-VI	601COS2102	03	75	45
3	MSC-VII	601COS2103	03	75	45
4	MSC-VIII	601COS2104	02	50	30
5	MSE-II	601COS2201	03	75	45
6	Field Project	601FP2501	04	100	60
7	Lab Course-V	601COS2105	01	50	30
8	Lab Course-VI	601COS2106	01	50	30
9	Lab Course-VII	601COS2107	01	50	30
10	Lab Course-VIII	601COS2202	01	50	30

Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

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M.Sc. (Computer Science)

Major & Major Elective (MSC& DSE):

Year Level	Sem	Major 24-28(22-26) per Sem 46-56 for two years		Lab Course	RM	OJT/FP	RP	Cum. Cr	Marks	Degree
		Mandatory	Elective							
I 6.0	I	Design and Analysis of Algorithm 3Cr Computer System Architecture 3Cr Object oriented Programming 3Cr NET/SET-I 2 Cr	Mobile Application Development 3Cr OR Computer Graphics 3Cr	LC-I 1Cr LC-II 1Cr LC-III 1Cr LC-IV 1Cr	RMC 4Cr	NA	NA	22Cr	Theory: 1Cr=25 M Lab Course: 1Cr=50 M	PG Diploma (After 03 Year UG Degree)
	II	Advanced DBMS 3Cr Compiler design 3Cr Web Programming 3Cr NET/SET-II 2 Cr	Internet Of Things 3Cr OR Information Security 3Cr	LC-V 1Cr LC-VI 1Cr LC-VII 1Cr LC-VIII 1Cr	NA	Field Project -I 4Cr	NA	22Cr	OJT/FP : 1Cr=25 M	
	Total	Major 22 Cr	MEC 06Cr	LC-8Cr	RMC 04Cr	OJT/ FP 04 Cr	NA	44 Cr		
Exit Option: PG Diploma with 44 Credits After 03 Year UG Degree										
II 6.5	III	Digital Image Processing 3Cr Machine Learning 3Cr Adv. Python Programming 3Cr	IoT & Cloud 3 Cr OR Network Security 3 Cr	LC-IX 1Cr LC-X 1Cr LC-XI 1Cr LC-XII 1Cr	*NA*	*NA*	Research Project I 4Cr	20Cr	RP I & RP II: 01 Cr. = 25 M	PG Degree (After 03 Year UG Degree)
	IV	Pattern Recognition 3 Cr Advanced Java Programming 3Cr Big Data Analysis 3Cr	Software Engineering 3 Cr OR Cyber Security 3 Cr	LC-XIII 1Cr LC-XIV 1Cr LC-XV 1Cr LC-XVI 1Cr	NA	NA	Research Project II 6Cr	22Cr		
	Total	Major 18Cr	MEC 6Cr	LC-8Cr	NA	NA	RP 10Cr	42Cr		
Cum. Total of I & II Yr.		Major 40Cr	MEC 12Cr	LC-16Cr	RMC 04Cr	OJT/FP 04Cr	RP 10Cr	44+42 =86Cr		86 Credits
		Exit Option: Two Years 04 Sem. PG Degree with 88 Credits After 03 Year UG Degree								

Sem-I

Sr. No.	Major Course Title/Elective	Course Code	Credits	Marks	Hours L/P
1	Design and Analysis of Algorithm	601COS1101	03	75	45
2	Lab Course-I	601COS1105	01	50	30
3	Computer System Architecture	601COS1102	03	75	45
4	Lab Course-II	601COS1106	01	50	30
5	Object oriented Programming Using Python	601COS1103	03	75	45
6	Lab Course-III	601COS1107	01	50	30
7	NET/SET I	601COS1104	02	50	30
8	Mobile Application Development OR Computer Graphics	601COS1201 601COS1202	03	75	45
9	Lab Course-IV	601COS1203 / 601COS1204	01	50	30
10	RMC	601RMC1501	04	100	60

