

*Placed at the meeting of  
Academic Council  
held on 15.11.2023*

APPENDIX – BR  
**MADURAI KAMARAJ UNIVERSITY**  
(University with Potential for Excellence)

**B.Sc. Computer Science**  
(Digital Forensic Science and Cyber Security)  
(Semester Pattern)

**CHOICE BASED CREDIT SYSTEM REVISED SYLLABUS**  
(With effect from 2023-24)

**SCHEME OF EXAMINATIONS, REGULATIONS AND SYLLABUS**

**1. Course objectives :**

- To prepare the students to manage the software components in a computer independently and to be a Programmer.
- To motivate the students to take up higher studies in Computer Science and other streams.

**2. Eligibility for Admission:**

A candidate should have studied +2 level Mathematics as one of the subjects in the 10 +2 stream.

**3. Duration of the Course:**

The students shall undergo the prescribed course of study for a period of not less than three academic years (Six semesters).

**4. Medium of Instruction:** English.

**5. Eligibility for the Degree:**

- A Candidate shall be eligible for the award of the degree on completion of the prescribed course of study and passing all the prescribed external examinations.
- Attendance progress, internal examinations, conduct certificate from the Head of the Institution shall be required for taking the external examination.
- The passing minimum and the ranking are as per the existing rule of the Choice Based Credit System for the affiliated college of the University.

## 6. Consolidated Semester wise and Component wise Credit distribution

Parts	Sem I	Sem II	Sem III	Sem IV	Sem V	Sem VI	Total Credits
<b>Part I</b>	3	3	3	3	-	-	12
<b>Part II</b>	3	3	3	3	-	-	12
<b>Part III</b>	13	13	13	13	22	18	92
<b>Part IV</b>	4	4	3	6	4	2	23
<b>Part V</b>	-	-	-	-	-	1	1
<b>Total</b>	23	23	22	25	26	21	<b>140</b>

**\*Part I, II, and Part III components will be separately taken into account for CGPA calculation and classification for the under graduate programme and the other components. IV, V has to be completed during the duration of the programme as per the norms, to be eligible for obtaining the UG degree**

MethodsofEvaluation			
<b>Internal Evaluation</b>	ContinuousInternalAssessmentTest		25 Marks
	Assignments		
	Seminars		
	AttendanceandClassParticipation		
<b>External Evaluation</b>	EndSemesterExamination		75 Marks
	Total		100 Marks
MethodsofAssessment			
<b>Recall(K1)</b>	Simpledefinitions,MCQ,Recallsteps,Conceptdefinitions		
<b>Understand/Comprehend(K2)</b>	MCQ,True/False,Shortessays,Conceptexplanations,Shortsummaryor Overview		
<b>Application (K3)</b>	Suggestidea/conceptwithexamples,Suggestformulae, Solveproblems, Observe,Explain		
<b>Analyze(K4)</b>	Problem-solvingquestions,Finishaprocedureinmanysteps,Differentiate betweenvariousideas,Mapknowledge		
<b>Evaluate(K5)</b>	Longer essay/Evaluationessay,Critiqueorjustifywithprosandcons		
<b>Create(K6)</b>	Checkknowledgeinspecificoroffbeatsituations,Discussion,Debatingor Presentations		

### 1. Introduction

**B.Sc. Computer Science (Digital Forensic Science and Cyber Security)**

Education is the key to development of any society. Role of higher education is crucial for securing right kind of employment and also to pursue further studies in best available world class institutes elsewhere within and outside India. Quality education in general and higher education in particular deserves high priority to enable the young and future generation of students to acquire skill, training and knowledge in order to enhance their thinking, creativity, comprehension and application abilities and prepare them to compete, succeed and excel globally. Learning Outcomes-based Curriculum Framework (LOCF) which makes it student-centric, interactive and outcome-oriented with well-defined aims, objectives and goals to achieve. LOCF also aims at ensuring uniform education standard and content delivery across the state which will help the students to ensure similar quality of education irrespective of the institute and location.

Computer Science is the study of quantity, structure, space and change, focusing on problem solving, application development with wider scope of application in science, engineering, technology, social sciences etc. throughout the world in last couple of decades and it has carved out a space for itself like any other disciplines of basic science and engineering. Computer science is a discipline that spans theory and practice and it requires thinking both in abstract terms and in concrete terms. Nowadays, practically everyone is a computer user, and many people are even computer programmers. Computer Science can be seen on a higher level, as a science of problem solving and problem solving requires precision, creativity, and careful reasoning. The ever-evolving discipline of computer science also 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 application domain. Computer science has a wide range of specialties. These include Computer Architecture, Software Systems, Graphics, Artificial Intelligence, Computational Science, and Software Engineering. Drawing from a common core of computer science knowledge, each specialty area focuses on specific challenges. Computer Science is practiced by mathematicians, scientists and engineers. Mathematics, the origins of Computer Science, provides reason and logic. Science provides the methodology for learning and refinement. Engineering provides the techniques for building hardware and software.

Programme Outcome, Programme Specific Outcome and Course Outcome

Computer Science is the study of quantity, structure, space and change, focusing on problem solving, application development with wider scope of application in science, engineering, technology, social sciences etc. The key core areas of study in Mathematics include Algebra, Analysis (Real & Complex), Differential Equations, Geometry, and Mechanics. The

Students completing this programme will be able to present Software application clearly and precisely, make abstract ideas precise by formulating them in the Computer languages. Completion of this programme will also enable the learners to join teaching profession, enhance their employability for government jobs, jobs in software industry, banking, insurance and investment sectors, data analyst jobs and jobs in various other public and private enterprises.

## **2. Programme Outcomes (PO) of B.Sc.degree programme in Computer Science(Digital Forensic Science and Cyber Security )**

- Scientific aptitude will be developed in Students will acquire basic Practical skills & Technical knowledge along with domain knowledge of different subjects in the Computer Science & humanities stream.
- Students will become employable; Students will be eligible for career opportunities in education field, Industry, or will be able to opt for entrepreneurship.
- Students will possess basic subject knowledge required for higher studies, professional and applied courses.
- Students will be aware of and able to develop solution oriented approach towards various Social and Environmental issues.
- Ability to acquire in-depth knowledge of several branches of Computer Science and aligned areas. This Programme helps learners in building a solid foundation for higher studies in Computer Science and applications.
- The skills and knowledge gained leads to proficiency in analytical reasoning, which can be utilized in modelling and solving real life problems.
- Utilize computer programming skills to solve theoretical and applied problems by critical understanding, analysis and synthesis.
- To recognize patterns and to identify essential and relevant aspects of problems.
- Ability to share ideas and insights while seeking and benefitting from knowledge and insight of others.
- Mould the students into responsible citizens in a rapidly changing interdependent society.

The above expectations generally can be pooled into 6 broad categories and can be modified according to institutional requirements:

PO1: Knowledge

PO2: Problem Analysis

PO3: Design / Development of Solutions

PO4: Conduct investigations of complex problems

PO5: Modern tool usage

PO6: Applying to society

### **3. Programme Specific Outcomes of B.Sc. Degree Programme in Computer Science(Digital Forensic Science and Cyber Security)**

PSO1: Think in a critical and logical based manner

PSO2: Familiarize the students with suitable software tools of computer science and industrial applications to handle issues and solve problems in mathematics or statistics and realtime application related sciences.

PSO3: Know when there is a need for information, to be able to identify, locate, evaluate,

and effectively use that information for the issue or problem at hand.

PSO4: Understand, formulate, develop programming model with logical approaches to a

Address issues arising in social science, business and other contexts.

PSO5: Acquire good knowledge and understanding to solve specific theoretical and applied

problems in advanced areas of Computer science and Industrial statistics.

PO6: Provide students/learners sufficient knowledge and skills enabling them to undertake

further studies in Computer Science or Applications or Information Technology and its allied areas on multiple disciplines linked with Computer Science.

PO7: Equip with Computer science technical ability, problem solving skills, creative talent

and power of communication necessary for various forms of employment.

PO8: Develop a range of generic skills helpful in employment, internships& societal activities.

PO9: Get adequate exposure to global and local concerns that provides platform for further

exploration into multi-dimensional aspects of Computing sciences.

Mapping of Course Learning Outcomes (CLOs) with Programme Outcomes (POs) and Programme Specific Outcomes (PSOs) can be carried out accordingly, assigning the appropriate level in the grids: (put tick mark in each row)

	POs							PSOs		
	1	2	3	4	5	6	...	1	2	...
CLO1										
CLO2										
CLO3										
CLO4										
CLO5										
CLO6										
...										

#### 4. Highlights of the Revamped Curriculum

- Student-centric, meeting the demands of industry & society, incorporating industrial components, hands-on training, skill enhancement modules, industrial project, project with viva-voce, exposure to entrepreneurial skills, training for competitive examinations, sustaining the quality of the core components and incorporating application oriented content wherever required.
- The Core subjects include latest developments in the education and scientific front, advanced programming packages allied with the discipline topics, practical training, devising mathematical models and algorithms for providing solutions to industry / real life situations. The curriculum also facilitates peer learning with advanced mathematical topics in the final semester, catering to the needs of stakeholders with research aptitude.
- The General Studies and Computer Science based problem solving skills are included as mandatory components in the ‘Training for Competitive Examinations’ course at the final semester, a first of its kind.

- The curriculum is designed so as to strengthen the Industry-Academia interface and provide more job opportunities for the students.
- The Industrial Statistics course is newly introduced in the fourth semester, to expose the students to real life problems and train the students on designing a mathematical model to provide solutions to the industrial problems.
- The Internship during the second year vacation will help the students gain valuable work experience that connects classroom knowledge to real world experience and to narrow down and focus on the career path.
- Project with viva-voce component in the fifth semester enables the student, application of conceptual knowledge to practical situations. The state of art technologies in conducting a Explain in a scientific and systematic way and arriving at a precise solution is ensured. Such innovative provisions of the industrial training, project and internships will give students an edge over the counterparts in the job market.
- State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature are incorporated as Elective courses, covering conventional topics to the latest –Python Programming, Computer Networks, Computer Forensics and Investigation, Cryptography, Cyber security, Information Security etc..

### 5. Value additions in the Revamped Curriculum:

Semester	Newly introduced Components	Outcome / Benefits
I	<b>Foundation Course</b> To ease the transition of learning from higher secondary to higher education, providing an overview of the pedagogy of learning abstract Mathematics and simulating mathematical concepts to real world.	<ul style="list-style-type: none"> <li>• Instil confidence among students</li> <li>• Create interest for the subject</li> </ul>
I, II, III, IV	<b>Skill Enhancement papers</b> (Discipline centric / Generic / Entrepreneurial)	<ul style="list-style-type: none"> <li>• Industry ready graduates</li> <li>• Skilled human resource</li> <li>• Students are equipped with essential skills to make them employable</li> </ul>
		<ul style="list-style-type: none"> <li>• Training on Computing / Computational skills enable the students gain knowledge and exposure on latest computational aspects</li> </ul>
		<ul style="list-style-type: none"> <li>• Data analytical skills will enable students gain internships, apprenticeships, field work involving data collection, compilation, analysis etc.</li> </ul>
		<ul style="list-style-type: none"> <li>• Entrepreneurial skill training will provide an opportunity for independent livelihood</li> <li>• Generates self – employment</li> <li>• Create small scale entrepreneurs</li> <li>• Training to girls leads to women empowerment</li> </ul>
		<ul style="list-style-type: none"> <li>• Discipline centric skill will improve the Technical knowhow of solving real life problems using ICT tools</li> </ul>
III, IV, V & VI	Elective papers- An open choice of topics categorized under Generic and Discipline Centric	<ul style="list-style-type: none"> <li>• Strengthening the domain knowledge</li> <li>• Introducing the stakeholders to the State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature</li> <li>• Students are exposed to Latest topics on Computer Science / IT, that require strong mathematical background</li> <li>• Emerging topics in higher education / industry / communication network / health sector etc. are introduced with hands-on-training, facilitates designing of mathematical models in the respective</li> </ul>



		sectors
<b>IV</b>	Industrial Statistics	<ul style="list-style-type: none"> <li>• Exposure to industry moulds students into solution providers</li> <li>• Generates Industry ready graduates</li> <li>• Employment opportunities enhanced</li> </ul>
<b>II year Vacation activity</b>	Internship / Industrial Training	<ul style="list-style-type: none"> <li>• Practical training at the Industry/ Banking Sector / Private/ Public sector organizations / Educational institutions, enable the students gain professional experience and also become responsible citizens.</li> </ul>
<b>V Semester</b>	Project with Viva – voce	<ul style="list-style-type: none"> <li>• Self-learning is enhanced</li> <li>• Application of the concept to real situation is conceived resulting in tangible outcome</li> </ul>
<b>VI Semester</b>	Introduction of Professional Competency component	<ul style="list-style-type: none"> <li>• Curriculum design accommodates all category of learners; ‘Mathematics for Advanced Explain’ component will comprise of advanced topics in Mathematics and allied fields, for those in the peer group / aspiring researchers;</li> <li>• ‘Training for Competitive Examinations’ –caters to the needs of the aspirants towards most sought - after services of the nation viz, UPSC, CDS, NDA, Banking Services, CAT, TNPSC group services, etc.</li> </ul>
<b>Extra Credits: For Advanced Learners / Honors degree</b>		<ul style="list-style-type: none"> <li>• To cater to the needs of peer learners / research aspirants</li> </ul>

<b>Skills acquired from the Courses</b>	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
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### Credit Distribution for UG Programmes

Sem I	Credit	H	Sem II	Credit	H	Sem III	Credit	H	Sem IV	Credit	H	Sem V	Credit	H	Sem VI	Credit	H
Part 1. Language – Tamil	3	6	Part..1. Language – Tamil	3	6	Part..1. Language – Tamil	3	6	Part..1. Language – Tamil	3	6	5.1 Core Course – \CC IX	4	5	6.1 Core Course – CC XIII	4	6
Part.2 English	3	6	Part..2 English	3	6	Part..2 English	3	6	Part..2 English	3	6	5.2 Core Course – CC X	4	5	6.2 Core Course – CC XIV	4	6
1.3 Core Course – CC I	5	5	2..3 Core Course – CC III	5	5	3.3 Core Course – CC V	5	5	4.3 Core Course – CC VII Core Industry Module	5	5	5. 3.Core Course CC -XI	4	5	6.3 Core Course – CC XV	4	6
1.4 Core Course – CC II	5	5	2.4 Core Course – CC IV	5	5	3.4 Core Course – CC VI	5	5	4.4 Core Course – CC VIII	5	5	5. 4.Core Course –/ Project with viva-voce CC -XII	4	5	6.4 Elective -VII Generic/ Discipline Specific	3	5
1.5 Elective I Generic/ Discipline Specific	3	4	2.5 Elective II Generic/ Discipline Specific	3	4	3.5 Elective III Generic/ Discipline Specific	3	4	4.5 Elective IV Generic/ Discipline Specific	3	3	5.5 Elective V Generic/ Discipline Specific	3	4	6.5 Elective VIII Generic/ Discipline Specific	3	5
1.6 Skill Enhancement Course SEC-1	2	2	2.6 Skill Enhancement Course SEC-2	2	2	3.6 Skill Enhancement Course SEC-4, (Entrepreneurial Skill)	1	1	4.6 Skill Enhancement Course SEC-6	2	2	5.6 Elective VI Generic/ Discipline Specific	3	4	6.6 Extension Activity	1	-
1.7 Skill Enhancement -(Foundation Course)	2	2	2.7 Skill Enhancement Course –SEC-3	2	2	3.7 Skill Enhancement Course SEC-5	2	2	4.7 Skill Enhancement Course SEC-7	2	2	5.7 Value Education	2	2	6.7 Professional Competency Skill	2	2
						3.8 E.V.S.	-	1	4.8 E.V.S	2	1	5.8 Summer Internship /Industrial Training	2				
	<b>23</b>	<b>30</b>		<b>23</b>	<b>30</b>		<b>22</b>	<b>30</b>		<b>25</b>	<b>30</b>		<b>26</b>	<b>30</b>		<b>21</b>	<b>30</b>
<b>Total – 140 Credits</b>																	

**B.Sc. Computer Science(Digital Forensic Science and Cyber Security) Curriculum****First Year****Semester-I**

<b>Part</b>	<b>List of Courses</b>	<b>Credit</b>	<b>Hours per week (L/T/P)</b>	<b>Internal Marks</b>	<b>External Marks</b>
Part-I	Language	3	6	25	75
Part-II	English	3	6	25	75
Part-III	CC1 - C Programming	5	5	25	75
	CC2 - Practical : C Programming Lab	5	5	25	75
	Elective Course 1 (Generic / Discipline Specific) – Discrete Mathematical Structures	3	4	25	75
Part-IV	Skill Enhancement Course- SEC-1 (Non Major Elective)- Office Automation	2	2	25	75
	Foundation Course FC - Problem Solving Techniques	2	2	25	75
		<b>23</b>	<b>30</b>		

