APPENDIX – BE

MADURAIKAMARAJUNIVERSITY

(University withPotentialforExcellence)

B.Sc.Computer Science (Data Science and Analytics)

CHOICE BASED CREDIT SYSTEM REVISED SYLLABUS
(Witheffect from2023-24)

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 ofthesubjects 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
Part I	3	3	3	3	-	-	12
Part II	3	3	3	3	-	-	12
Part III	13	13	13	13	22	18	92
Part IV	4	4	3	6	4	2	23
Part V	-	-	-	-	-	1	1
Total	23	23	22	25	26	21	**140**

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

1. Introduction

B.Sc. Computer Science (Data Science and Analytics)

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(Data Science and Analytics)

- Scientific aptitude will be developed in Students
- 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(Data Science and Analytics)

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 real-time 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 – Statistics with R Programming, Data Science, Machine learning. Internet of Things and Artificial Intelligence etc..

5. Value additions in the Revamped Curriculum:

Semester	Newly introduced Components	Outcome / Benefits
I	**Foundation Course** 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.	• Instil confidence among students • Create interest for the subject
I, II, III, IV	**Skill Enhancement papers** (Discipline centric / Generic / Entrepreneurial)	• Industry ready graduates • Skilled human resource • Students are equipped with essential skills to make them employable
		• Training on Computing / Computational skills enable the students gain knowledge and exposure on latest computational aspects
		• Data analytical skills will enable students gain internships, apprenticeships, field work involving data collection, compilation, analysis etc.
		• Entrepreneurial skill training will provide an opportunity for independent livelihood • Generates self – employment • Create small scale entrepreneurs • Training to girls leads to women empowerment
		• Discipline centric skill will improve the Technical knowhow of solving real life problems using ICT tools
III, IV, V & VI	Elective papers- An open choice of topics categorized under Generic and Discipline Centric	• Strengthening the domain knowledge • Introducing the stakeholders to the State-of Art techniques from the streams of multi-disciplinary, cross disciplinary and inter disciplinary nature • Students are exposed to Latest topics on Computer Science / IT, that require strong mathematical background

		• 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 sectors
IV	Industrial Statistics	• Exposure to industry moulds students into solution providers • Generates Industry ready graduates • Employment opportunities enhanced
II year Vacation activity	Internship / Industrial Training	• Practical training at the Industry/ Banking Sector / Private/ Public sector organizations / Educational institutions, enable the students gain professional experience and also become responsible citizens.
V Semester	Project with Viva – voce	• Self-learning is enhanced • Application of the concept to real situation is conceived resulting in tangible outcome
VI Semester	Introduction of Professional Competency component	• 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; • '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.
Extra Credits: **For Advanced Learners / Honors degree**		• To cater to the needs of peer learners / research aspirants
Skills acquired from the Courses		Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

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 –/	4	5	6.4 Elective -VII Generic/	3	5

												Project with viva-voce CC - XII			Discipline Specific		
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				
	23	**30**		**23**	**30**		**22**	**30**		**25**	**30**		**26**	**30**		**21**	**30**
Total – 140 Credits																	

B.Sc. Computer Science (Data Science & Analytics) Curriculum

First Year Semester-I

Part	Subjects	Credits	Hours	Internal Marks	External Marks
Part-I	Language	3	6	25	75
Part-II	English	3	6	25	75
Part-III	CC1: Programming in C	5	5	25	75
	CC2: Practical :Programming in C 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
	TOTAL	**23**	**30**		

First Year - Semester-II

Part	Subjects	Credits	Hours	Internal Marks	External Marks
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	SEC-2 (Non Major Elective) - Quantitative Aptitude	2	2	25	75
	Skill Enhancement Course – SEC-3 (Discipline / Subject Specific) – Digital Computer Fundamentals	2	2	25	75
	TOTAL	**23**	**30**		

Second Year - Semester-III

PART	Subjects	Credits	Hours	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 - Practical: 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) – PHP Programming Lab	1	1	25	75
	Skill Enhancement Course -SEC-5 (Discipline Specific/ Generic) – Advanced Excel	2	2	25	75
	Environmental Studies	-	1	-	-
	TOTAL	**22**	**30**		

Second Year - Semester-IV

Part	Subjects	Credits	Hours	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) – Database Management systems	3	3	25	75
Part-IV	Skill Enhancement Course – SEC-6: Database Management systems Lab	2	2	25	75

	Skill Enhancement Course - SEC-7 – Resource Management Techniques	2	2	25	75
	Environmental Science	2	1	25	75
	TOTAL	**25**	**30**		

Third Year Semester-V

Part	List of Courses	Credit	Hours	Internal Marks	External Marks
Part-III	CC9 - Software Engineering	4	5	25	75
	CC10 - Data Preparation and Visualization	4	5	25	75
	CC11 - Practical: Data Preparation and Visualization Lab	4	5	25	75
	Elective Course – EC5 (Generic / Discipline Specific) – Business Analytics	3	4	25	75
	Elective Course – EC6 (Generic / Discipline Specific) – Business Analytics Programming Lab	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	-	-	-
	TOTAL	**26**	**30**		