Sem-II

Sr. No.	Major Course Title/Elective	Course Code	Credits	Marks	Hours L/P
1	Advanced DBMS	601COS2101	03	75	45
2	Lab Course V	601COS2105	01	50	30
3	Compiler design	601COS2102	03	75	45
4	Lab Course VI	601COS2206	01	50	30
5	Web Programming	601FP2503	03	75	45
6	Lab Course VII	601COS2107	01	50	30
7	NET/SET I	601COS2104	02	50	30
8	Internet Of Things OR Information Security	601COS2201 601COS2202	03	75	45
9	Lab Course VIII	601COS2203/ 601COS2204	01	50	30
10	Field Project	601COS2501	04	100	60

Programme Outcomes (POs) for M.Sc. Programme	
PO No.	Upon completion of this programme the students will be able to:
PO1	**Disciplinary Knowledge and Computing Fundamentals:** Apply in-depth mathematical, scientific, and computing fundamentals to understand, formulate, and solve complex problems in computer science and related domains
PO2	**Problem Analysis and System Design:** Identify, formulate, and analyze real-world challenges to design, implement, and evaluate efficient algorithms, software 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 advanced programming environments like Python, Java, MATLAB, and Cloud platforms) to complex computing activities
PO4	**Research, Innovation, and Exploration:** Utilize research-based knowledge and methods-including experiment design, data analysis, and interpretation-to provide valid conclusions, develop lab-to-land solutions, and foster a strong scientific outlook
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 for the benefit of society
PO6	**Professional Competence and Project Management:** Apply software engineering and project management principles to software development, demonstrating the ability to function independently or lead diverse teams to identify and achieve business opportunities
PO7	**Communication and Interpersonal Skills:** Communicate effectively with the computing community and society at large, write effective reports, and integrate interpersonal skills in multidisciplinary settings
PO8	**Self-Directed Life-long Learning:** Recognise the need for continuous learning, adapting to emerging technologies, and possessing the preparation and ability to clear national and international competitive examinations (such as NET, SET, GATE)

Programme Specific Outcomes (PSOs) for M.Sc. Computer Science	
PSO No.	Upon completion of this programme the students will be able to:
PSO1	**Software & Web Application Development:** Design, develop, and deploy secure, responsive software and mobile/web applications using modern languages (Java, Python, ASP.NET) and rigorous Software Engineering practices, delivering them via effective reports and presentations
PSO2	**Data Science and Artificial Intelligence:** Apply concepts of Machine Learning, Pattern Recognition, Big Data Analytics, and Advanced Database Management (DBMS) to extract insights, build intelligent predictive models, and secure jobs in Data Science
PSO3	**Core Computing and Algorithmic Efficiency:** Apply fundamental principles of Computer System Architecture, Compiler Design, and the 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, real-time monitoring, and data scalability
PSO5	**Visual Computing and Digital Image Processing:** Implement advanced computing techniques in specialized areas such as Digital Image Processing and Computer Graphics to solve domain-specific challenges in health, education, and entertainment
PSO6	**Cybersecurity and Research Readiness:** Cultivate research acumen and implement advanced cybersecurity, cryptography, and network security measures to protect digital infrastructures, demonstrating readiness for industry roles, teaching, and higher education

Semester - I

Shiv Chhatrapati Shikshan Sanstha's

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Faculty of Science & Technology

Department of Computer Science

Course Type : MMC1

Course Title : Design and Analysis of Algorithm

Course Code : 601COS1101

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. Explain good principles of algorithm design.

CO2. Evaluate algorithms and estimate their computational complexity.

CO3. Develop and apply fundamental data structures.

CO4. Describe 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 priory 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: Compare sorting algorithms and evaluate their time and space complexities. UO2: Apply performance analysis techniques, asymptotic notations, and utilize data structures such as arrays, linked lists, stacks, queues, 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.
	UO1: Apply divide-and-conquer, sorting, and greedy algorithms to solve real-world problems. UO2: Determine when and how to use these algorithms effectively for design and optimization.	
III	**Dynamic Programming, Back Tracking and Branch &Bound Algorithms**	**10**
	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.	
	Unit Outcomes: UO1: Apply dynamic programming techniques to solve graph-related problems. UO2: Use and evaluate these algorithms effectively in real-world scenarios.	
IV	**Lower bound Theory**	**10**
	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	
	Unit Outcomes: UO1: Apply lower bound theory to algorithmic problems. UO2: Use comparison trees and reduction techniques to establish lower bounds.	