**Semester-II**

<b>Part</b>	<b>List of Courses</b>	<b>Credit</b>	<b>Hours per week(L/T/P)</b>	<b>Internal Marks</b>	<b>External Marks</b>
Part-I	Language	3	6	25	75
Part-II	English	3	6	25	75
Part-III	CC3 – Data Structures and Algorithms	5	5	25	75
	CC4 - Practical: Data Structures and Algorithms Lab with C/C++	5	5	25	75
	Elective Course 2 (Generic / Discipline Specific) – Numerical Methods	3	4	25	75
Part-IV	Skill Enhancement Course- SEC-2 (Non Major Elective) - Quantitative Aptitude	2	2	25	75
	Skill Enhancement Course – SEC-3 (Discipline / Subject Specific) – Advanced Excel	2	2	25	75
		<b>23</b>	<b>30</b>		

### Second Year - Semester-III

Part	List of Courses	Credit	Hours per week(L/T/P)	Internal Marks	External Marks
Part-I	Language	3	6	25	75
Part-II	English	3	6	25	75
Part-III	CC5- Python Programming	5	5	25	75
	CC6 – Python Programming Lab	5	5	25	75
	Elective Course 3 (Generic / Discipline Specific) - EC3 – Probability and Statistics	3	4	25	75
Part-IV	Skill Enhancement Course - SEC-4 (Entrepreneurial Based) – Practical - PHP Programming Lab	1	1	25	75
	Skill Enhancement Course - SEC-5 (Discipline Specific/ Generic) – Digital Computer Fundamentals	2	2	25	75
	Environmental Studies	-	1	-	-
		<b>22</b>	<b>30</b>		

### Semester-IV

Part	List of Courses	Credit	Hours per week (L/T/P)	Internal Marks	External Marks
Part-I	Language	3	6	25	75
Part-II	English	3	6	25	75
Part-III	CC7 - Industry Module –Java Programming	5	5	25	75
	CC8 - Practical: Java Programming Lab	5	5	25	75
	Elective Course - EC4 (Generic / Discipline Specific) – Resource Management Techniques	3	3	25	75
Part-IV	Skill Enhancement Course – SEC-6 - Ethical Hacking Fundamentals	2	2	25	75
	Skill Enhancement Course - SEC-7 - Ethical Hacking Fundamentals Lab	2	2	25	75
	Environmental science	2	1	25	75
		<b>25</b>	<b>30</b>		

**Third Year  
Semester-V**

<b>Part</b>	<b>List of Courses</b>	<b>Credit</b>	<b>Hours per week (L/T/P)</b>	<b>Internal Marks</b>	<b>External Marks</b>
Part-III	CC9 – Software Engineering	4	5	25	75
	CC10 - Database Management Systems	4	5	25	75
	CC11 - Practical: Database Management Systems Lab	4	5	25	75
	Elective Course – EC5 (Generic / Discipline Specific) – Operating Systems	3	4	25	75
	Elective Course – EC6 (Generic / Discipline Specific) – Information Security	3	4	25	75
	CC12 - Core /Project with Viva voce	4	5	25	75
Part-IV	Value Education	2	2	25	75
	Internship / Industrial Training (Summer vacation at the end of IV semester activity)	2	-	-	-
	<b>TOTAL</b>	<b>26</b>	<b>30</b>		

**Semester-VI**

<b>Part</b>	<b>List of Courses</b>	<b>Credit</b>	<b>Hours per week (L/T/P)</b>	<b>Internal Marks</b>	<b>External Marks</b>
Part-III	CC13 – Computer Networks	4	6	25	75
	CC14 - Computer Forensics and Investigation	4	6	25	75
	CC15 - Practical: Computer Forensics and Investigation Lab	4	6	25	75
	Elective Course – EC7 (Generic / Discipline Specific) – Cryptography	3	5	25	75
	Elective Course – EC8 (Generic / Discipline Specific) – Cyber security	3	5	25	75
Part-IV	Professional Competency Skill Enhancement Course SEC8 - Quantitative Aptitude	2	2	25	75
Part -V	Extension Activity	1	0	-	-
	<b>TOTAL</b>	<b>21</b>	<b>30</b>		

**Total Credits : 140**

**SYLLABUS****First Year (Semester – I)**

<b>CourseCode: CC1</b>	<b>C PROGRAMMING</b>		<b>Credits: 5</b>
<b>LectureHours:(L) perweek: 5</b>	<b>TutorialHours: (T)perweek</b>	<b>LabPractice Hours: (P)perweek</b>	<b>Total:(L+T+P) perweek: 5</b>
<b>CourseCategory: CC1</b>	<b>Year&amp;Semester: I Year I Semester</b>	<b>AdmissionYear:2023- 2024</b>	
<b>Pre-requisite</b>	Basic knowledge in C language		
<b>LearningObjectives:</b>			
<ul style="list-style-type: none"> <li>To gain knowledge in C language.</li> <li>To inculcate fundamental programming skills.</li> </ul>			
<b>CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)</b>			
<b>CO1:</b> Remember the program structure of C with its syntax and semantics			
<b>CO2:</b> Understand the programming principles in C (data types, operators, branching and looping, arrays, functions, structures, pointers and files)			
<b>CO3:</b> Apply the programming principles learnt in real-time problems			
<b>CO4:</b> Analyze the various methods of solving a problem and choose the best method			
<b>CO5:</b> Code, debug and test the programs with appropriate test cases			
<b>Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)</b>			
<b>Units</b>	<b>Contents</b>	<b>RequiredHours</b>	
<b>I</b>	<p>Overview of C: Importance of C, sample C program, C program structure, executing C program. Constants, Variables, and Data Types: Character set, C tokens, keywords and identifiers, constants, variables, data types, declaration of variables, Assigning values to variables--- Assignment statement, declaring a variable as constant, as volatile.</p> <p>Operators and Expression: Arithmetic, Relational, logical, assignment, increment, decrement, conditional, bitwise and special operators, arithmetic expressions, operator precedence, type conversions, mathematical functions</p> <p>Managing Input and Output Operators: Reading and writing a character, formatted input, formatted output.</p>	<b>15</b>	

<b>II</b>	Decision Making and Branching: Decision making with If, simple IF, IF ELSE, nested IF ELSE , ELSE IF ladder, switch, GOTO statement. Decision Making and Looping: While, Do-While, For, Jumps in loops.	<b>15</b>
<b>III</b>	Arrays: Declaration and accessing of one & two-dimensional arrays, initializing two-dimensional arrays, multidimensional arrays. Functions: The form of C functions, Return values and types, calling a function, categories of functions, Nested functions, Recursion, functions with arrays, call by value, call by reference, storage classes-character arrays and string functions.	<b>15</b>
<b>IV</b>	Structures and Unions: Defining, giving values to members, initialization and comparison of structure variables, arrays of structure, arrays within structures, structures within structures, structures and functions, unions. Preprocessors: Macro substitution, file inclusion.	<b>15</b>
<b>V</b>	Pointers: definition, declaring and initializing pointers, accessing a variable through address and through pointer, pointer expressions, pointer increments and scale factor, pointers and arrays, pointers and functions, pointers and structures. File Management in C: Opening, closing and I/O operations on files, random access to files, command line arguments.	<b>15</b>

<p>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</p>	<p>Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC– CSIR/GATE/TNPSC/other to be solved (To be discussed during the Tutorial hour)</p>	
<p>Skills acquired from the course</p>	<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferable Skill</p>	
<p><b>Learning Resources:</b></p> <ul style="list-style-type: none"> <li>• <b>Recommended Texts</b> <ol style="list-style-type: none"> <li>1. E. Balagurusamy, Programming in ANSI C, Fifth Edition, Tata McGraw-Hill, 2010.</li> </ol> </li> <li>• <b>Reference Books</b> <ol style="list-style-type: none"> <li>1. Byron Gottfried, Schaum’s Outline Programming with C, Fourth Edition, Tata McGraw-Hill, 2018.</li> <li>2. Kernighan and Ritchie, The C Programming Language, Second Edition, Prentice Hall, 1998.</li> <li>3. Yashavant Kanetkar, Let Us C, Eighteenth Edition, BPB Publications, 2021</li> </ol> </li> <li>• <b>Web resources:</b> Web resources from NDL Library, E-content from open-source libraries</li> </ul>		



<b>CourseCode: CC2</b>	<b>C PROGRAMMING LAB</b>		<b>Credits: 5</b>
<b>LectureHours:(L) perweek</b>	<b>TutorialHours: (T)perweek</b>	<b>LabPractice Hours: (P)perweek: 5</b>	<b>Total:(L+T+P) perweek: 5</b>
<b>CourseCategory: CC2</b>	<b>Year&amp;Semester: I Year I Semester</b>	<b>AdmissionYear:2023-2024</b>	
<b>Pre-requisite</b>	Basic knowledge of programming skills		
<b>LearningObjectives:</b>			
<ul style="list-style-type: none"> <li>To implement programming skills using C</li> <li>To impart knowledge and provide efficient solutions for real time problems using C language</li> </ul>			
<b>CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)</b>			
<b>CO1:</b> Remember and understand how to write programs using the basic syntax and semantics in C			
<b>CO2:</b> Apply the concepts of functions, macros, arrays, structures, pointers and files in programs to solve problems			
<b>CO3:</b> Analyze and understand programs written in C language			
<b>CO4:</b> Evaluate the program execution flow with test cases and apply debugging			
<b>CO5:</b> Design algorithms and write programs in C language for the given problems			
<b>Recap:</b> (notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdone during2Tutorialhours)			
<b>Units</b>	<b>Contents</b>	<b>RequiredHours</b>	
<b>I</b>	<b>Variables, Data types, Constants and Operators</b> <ol style="list-style-type: none"> <li>Evaluation of expression ex: <math>((x+y)^2 * (x+z))/w</math></li> <li>Temperature conversion problem (Fahrenheit to Celsius)</li> <li>Program to convert days to months and days (Ex: 364 days = 12 months and 4 days)</li> <li>Solution of quadratic equation</li> <li>Salesman salary (Given: Basic Salary, Bonus for every item sold, commission on the total monthly sales)</li> </ol>	<b>75</b>	

<b>II</b>	<p><b>Decision making Statements</b></p> <p>6. Maximum of three numbers</p> <p>7. Calculate Square root of five numbers (using goto statement)</p> <p>8. Pay-Bill Calculation for different levels of employee (Switch statement)</p> <p>9. Fibonacci series</p> <p>10. Floyds Triangle</p> <p>11. Pascal's Triangle</p>	
<b>III</b>	<p><b>Arrays, Functions and Strings</b></p> <p>12. Prime numbers in an array</p> <p>13. Sorting data (Ascending and Descending)</p> <p>14. Matrix Addition and Subtraction</p> <p>15. Matrix Multiplication</p> <p>16. Function with no arguments and no return values</p> <p>17. Function that convert lower case letters to upper case</p> <p>18. Factorial using recursion.</p> <p>19. Perform String Operations using Switch Case.</p>	
<b>IV</b>	<p><b>Structures and Macros</b></p> <p>20. Structure that describes a Hotel (name, address, grade, avg room rent, number of rooms)</p>	

	<p>Perform some operations (list of hotels of a given grade etc.)</p> <p>21. Using Pointers in Structures.</p> <p>22. Cricket team details using Union.</p> <p>23. Write a macro that calculates the max and min of two numbers</p> <p>24. Nested macro to calculate Cube of a number.</p>	
<b>V</b>	<p><b>Pointers and Files</b></p> <p>25. Evaluation of Pointer expressions</p> <p>26. Function to exchange two pointer values</p> <p>27. Creation, insertion and deletion in a linked list</p> <p>28. Program to read a file and print the data.</p> <p>29. Program to receive a file name and a line of text as command line arguments and write the text to the file</p> <p>30. Program to copy the content of one file to another file.</p>	
<p>Extended Professional Component (is a part of internal component only, Not to be included in the External Exa</p>	<p>Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC – CSIR/GATE/TNPSC/other to be solved (To be discussed during the Tutorial hour)</p>	

minationque stion paper)		
Skillsacquire dfrom the course	Knowledge,ProblemSolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferrable Skill	
<p><b>LearningResources:</b></p> <ul style="list-style-type: none"> <li>• <b>RecommendedTexts</b> <ol style="list-style-type: none"> <li>1. E. Balagurusamy, Programming in ANSI C, Fifth Edition, Tata McGraw-Hill, 2010.</li> </ol> </li> <li>• <b>ReferenceBooks</b> <ol style="list-style-type: none"> <li>1. Byron Gottfried, Schaum’s Outline Programming with C, Fourth Edition, Tata McGraw-Hill, 2018.</li> <li>2. Kernighan and Ritchie, The C Programming Language, Second Edition, Prentice Hall, 1998.</li> <li>3. YashavantKanetkar, Let Us C, Eighteenth Edition, BPB Publications, 2021</li> </ol> </li> <li>• <b>Webresources:</b> Web resources from NDL Library, E-content from open-source libraries</li> </ul>		

<b>CourseCode: EC-1</b>	<b>DISCRETE MATHEMATICAL STRUCTURES</b>		<b>Credits: 3</b>
<b>LectureHours:(L) perweek: 4</b>	<b>TutorialHours: (T)perweek</b>	<b>LabPractice Hours: (P)perweek</b>	<b>Total:(L+T+P) perweek: 4</b>
<b>CourseCategory:EC-1</b>	<b>Year&amp;Semester: II Year III Semester</b>	<b>AdmissionYear: 2023- 2024</b>	
<b>Pre-requisite</b>	Basic Knowledge on probability and mathematical logic		
<b>LearningObjectives:(forteachers:whatttheyhavetodointheclass/lab/field)</b>			

To understand the mathematical concepts like set theory, logics, number theory, combinatory and relations.		
<b>Course Outcomes:</b> (for students: To know what they are going to learn)		
<b>CO1:</b> To gain knowledge on set theory		
<b>CO2:</b> Able to understand different mathematical logics and functions		
<b>CO3:</b> To get an idea on Permutations and Combinations		
<b>CO4:</b> Understanding the different form of number theory		
<b>CO5:</b> Able to understand Relations and its applications		
<b>Recap:</b> (not for examination) Motivation/previous lecture/relevant portions required for the course)[This is done during 2 Tutorial hours)		
<b>Units</b>	<b>Contents</b>	<b>Required Hours</b>
<b>I</b>	<b><i>SET THEORY</i></b> Introduction- set and Its Element – Set Description (Roster, Set Builder and cardinal number method) Types of Sets- Set Operations and Laws of set Theory. Partition of sets. Minsets-Countable and un Countable set. Algebra of sets and Duality	<b>12</b>
<b>II</b>	<b><i>MATHEMATICAL LOGIC</i></b> Basic Logic and Proof, logical operations – Logic Propositional equivalence, Predicates and Quantities, Tautology-Contradiction-Methods of proofs(Direct and Indirect)- Function- Definition-Notation- Types of Function- Composition of Functions-	<b>12</b>
<b>III</b>	<b><i>NUMBER THEORY</i></b> The Integers and Division, Integers and Algorithms,(Multiplication, Addition and Division -Sequences and Summations, Recursive algorithms,	<b>12</b>

	Program correctness	
<b>IV</b>	<b>COMBINATORICS:</b> The basics of counting, the pigeonhole principle, Permutations and Combinations, Binomial coefficients, Generalized permutations and combinations	<b>12</b>
<b>V</b>	<b>RELATIONS</b> Relations – Relations and their properties, Representing Relations, Closures of relations, Equivalence relations, Partial orderings-Recurrence Relations Binary Relations.	<b>12</b>
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC– CSIR/GATE/TNPSC/other to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferable Skill	

**Learning Resources:**

- **Recommended Texts**

1. Rosen K.H. Discrete Mathematics and its Applications, 5th edition, Tata McGraw – Hills, 2003.
2. J.K Sharma “DISCRETE MATHEMATICS” 3 rd Edition Macmillan Reprint 2011

- **Reference Books**

1. Johnson Baugh R, and Carman R, Discrete mathematics, 5th edition, Person Education, 2003.
2. Kolman B, Busoy R.C, and Ross S.C, Discrete Mathematical Structures, 5th edition, Prentice – Hall, 2004.
3. Mott J.L, Kandel A, and Bake T.P, Discrete Mathematics for Computer Scientists & Mathematicians, 2nd edition, Prentice-Hall of India, 2002.