Third Year Semester-VI

Part	List of Courses	Credit	Hours	Internal Marks	External Marks
Part-III	CC13 - Computer Networks	4	6	25	75
	CC14 - Big Data Analytics	4	6	25	75
	CC15 – Statistical Data Analysis	4	6	25	75
	Elective Course – EC7 (Generic / Discipline Specific) – Machine Learning	3	5	25	75
	Elective Course – EC8 (Generic / Discipline Specific) –	3	5	25	75

	Statistical data Analysis Lab				
Part-IV	Professional Competency Skill Enhancement Course SEC8-Quantitative Aptitude	2	2	25	75
Part -V	Extension Activity	1	-	-	-
	TOTAL	**21**	**30**		

Total Credits: 140

FIRST YEAR I SEMESTER				
CourseCode -CC1	**CC1: Programming in C**			**Credits 5**
	LectureHours:(L) Perweek - 5	**TutorialHours: (T)perweek**	**LabPractice Hours: (P)perweek**	**Total:(L+T+P) Perweek: 5**
CourseCategory: Core		**Year: I Semester: I**	**AdmissionYear: 2023-2024**	
Pre-requisite		Basic Knowledge of Programming concept		

LearningObjectives:

- To gain knowledge in C language.
- To inculcate fundamental programming skills.

CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)

CO1: Remember the program structure of C with its syntax and semantics

CO2: Understand the programming principles in C (data types, operators, branching and looping, arrays, functions, structures, pointers and files)

CO3: Apply the programming principles learnt in real-time problems

CO4: Analyze the various methods of solving a problem and choose the best method

CO5: Code, debug and test the programs with appropriate test cases

Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)

Units	**Contents**	**RequiredHours**
I	**Overview of C:** Importance of C, sample C program, C program structure, executing C program. Constants, Variables,	**15**

	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. **Operators and Expression**: Arithmetic, Relational, logical, assignment, increment, decrement, conditional, bitwise and special operators, arithmetic expressions, operator precedence, type conversions, mathematical functions Managing Input and Output Operators: Reading and writing a character, formatted input, formatted output.	
II	**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.	**15**
III	**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.	**15**
IV	**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.	**15**

V	**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.	**15**
ExtendedProfessionalComponent (isapartofinternalcomponent only,Notto be includedin the ExternalExaminationquestion paper)	Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminationsUPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/otherstobesolved(TobediscussedduringtheTutorialhour)	
Skillsacquired from the course	Knowledge,ProblemSolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferrable Skill	

LearningResources:

- **RecommendedTexts**
  1. E. Balagurusamy, Programming in ANSI C, Fifth Edition, Tata McGraw-Hill, 2010.
- **ReferenceBooks**
  1. Byron Gottfried, Schaum's Outline Programming with C, Fourth Edition, Tata McGraw-Hill, 2018.
  2. Kernighan and Ritchie, The C Programming Language, Second Edition, Prentice Hall, 1998.

FIRST YEAR I SEMESTER			
CourseCode : CC2	**CC2: Practical : Programming in C Lab**		**Credits 5**
LectureHours:(L) Perweek	**TutorialHours: (T)perweek**	**LabPractice Hours: (P)perweek :5**	**Total:(L+T+P) Perweek 5**
CourseCategory:Core	**Year: I Semester: I**	**AdmissionYear:2023-2024**	
Pre-requisite			

LearningObjectives:

- To implement programming skills using C
- To impart knowledge and provide efficient solutions for real time problems using C language

CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)

CO1: Remember and understand how to write programs using the basic syntax and semantics in C

CO2: Apply the concepts of functions, macros, arrays, structures, pointers and files in programs to solve problems

CO3: Analyze and understand programs written in C language

CO4: Evaluate the program execution flow with test cases and apply debugging

CO5: Design algorithms and write programs in C language for the given problems

Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)

Units	Contents	Required hours
	Variables, Data types, Constants and Operators 1. Evaluation of expression ex: ((x+y) ^2 * (x+z))/w 2. Temperature conversion problem (Fahrenheit to Celsius) 3. Program to convert days to months and days (Ex: 364 days = 12 months and 4 days) 4. Solution of quadratic equation 5. Salesman salary (Given: Basic Salary, Bonus for every item sold, commission on the total monthly sales)	**75**
	Decision making Statements	

	6. Maximum of three numbers 7. Calculate Square root of five numbers (using goto statement) 8. Pay-Bill Calculation for different levels of employee (Switch statement) 9. Fibonacci series 10. Floyds Triangle 11. Pascal's Triangle	
	Arrays, Functions and Strings 12. Prime numbers in an array 13. Sorting data (Ascending and Descending) 14. Matrix Addition and Subtraction 15. Matrix Multiplication 16. Function with no arguments and no return values 17. Function that convert lower case letters to upper case 18. Factorial using recursion. 19. Perform String Operations using Switch Case.	
	Structures and Macros 20. Structure that describes a Hotel (name, address, grade,avg room rent, number of rooms) Perform some operations (list of hotels of a given grade etc.) 21. Using Pointers in Structures. 22. Cricket team details using Union. 23. Write a macro that calculates the max and min of two numbers	