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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Empowered Autonomous Institution

Faculty of Science & Technology

Department of Computer Science

Course Type : MMC Lab Course

Course Title : Laboratory Course-I

Course Code : 601COS1105

Credit : 01 **Max. Marks: 50** **Lectures: 30 Hrs.**

Learning Objectives:

LO1: Explain the principles and working of various algorithms.

LO2: Implement greedy algorithms and graph traversal techniques (DFS) in Python.

LO3: Apply backtracking to solve problems such as the 8-queens puzzle.

LO4: Develop solutions using dynamic programming and graph algorithms (e.g., Kruskal's MST, optimal BST).

.Course Outcomes:

After completion of the course, students 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.

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.

Practical No.	Unit
12	Program in Python to implements Prim's algorithm to generate minimum cost spanning tree.
13	Program in Python to Kr–uskal'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:

Record Book Submission

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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Rajarshi Shahu Mahavidyalaya, Latur

Empowered Autonomous Institution

Faculty of Science & Technology

Department of Computer Science

Course Type : MMC2

Course Title : Computer System Architecture

Course Code : 601COS1102

Credits : 03 **Max. Marks: 75** **Lectures: 45 Hrs.**

Learning Objectives:

LO 1. Explain design methodologies across gate, register, and processor levels.
LO 2. Describe control unit architectures and memory organization techniques.
LO 3. Illustrate the instruction cycle, addressing modes, and programming of microprocessors.
LO 4. Compare features and architectures of Intel microprocessors and peripheral devices. problem.

Course Outcomes:

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

CO 1. Apply design principles to develop combinational, sequential, and processor-level circuits.
CO 2. Analyze control unit models and memory hierarchies for efficient system design.
CO 3. Implement assembly language programs using Intel 8085 and 8086 instruction sets.
CO 4. Evaluate microprocessor architectures and interfacing techniques for real-world applications.

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: Apply digital circuit and processor design methodologies to build efficient systems. UO2: Select appropriate design techniques and components to optimize 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. Virtual Memory - Memory Hierarchies, Main Memory Allocation, Segments, Pages & Files. High Speed Memories- Interleaved memories, Caches and Associative memories.	
	Unit Outcomes: UO1. Analyze and Compare Control Unit Architectures.	

Unit No.	Title of Unit & Contents	Hrs.
	UO2. Evaluate Memory Hierarchy and Optimization Techniques	
III	**Introduction to Microprocessor 8085**	**10**
	Introduction to Microprocessor 8085, Instruction Cycle, Timing Diagram, RISC and CICS processors. Instruction set- Instruction and data formats, addressing modes, Intel 8085 Instructions, Assembly Language Programming.	
	Unit Outcomes: UO1 Apply digital circuit and processor design methodologies to build foundational systems. UO2: Select and evaluate design techniques and components to optimize performance and efficiency of digital systems and processors.	
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 80836, Architecture of 80836. Address space partitioning, memory & I/O Interfacing, Interfacing Devices & I/O Devices.	
	Unit Outcomes: UO1**: Analyze** the architecture, instruction set, and memory interfacing of Intel 8086 and 80386 microprocessors. UO2: **Evaluate** key features and advantages of Intel 8086 and 80386 to **select** appropriate processors 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.

Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

Empowered Autonomous Institution

Faculty of Science & Technology

Department of Computer Science

Course Type : MMC Laboratory Course

Course Title : MMCr Laboratory Course-II

Course Code : 601COS1106

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. Implement digital logic and microprocessor programming to solve problems using Assembly Language for the 8086 microprocessor.

CO2. Analyze the logical behavior of digital components and apply them in computer arithmetic and data manipulation.

CO3. Implement algorithms to find the smallest and largest numbers in an array using the Microprocessors.