- **Webresources:** Web resources from NDL Library, E-content from open-source libraries

<b>Course Code: SEC-1</b>	<b>Office Automation</b>		<b>Credits: 2</b>
<b>Lecture Hours: (L) per week: 2</b>	<b>Tutorial Hours: (T) per week</b>	<b>Lab Practice Hours: (P) per week</b>	<b>Total: (L+T+P) per week: 2</b>
<b>Course Category: SEC-1</b>	<b>Year &amp; Semester: I Year I Semester</b>	<b>Admission Year: 2023- 2024</b>	
<b>Pre-requisite</b>	Basic skills in Computer operations		
<b>Learning Objectives:</b> (for teachers: what they have to do in the class/lab/field)			
<ul style="list-style-type: none"> <li>• The major objective in introducing the Computer Skills course is to impart</li> </ul>			

<p>training for students in Microsoft Office which has different components like MS Word, MS Excel and Powerpoint.</p> <ul style="list-style-type: none"> <li>• The course is highly practice oriented rather than regular classroom teaching.</li> <li>• To acquire knowledge on editor, spreadsheet and presentation software.</li> </ul>		
<p><b>Course Outcomes:</b> (for students: To know what they are going to learn)</p> <p><b>CO1:</b> Understand the basics of computer systems and its components.</p> <p><b>CO2:</b> Understand and apply the basic concepts of a word processing package.</p> <p><b>CO3:</b> Understand and apply the basic concepts of electronic spreadsheet software.</p> <p><b>CO4:</b> Understand and apply the basic concepts of database management system.</p> <p><b>CO5:</b> Understand and create a presentation using PowerPoint tool.</p>		
<p><b>Recap:</b> (not for examination) Motivation/previous lecture/relevant portions required for the course) [This is done during 2 Tutorial hours]</p>		
<b>Units</b>	<b>Contents</b>	<b>Required Hours</b>
<b>I</b>	<p><b>Introductory concepts:</b> Memory unit– CPU-Input Devices: Key board, Mouse and Scanner. Output devices: Monitor, Printer. Introduction to Operating systems &amp; its features: DOS– UNIX– Windows. Introduction to Programming Languages.</p>	<b>6</b>
<b>II</b>	<p><b>Word Processing:</b> Open, Save and close word document; Editing text – tools, formatting, bullets; Spell Checker – Document formatting – Paragraph alignment, indentation, headers and footers, numbering; printing–Preview, options, merge.</p>	<b>6</b>
<b>III</b>	<p><b>Spreadsheets:</b> Excel– opening, entering text and data, formatting, navigating; Formulas–entering, handling and copying; Charts– creating, formatting and printing, analysis tables, preparation of financial statements, introduction to data analytics.</p>	<b>6</b>



<b>IV</b>	<b>Database Concepts:</b> The concept of data base management system; Data field, records, and files, Sorting and indexing data; Searching records. Designing queries, and reports; Linking of datafiles; Understanding Programming environment in DBMS; Developing menu drive applications in query language (MS–Access).	<b>6</b>
<b>V</b>	<b>Power point:</b> Introduction to Power point - Features – Understanding slide type casting & viewing slides – creating slide shows. Applying special object – including objects & pictures – Slide transition– Animation effects, audio inclusion, timers.	<b>6</b>
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC– CSIR/GATE/TNPSC/other to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferable Skill	

**LearningResources:**

- **RecommendedTexts**

1. Peter Norton, "Introduction to Computers" – Tata McGraw-Hill.

- **ReferenceBooks**

1. Jennifer Ackerman Kettel, Guy Hat-

Davis, Curt Simmons, "Microsoft 2003", Tata McGraw-Hill.

- **Webresources** : Web content from NDL / SWAYAM or opensource web resources

<b>CourseCode: FC1</b>	<b>Problem Solving Techniques</b>		<b>Credits: 2</b>
<b>LectureHours:(L) perweek: 2</b>	<b>TutorialHours: (T)perweek</b>	<b>LabPractice Hours: (P)perweek</b>	<b>Total:(L+T+P) perweek: 2</b>
<b>CourseCategory: FC</b>	<b>Year&amp;Semester:I Year I Semester</b>		<b>AdmissionYear: 2023- 2024</b>
<b>Pre-requisite</b>	Basic of Problem-solving skills		
<b>LearningObjectives:</b>			
<ul style="list-style-type: none"> <li>• To understand the importance of algorithms and programs, and to know of the basic problem solving strategies.</li> <li>• To learn efficient strategies and algorithms to solve standard problems, thus laying a firm foundation for designing algorithmic solutions to problems.</li> </ul>			
<b>CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)</b>			
<b>CO1:</b> Understand the systematic approach to problem solving.			
<b>CO2:</b> Know the approach and algorithms to solve specific fundamental problems.			
<b>CO3:</b> Understand the efficient approach to solve specific factoring-related problems.			
<b>CO4:</b> Understand the efficient array-related techniques to solve specific problems.			
<b>CO5:</b> Understand the efficient methods to solve specific problems related to text processing. Understand how recursion works.			

<b>Recap:</b> (notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)		
<b>Units</b>	<b>Contents</b>	<b>RequiredHours</b>
<b>I</b>	<b>Introduction:</b> Notion of algorithms and programs – Requirements for solving problems by computer – The problem-solving aspect: Problem definition phase, Getting started on a problem, The use of specific examples, Similarities among problems, Working backwards from the solution – General problem-solving strategies - Problem solving using top-down design – Implementation of algorithms – The concept of Recursion.	<b>6</b>
<b>II</b>	<b>Fundamental Algorithms:</b> Exchanging the values of two variables – Counting - Summation of a set of numbers - Factorial computation - Sine function computation - Fibonacci Series generation - Reversing the digits of an integer – Base Conversion.	<b>6</b>
<b>III</b>	<b>Factoring Methods:</b> Finding the square root of a number – The smallest divisor of an integer – Greatest common divisor of two integers - Generating prime numbers – Computing the prime factors of an integer – Generation of pseudo-random numbers - Raising a number to a large power – Computing the $n$ th Fibonacci number.	<b>6</b>
<b>IV</b>	<b>Array Techniques:</b> Array order reversal – Array counting or histogramming – Finding the maximum number in a set - Removal of duplicates from an ordered array - Partitioning an array – Finding the $k^{\text{th}}$ smallest element – Longest monotone subsequence.	<b>6</b>
<b>V</b>	<b>Text Processing and Pattern Searching:</b> Text line length	<b>6</b>

	adjustment – Left and right justification of text – Keyword searching in text – Text line editing – Linear pattern search.  <b>Recursive algorithms:</b> Towers of Hanoi – Permutation generation.	
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC – CSIR/GATE/TNPSC/other to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferable Skill	
<p><b>Learning Resources:</b></p> <ul style="list-style-type: none"> <li>• <b>Recommended Texts</b> <ol style="list-style-type: none"> <li>1. R. G. Dromey, <i>How to Solve it by Computer</i>, Pearson India, 2007.</li> </ol> </li> <li>• <b>Reference Books</b> <ol style="list-style-type: none"> <li>1. George Polya, Jeremy Kilpatrick, <i>The Stanford Mathematics Problem Book: With Hints and Solutions</i>, Dover Publications, 2009 (Kindle Edition 2013).</li> </ol> </li> <li>• Greg W. Scragg, <i>Problem Solving with Computers</i>, Jones &amp; Bartlett 1st edition, 1996.</li> </ul> <p><b>webresources:</b> Web resources from NDL Library, E-content from open-source libraries.</p>		

### First Year (Semester – II)

<b>CourseCode: CC3</b>		<b>Data Structures &amp; Algorithms</b>		<b>Credits: 5</b>	
<b>LectureHours:(L) perweek: 5</b>		<b>TutorialHours: (T)perweek</b>	<b>LabPractice Hours: (P)perweek</b>		<b>Total:(L+T+P) perweek: 5</b>
<b>CourseCategory: CC3</b>		<b>Year&amp;Semester: I Year II Semester</b>		<b>AdmissionYear: 2023- 2024</b>	
<b>Pre-requisite</b>		Basic knowledge in data and representations			
<b>Linksto otherCourses</b>					
<p><b>LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)</b></p> <ul style="list-style-type: none"> <li>• To impart the basic concepts of data structures and algorithms.</li> <li>• To acquaint the student with the basics of the various data structures and make the students knowledgeable in the area of data structures.</li> <li>• This course also gives insight into the various algorithm design techniques</li> </ul>					
<p><b>CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)</b></p> <p><b>CO1:</b>To introduce the concepts of Data structures and to understand simple linear data structures.</p> <p><b>CO2:</b>Learn the basics of stack data structure, its implementation and application</p> <p><b>CO3:</b>Use the appropriate data structure in context of solution of given problem and demonstrate a familiarity with major data structures.</p> <p><b>CO4:</b> To introduce the basic concepts of algorithms</p> <p><b>CO5:</b> To give clear idea on algorithmic design paradigms like Dynamic Programming, Backtracking, Branch and Bound</p>					
<p><b>Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)</b></p>					
<b>Units</b>	<b>Contents</b>				<b>RequiredHours</b>
<b>I</b>	<b>INTRODUCTION TO DATA STRUCTURES:</b> Data Structures: Definition- Time & Space Complexity,				<b>15</b>

	<ul style="list-style-type: none"> <li>• Arrays: Representation of arrays, Applications of arrays, sparse matrix and its representation,</li> <li>• Linear list: Singly linked list implementation, insertion, deletion and searching operations on linear list</li> <li>• Circular linked list: implementation, Double linked list implementation, insertion, deletion and searching operations. Applications of linked lists- Dynamic Storage management.</li> </ul>	
<b>II</b>	<b>STACKS:</b> <ul style="list-style-type: none"> <li>• Operations, array and linked representations of stack,</li> <li>• stack applications, infix to postfix conversion, postfix expression evaluation, recursion implementation</li> </ul>	<b>15</b>
<b>III</b>	<b>QUEUES, TREES &amp; GRAPHS:</b> <ul style="list-style-type: none"> <li>• <b>Queues:</b> operations on queues, array and linked representations.</li> <li>• <b>Circular Queue:</b> operations,, applications of queues.</li> <li>• <b>Trees:</b> Definitions and Concepts- Representation of binary tree, Binary tree traversals (Inorder, Postorder , preorder),</li> <li>• Binary search trees</li> <li>• <b>Graphs :</b> Representation of Graphs- Types of graphs -Breadth first traversal – Depth first traversal- - Applications of graphs –</li> </ul>	<b>15</b>
<b>IV</b>	<b>INTRODUCTION TO ALGORITHMS:</b> <ul style="list-style-type: none"> <li>• <b>INTRODUCTION:</b> Definition of Algorithms-</li> </ul>	<b>15</b>

	<p>Overview and importance of algorithms- pseudocode conventions, Asymptotic notations, practical complexities.</p> <ul style="list-style-type: none"> <li>• <b>Divide-and-Conquer:</b> : General Method – Binary Search- Quick Sort- Merge Sort.</li> <li>• <b>Greedy Method:</b> General method- Knapsack problem- Tree vertex splitting- Job sequencing with deadlines</li> </ul>	
V	<p><b>DYNAMIC PROGRAMMING, BACKTRACKING &amp; BRANCH &amp; BOUND</b></p> <ul style="list-style-type: none"> <li>• <b>Dynamic programming:</b> General method, Multistage Graphs, All pairs shortest path, Single source shortest path.</li> <li>• <b>Backtracking:</b> General method, 8 Queens, Graph coloring, Hamiltonian cycle.</li> <li>• <b>Branch &amp; Bound:</b> General method, Travelling salesperson problem.</li> </ul>	15
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question)	<p>Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC – CSIR/GATE/TNPSC/other to be solved (To be discussed during the Tutorial hour)</p>	

paper)		
Skillsacquire dfrom the course	Knowledge,ProblemSolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferrable Skill	
<p><b>LearningResources:</b></p> <ul style="list-style-type: none"> <li>• <b>RecommendedTexts</b> <ol style="list-style-type: none"> <li>1. Ellis Horowitz , SartajSahni, Susan Anderson Freed, Second Edition , “Fundamentals of Data in C”, Universities Press</li> <li>2. E. Horowitz, S. Sahni and S. Rajasekaran, Second Edition ,“Fundamentals of Computer Algorithms “ Universities Press</li> </ol> </li> <li>• <b>ReferenceBooks</b> <ol style="list-style-type: none"> <li>1. Seymour Lipschutz ,”Data Structures with C”, First Edition, Schaum’s outline series in computers, Tata McGraw Hill.</li> <li>2. .2. R.Krishnamoorthy and G.IndiraniKumaravel, Data Structures using C, Tata McGrawHill – 2008.</li> <li>3. A.K.Sharma, Data Structures using C , Pearson Education India,2011.</li> <li>4. . G. Brassard and P. Bratley, “Fundamentals of Algorithms”, PHI, New Delhi, 1997.</li> <li>5. 4, . A.V. Aho, J.E. Hopcroft, J.D. Ullmann,, “The design and analysis of Computer Algorithms”, Addison Wesley, Boston, 1974</li> <li>7. 5. Thomas H. Cormen, C.E. Leiserson, R L.Rivest and C. Stein, Introduction to Algorithms, Third edition, MIT Press, 2009</li> <li>8. SanjoyDasgupta, C.Papadimitriou and U.Vazirani , Algorithms , Tata McGraw- Hill, 2008.</li> </ol> </li> <li>• <b>Webresources:</b> Web resources from NDL Library, E-content from open source libraries</li> </ul>		



<b>CourseCode: CC4</b>	<b>Data Structures &amp; Algorithms Lab with C/C++</b>		<b>Credits: 5</b>
<b>LectureHours:(L) perweek</b>	<b>TutorialHours: (T)perweek</b>	<b>LabPractice Hours: (P)perweek: 5</b>	<b>Total:(L+T+P) perweek: 5</b>
<b>CourseCategory: CC4</b>	<b>Year&amp;Semester: I Year II Semester</b>	<b>AdmissionYear: 2023-2024</b>	
<b>Pre-requisite</b>	Basic skills in problem solving		
<p><b>LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)</b></p> <ul style="list-style-type: none"> <li>• To understand and implement basic data structures using C</li> <li>• To apply linear and non-linear data structures in problem solving.</li> <li>• To learn to implement functions and recursive functions by means of data structures</li> <li>• To implement searching and sorting algorithms</li> </ul>			
<p><b>CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)</b></p> <p><b>CO1:</b>Implement data structures using C</p> <p><b>CO2:</b>Implement various types of linked lists and their applications</p> <p><b>CO3:</b>Implement Tree Traversals</p> <p><b>CO4:</b> Implement various algorithms in C</p> <p><b>CO5:</b> Implement different sorting and searching algorithms</p>			
<p><b>Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)</b></p>			
	<b>List of Exercises:</b>		<b>RequiredHours</b>
	Implement the following exercises using C Programming language: <ol style="list-style-type: none"> <li>1. Array implementation of stacks</li> <li>2. Array implementation of Queues</li> <li>3. Linked list implementation of stacks</li> <li>4. Linked list implementation of Queues</li> <li>5. Binary Tree Traversals (Inorder, Preorder, Postorder)</li> <li>6. Implementation of Linear search and binary search</li> <li>7. Implementation Insertion sort, Quick sort and Merge</li> </ol>		<b>75</b>

	<p>Sort</p> <p>8. Implementation of Depth-First Search &amp; Breadth-First Search of Graphs.</p> <p>9. Finding all pairs of Shortest Path of a Graph.</p> <p>10. Finding single source shortest path of a Graph.</p>	
<p>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</p>	<p>Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC – CSIR/GATE/TNPSC/other to be solved (To be discussed during the Tutorial hour)</p>	
<p>Skills acquired from the course</p>	<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferable Skill</p>	
<p><b>Learning Resources:</b></p> <p><b>Learning Resources:</b></p> <ul style="list-style-type: none"> <li>• <b>Recommended Texts</b> <ol style="list-style-type: none"> <li>1. Ellis Horowitz , Sartaj Sahni, Susan Anderson Freed, Second Edition , “Fundamentals of Data in C”, Universities Press</li> <li>2. E. Horowitz, S. Sahni and S. Rajasekaran, Second Edition , “Fundamentals of Computer Algorithms “ Universities Press</li> </ol> </li> <li>• <b>Reference Books</b></li> </ul>		

1. Seymour Lipschutz ,”Data Structures with C”, First Edition, Schaum’s outline series in computers, Tata McGraw Hill.
2. .2. R.Krishnamoorthy and G.IndiraniKumaravel, Data Structures using C, Tata McGrawHill – 2008.
3. A.K.Sharma, Data Structures using C , Pearson Education India,2011.
4. . G. Brassard and P. Bratley, “Fundamentals of Algorithms”, PHI, New Delhi, 1997.
5. 4, . A.V. Aho, J.E. Hopcroft, J.D. Ullmann,, “The design and analysis of Computer Algorithms”, Addison Wesley, Boston, 1974
7. 5. Thomas H. Cormen, C.E. Leiserson, R L.Rivest and C. Stein, Introduction to Algorithms, Third edition, MIT Press, 2009
8. SanjoyDasgupta, C.Papadimitriou and U.Vazirani , Algorithms , Tata McGraw-Hill, 2008.

- **Webresources:** Web resources from NDL Library, E-content from open source libraries

<b>CourseCode-EC-2</b>	<b>NUMERICAL METHODS</b>		<b>Credits3</b>
<b>LectureHours:(L) perweek - 4</b>	<b>TutorialHours: (T)perweek</b>	<b>LabPractice Hours: (P)perweek</b>	<b>Total:(L+T+P) perweek: 4</b>
<b>CourseCategory: EC-2</b>	<b>Year&amp;Semester: I Year II Semester</b>		<b>AdmissionYear: 2023- 2024</b>
<b>Pre-requisite</b>	Basic Knowledge of Programming concept		
The main objectives of this course are:			
1. To introduce the various topics in Numerical methods.			
2. To make understand the fundamentals of algebraic equations.			

<p>3. To apply interpolation and approximation on examples.</p> <p>4. To solve problems using numerical differentiation and integration.</p> <p>5. To solve linear systems, numerical solution of ordinary differential equations.</p>		
<p><b>Course Outcomes:</b>(for students: To know what they are going to learn)</p> <p><b>CO1:</b> Know how to solve various problems on numerical methods</p> <p><b>CO2:</b> Use approximation to solve problems</p> <p><b>CO3:</b> Differentiation and integration concept are applied</p> <p><b>CO4:</b> Apply, direct methods for solving linear systems</p> <p><b>CO5:</b> Numerical solution of ordinary differential equations</p>		
<p><b>Recap:</b>(not for examination) Motivation/previous lecture/relevant portions required for the course)[This is done during 2 Tutorial hours)</p>		
<b>Units</b>	<b>Contents</b>	<b>Required Hours</b>
<b>I</b>	<b>FUNDAMENTALS OF ALGEBRAIC EQUATION:</b> Solution of algebraic and transcendental equations-Bisection method – Fixed point iteration method – Newton Raphson method –linear system of equations – Gauss elimination method – Gauss Jordan method .	<b>12</b>
<b>II</b>	<b>ITERATIVE, INTERPOLATION AND APPROXIMATION:</b> Iterative methods - Gauss Jacobi and Gauss Seidel – Eigen values of a matrix by Power method and Jacobi’s method for symmetric matrices. Interpolation with unequal intervals – Lagrange’s interpolation – Newton’s divided difference interpolation	<b>12</b>
<b>III</b>	<b>INTERPOLATION WITH EQUAL INTERVAL:</b> Difference operators and relations. -Interpolation with equal intervals – Newton’s forward and backward difference formulae.	<b>12</b>
<b>IV</b>	<b>NUMERICAL DIFFERENTIATION AND INTEGRATION:</b> Approximation of derivatives using	<b>12</b>

	interpolation polynomials – Numerical integration using Trapezoidal, Simpson’s 1/3 rule	
<b>V</b>	<b>INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS:</b> Single step methods – Taylor’s series method – Euler’s method – Modified Euler’s method - RungeKutta method for solving( first, second , Third and 4th) order equations – Multi step methods	<b>12</b>
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC – CSIR/GATE/TNPSC/other to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferable Skill	
<p><b>Learning Resources:</b></p> <ul style="list-style-type: none"> <li>• <b>Recommended Texts</b> <ol style="list-style-type: none"> <li>1. Numerical Methods, Second Edition, S.Arumugam, A.Thangapandi Issac, A.Somasundaram, SCITECH publications, 2009.</li> </ol> </li> <li>• <b>Reference Books</b> <ol style="list-style-type: none"> <li>1. Mathews J.H. Numerical Method for Maths, Science and Engineering; PHI,</li> </ol> </li> </ul>		

<p>New Delhi, 2001.</p> <p>2. Iqbal H. Khan &amp; Q. Hassan Numerical Methods for Engineers and Scientist - Galgotia Publications (P) Ltd., New Delhi – 1997.</p> <p>3. M.K. Jain, S.R.K. Iyengar &amp; R.K. Jain - Numerical Methods for Scientific and Engineering Computation - New Age International (P) Ltd., New Delhi – 1996.</p> <ul style="list-style-type: none"> <li>• <b>Webresources:</b> Web resources from NDL Library, E-content from open source libraries</li> </ul>
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<b>CourseCode: SEC-2</b>	<b>Quantitative Aptitude</b>		<b>Credits: 2</b>
<b>LectureHours:(L) perweek: 2</b>	<b>TutorialHours: (T)perweek</b>	<b>LabPractice Hours: (P)perweek</b>	<b>Total:(L+T+P) perweek: 2</b>
<b>CourseCategory:SEC-2</b>	<b>Year&amp;Semester:I Year II Semester</b>		<b>AdmissionYear: 2023-2024</b>
<b>Pre-requisite</b>	Basic knowledge in numerical ability		
<b>LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)</b> <ul style="list-style-type: none"> <li>• Toimprovethequantitativeskillsofthestudents</li> <li>• Topreparethestudentsforvariouscompetitiveexams</li> </ul>			
<b>CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)</b> <b>CO1:</b> To gain knowledge on LCM and HCF and its related problems <b>CO2:</b> To get an idea of age, profit and loss related problem solving. <b>CO3:</b> Able to understand time series simple and compound interests <b>CO4:</b> Understanding the problem related to probability, and series <b>CO5:</b> Able to understand graphs, charts			
<b>Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)</b>			
<b>Units</b>	<b>Contents</b>		<b>RequiredHours</b>
<b>I</b>	Numbers-HCFandLCMofnumbers-		<b>6</b>

	Decimal fractions-Simplification- Square roots and cube roots-Average- problems on Numbers	
<b>II</b>	Problems on Ages - Surds and Indices - percentage - profits and loss - ratio and proportion-partnership-Chain rule.	<b>6</b>
<b>III</b>	Time and work - pipes and cisterns - Time and Distance - problems on trains -Boats and streams - simple interest - compound interest - Logarithms - Area -Volume and surface area- races and Games of skill.	<b>6</b>
<b>IV</b>	Permutation and combination-probability- True Discount-Bankers Discount - Height and Distances-Odd man out & Series.	<b>6</b>
<b>V</b>	Calendar - Clocks - stocks and shares - Data representation - Tabulation - Bar Graphs-Pie charts- Line graphs	<b>6</b>
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC- CSIR/GATE/TNPSC/other to be solved (To be discussed during the Tutorial hour)	

Skillsacquire dfrom the course	Knowledge,ProblemSolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferrable Skill		
<b>LearningResources:</b>			
<ul style="list-style-type: none"> <li>• <b>RecommendedTexts</b> <ol style="list-style-type: none"> <li>1. .“QuantitativeAptitude”,R.S.AGGARWAL.,S.Chand&amp;CompanyLtd.,</li> </ol> </li> <li>• <b>Webresources: Authentic</b> Web resources related to Competitive examinations</li> </ul>			
<b>CourseCode: SEC-3</b>	<b>Advanced Excel</b>		<b>Credits: 2</b>
<b>LectureHours:(L) perweek: 2</b>	<b>TutorialHours: (T)perweek</b>	<b>LabPractice Hours: (P)perweek</b>	<b>Total:(L+T+P) perweek: 2</b>
<b>CourseCategory: SEC-3</b>	<b>Year&amp;Semester:I Year II Semester</b>		<b>AdmissionYear: 2023- 2024</b>
<b>Pre-requisite</b>	Basic knowledge in office automation / Excel		
<b>LearningObjectives:(forteachers:whatttheyhavetodointheclass/lab/field)</b>			
The objective of this course is to help the students learn the advanced features of Excel, to summarize, analyze, explore, and present visualizations of data in the form of charts, graphs.			
<b>CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)</b>			
<b>CO1:</b> Handle large amounts of data			
<b>CO2:</b> Aggregate numeric data and summarize into categories and subcategories			
<b>CO3:</b> Filtering, sorting, and grouping data or subsets of data			
<b>CO4:</b> Create pivot tables to consolidate data from multiple files			
<b>CO5:</b> Presenting data in the form of charts and graphs			
<b>Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)</b>			
<b>Units</b>	<b>Contents</b>		<b>RequiredHours</b>



<b>I</b>	Basics of Excel- Customizing common options- Absolute and relative cells- Protecting and un-protecting worksheets and cells- Working with Functions - Writing conditional expressions - logical functions - lookup and reference functions- VlookUP with Exact Match, Approximate Match- Nested VlookUP with Exact Match- VlookUP with Tables, Dynamic Ranges- Nested VlookUP with Exact Match- Using VLookUP to consolidate Data from Multiple Sheets	<b>6</b>
<b>II</b>	Data Validations - Specifying a valid range of values - Specifying a list of valid values- Specifying custom validations based on formula - Working with Templates Designing the structure of a template- templates for standardization of worksheets - Sorting and Filtering Data - Sorting tables- multiple-level sorting- custom sorting- Filtering data for selected view - advanced filter options- Working with Reports Creating subtotals- Multiple-level subtotal.	<b>6</b>
<b>III</b>	Creating Pivot tables Formatting and customizing Pivot tables- advanced options of Pivot tables- Pivot charts- Consolidating data from multiple sheets and files using Pivot tables- external data sources- data consolidation feature to consolidate data- Show Value As % of Row, % of Column, Running Total, Compare with Specific Field- Viewing Subtotal under Pivot- Creating Slicers.	<b>6</b>
<b>IV</b>	More Functions Date and time functions- Text functions- Database functions- Power Functions - Formatting Using auto formatting option for worksheets- Using conditional formatting option for rows, columns and cells- WhatIf Analysis - Goal Seek- Data Tables- Scenario Manager.	<b>6</b>

V	Charts - Formatting Charts- 3D Graphs- Bar and Line Chart together- Secondary Axis in Graphs- Sharing Charts with PowerPoint / MS Word, Dynamically- New Features Of Excel Sparklines, Inline Charts, data Charts- Overview of all the new features.	6
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC – CSIR/GATE/TNPSC/other to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferable Skill	
<p><b>Learning Resources:</b></p> <ul style="list-style-type: none"> <li>• <b>Recommended Text</b> Excel 2019 All-in-One For Dummies – 2018- <u>Greg Harvey</u></li> <li>• <b>Reference Books</b> Microsoft Excel 2019 Pivot Table Data Crunching-2019, <u>Bill Jelen</u> and <u>Michael Alexander</u></li> <li>• <b>Web resources:</b> Web resources from NDL Library, E-content from open source libraries</li> </ul>		

**Second Year (Semester – III)**

<b>CourseCode-CC5</b>	<b>Python Programming</b>		<b>Credits5</b>
<b>LectureHours:(L) perweek - 5</b>	<b>TutorialHours: (T)perweek</b>	<b>LabPractice Hours: (P)perweek</b>	<b>Total:(L+T+P) perweek: 5</b>
<b>CourseCategory: Core</b>	<b>Year&amp;Semester: II Year III Semester</b>	<b>AdmissionYear: 2023- 2024</b>	
<b>Pre-requisite</b>	Basic Knowledge of Programming concept		
<b>LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)</b> <ul style="list-style-type: none"> <li>• Describe the core syntax and semantics of Python programming language.</li> <li>• Discover the need for working with the strings and functions.</li> <li>• Illustrate the process of structuring the data using lists, dictionaries, tuples and sets.</li> <li>• Understand the usage of packages and Dictionaries</li> </ul>			
<b>CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)</b> <b>CO1:</b> Develop and execute simple Python programs <b>CO2:</b> Write simple Python programs using conditionals and looping for solving problems <b>CO3:</b> Decompose a Python program into functions <b>CO4:</b> Represent compound data using Python lists, tuples, dictionaries etc. <b>CO5:</b> Read and write data from/to files in Python programs			
<b>Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)</b>			
<b>Units</b>	<b>Contents</b>	<b>RequiredHours</b>	
<b>I</b>	Introduction: The essence of computational problem solving – Limits of computational problem solving-Computer algorithms-Computer Hardware-Computer Software-The process of computational problem solving-Python programming language - Literals - Variables and Identifiers - Operators - Expressions and Data types, Input / output	<b>15</b>	

<b>II</b>	Control Structures: Boolean Expressions - Selection Control - If Statement- Indentation in Python- Multi-Way Selection -- Iterative Control- While Statement- Infinite loops- Definite vs. Indefinite Loops- Boolean Flag. String, List and Dictionary, Manipulations Building blocks of python programs, Understanding and using ranges.	<b>15</b>
<b>III</b>	Functions: Program Routines- Defining Functions- More on Functions: Calling Value-Returning Functions- Calling Non-Value-Returning Functions- Parameter Passing - Keyword Arguments in Python - Default Arguments in Python- Variable Scope. Recursion: Recursive Functions	<b>15</b>
<b>IV</b>	Objects and their use: Software Objects - Turtle Graphics – Turtle attributes-Modular Design: Modules - Top-Down Design - Python Modules - Text Files: Opening, reading and writing text files – Database Programming: Connecting to a database, Creating Tables, INSERT, UPDATE, DELETE and READ operations, Transaction Control, Disconnecting from a database, String Processing - Exception Handling	<b>15</b>
<b>V</b>	Dictionaries and Sets: Dictionary type in Python - Set Data type. Object Oriented Programming using Python: Encapsulation - Inheritance – Polymorphism. Python packages: Simple programs using the built-in functions of packages matplotlib, numpy, pandas etc.	<b>15</b>
Extended Professional Component (is a part of internal component only, Not to	Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC – CSIR/GATE/TNPSC/other to be solved (To be discussed during the Tutorial hour)	

be included in the External Examination question paper)		
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferable Skill	
<p><b>Learning Resources:</b></p> <ul style="list-style-type: none"> <li>• <b>Recommended Texts</b> <ol style="list-style-type: none"> <li>1. Charles Dierbach, “Introduction to Computer Science using Python - A computational Problem solving Focus”, Wiley India Edition, 2015.</li> <li>2. Wesley J. Chun, “Core Python Applications Programming”, 3rd Edition , Pearson Education, 2016</li> </ol> </li> <li>• <b>Reference Books</b> <ol style="list-style-type: none"> <li>1. Mark Lutz, “Learning Python Powerful Object Oriented Programming”, O’reilly Media 2018, 5th Edition.</li> <li>2. Timothy A. Budd, “Exploring Python”, Tata McGraw Hill Education Private Limited 2011, 1 st Edition.</li> <li>3. John Zelle, “Python Programming: An Introduction to Computer Science”, Second edition, Course Technology Cengage Learning Publications, 2013, ISBN 978- 1590282410</li> <li>4. Michel Dawson, “Python Programming for Absolute Beginners” , Third Edition, Course Technology Cengage Learning Publications, 2013, ISBN 978-1435455009</li> </ol> </li> <li>• <b>Webresources</b> <ol style="list-style-type: none"> <li>1. <a href="https://onlinecourses.swyam2.ac.in/cec22_cs20/preview">https://onlinecourses.swyam2.ac.in/cec22_cs20/preview</a></li> </ol> </li> </ul>		

<b>CourseCode: CC6</b>	<b>Python Programming Lab</b>		<b>Credits : 5</b>
<b>LectureHours:(L) perweek:</b>	<b>TutorialHours: (T)perweek</b>	<b>LabPractice Hours: 5 perweek</b>	<b>Total:(L+T+P) perweek: 5</b>
<b>CourseCategory:Core</b>	<b>Year&amp;Semester: II Year III Semester</b>	<b>AdmissionYear: 2023-2024</b>	
<b>Pre-requisite</b>	Basic knowledge of programming skill		
<b>LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)</b> <ul style="list-style-type: none"> <li>• Acquire programming skills in core Python.</li> <li>• Acquire Object-oriented programming skills in Python.</li> <li>• Develop the skill of designing graphical-user interfaces (GUI) in Python.</li> <li>• Develop the ability to write database applications in Python.</li> <li>• Acquire Python programming skills to move into specific branches</li> </ul>			
<b>CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)</b> <b>CO1:</b> To understand the problem solving approaches <b>CO2:</b> To learn the basic programming constructs in Python <b>CO3:</b> To practice various computing strategies for Python-based solutions to real world problems <b>CO4:</b> To use Python data structures - lists, tuples, dictionaries. <b>CO5:</b> To do input/output with files in Python.			
<b>Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)</b>			
	<b>List of Exercises:</b>		<b>RequiredHours</b>
	1. Program to convert the given temperature from Fahrenheit to Celsius and vice versa depending upon user's choice. 2. Program to calculate total marks, percentage and grade of a student. Marks obtained in each of the five subjects are to be input by user. Assign grades according to the following criteria:		<b>75</b>

	<p>Grade A: Percentage <math>\geq 80</math>      Grade B: Percentage <math>\geq 70</math> and <math>&lt; 80</math></p> <p>Grade C: Percentage <math>\geq 60</math> and <math>&lt; 70</math>      Grade D: Percentage <math>\geq 40</math> and <math>&lt; 60</math></p> <p>Grade E: Percentage <math>&lt; 40</math></p> <ol style="list-style-type: none"> <li>3. Program, to find the area of rectangle, square, circle and triangle by accepting suitable input parameters from user.</li> <li>4. Write a Python script that prints prime numbers less than 20.</li> <li>5. Program to find factorial of the given number using recursive function.</li> <li>6. Write a Python program to count the number of even and odd numbers from array of N numbers.</li> <li>7. Write a Python class to reverse a string word by word.</li> <li>8. Given a tuple and a list as input, write a program to count the occurrences of all items of the list in the tuple. (Input : tuple = ('a', 'a', 'c', 'b', 'd'), list = ['a', 'b'], Output : 3)</li> <li>9. Create a Savings Account class that behaves just like a BankAccount, but also has an interest rate and a method that increases the balance by the appropriate amount of interest (Hint:use Inheritance).</li> <li>10. Write a Python program to construct the following pattern, using a nested loop <pre style="margin-left: 40px;"> * ** *** **** </pre> </li> </ol>	
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	<p style="text-align: center;">***** **** *** ** *</p> <p>11. Read a file content and copy only the contents at odd lines into a new file.</p> <p>12. Create a Turtle graphics window with specific size.</p> <p>13. Write a Python program for Towers of Hanoi using recursion</p> <p>14. Create a menu driven Python program with a dictionary for words and their meanings.</p> <p>15. Devise a Python program to implement the Hangman Game.</p>	
<p>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</p>	<p>Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC – CSIR/GATE/TNPSC/other to be solved (To be discussed during the Tutorial hour)</p>	
<p>Skills acquired from the course</p>	<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferable Skill</p>	