CO4. Understand the working principles of multiplexers and demultiplexers. Create and verify truth tables for multiplexer and De- multiplexer 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

Practical No.	Unit
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:

Record Book Submission

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

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

Course Type : MMC 3
Course Title : Object Oriented Programming
Course Code : 601COS1103
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: **UO1: Implement** Python programming basics including variables, data types, operators, control statements, and built-in functions for strings, lists, tuples, and dictionaries. **UO2: Apply** functions, modules, and packages to **organize** Python projects and **utilize** standard libraries (e.g., math, datetime, NumPy, Pandas, SciPy) for problem-solving.	
II	**OOPs Concept, & File Handling in Python**	**10**

Unit No.	Title of Unit & Contents	Hrs.
	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. Inheritance: Single, Multiple, Multilevel, Hierarchical, Hybrid, Python Constructor in Inheritance, Constructor/ Method Overriding, Method Overloading, Operator Overloading Abstract Classes & Interfaces: Abstract Method & Class, Interfaces in Python, Abstract Class Vs Interface File Handling in Python: Types of Files, Reading, Writing Files using Python, With Statement. Understanding read functions, read (), readline() and readlines(), Understanding write functions, write() and writelines(), Manipulating file pointer using seek, Programming using file operations.	
	Unit Outcome: UO 1. Understand the OOPs concepts Using Python. UO 2. Explain the file handling using Python	
III	**Graphical User Interface in Python**	**10**
	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	
	Unit Outcomes: UO1. Design graphical user interfaces in Python using root windows, frames, containers, and widgets. UO2: Implement interactive components such as buttons, menus, tables, and input widgets to develop user-friendly applications.	
IV	**Python Regular Expression, Exception Handling & Database Interaction**	**15**
	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.	
	Unit Outcome: UO1. Apply regular expressions to perform pattern matching, data parsing, and validation tasks in Python. UO2: Implement exception handling and database connections to develop reliable and efficient Python applications.	

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					2	3	2	1			1
CO2	2	3	3					2	3	2	1			1
CO3	1	3	3					2	3		1			1
CO4	2	3	3	1				2	3	2	1			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

Course Type : MMC Laboratory Course
Course Title : MMC Laboratory Course-III
Course Code : 601COS1106
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:

Record Book Submission

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.

Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

Empowered Autonomous Institution

Faculty of Science & Technology

Department of Computer Science

Course Type : Major IV

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

Course Code : 601COS1104

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.

Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

Empowered Autonomous Institution

Faculty of Science & Technology

Department of Computer Science

Course Type: MEC I (A)

Course Title: Mobile Application Development

Course Code: 601COS1201A

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 & Nutrlicious 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 Outcome:	

Unit No.	Title of Unit & Contents	Hrs.
	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. **Kuddo,** a To Do List App: Creating the project, Adding the Recycler View, 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 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
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
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.

Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

Empowered Autonomous Institution

Faculty of Science & Technology

Department of Computer Science

Course Type : MEC Lab Course
Course Title : MEC Lab Course-IA
Course Code : 601COS1202A
Credits : 03 Max. Marks: 50 Lectures: 30 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 & Nutrlicious tool for the development of Android App
CO4. Develop the complex Application Development
CO5.

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 constructers 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:

Record Book Submission

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.

Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

Empowered Autonomous Institution

Faculty of Science & Technology

Department of Computer Science

Course Type: MEC I B

Course Title: Computer Graphics

Course Code: 601COS1201B

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,	

Unit No.	Title of Unit & Contents	Hrs.
	Transformation between coordinate systems, two-dimensional viewing: The Viewing Pipeline, viewing coordinate reference frame, window to view port coordinate transformation, **Line Clipping:** (Cohen-Sutherland & Liang-Barsky algorithm) and Polygon Clipping (Sutherland-Hodgeman Algorithm).	
	Unit Outcome: UO1. Apply two-dimensional geometric transformations to manipulate objects and perform coordinate conversions in computer graphics. UO2: Implement line and polygon clipping algorithms (Cohen–Sutherland, Liang–Barsky, and Sutherland–Hodgeman) to analyze and solve two-dimensional viewing problems.	
III	**Three-Dimensional Graphics**	**10**
	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. Three-dimensional Viewing: Viewing Pipeline, Viewing Coordinates, Projections (Parallel and Perspective) Clipping.	
	Unit Outcomes: UO 1. Represent and manipulate three-dimensional objects using various methods. UO 2. Apply different geometric and modeling transformations, such as translation, rotation, scaling, reflection, shear, composite transformations, modeling and coordinate transformations, etc.	
IV	**Illumination and Color Models**	**10**
	Visible Surface Detection Methods: Classification of Visible-Surface Detection Algorithms, Back-Face Detection, Depth-Buffer Method, A-Buffer Method, Scan line and Depth Sorting, **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; Properties of light–Standard primaries and chromaticity diagram; Intuitive colour concepts–RGB colour model–YIQ colour model–CMY colour model–HSV colour model–HLS colour model; Colour selection.	
	Unit Outcome: 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.	