**Learning Resources:**

- **Recommended Texts**

1. Charles Dierbach, “Introduction to Computer Science using Python - A computational Problem solving Focus”, Wiley India Edition, 2015.
2. Wesley J. Chun, “Core Python Applications Programming”, 3rd Edition , Pearson Education, 2016

- **Reference Books**

1. Mark Lutz, “Learning Python Powerful Object Oriented Programming”, O’reilly Media 2018, 5th Edition.
2. Timothy A. Budd, “Exploring Python”, Tata MCGraw Hill Education Private Limited 2011, 1 st Edition.
3. John Zelle, “Python Programming: An Introduction to Computer Science”, Second edition, Course Technology Cengage Learning Publications, 2013, ISBN 978- 1590282410
4. Michel Dawson, “Python Programming for Absolute Beginners” , Third Edition, Course Technology Cengage Learning Publications, 2013, ISBN 978- 1435455009

<b>CourseCode: EC3</b>	<b>Probability and Statistics</b>		<b>Credits: 3</b>
<b>LectureHours:(L) perweek: 4</b>	<b>TutorialHours: (T)perweek</b>	<b>LabPractice Hours: (P)perweek</b>	<b>Total:(L+T+P) perweek: 4</b>
<b>CourseCategory:EC3</b>	<b>Year&amp;Semester: II Year III Semester</b>		<b>AdmissionYear: 2023- 2024</b>
<b>Pre-requisite</b>	Basic knowledge of Statistics		
<b>LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)</b>			

<ol style="list-style-type: none"> <li>1. To introduce the various topics in Probability and Statistics</li> <li>2. To make understand the fundamentals of Statistics.</li> <li>3. To apply Measures of dispersion on examples.</li> <li>4. To solve problems using. Correlation and regression</li> <li>5. To study the test of significance</li> </ol>		
<p><b>Course Outcomes:</b>(for students: To know what they are going to learn)</p> <p><b>CO1:</b> Know how to solve various problems on Probability and Statistics</p> <p><b>CO2:</b> Use Correlation and regression method to solve problems</p> <p><b>CO3:</b> Probability and Statistics concept are applied</p> <p><b>CO4:</b> Apply, different types of tests</p> <p><b>CO5:</b> calculate probabilities using conditional probability</p>		
<p><b>Recap:</b>(not for examination) Motivation/previous lecture/relevant portions required for the course)[This is done during 2 Tutorial hours)</p>		
<b>Units</b>	<b>Contents</b>	<b>Required Hours</b>
<b>I</b>	Introduction to statistics – primary and secondary data – classification, tabulation and Diagrammatic Representation of statistical data – Bar-charts, Pie-diagrams’ – Graphical Representation of data – Histograms, Frequency polygon, Ogives.	<b>12</b>
<b>II</b>	Measures of dispersion – characteristics – coefficient of dispersion - Coefficient of variation – Moments – skewness and kurtosis – Pearson’s coefficient of skewness - Bowley’s coefficient of Skewness – Coefficient of skewness based upon moments.	<b>12</b>
<b>III</b>	Simple correlation – Karl Pearson’s coefficient of correlation – correlation coefficient for A bivariate frequency distribution – Rank correlation – Regression – lines of regression – Properties of regression coefficient.	<b>12</b>
<b>IV</b>	Events and sets – sample space – concept of probability –	<b>12</b>

	addition and multiplications Theorem on probability – conditional probability and independence of events – Baye’s Theorem – concept of random variable – Mathematical Expectation.	
<b>V</b>	Concept of sampling distributions – standard error – Tests of significance based on, Chi-square and F distributions with respect to mean, variance.	<b>12</b>
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC – CSIR/GATE/TNPSC/other to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferable Skill	
<p><b>Learning Resources:</b></p> <ul style="list-style-type: none"> <li>• <b>Recommended Texts</b> Statistical Methods, S.P. Gupta, Sultan Chand and Sons, 2004.</li> <li>• <b>Reference Books</b> <ol style="list-style-type: none"> <li>1. Statistics, Dr. S. Arumugam and A. Thangapandi Issac, New Gamma Publication house, 2002.</li> <li>2. Kishor S. Trivedi - Probability and statistics with reliability queuing and Computer Science Applications - Prentice Hall of India (P) Ltd., New Delhi - 1997.</li> </ol> </li> </ul>		

3. Discrete Mathematics - Seymour Lipschutz, Marc Lars Lipson Schaum's Outlines- by, 3rd Edition., Tata McGraw Hill, Education Pvt. Ltd., New Delhi. 5th Reprint 2012.

**Webresources:** Web resources from NDL Library, E-content from open-source libraries

<b>CourseCode SEC-4</b>	<b>PHP Programming Lab</b>		<b>Credits 1</b>
<b>LectureHours:(L) perweek</b>	<b>TutorialHours: (T)perweek</b>	<b>LabPractice Hours: (P)perweek1</b>	<b>Total:(L+T+P) perweek 1</b>
<b>CourseCategory:SEC</b>	<b>Year&amp;Semester: II Year III Semester</b>	<b>AdmissionYear: 2023-2024</b>	
<b>Pre-requisite</b>	Basic knowledge of programming skills		
<b>Linksto otherCourses</b>			
<b>LearningObjectives:(forteachers:whatttheyhavetodointheclass/lab/field)</b>			
<ul style="list-style-type: none"> <li>• To provide the necessary knowledge to design and develop dynamic, database-driven web applications using PHP</li> <li>• To know the Database manipulation and MYSQL queries</li> <li>• To Understand and Generate Reports in PHP</li> </ul>			
<b>CourseOutcomes:(forstudents:Toknowwhatttheyaregoingtolearn)</b>			
<b>CO1::</b> Define the basic concepts of Web and PHP			
CO2: Explain the usage of basic data types, Functions, Arrays, Strings, Date and Times, Regular Expressions of PHP			
CO3: Outline the basic concepts of Object Oriented Programming			
CO4: Experiment with the Database manipulation and MYSQL queries			
CO5: How to Generate Reports in PHP			
<b>Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)</b>			
<b>Units</b>	<b>Contents</b>		<b>RequiredHours</b>
<b>I</b>	1. Simple PHP programs using expressions and operators. 2. Programs to demonstrate the usage of control structures 3. Programs using Looping structures 4. Programs using arrays 5. Programs using string functions		<b>15</b>

	6. Simple and parameterized functions 7. Programs using OOPS concepts 8. Program to design a web page using various form controls 9. Data validation in web pages. 10. Using cookies and session variables	
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC – CSIR/GATE/TNPSC/other to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferable Skill	
<b>Learning Resources:</b> <ul style="list-style-type: none"> <li>• <b>Recommended Texts</b> <ol style="list-style-type: none"> <li>1. Head First PHP &amp; MySQL: A Brain-Friendly Guide- 2009-Lynn mighley and Michael Morrison.</li> <li>2. The Joy of PHP: A Beginner's Guide to Programming Interactive Web Applications with PHP and MySQL- Alan Forbes</li> </ol> </li> </ul>		

<b>Course Code: SEC-5</b>	<b>Digital Computer Fundamentals</b>		<b>Credits: 2</b>
<b>Lecture Hours: (L) per week: 2</b>	<b>Tutorial Hours: (T) per week</b>	<b>Lab Practice Hours: (P) per week</b>	<b>Total: (L+T+P) per week: 2</b>
<b>Course Category: SEC-5</b>	<b>Year &amp; Semester: II Year III Semester</b>		<b>Admission Year: 2023-2024</b>

<b>Pre-requisite</b>	Basic knowledge of Digital Computer Fundamentals	
<b>Links to other Courses</b>		
<b>Learning Objectives:</b> (for teachers: what they have to do in the class/lab/field)		
<ul style="list-style-type: none"> <li>• It aims to train the student to the basic concepts of Digital Computer Fundamentals</li> <li>• To impart the in-depth knowledge of logic gates, Boolean algebra, combinational circuits and sequential circuits.</li> </ul>		
<b>Course Outcomes:</b> (for students: To know what they are going to learn)		
<b>CO1:</b> Identify the logic gates and their functionality.		
<b>CO2:</b> Perform number conversions from one system to another system		
<b>CO3:</b> Understand the functions of combinational circuits		
<b>CO4:</b> Perform number conversions.		
<b>CO5:</b> Perform Counter design and learn its operations.		
<b>Recap:</b> (not for examination) Motivation/previous lecture/relevant portions required for the course) [This is done during 2 Tutorial hours]		
<b>Units</b>	<b>Contents</b>	<b>Required Hours</b>
<b>I</b>	Number Systems and Codes: Number System – Base Conversion – Binary Codes – Code Conversion. Digital Logic: Logic Gates – Truth Tables – Universal Gates.	<b>6</b>
<b>II</b>	Boolean Algebra: Laws and Theorems – SOP, POS Methods – Simplification of Boolean Functions – Using Theorems, K-Map, Prime-Implicant Method – Binary Arithmetic: Binary Addition – Subtraction – Various Representations of Binary Numbers – Arithmetic Building Blocks – Adder – Subtractor.	<b>6</b>
<b>III</b>	Combinational Logic: Multiplexers – Demultiplexers – Decoders – Encoders – Code Converters – Parity Generators and Checkers.	<b>6</b>
<b>IV</b>	Sequential Logic: RS, JK, D, and T Flip-Flops – Master-Slave Flip-Flops. Registers: Shift Registers – Types of Shift Registers.	<b>6</b>
<b>V</b>	Counters: Asynchronous and Synchronous Counters - Ripple, Mod, Up-Down Counters – Ring Counters. Memory: Basic Terms and Ideas – Types of ROMs – Types of RAMs.	<b>6</b>

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/other to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferable Skill	
<p><b>Learning Resources:</b></p> <ul style="list-style-type: none"> <li>• <b>Recommended Texts</b> <ol style="list-style-type: none"> <li>1. V. Rajaraman and T. Radhakrishnan, <i>Digital Computer Design</i>, Prentice Hall of India, 2001</li> <li>2. D.P. Leach and A.P. Malvino, <i>Digital Principles and Applications</i>–TMH–Fifth Edition–2002.</li> <li>3. M. Moris Mano, <i>Digital Logic and Computer Design</i>, PHI, 2001.</li> <li>4. T.C. Bartee, <i>Digital Computer Fundamentals</i>, 6<sup>th</sup> Edition, Tata McGraw Hill, 1991.</li> </ol> </li> <li>• <b>Reference Books</b> <ol style="list-style-type: none"> <li>1. Digital Design, R. Anantha Natarajan, PHI Learning, 2015.</li> <li>2. Principles of Digital Electronics, K. Meena, PHI Learning, 2013.</li> <li>3. Digital Computer Fundamentals, Thomas C. Bartee TMH 2007.</li> </ol> </li> <li>• <b>Web resources:</b> Web resources from NDL Library, E-content from open-source libraries</li> </ul>		

### Second Year (Semester – IV)

<b>Course Code: CC7</b>	<b>Java Programming</b>		<b>Credits: 5</b>
<b>Lecture Hours: (L)</b> <b>per week: 5</b>	<b>Tutorial Hours:</b> <b>(T) per week</b>	<b>Lab Practice</b> <b>Hours: (P) per week</b>	<b>Total: (L+T+P)</b> <b>per week: 5</b>

<b>CourseCategory:CC7</b>	<b>Year&amp;Semester: II Year IV Semester</b>	<b>AdmissionYear: 2023-2024</b>
<b>Pre-requisite</b>	Basic knowledge of Programming skill	
<b>LearningObjectives:(forteachers:whatttheyhavetodointheclasse/lab/field)</b> <ul style="list-style-type: none"> <li>To provide fundamental knowledge of object-oriented programming.</li> <li>To equip the student with programming knowledge in Core Java from the basics up.</li> <li>To enable the students to use AWT controls, Event Handling and Swing for GUI.</li> </ul>		
<b>CourseOutcomes:(forstudents:Toknowwhatttheyaregoingtolearn)</b> <b>CO1:</b> Understand the basic Object-oriented concepts.  Implement the basic constructs of Core Java <b>CO2:</b> Implement inheritance, packages, interfaces and exception handling of Core Java. <b>CO3:</b> Implement multi-threading and I/O Streams of Core Java <b>CO4:</b> Implement AWT and Event handling. <b>CO5:</b> Use Swing to create GUI.		
<b>Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)</b>		
<b>Units</b>	<b>Contents</b>	<b>RequiredHours</b>
<b>I</b>	<b>Introduction:</b> ReviewofObject Orientedconcepts - HistoryofJava - Javabuzzwords - JVMArchitecture - Datatypes - Variables - Scope and life timeofvariables - arrays - operators - controlstatements - type conversion and casting - simple java program - constructors - methods - Static block - Static Data - StaticMethodStringand StringBufferClasses	<b>15</b>
<b>II</b>	<b>Inheritance:</b> Basic concepts - Types of inheritance - Member access rules - Usage of this and Super key word - Method Overloading - Method overriding - Abstract classes - Dynamic method dispatch - Usage of final	<b>15</b>



	<p>keyword.</p> <p><b>Packages:</b> Definition-AccessProtection Importing Packages.</p> <p><b>Interfaces:</b> Definition-Implementation-Extending Interfaces.</p> <p><b>Exception Handling:</b> <i>try - catch - throw - throws - finally</i> - Built-in exceptions - Creating own Exception classes.</p>	
<b>III</b>	<p><b>Multithreaded Programming:</b> Thread Class - Runnable interface -Synchronization- Using synchronized methods- Using <i>synchronized</i> statement- Interthread Communication -Deadlock.</p> <p><b>I/O Streams:</b> Concepts of streams - Stream classes- Byte and Character stream - Reading console Input and Writing Console output - File Handling.</p>	<b>15</b>
<b>IV</b>	<p><b>AWT Controls:</b> The AWT class hierarchy - user interface components- Labels - Button - Text Components - Check Box - Check Box Group - Choice - List Box - Panels - Scroll Pane - Menu - Scroll Bar. Working with Frame class - Colour - Fonts and layout managers.</p> <p><b>Event Handling:</b> Events - Event sources - Event Listeners - Event Delegation Model (EDM) - Handling Mouse and Keyboard Events - Adapter classes - Inner classes.</p>	<b>15</b>
<b>V</b>	<p><b>Swing:</b> Introduction to Swing - Hierarchy of swing components. Containers - Top level containers - JFrame - JWindow - JDialog - JPanel - JButton - JToggleButton - JCheckBox - JRadioButton - JLabel, JTextField -</p>	<b>15</b>

	JTextArea - JList - JComboBox - JScrollPane	
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC – CSIR/GATE/TNPSC/other to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferable Skill	
<p><b>Learning Resources:</b></p> <ul style="list-style-type: none"> <li>• <b>Recommended Texts</b> <ol style="list-style-type: none"> <li>1. Herbert Schildt, The Complete Reference, Tata McGraw Hill, New Delhi, 7th Edition, 2010.</li> <li>2. Gary Cornell, Core Java 2 Volume I – Fundamentals, Addison Wesley, 1999.</li> </ol> </li> <li>• <b>Reference Books</b> <ol style="list-style-type: none"> <li>1. Head First Java, O’Rielly Publications,</li> <li>2. Y. Daniel Liang, <i>Introduction to Java Programming</i>, 7th Edition, Pearson Education India, 2010.</li> </ol> </li> </ul> <p><b>Web resources:</b> Web resources from NDL Library, E-content from open-source libraries</p>		

<b>Course Code: CC8</b>	<b>Java Programming Lab</b>		<b>Credits: 5</b>
<b>Lecture Hours: (L) per week</b>	<b>Tutorial Hours: (T) per week</b>	<b>Lab Practice Hours: (P) per week: 5</b>	<b>Total: (L+T+P) per week: 5</b>
<b>Course Category: CC8</b>	<b>Year &amp; Semester: II Year IV Semester</b>	<b>Admission Year: 2023-2024</b>	
<b>Pre-requisite</b>	Basic knowledge Programming debugging skills		

<p><b>Learning Objectives:</b>(for teachers: what they have to do in the class/lab/field)</p> <ul style="list-style-type: none"> <li>To gain practical expertise in coding Core Java programs</li> <li>To become proficient in the use of AWT, Event Handling and Swing.</li> </ul>		
<p><b>Course Outcomes:</b>(for students: To know what they are going to learn)</p> <p><b>CO1:</b>Code, debug and execute Java programs to solve the given problems</p> <p><b>CO2:</b>Implement multi-threading and exception-handling</p> <p><b>CO3:</b>Implement functionality using String and StringBuffer classes</p> <p><b>CO4:</b> Demonstrate Event Handling.</p> <p><b>CO5:</b> Create applications using Swing and AWT</p>		
<p><b>Recap:</b>(not for examination) Motivation/previous lecture/relevant portions required for the course)[This is done during 2 Tutorial hours)</p>		
	<p><b>List of Exercises:</b></p>	<p><b>Required Hours</b></p>
	<ol style="list-style-type: none"> <li>Write a Java program that prompts the user for an integer and then prints out all the prime numbers up to that Integer?</li> <li>Write a Java program to multiply two given matrices.</li> <li>Write a Java program that displays the number of characters, lines and words in a text?</li> <li>Generate random numbers between two given limits using Random class and print messages according to the range of the value generated.</li> <li>Write a program to do String Manipulation using Character Array and perform the following string operations: <ol style="list-style-type: none"> <li>String length</li> <li>Finding a character at a particular position</li> <li>Concatenating two strings</li> </ol> </li> </ol>	<p><b>75</b></p>

	<p>6. Write a program to perform the following string operations using String class:</p> <ol style="list-style-type: none"><li>StringConcatenation</li><li>Search a substring</li><li>To extract substring from given string</li></ol> <p>7. Write a program to perform string operations using StringBuffer class:</p> <ol style="list-style-type: none"><li>Length of a string</li><li>Reverse a string</li><li>Delete a substring from the given string</li></ol> <p>8. Write a Java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.</p> <p>9. Write a threading program which uses the same method asynchronously to print the numbers 1 to 10 using Thread 1 and to print 90 to 100 using Thread 2.</p> <p>10. Write a program to demonstrate the use of following exceptions.</p> <ol style="list-style-type: none"><li>ArithmeticException</li><li>NumberFormatException</li><li>ArrayIndexOutOfBoundsException</li><li>NegativeArraySizeException</li></ol> <p>11. Write a Java program that reads a file name from the</p>	
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	<p>user, then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes?</p> <p>12. Write a program to accept text and change its size and font. Include bold, italic options. Use frames and controls.</p> <p>13. Write a Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired. (Use adapter classes).</p> <p>14. Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -, *, % operations. Add a text field to display the result. Handle any possible exceptions like divide by zero.</p> <p>15. Write a Java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with “stop” or “ready” or “go” should appear above the buttons in a selected color. Initially there is no message shown.</p>	
<p>Extended Professional Component (is a part of internal component only, Not to be included)</p>	<p>Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC – CSIR/GATE/TNPSC/other to be solved (To be discussed during the Tutorial hour)</p>	

in the External Examination question paper)		
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferable Skill	
<p><b>Learning Resources:</b></p> <ul style="list-style-type: none"> <li>• <b>Recommended Texts</b> <ol style="list-style-type: none"> <li>1. Herbert Schildt, The Complete Reference, Tata McGraw Hill, New Delhi, 7th Edition, 2010.</li> <li>2. Gary Cornell, Core Java 2 Volume I – Fundamentals, Addison Wesley, 1999.</li> </ol> </li> <li>• <b>Reference Books</b> <ol style="list-style-type: none"> <li>1. Head First Java, O’Rielly Publications,</li> <li>2. Y. Daniel Liang, <i>Introduction to Java Programming</i>, 7th Edition, Pearson Education India, 2010.</li> </ol> </li> </ul> <p><b>Web resources:</b> Web resources from NDL Library, E-content from open-source libraries</p>		

<b>Course Code: EC4</b>	<b>Resource Management Techniques</b>		<b>Credits: 3</b>
<b>Lecture Hours: (L) per week: 3</b>	<b>Tutorial Hours: (T) per week</b>	<b>Lab Practice Hours: (P) per week</b>	<b>Total: (L+T+P) per week: 3</b>
<b>Course Category: EC4</b>	<b>Year &amp; Semester: II Year IV Semester</b>	<b>Admission Year: 2023-2024</b>	
<b>Pre-requisite</b>	Basic knowledge of Mathematics		
<b>Learning Objectives:</b>			
<ul style="list-style-type: none"> <li>• To provide fundamental knowledge of OR</li> </ul>			

<ul style="list-style-type: none"> <li>• To understand the Linear Programming Problem</li> <li>• To apply the Simplex Method</li> <li>• To solve problems in Duality Theorems</li> <li>• To solve Mathematical formulation of Transportation Problem</li> </ul>		
<b>Course Outcomes:</b>		
<b>CO1:</b> Know how to solve various problems on OR		
<b>CO2:</b> Use Simplex Method to solve problems		
<b>CO3:</b> Duality Theorems and Linear Programming Problem concept are applied		
<b>CO4:</b> Apply, Mathematical formulation of Transportation Problem		
<b>Recap:</b> (not for examination) Motivation/previous lecture/relevant portions required for the course) [This is done during 2 Tutorial hours]		
<b>Units</b>	<b>Contents</b>	<b>Required Hours</b>
<b>I</b>	<b>Development of OR:</b> Definition of R – Modeling - Characteristics and Phases - Tools, Techniques & Methods - scope of OR.	<b>9</b>
<b>II</b>	<b>Linear Programming Problem:</b> Formulation - Slack & surplus variables - Graphical solution of LPP.	<b>9</b>
<b>III</b>	<b>Simplex Method:</b> Computational Procedure - Big-M method - Concept of duality in LPP - Definition of primal dual problems - General rules for converting any primal into its dual.	<b>9</b>
<b>IV</b>	<b>Duality Theorems:</b> (without proof) Primal dual correspondence - Duality and Simplex method - Mathematical formulation of assignment problem - Method for solving assignment problem.	<b>9</b>
<b>V</b>	<b>Mathematical formulation of Transportation Problem:</b> Methods for finding IBFS for the Transportation Problems.	<b>9</b>

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/other to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferable Skill	
<p><b>Learning Resources:</b></p> <p><b>Recommended Texts</b></p> <p>Operations Research, S.D. Sharma, Kedar Nath Ram Nath &amp; Co.</p> <p><b>Reference Books</b></p> <ul style="list-style-type: none"> <li>• Operation Research, Nita H. Shah, Ravi M. Gor and Hardiksoni, Prentice-Hall of India Pvt. Ltd., New Delhi 2008.</li> <li>• Operation Research, R. Sivarethinamohan, Tata McGraw Hill, 2005.</li> <li>• Operations Research – An Introduction by Hamdy A. Taha. Ninth Edition, Dorling Kindersley Pvt. Ltd., Noida, India, 2012.</li> </ul> <p><b>Web resources:</b> Web resources from NDL Library, E-content from open-source libraries</p>		

<b>Course Code: SEC-6</b>	<b>Ethical hacking Fundamentals</b>		<b>Credits: 2</b>
<b>Lecture Hours: (L) per week: 2</b>	<b>Tutorial Hours: (T) per week</b>	<b>Lab Practice Hours: (P) per week</b>	<b>Total: (L+T+P) per week: 2</b>
<b>Course Category: SEC-6</b>	<b>Year &amp; Semester: II Year IV Semester</b>		<b>Admission Year: 2023-2024</b>
<b>Pre-requisite</b>	Basic knowledge of networking		



<b>Learning Objectives:</b>		
To learn about the Ethical Hacking, Attacking methodology, Web and Network hacking, Report writing and Mitigation. On successful completion of this subject the students should have understood basic of Hacking and Penetration.		
<b>Course Outcomes:</b>		
CO1: To understand Hacking, Attacking methodology, Web and Network hacking		
CO2: Use Report writing and Mitigation		
CO3: To understand the basic of Hacking and Penetration		
<b>Recap:</b> (not for examination) Motivation/previous lecture/relevant portions required for the course) [This is done during 2 Tutorial hours)		
<b>Units</b>	<b>Contents</b>	<b>Required Hours</b>
<b>I</b>	<b>Introduction to Ethical Hacking</b> – Ethical Hacking – Difference between hacking and ethical hacking- Hacking Methodology- Process of Malicious Hacking- Foot printing and Scanning- Enumeration - System Hacking and Trojans and Black Box Vs White Box Techniques.	<b>5</b>
<b>II</b>	<b>Attacking methodology</b> - Denial of Service – Sniffers - Session Hijacking and Hacking Web Servers - Session Hijacking - Hacking Web Servers - Web Application Vulnerabilities and Web Techniques Based Password Cracking - Web Application Vulnerabilities - Web Based Password Cracking Techniques.	<b>6</b>
<b>III</b>	Web and Network hacking - SQL Injection - Hacking Wireless Networking – Viruses - Worms and Physical Security - Linux Hacking - Evading IDS and Firewalls.	<b>6</b>
<b>IV</b>	<b>Report writing</b> - Introduction to Report Writing - Demonstration of vulnerabilities.	<b>6</b>
<b>V</b>	<b>Mitigation</b> - Mitigation- requirements for low level reporting and high level reporting of Penetration testing results- Mitigation of issues identified including tracking.	<b>7</b>

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/other to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferable Skill	
<p><b>Learning Resources:</b>  <b>Recommended Texts</b></p> <ol style="list-style-type: none"> <li>1. Stuart McClure, Joel Scambray, George Kurtz, “Hacking Exposed” 7th Edition, McGraw Hill, 1 August 2012.</li> <li>2. Dexter Jackson, “Hacking: Ultimate Beginner's Guide to Computer Hacking in 2016; Hacking for Beginners, Hacking University, Hacking Made Easy, Hacking Exposed, Hacking Basics”, Create Space Independent Publishing Platform (30 August 2016).</li> <li>3.</li> </ol> <p><b>Reference Books</b></p> <ul style="list-style-type: none"> <li>• Patrick Engerbrestson, “Basic of Hacking and Penetration: Ethical Hacking and Penetration Testing Made Easy”, Syngress; 2 edition (12 September 2013).</li> <li>• Justin Hatmaker, “Hacking:: Penetration Testing, Basic Security and How To Hack”, Create Space Independent Publishing Platform (19 January 2016).</li> </ul> <p><b>Web resources:</b> Web resources from NDL Library, E-content from open-source libraries</p>		

<b>Course Code: SEC-7</b>	<b>Ethical hacking Fundamentals Lab</b>		<b>Credits: 2</b>
<b>Lecture Hours: (L) per week:</b>	<b>Tutorial Hours: (T) per week</b>	<b>Lab Practice Hours: (P) per week:</b>	<b>Total: (L+T+P) per week: 2</b>

		2	
<b>CourseCategory: SEC-7</b>	<b>Year&amp;Semester: II Year IV Semester</b>	<b>AdmissionYear: 2023-2024</b>	
<b>Pre-requisite</b>	Basic knowledge of networking		
<b>LearningObjectives:</b>			
<ul style="list-style-type: none"> <li>• To Introduces the ethical hacking methodologies</li> <li>• To understand the basic concepts of hacking</li> <li>• To gain knowledge about Ethical hacking and penetration testing.</li> </ul>			
<b>CourseOutcomes:</b>			
<ul style="list-style-type: none"> <li>• To able to understand the ethical hacking methodologies</li> <li>• To testing Ethical hacking and penetration</li> </ul>			
<b>Recap:</b> (notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)			
	<b>List of Exercises</b>	<b>RequiredHours</b>	
	<ul style="list-style-type: none"> <li>• PassiveReconnaissance using“Whois”andOnline tools.</li> <li>• ActiveReconnaissanceusing“Sampad”andweb site details.</li> <li>• FullScan,Half OpenScanandStealthscanusing“nmap”.</li> <li>• UDPandPingScanningusing“Advance LanScanner”and“ Super scan”.</li> <li>• Packetcraftingusing“Packet creator” tools.</li> <li>• ExploitingNet BIOS vulnerability.</li> <li>• PasswordRevelationfrombrowsersandsocialne tworking application.</li> <li>• CreatingandAnalyzingspoofed emails.</li> <li>• CreatingandAnalyzing Trojans.</li> <li>• OSpassword cracking.</li> </ul>	<b>30</b>	

**Third Year (Semester – V)**

<b>CourseCode: CC9</b>	<b>Software Engineering</b>		<b>Credits: 4</b>
<b>LectureHours:(L) perweek: 5</b>	<b>TutorialHours: (T)perweek</b>	<b>LabPractice Hours: (P)perweek</b>	<b>Total:(L+T+P) perweek: 5</b>
<b>CourseCategory:CC9</b>	<b>Year&amp;Semester: III Year V Semester</b>	<b>AdmissionYear: 2023- 2024</b>	
<b>Pre-requisite</b>	Basic Knowledge on Software Applications		
<b>LearningObjectives:(forteachers:whatttheyhavetodointheclass/lab/field)</b>			
<ul style="list-style-type: none"> <li>To understand the software engineering concepts and to create a system model in real life applications</li> </ul>			
<b>CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)</b>			
<b>CO1:</b> Gain basic knowledge of analysis and design of systems			
<b>CO2:</b> Ability to apply software engineering principles and techniques			
<b>CO3:</b> Model a reliable and cost-effective software system			
<b>CO4:</b> Ability to design an effective model of the system			
<b>CO5:</b> Perform Testing at various levels and produce an efficient system.			
<b>Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)</b>			
<b>Units</b>	<b>Contents</b>		<b>RequiredHours</b>
<b>I</b>	<p>Introduction: The software engineering discipline, programs vs. software products, why study software engineering, emergence of software engineering, Notable changes in software development practices, computer systems engineering.</p> <p>Software Life Cycle Models: Why use a life cycle model, Classical waterfall model, iterative waterfall model, prototyping model, evolutionary model, spiral model, comparison of different life cycle models.</p>		<b>15</b>

<p style="text-align: center;"><b>II</b></p>	<p><b>Requirements Analysis and Specification:</b> Requirements gathering and analysis, Software requirements specification (SRS)</p> <p><b>Software Design:</b> Good software design, cohesion and coupling, neat arrangement, software design approaches, object- oriented vs function-oriented design</p>	<p style="text-align: center;"><b>15</b></p>
<p style="text-align: center;"><b>III</b></p>	<p>Function-Oriented Software Design: Overview of SA/SD methodology, structured analysis, data flow diagrams (DFD's), structured design, detailed design.</p> <p>User-Interface design: Characteristics of a good interface; basic concepts; types of user interfaces; component based GUI development, a user interface methodology.</p>	<p style="text-align: center;"><b>15</b></p>
<p style="text-align: center;"><b>IV</b></p>	<p>Coding and Testing: Coding; code review; testing; testing in the large vs testing in the small; unit testing; black-box testing; white-box testing; debugging; program analysis tools; integration testing; system testing; some general issues associated with testing.</p> <p>Software Reliability and Quality Management: Software reliability; statistical testing; software quality; software quality management system; SEI capability maturity model; personal software process.</p>	<p style="text-align: center;"><b>15</b></p>
<p style="text-align: center;"><b>V</b></p>	<p>Computer Aided Software Engineering: CASE and its scope; CASE environment; CASE support in software life cycle; other characteristics of CASE tools; towards second generation CASE tool; architecture of a CASE environment.</p> <p>Software Maintenance: Characteristic of software maintenance; software reverse engineering; software maintenance process models; estimation of</p>	<p style="text-align: center;"><b>15</b></p>

	maintenance cost;	
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC– CSIR/GATE/TNPSC/other to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferable Skill	
<p><b>Learning Resources:</b></p> <ul style="list-style-type: none"> <li>• <b>Recommended Texts</b> <ol style="list-style-type: none"> <li>1. Rajib Mall, Fundamentals of Software Engineering, Fifth Edition, Prentice-Hall of India, 2018</li> </ol> </li> <li>• <b>Reference Books</b> <ol style="list-style-type: none"> <li>1. Richard Fairley, Software Engineering Concepts, Tata McGraw-Hill publishing company Ltd, Edition 1997.</li> <li>2. Roger S. Pressman, Software Engineering, Seventh Edition, McGraw-Hill.</li> <li>James A. Senn, Analysis &amp; Design of Information Systems, Second Edition, McGraw-Hill International Editions.</li> </ol> </li> </ul> <p><b>Web resources:</b> Web resources from NDL Library, E-content from open-source libraries</p>		

<b>CourseCode: CC-10</b>	<b>Database Management Systems</b>		<b>Credits:4</b>
<b>LectureHours:(L) perweek: 5</b>	<b>TutorialHours: (T)perweek</b>	<b>LabPractice Hours: (P)perweek</b>	<b>Total:(L+T+P) perweek: 5</b>
<b>CourseCategory:CC-10</b>	<b>Year&amp;Semester: III YEAR V SEMESTER</b>	<b>AdmissionYear: 2023- 2024</b>	
<b>Pre-requisite</b>	Basic knowledge on Data and its relations		
<p><b>LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)</b></p> <ul style="list-style-type: none"> <li>• To enable the students to learn the designing of data base systems, foundation on the relational model of data and normal forms.</li> <li>• To understand the concepts of data base management system, design simple Database models</li> <li>• To learn and understand to write queries using SQL, PL/SQL.</li> </ul>			
<p><b>CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)</b></p> <p><b>CO1:</b>Understand the various basic concepts of Data Base System. Difference between file system and DBMS and compare various data models.</p> <p><b>CO2:</b>Define the integrity constraints. Understand the basic concepts of Relational Data Model, Entity-Relationship Model.</p> <p><b>CO3:</b>Design database schema considering normalization and relationships within database. Understand and construct database using Structured Query Language. Attain a good practical skill of managing and retrieving of data using Data Manipulation Language (DML).</p> <p><b>CO4:</b> Classify the different functions and various join operations and enhance the knowledge of handling multiple tables.</p> <p><b>CO5:</b> Learn to design Data base operations and implement using PL/SQL programs. Learn basics of PL/SQL and develop programs using Cursors, Exceptions</p>			
<b>Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)</b>			
<b>Units</b>	<b>Contents</b>		<b>RequiredHours</b>
<b>I</b>	<b>Database Concepts:</b> Database Systems - Data vs Information - Introducing the database -File system -		<b>15</b>