Unit No.	Title of Unit & Contents	Hrs.
	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.	

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

Course Type : MEC Lab Course

Course Title : MEC Lab Course-IB

Course Code : 601COS1202B

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:

Record Book Submission

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.

Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

Empowered Autonomous Institution

Faculty of Science & Technology

Department of Computer Science

Course Type : RMC
Course Title : Research Methodology
Course Code : 601COS1301
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. Apply principles of report writing and evaluate methods for assessing reports.
CO2. Examine the plagiarism by using various apps.

Unit No.	Title of Unit & Contents	Hrs.
I	**Introduction and Methods of Research**	**15**
	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 Research 4. 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**
	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 Group 3. 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. Apply principles of report writing and evaluate methods for assessing reports.	
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. Chandera 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.

Semester- II

Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

Empowered Autonomous Institution

Faculty of Science & Technology

Department of Computer Science

Course Type : Major-V
Course Title : Advanced DBMS
Course Code : 601COS2101
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: UO1. Understand the relational database concepts - Tuple Relational Calculus, Domain Relational Calculus UO2. 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. **Analyze** query cost measures and **apply** relational expression transformations, statistics estimation, and evaluation plan choices for query optimization.	

Unit No.	Title of Unit & Contents	Hrs.
	UO2. **Implement** advanced query optimization techniques, including materialized views, sorting, join operations, and **evaluate** their effectiveness in improving database performance.	
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: UO1. Apply transaction concepts, atomicity, durability, isolation, and serializability to develop reliable SQL-based transaction models. UO2. Implement concurrency control protocols (lock-based, timestamp-based, validation-based) and analyze deadlock handling strategies for efficient transaction management.	
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: UO1. Discuss various types of databases. UO2. 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:

Home Assignment

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

Course Type : MMC Laboratory Course

Course Title : Major Laboratory Course IV

Course Code : 601COS2105

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
5	Programs on PL/SQL Block in ORACLE 10g

Practical No.	Unit
	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:

Record Book Submission

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

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

Course Type : MMC VI

Course Title : Compiler Design

Course Code : 601COS2102

Credits : 03 **Max. Marks: 75** **Lectures: 45 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.

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 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	
	Unit Outcomes: UO 1. Construct and Validate Formal Grammars UO 2. Implement Advanced Parsing Algorithms	
III	**Syntax Directed Translation and Symbol Table**	**11**
	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	
	Unit Outcomes: UO 1. Design Syntax-Directed Translation Schemes. UO 2. Implement and Manage Symbol Table Architectures.	
IV	**Code Optimization and Code Generation**	**11**
	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.	
	Unit Outcomes: UO 1. Perform Compiler-Driven Code Optimization. UO 2. Develop and Evaluate Code Generation Strategies.	

Learning Resources:

1. Principles of Compiler Design - Alfred V.Aho, Jeffey D. Ullman (Narosa Publishing House)
2. Compiler Construction – Principles & Practices D. M. Dhamdhere,
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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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.

Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

Empowered Autonomous Institution

Faculty of Science & Technology

Department of Computer Science

Course Type : Major Lab Course

Course Title : Major Lab Course-V

Course Code : 601COS2106

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
4	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 Ɛ-NFA from it. Need to postfix form. Scan a string and check whether the string matches against the
10	given regular expression or not

Practical No.	Experiment
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, Jeffey D. Ullman (Narosa Publishing House)
2. Compiler Construction – Principles & Practices D. M. Dhamdhere,
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: 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
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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.

Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

Empowered Autonomous Institution

Faculty of Science & Technology

Department of Computer Science

Course Type : Major VII
Course Title : Web Programming
Course Code : 601COS2103
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. Analyze Web Architecture and Communication Models 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. UO 2. Differentiate between HTML controls and web controls in ASP.NET.	
III	**Syntax Directed Translation and Symbol Table**	**15**

Unit No.	Title of Unit & Contents	Hrs.
	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. Manage Application State and Integrate Data-Driven Services.	

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

Rajarshi Shahu Mahavidyalaya, Latur

Empowered Autonomous Institution

Faculty of Science & Technology

Department of Computer Science

Course Type : Major Lab Course
Course Title : Major Lab Course-VI
Course Code : 601COS2107
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.

Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

Empowered Autonomous Institution

Faculty of Science & Technology

Department of Computer Science

Course Type : Major VIII
Course Title : Syllabus of Preparation of NET/SET Examination-II
Course Code : 601COS2104
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.

Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

Empowered Autonomous Institution

Faculty of Science & Technology

Department of Computer Science

Course Type : MEC II A

Course Title : Internet of Things

Course Code : 601COS2201A

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 diagnostic Agriculture- smart irrigation, green house control Industry- machine diagnostic, prognosis, indoor air quality monitoring Health and Lifestyle. IOT vs	

Unit No.	Title of Unit & Contents	Hrs.
	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.	
	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.	
III	**IoT Design Methodology**	**11**
	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.	
	Unit Outcomes: UO 1. Apply Systematic IoT Design Frameworks. UO 2. Integrate IoT Components and Develop Applications.	
IV	**Developing IoT Solutions.**	**11**
	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.	
	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. Deploy and Analyze IoT Solutions using Cloud Platforms.	

Learning Resources:

1. Internet of Things (A hands on approach) - Vijay Madisetti 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.

Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

Empowered Autonomous Institution

Faculty of Science & Technology

Department of Computer Science

Course Type : MEC Lab Course

Course Title : MEC Lab Course-IIA

Course Code : 601COS2202A

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.

Practical No.	Experiment
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 Madisetti 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:

Record Book Submission

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.

Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

Empowered Autonomous Institution

Faculty of Science & Technology

Department of Computer Science

Course Type : MEC IIB

Course Title : Information Security

Course Code : 601COS2201B

Credits : 03 **Max. Marks: 75** **Lectures: 45 Hrs.**

Learning Objectives:

LO1. Understand Core Information Security Foundations.

LO2. Evaluate Security Standards and Emerging Trends.

LO3. Analyze Risk Management and Compliance.

LO4. Perform Comprehensive Security Assessments.

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: UO 1. Articulate the necessity of information security and evaluate the CIA triad to classify security threats and protective requirements in various digital environments. UO 2. 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	
	Unit Outcomes: UO 1. Identify and evaluate the current trends and challenges in information security, such as cloud computing, cyberattacks, data breaches, etc.	

Unit No.	Title of Unit & Contents	Hrs.
	UO 2. Understand the standards and frameworks available for information security, such as COBIT, Cadbury, ISO27001, OWASP, OSSTMM, etc.	
III	**UNIT III Threat and Risk**	**11**
	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	
	Unit Outcomes: UO1. Define vulnerability, threat, and risk in the context of information security, and conduct risk assessment and mitigation using appropriate methods and tools. UO2. Implement quick fixes to reduce the impact of information security incidents, and understand the concepts and importance of business continuity planning (BCP).	
IV	**UNIT IV assessments for Information Security**	**11**
	Types of assessments for Information Security 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	
	Unit Outcomes: UO 1. Perform different types of assessments for information security, such as vulnerability assessment and penetration testing (VAPT) of networks. UO 2. Analyze and report the results of the assessments using appropriate formats and tools, such as graphs, charts, tables, reports, 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: 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.

Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

Empowered Autonomous Institution

Faculty of Science & Technology

Department of Computer Science

Course Type : MEC Lab Course

Course Title : MEC Lab Course-IIB

Course Code : 601COS2202B

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.

Practical No.	Unit
6	Understand and prepare for theprocess 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 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.

Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

Empowered Autonomous Institution

Faculty of Science & Technology

M.Sc. I Year

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.

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
1	2	3				4		5	6	5 + 6
		Att.	CAT I	Mid Term	CAT II	Att.	CAT			
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