	Problems with file system – Database systems. Data models - Importance - Basic Building Blocks - Business rules - Evolution of Data models - Degrees of Data Abstraction	
<b>II</b>	<b>Design Concepts:</b> Relational database model - logical view of data-keys -Integrity rules - relational set operators - data dictionary and the system catalog - relationships -data redundancy revisited -indexes - codd's rules. Entity relationship model - ER diagram	<b>15</b>
<b>III</b>	<b>Normalization of Database Tables:</b> Database tables and Normalization – The Need for Normalization –The Normalization Process – Higher level Normal Form.  <b>Introduction to SQL:</b> Data Definition Commands – Data Manipulation Commands – SELECT Queries – Additional Data Definition Commands – Additional SELECT Query Keywords – Joining Database Tables.	<b>15</b>
<b>IV</b>	<b>Advanced SQL:</b> Relational SET Operators: UNION – UNION ALL – INTERSECT - MINUS.SQL Join Operators: Cross Join – Natural Join – Join USING Clause – JOIN ON Clause – Outer Join. <b>Sub Queries and Correlated Queries:</b> WHERE – IN – HAVING – ANY and ALL – FROM. SQL Functions: Date and Time Function – Numeric Function – String Function – Conversion Function	<b>15</b>
<b>V</b>	<b>PL/SQL:</b> A Programming Language: History – Fundamentals – Block Structure – Comments – Data Types – Other Data Types – Variable Declaration – Assignment operation –Arithmetic operators. <b>Control Structures and Embedded SQL:</b> Control Structures –	<b>15</b>



	Nested Blocks – SQL in PL/SQL – Data Manipulation – Transaction Control statements. <b>PL/SQL Cursors and Exceptions:</b> Cursors – Implicit Cursors, Explicit Cursors and Attributes – Cursor FOR loops – SELECT...FOR UPDATE – WHERE CURRENT OF clause – Cursor with Parameters – Cursor Variables – Exceptions – Types of Exceptions.	
Extended Professional Component (a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC – CSIR/GATE/TNPSC/other to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferable Skill	
<p><b>Learning Resources:</b></p> <ul style="list-style-type: none"> <li>• <b>Recommended Texts</b> <ol style="list-style-type: none"> <li>1. Coronel, Morris, Rob, "Database Systems, Design, Implementation and Management", Ninth Edition</li> <li>2. Nilesh Shah, "Database Systems Using Oracle", 2nd edition, Pearson Education India, 2016</li> </ol> </li> <li>• <b>Reference Books</b> <ol style="list-style-type: none"> <li>1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, "Database System Concepts", McGraw Hill International Publication, VI Edition.</li> <li>2. Shio Kumar Singh, "Database Systems", Pearson publications, II Edition</li> </ol> </li> </ul> <p><b>Web resources:</b> Web resources from NDL Library, E-content from open-source libraries</p>		
<b>Course Code: CC-11</b>	<b>DATABASE MANAGEMENT SYSTEMS LAB</b>	<b>Credits: 4</b>

<b>LectureHours:(L) perweek</b>	<b>TutorialHour s: (T)perweek</b>	<b>LabPractice Hours: (P)perweek: 5</b>	<b>Total:(L+T+P) perweek:5</b>
<b>CourseCategory:CC-11</b>	<b>Year&amp;Semester: III Year V semester</b>	<b>AdmissionYear: 2023- 2024</b>	
<b>Pre-requisite</b>	Basic Knowledge on Database Tools		
<b>LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)</b>  Students can learn various SQL and PL/SQL commands, cursor and various applicationprograms.			
<b>CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)</b>  <b>CO1:</b> Understand the various basic concepts of Data Base System. Difference between file system and DBMS and compare various data models.  <b>CO2:</b> Define the integrity constraints. Understand the basic concepts of Relational Data Model, Entity-Relationship Model.  <b>CO3:</b> Design database schema considering normalization and relationships within database. Understand and construct database using Structured Query Language. Attain a good practical skill of managing and retrieving of data using Data Manipulation Language (DML).  <b>CO4:</b> Classify the different functions and various join operations and enhance the knowledge of handling multiple tables.  <b>CO5:</b> Learn to design Data base operations and implement using PL/SQL programs. Learn basics of PL/SQL and develop programs using Cursors, Exceptions			
<b>Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)</b>			
	<b>List of Exercises:</b>		<b>RequiredHours</b>
	<b><i>I. SQL</i></b>  1. DDLCOMMANDS 2. DMLCOMMANDS 3. TCLCOMMANDS		<b>75</b>

	<p><b>II. PL/SQL</b></p> <p>4. FIBONACCISERIES</p> <p>5. FACTORIAL</p> <p>6. STRINGREVERSE</p> <p>7. SUM OFSERIES</p> <p>8. TRIGGER</p> <p><b>III. CURSOR</b></p> <p>9. STUDENT MARK ANALYSIS USINGCURSOR</p> <p><b>IV. APPLICATION</b></p> <p>10. LIBRARY MANAGERMENTSYSTEM</p> <p>11. STUDENT MARKANALYSIS</p>	
<p>Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)</p>	<p>Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC– CSIR/GATE/TNPSC/other to be solved (To be discussed during the Tutorial hour)</p>	
<p>Skills acquired from the</p>	<p>Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable</p>	

course	Skill	
<p><b>LearningResources:</b></p> <ul style="list-style-type: none"> <li>• <b>RecommendedTexts</b> <ol style="list-style-type: none"> <li>1. Coronel, Morris, Rob, "Database Systems, Design, Implementation and Management", Ninth Edition</li> <li>2. Nilesh Shah, "Database Systems Using Oracle", 2nd edition, Pearson Education India, 2016</li> </ol> </li> <li>• <b>ReferenceBooks</b> <ol style="list-style-type: none"> <li>1. Abraham Silberschatz, Henry F.Korth and S.Sudarshan,“Database System Concepts”, McGraw Hill International Publication ,VI Edition.</li> <li>2. Shio Kumar Singh , “Database Systems “,Pearson publications ,II Edition</li> <li>3. Albert Lulushi, “Developing ORACLE FORMS Applications”, Prentice Hall ,1997</li> </ol> </li> </ul> <p><b>Webresources:</b> Web resources from NDL Library, E-content from open-source libraries</p>		

<b>CourseCode: EC5</b>	<b>Operating Systems</b>		<b>Credits: 3</b>
<b>LectureHours:(L) perweek: 4</b>	<b>TutorialHours: (T)perweek</b>	<b>LabPractice Hours: (P)perweek</b>	<b>Total:(L+T+P) perweek: 4</b>
<b>CourseCategory:EC-5</b>	<b>Year&amp;Semester:III Year V Semester</b>	<b>AdmissionYear: 2023-2024</b>	
<b>Pre-requisite</b>	Basic Knowledge on Computer and its functions		
<p><b>LearningObjectives:(forteachers:whatttheyhavetodointheclass/lab/field)</b></p> <ul style="list-style-type: none"> <li>• Understanding the design of the Operating System</li> <li>• Imparting knowledge on CPU scheduling, Process and Memory Management.</li> <li>• To code specialized programs for managing overall resources and operations of the computer.</li> </ul>			

<p><b>Course Outcomes:</b>(for students: To know what they are going to learn)</p> <p><b>CO1:</b> Define the fundamentals of OS and identify the concepts relevant to process, process life cycle, Scheduling Algorithms, Deadlock and Memory management</p> <p><b>CO2:</b> know the critical analysis of process involving various algorithms, an exposure to threads and semaphores</p> <p><b>CO3:</b> Have a complete study about Deadlock and its impact over OS. Knowledge of handling Deadlock with respective algorithms and measures to retrieve from deadlock. .</p> <p><b>CO4:</b> Have complete knowledge of Scheduling Algorithms and its types.</p> <p><b>CO5:</b> understand memory organization and management</p>		
<p><b>Recap:</b>(not for examination) Motivation/previous lecture/relevant portions required for the course)[This is done during 2 Tutorial hours)</p>		
Units	Contents	Required Hours
<b>I</b>	<p><b>Introduction:</b> operating system, history (1990s to 2000 and beyond), distributed computing, parallel computation.</p> <p><b>Process concepts:</b> definition of process, process states-Life cycle of a process, process management-process state transitions, process control block(PCB), process operations, suspend and resume, context switching, Interrupts -Interrupt processing, interrupt classes, Inter process communication-signals, message passing.</p>	<b>12</b>
<b>II</b>	<p><b>Asynchronous concurrent processes:</b> mutual exclusion- critical section, mutual exclusion primitives, implementing mutual exclusion primitives, Peterson's algorithm, software solutions to the mutual Exclusion Problem-, n-thread mutual exclusion- Lamports Bakery</p>	<b>12</b>

	<p>Algorithm. Semaphores – Mutual exclusion with Semaphores, thread synchronization with semaphores, counting semaphores, implementing semaphores.</p> <p><b>Concurrent programming:</b> monitors, message passing</p>	
<b>III</b>	<p><b>Deadlock and indefinite postponement:</b> Resource concepts, four necessary conditions for deadlock, deadlock prevention, deadlock avoidance and Dijkstra’s Banker’s algorithm, deadlock detection, deadlock recovery</p>	<b>12</b>
<b>IV</b>	<p><b>Job and processor scheduling:</b> scheduling levels, scheduling objectives, scheduling criteria, preemptive vs non-preemptive scheduling, interval timer or interrupting clock, priorities, scheduling algorithms- FIFO scheduling, RR scheduling, quantum size, SJF scheduling, SRT scheduling, HRN scheduling, multilevel feedback queues, Fair share scheduling</p>	<b>12</b>
<b>V</b>	<p><b>Real Memory organization and Management::</b> Memory organization, Memory management, Memory hierarchy, Memory management strategies, contiguous vs non-contiguous memory allocation, single user contiguous memory allocation, fixed partition multiprogramming, variable partition multiprogramming, Memory swapping</p> <p><b>Virtual Memory organization:</b> virtual memory basic concepts, multilevel storage organization, block mapping, paging basic concepts, segmentation, paging/segmentation systems.</p> <p><b>Virtual Memory Management:</b> Demand Paging, Page</p>	<b>12</b>

	replacement strategies	
Extended Professional Component (i.e. a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/other to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferable Skill	
<p><b>Learning Resources:</b></p> <ul style="list-style-type: none"> <li>• <b>Recommended Texts</b> <ol style="list-style-type: none"> <li>1. H.M. Deitel, Operating Systems, Third Edition, Pearson Education Asia, 2011</li> </ol> </li> <li>• <b>Reference Books</b> <ol style="list-style-type: none"> <li>1. William Stallings, Operating System: Internals and Design Principles, Seventh Edition, Prentice-Hall of India, 2012.</li> <li>2. A. Silberschatz, and P.B. Galvin., Operating Systems Concepts, Ninth Edition, John Wiley &amp; Sons (ASIA) Pte Ltd., 2012</li> </ol> </li> </ul> <p><b>Web resources:</b> Web resources from NDL Library, E-content from open-source libraries</p>		

<b>Course Code: EC6</b>	<b>Information Security</b>		<b>Credits: 3</b>
<b>Lecture Hours: (L) per week: 4</b>	<b>Tutorial Hours: (T) per week</b>	<b>Lab Practice Hours: (P) per week</b>	<b>Total: (L+T+P) per week: 4</b>
<b>Course Category: EC6</b>	<b>Year &amp; Semester: III Year V</b>		<b>Admission Year: 2023-</b>

		Semester	2024
<b>Pre-requisite</b>		Basic knowledge of network	
<p><b>Learning Objectives:</b>(for teachers: what they have to do in the class/lab/field)</p> <ul style="list-style-type: none"> <li>• To know the objectives of information security</li> <li>• Understand the importance and application of each of confidentiality, integrity, authentication and availability</li> <li>• Understand various cryptographic algorithms</li> <li>• Understand the basic categories of threats to computers and networks</li> </ul>			
<p><b>Course Outcomes:</b>(for students: To know what they are going to learn)</p> <p><b>CO1:</b> Understand network security threats, security services, and countermeasures</p> <p><b>CO2:</b> Understand vulnerability analysis of network security</p> <p><b>CO3:</b> Acquire background on hash functions; authentication; firewalls; intrusion detection techniques.</p> <p><b>CO4:</b> Gain hands-on experience with programming and simulation techniques for security protocols.</p> <p><b>CO5:</b> Apply methods for authentication, access control, intrusion detection and prevention.</p>			
<p><b>Recap:</b>(not for examination) Motivation/previous lecture/relevant portions required for the course)[This is done during 2 Tutorial hours)</p>			
Units	Contents	Required Hours	
I	Introduction to Information Security : Security mindset, Computer Security Concepts (CIA), Attacks, Vulnerabilities and protections, Security Goals, Security Services, Threats, Attacks, Assets, malware, program analysis and mechanisms.	12	
II	The Security Problem in Computing: The meaning of computer Security, Computer Criminals, Methods of Defense. Cryptography: Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption	12	



<b>III</b>	Symmetric and Asymmetric Cryptographic Techniques : DES, AES, RSA algorithms .Authentication and Digital Signatures : Use of Cryptography for authentication, Secure Hash function, Key management – Kerberos.	<b>12</b>
<b>IV</b>	Program Security : Non-malicious Program errors – Buffer overflow, Incomplete mediation, Time-of-check to Time-of-use Errors, Viruses, Trapdoors, Salami attack, Man-in-the-middle attacks, Covert channels. File protection Mechanisms, User Authentication Designing Trusted O.S: Security polices, models of security, trusted O.S design, Assurance in trusted O.S. Implementation examples.	<b>12</b>
<b>V</b>	Security in Networks : Threats in networks, Network Security Controls – Architecture, Encryption, Content Integrity, Strong Authentication, Access Controls, Wireless Security, Honeypots, Traffic flow security. Web Security: Web security considerations, Secure Socket Layer and Transport Layer Security, Secure electronic transaction.	<b>12</b>
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question	Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC– CSIR/GATE/TNPSC/other to be solved (To be discussed during the Tutorial hour)	

paper)		
Skillsacquire dfrom the course	Knowledge,ProblemSolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferrable Skill	
<p><b>LearningResources:</b></p> <ul style="list-style-type: none"> <li>• <b>RecommendedTexts</b> <ol style="list-style-type: none"> <li>1. Security in Computing, Fourth Edition, by Charles P. Pfleeger, Pearson Education</li> <li>2. Cryptography And Network Security Principles And Practice, Fourth or Fifth Edition, William Stallings, Pearson</li> </ol> </li> <li>• <b>ReferenceBooks</b> <ol style="list-style-type: none"> <li>1. Cryptography and Network Security: C K Shyamala, N Harini, Dr T R Padmanabhan, Wiley India, 1st Edition.</li> <li>2. Cryptography and Network Security: ForouzanMukhopadhyay, McGraw Hill, 2"d Edition</li> <li>3. Information Security, Principles and Practice: Mark Stamp, Wiley India.</li> <li>4. Principles of Computer Sceurity: WM.Arthur Conklin, Greg White, TMH</li> </ol> </li> <li>• <b>Webresources:</b> Web resources from NDL Library, E-content from open-source libraries</li> </ul>		

### Third Year (Semester – VI)

<b>CourseCode: CC-13</b>	<b>Computer Networks</b>		<b>Credits: 4</b>
<b>LectureHours:(L) perweek: 6</b>	<b>TutorialHours: (T)perweek</b>	<b>LabPractice Hours: (P)perweek</b>	<b>Total:(L+T+P) perweek: 6</b>
<b>CourseCategory:CC-13</b>	<b>Year&amp;Semester: III Year VI Semester</b>		<b>AdmissionYear: 2023- 2024</b>

<b>Pre-requisite</b>	Basic Knowledge on Networking	
<b>Learning Objectives:</b> (for teachers: what they have to do in the class/lab/field) <ul style="list-style-type: none"> <li>• To understand the concept of Data communication and Computer network</li> <li>• To get a knowledge on routing algorithms.</li> <li>• To impart knowledge about networking and inter networking devices</li> </ul> <p>To gain the knowledge on Security over Network communication</p>		
<b>Course Outcomes:</b> (for students: To know what they are going to learn) <p><b>CO1:</b>To Understand the basics of Computer Network architecture, OSI and TCP/IP reference models</p> <p><b>CO2:</b>To gain knowledge on Telephone systems and Satellite communications</p> <p><b>CO3:</b>To impart the concept of Elementary data link protocols</p> <p><b>CO4:</b> To analyze the characteristics of Routing and Congestion control algorithms</p> <p><b>CO5:</b> To understand network security and define various protocols such as FTP, HTTP, Telnet, DNS</p>		
<b>Recap:</b> (not for examination) Motivation/previous lecture/relevant portions required for the course)[This is done during 2 Tutorial hours)		
<b>Units</b>	<b>Contents</b>	<b>Required Hours</b>
<b>I</b>	Introduction – Network Hardware – Software – Reference Models – OSI and TCP/IP Models – Example Networks: Internet, ATM, Ethernet and Wireless LANs - Physical Layer – Theoretical Basis for Data Communication - Guided Transmission Media	<b>18</b>
<b>II</b>	Wireless Transmission - Communication Satellites – Telephone System: Structure, Local Loop, Trunks and Multiplexing and Switching. Data Link Layer: Design Issues – Error Detection and Correction.	<b>18</b>
<b>III</b>	Elementary Data Link Protocols - Sliding Window Protocols – Data Link Layer in the Internet - Medium Access Layer –	<b>18</b>

	Channel Allocation Problem – Multiple Access Protocols – Bluetooth	
<b>IV</b>	Network Layer - Design Issues - Routing Algorithms - Congestion Control Algorithms – IP Protocol – IP Addresses – Internet Control Protocols.	<b>18</b>
<b>V</b>	Transport Layer - Services - Connection Management - Addressing, Establishing and Releasing a Connection – Simple Transport Protocol – Internet Transport Protocols (ITP) - Network Security: Cryptography.	<b>18</b>
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC – CSIR/GATE/TNPSC/other to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferable Skill	

**LearningResources:**

- **RecommendedTexts**

1. A. S. Tanenbaum, “Computer Networks”, 4th Edition, Prentice-Hall of India, 2008.

- **ReferenceBooks**

1. B. A. Forouzan, “Data Communications and Networking”, Tata McGraw Hill, 4th Edition, 2017.
2. F. Halsall, “Data Communications, Computer Networks and Open Systems”, Pearson Education, 2008.
3. D. Bertsekas and R. Gallager, “Data Networks”, 2nd Edition, PHI, 2008.
4. Lamarca, “Communication Networks”, Tata McGraw- Hill, 2002

**Webresources:** Web resources from NDL Library, E-content from open-source libraries

<b>CourseCode: CC14</b>	<b>Computer Forensics and Investigation</b>		<b>Credits: 4</b>
<b>LectureHours:(L) perweek: 6</b>	<b>TutorialHours: (T)perweek</b>	<b>LabPractice Hours: (P)perweek</b>	<b>Total:(L+T+P) perweek: 6</b>
<b>CourseCategory: CC14</b>	<b>Year&amp;Semester: III Year VI Semester</b>		<b>AdmissionYear: 2023- 2024</b>
<b>Pre-requisite</b>	Basic knowledge of networking		
<b>LearningObjectives:</b>			
This course deals with Computer Forensics and Investigation. On successful completion of this subject the students should have understood			
<ul style="list-style-type: none"> <li>• Computer Forensics</li> <li>• Storage Devices</li> <li>• ForensicsTechniques</li> <li>• CyberLaw</li> </ul>			
<b>CourseOutcomes:</b>			
<b>CO1:</b> To Understand the basics of Computer Forensics			
<b>CO2:</b> To gain knowledge on Forensics Techniques			
<b>CO3:</b> To impart the concept of CyberLaw			

<b>Recap:</b> (notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)		
<b>Units</b>	<b>Contents</b>	<b>RequiredHours</b>
<b>I</b>	<b>Computer Forensics</b> - Introduction to Computer Forensics - Forms of Cyber Crime -First Responder Procedure- Non-technical staff - Technical Staff - Forensics Expert and ComputerInvestigationprocedure.	<b>18</b>
<b>II</b>	<b>Storage Devices &amp; Data Recover Methods</b> - Storage Devices- Magnetic Medium - Non- magnetic medium and Optical Medium - Working of Storage devices-Platter - Head assembly- spindle motor - Data Acquisition - Data deletion and data recovery method andtechniques.	<b>18</b>
<b>III</b>	<b>Forensics Techniques</b> - Windows forensics - Linux Forensics - Mobile Forensics –Steganography- ApplicationPasswordcracking-Bruteforce- Dictionaryattack-Rainbowattack -Email Tacking– Headeroption of SMTP, POP3,IMAP.	<b>18</b>
<b>IV</b>	<b>Cyber Law</b> - Corporate espionage - Evidence handling procedure - Chain of custody -Mainfeatures ofIndianITAct 2008 (Amendment).	<b>18</b>
<b>V</b>	<b>RoleofDigitalEvidence</b> -DigitalEvidence– AuthenticationofEvidence-Importance of digital evidences in investigation and in court of law – Capabilities of a digitalforensicinvestigator.	<b>18</b>
ExtendedProfessionalComponent(isa partofinternal component only,Notto be included in the	Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminationsUPSC/TRB/NET/UGC– CSIR/GATE/TNPSC/otherstobesolved(Tob ediscussedduringtheTutorialhour)	

External Examination question paper)		
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferable Skill	
<p><b>Learning Resources:</b></p> <p><b>Recommended Texts</b></p> <ol style="list-style-type: none"> <li>1. B. Nelson, "Guide to Computer Forensics and Investigations", 3rd Edition, Cengage, 2010 BBS.</li> <li>2. Marie-Helen Maras, "Computer Forensics: Cyber Criminals, Laws and Evidence", 1st edition, Jones and Bartlett Publishers, 1 February 2011.</li> <li>3. John.R. Vacca, "Computer Forensics, Computer Crime Scene Investigation", 2nd Edition, Charles River Media Publication, 15 June 2002.</li> </ol> <p><b>Reference Books</b></p> <ul style="list-style-type: none"> <li>• Aaron Philipp, David Cowen, Chris Davis, "Hacking Exposed Computer Forensics", Pub: McGrawHill-2011.</li> <li>• Albert Marcella, Jr., Doug Menendez, "Cyber Forensics: A field manual for collecting, Examining, preserving evidence of computer crimes", Second Edition, CRC Press 2007.</li> <li>• Bill Nelson, Amelia Phillips, Christopher Steuart, "Guide to Computer Forensics and Investigations, Processing Digital Evidence", 4th edition, Delmar Cengage Learning, 28 Oct 2009.</li> <li>• Larry Daniel, Lars Daniel, "Digital Forensics for Legal Professionals - Understanding Digital Evidence from the Warrant to the Courtroom", 1st edition, Syngress, 14 October 2011.</li> </ul> <p><b>Web resources:</b> Web resources from NDL Library, E-content from open-source libraries</p>		

<b>CourseCode: CC15</b>	<b>Computer Forensics and Investigation Lab</b>		<b>Credits: 4</b>
<b>LectureHours:(L) perweek:</b>	<b>TutorialHours: (T)perweek</b>	<b>LabPractice Hours: (P)perweek: 6</b>	<b>Total:(L+T+P) perweek: 6</b>
<b>CourseCategory: CC15</b>	<b>Year&amp;Semester: III Year VI Semester</b>	<b>AdmissionYear: 2023- 2024</b>	
<b>Pre-requisite</b>	Basic knowledge of programming skill		
<ul style="list-style-type: none"> <li>• <b>LearningObjectives:</b>Students can AnalysingWord processingandGraphicfile format.</li> </ul>			
<b>CourseOutcomes:</b> <ul style="list-style-type: none"> <li>• To gain knowledge onNetworkdatasniffingand analyzing, Passwordandencryption techniques, InternetforensicandMalware analysis</li> </ul>			
<b>Recap:</b> (notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)			
	<b>List of Exercises</b>		<b>RequiredHours</b>
	<ul style="list-style-type: none"> <li>• PhysicalCollectionofelectronicvidenceusingforensicstandards.</li> <li>• Dismantlingand re-buildingPCs in orderto access thestoragemediasafely.</li> <li>• BootsequenceandPowerOnSelf-Testmodeanalysis.</li> <li>• ExaminationofFilesystemsofWindows, LinuxandMac.</li> <li>• AnalysingWord processingandGraphicfileformat.</li> <li>• Networkdatasniffingandanalyzing.</li> <li>• Passwordandencryptiontechniques.</li> <li>• InternetforensicandMalwareanalysis.</li> <li>• Datarecoverytechniques forharddrive.</li> <li>• DatarecoverytechniquesforPen drive andCD.</li> </ul>		<b>90</b>



<b>CourseCode: EC7</b>	<b>Cryptography</b>		<b>Credits: 3</b>
<b>LectureHours:(L) perweek: 5</b>	<b>TutorialHours: (T)perweek</b>	<b>LabPractice Hours: (P)perweek</b>	<b>Total:(L+T+P) perweek: 5</b>
<b>CourseCategory:EC7</b>	<b>Year&amp;Semester:III Year VI Semester</b>	<b>AdmissionYear: 2023- 2024</b>	
<b>Pre-requisite</b>	Basic skills on internet and its functions		
<b>LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)</b> This course deals with an overview of Cryptography. The goal of this paper is to make a student learn the basic concepts of Cryptography, Algorithms, Key Management, and Encryption Techniques. To inculcate knowledge on Cryptography and its Techniques.			
<b>CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)</b> CO1:To understand the concepts of Cryptography CO2: To apply the Cryptography and Encryption Techniques.			
<b>Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)</b>			
<b>Units</b>	<b>Contents</b>		<b>RequiredHours</b>
<b>I</b>	<b>Introduction to Cryptography</b> - Defining Cryptography, Privacy, Authentication, Shift Cipher - The Confidentiality - Integrity and Availability (CIA) Triad - Cryptographic concepts - methodologies and practices – Symmetric and Asymmetric cryptography – public and private keys - Cryptographic algorithms and uses – Construction and use of Digital signatures.		<b>15</b>
<b>II</b>	<b>Types of Algorithms</b> - The basic functionality of hash/crypto algorithms (DES, RSA, SHA, MD5, HMAC, DSA) and effects on key length concepts in Elliptical Curve Cryptography and Quantum Cryptography.		<b>15</b>
<b>III</b>	<b>Key Management</b> - The basic functions involved in key management including creation – distribution – verification -		<b>15</b>

	revocation and destruction – storage - recovery and life span and how these functions affect cryptographic integrity.	
<b>IV</b>	Application of Cryptography - Major key distribution methods and algorithms including Kerberos - ISAKMP etc., - Vulnerabilities to cryptographic functions - the Use and functions of Certifying Authorities (CAs) - Public Key Infrastructure (PKI) and System architecture requirements for implementing cryptographic functions.	<b>15</b>
<b>V</b>	<b>Cryptology</b> - Classical Encryption Techniques - Substitution Techniques - Transposition Techniques – Permutation Methods - Confidentiality using conventional encryption - Placement of Encryption - Symmetric and Asymmetric crypto systems – common crypto standards and applications.	<b>15</b>
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC – CSIR/GATE/TNPSC/other to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferable Skill	

**Learning Resources:****Recommended Texts**

- V. I Ashchenko, “Cryptography: An Introduction”, Pub: American Mathematical Society 2002.
- John E. Hershey, “Cryptography demystified”, McGrawHill Education (1 September 2002).

**Reference Books**

1. Song Y. Yan, “Cryptanalytic attacks on RSA”, Springer; Softcover reprint of hardcover, 1st ed. 2008 edition (12 February 2010).
2. Harold F. Tipton, “Official (ISC)2 Guide to the CISSP CBK”, Second Edition – 2005.

**Web resources:** Web resources from NDL Library, E-content from open-source libraries

<b>Course Code: EC8</b>	<b>Cyber Security</b>		<b>Credits: 3</b>
<b>Lecture Hours: (L) per week: 5</b>	<b>Tutorial Hours: (T) per week</b>	<b>Lab Practice Hours: (P) per week</b>	<b>Total: (L+T+P) per week: 5</b>
<b>Course Category: EC8</b>	<b>Year &amp; Semester: III Year VI Semester</b>	<b>Admission Year: 2023- 2024</b>	
<b>Pre-requisite</b>	Basic skills on internet and its functions		
<b>Learning Objectives:</b> (for teachers: what they have to do in the class/lab/field)			
The students will be able to			
<ul style="list-style-type: none"> <li>• Understand various block cipher and stream cipher models</li> <li>• Describe the principles of public key cryptosystems, hash functions and digital signature</li> <li>• To get a firm knowledge on Cyber Security Essentials</li> </ul>			

<p><b>Course Outcomes:</b>(for students: To know what they are going to learn)</p> <p><b>CO1:</b> Implement basic security algorithms required by any computing system</p> <p><b>CO2:</b> Analyze the vulnerabilities in any computing system and hence be able to design a security solution</p> <p><b>CO3:</b> Analyze the possible security attacks in complex real time systems and their effective countermeasures</p> <p><b>CO4:</b> Differentiate various governing bodies of cyber laws</p> <p><b>CO5:</b> Impart various privacy policies for an organization</p>		
<p><b>Recap:</b>(not for examination) Motivation/previous lecture/relevant portions required for the course)[This is done during 2 Tutorial hours)</p>		
<b>Units</b>	<b>Contents</b>	<b>Required Hours</b>
<b>Unit I</b>	<p><b>Introduction to Security</b></p> <p>Data Encryption Standard-Block cipher principles-block cipher modes of operation-Advanced Encryption Standard (AES)-Triple DES-Blowfish-RC5 algorithm.</p>	<b>15</b>
<b>Unit II</b>	<p><b>Public Key Cryptography and Hash Algorithms</b></p> <p>Principles of public key cryptosystems-The RSA algorithm- Key management - Diffie Hellman Key exchange- Hash functions-Hash Algorithms (MD5, Secure Hash Algorithm</p>	<b>15</b>
<b>Unit III</b>	<p><b>Fundamentals of Cyber Security</b></p> <p>How Hackers Cover Their Tracks- Fraud Techniques- Threat Infrastructure- Techniques to Gain a Foothold (Shellcode, SQL Injection, Malicious PDF Files)- Misdirection, Reconnaissance, and Disruption Methods.</p>	<b>15</b>

<b>Unit IV</b>	<b>Planning for Cyber Security</b>  Privacy Concepts -Privacy Principles and Policies - Authentication and Privacy - Data Mining - Privacy on the Web - Email Security - Privacy Impacts of Emerging Technologies.	<b>15</b>
<b>Unit V</b>	<b>Cyber Security Management</b>  Security Planning - Business Continuity Planning - Handling Incidents - Risk Analysis - Dealing with Disaster – Legal Issues – Protecting programs and Data – Information and the law – Rights of Employees and Employers - Emerging Technologies - The Internet of Things - Cyber Warfare.	<b>15</b>
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC– CSIR/GATE/TNPSC/other to be solved (To be discussed during the Tutorial hour)	
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferable Skill	

**Learning Resources:**

- **Recommended Texts**

1. William Stallings, “Cryptography and Network Security”, Pearson Education, 6th Edition, 2013.
2. Charles P. Pfleeger Shari Lawrence Pfleeger Jonathan Margulies, Security in Computing, 5<sup>th</sup> Edition, Pearson Education, 2015.

- **Reference Books**

1. Graham, J. Howard, R., Olson, R., Cyber Security Essentials, CRC Press, 2011.
2. George K. Kostopoulos, Cyber Space and Cyber Security, CRC Press, 2013.

**Web resources:** Web resources from NDL Library, E-content from open-source libraries

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks			
									CIA	External	Total	
SEC8	Quantitative Aptitude	Skill Enha. Course (SEC)	2	-	-	-	2	2	25	75	100	
<b>Learning Objectives</b>												
LO1	To understand the basic concepts of numbers											
LO2	Understand and apply the concept of percentage, profit & loss											
LO3	To study the basic concepts of time and work, interests											
LO4	To learn the concepts of permutation, probability, discounts											
LO5	To study about the concepts of data representation, graphs											
UNIT	Contents							No. of Hours				
I	Numbers-HCF and LCM of numbers-Decimal fractions-Simplification-Square root and cube roots - Average-problems on Numbers.							6				
II	Problems on Ages - Surds and Indices - percentage - profits and loss - ratio and proportion-partnership-Chain							6				

	rule.	
III	Time and work - pipes and cisterns - Time and Distance - problems on trains -Boats and streams - simple interest - compound interest - Logarithms - Area-Volume and surface area -races and Games of skill.	6
IV	Permutation and combination-probability-True Discount-Bankers Discount – Height and Distances-Odd man out & Series.	6
V	Calendar - Clocks - stocks and shares - Data representation - Tabulation – Bar Graphs- Pie charts- Line graphs.	6
	<b>Total</b>	<b>60</b>
<b>Course Outcomes</b>		<b>Programme Outcome</b>
CO	On completion of this course, students will	
CO1	understand the concepts, application and the problems of numbers	PO1
CO2	To have basic knowledge and understanding about percentage, profit & loss related processings	PO1, PO2
CO3	To understand the concepts of time and work	PO4, PO6
CO4	Speaks about the concepts of probability, discount	PO4, PO5
CO5	Understanding the concept of problem solving involved in stocks & shares, graphs	PO3, PO6
<b>Text Book</b>		
1	“QuantitativeAptitude”,R.S.AGGARWAL.,S.Chand&CompanyLtd.,	
<b>Reference Books</b>		
1.		
<b>Web Resources</b>		
1.	<a href="https://www.javatpoint.com/aptitude/quantitative">https://www.javatpoint.com/aptitude/quantitative</a>	
2.	<a href="https://www.toppr.com/guides/quantitative-aptitude/">https://www.toppr.com/guides/quantitative-aptitude/</a>	