	24. Nested macro to calculate Cube of a number.	
	Pointers and Files 25.Evaluation of Pointer expressions 26.Function to exchange two pointer values 27.Creation, insertion and deletion in a linked list 28.Program to read a file and print the data. 29.Program to receive a file name and a line of text as command line arguments and write the text to the file 30. Program to copy the content of one file to another file.	
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/others 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 Transferrable Skill	

LearningResources:

- **RecommendedTexts**
  1. E. Balagurusamy, Programming in ANSI C, Fifth Edition, Tata McGraw-Hill, 2010.
- **ReferenceBooks**
  1. Byron Gottfried, Schaum's Outline Programming with C, Fourth Edition, Tata McGraw-Hill, 2018.

2. Kernighan and Ritchie, The C Programming Language, Second Edition, Prentice Hall, 1998.
3. YashavantKanetkar, Let Us C, Eighteenth Edition, BPB Publications, 2021

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

FIRST YEAR I SEMESTER			
CourseCode: EC-1	**DISCRETE MATHEMATICAL STRUCTURES**		**Credits: 3**
LectureHours:(L) Perweek: 4	**TutorialHours: (T)perweek**	**LabPractice Hours: (P)perweek**	**Total:(L+T+P) Perweek: 4**
CourseCategory:Generic / Discipline Specific	**Year : I Semester: I**	**AdmissionYear:2023-2024**	
Pre-requisite	Basic Knowledge on probability and mathematical logic		

LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)

To understand the mathematical concepts like set theory, logics, number theory, combinatory and relations.

CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)

CO1: To gain knowledge on set theory.

CO2: Able to understand different mathematical logics and functions.

CO3: To get an idea on Permutations and Combinations.

CO4: Understanding the different form of number theory.

CO5: Able to understand Relations and its applications.

Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)

Units	**Contents**	**RequiredHours**

I	**SET THEORY** - 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 andDuality	**12**
II	***MATHEMATICAL LOGIC*** **-** 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-	**12**
III	***NUMBER THEORY*** **-** The Integers and Division, Integers and Algorithms,(Multiplication, Addition and Division - Sequences and Summations, Recursive algorithms, Program correctness.	**12**
IV	**COMBINATORICS: -** The basics of counting, the pigeonhole principle, Permutations and Combinations, Binomial coefficients, Generalized permutations and combinations	**12**
V	***RELATIONS*** **-** Relations – Relations and their properties, Representing Relations, Closures of relations, Equivalence relations, Partial orderings-Recurrence Relations Binary Relations.	**12**
Extended Professional Component (is a part of internal component only, Not to be included in the	Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/others to be solved (To be discussed during the Tutorial hour)	

External Examination question paper)		
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable 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 Reprint2011

- **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, Pretitice – 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.

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

FIRST YEAR I SEMESTER			
CourseCode : SEC-1	**Office Automation**		**Credits 2**
LectureHours:(L) Perweek : 2	**TutorialHours: (T)perweek**	**LabPractice Hours: perweek**	**Total:(L+T+P) Perweek 2**
CourseCategory: Skill	**Year : I Semester: I**		**AdmissionYear:**

Enhancement Course		**2023-2024**
Pre-requisite	Basic skills in Computer operations	
Linksto otherCourses	NIL	

LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)

- The major objective in introducing the Computer Skills course is to impart training forstudents in Microsoft Office which has different components like MS Word, MS Excel andPowerpoint.
- Thecourseishighlypracticeorientedratherthanregularclassroomteaching.
- Toacquireknowledgeoneditor,spreadsheetandpresentationsoftware.

CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)

CO1: Understandthebasicsofcomputersystemsanditscomponents.

CO2: Understand and applythebasicconceptsofawordprocessingpackage.

CO3: Understandand applythebasicconceptsofelectronicspreadsheetsoftware.

CO4: Understandandapplythebasicconceptsofdatabasemanagementsystem.

CO5: UnderstandandcreatеapresentationusingPowerPointtool.

Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)

Units	Contents	RequiredHours
I	**Introductory concepts:** Memory unit– CPU-Input Devices: Key board, Mouse and Scanner.Outputdevices:Monitor,Printer.Introduction toOperatingsystems&itsfeatures:DOS– UNIX– Windows. IntroductiontoProgrammingLanguages.	**6**
II	**Word Processing:** Open, Save and close word document; Editing text – tools, formatting, bullets;SpellChecker - Document formatting – Paragraph alignment, indentation, headers and footers,numbering;printing–Preview,options,merge.	**6**
III	**Spreadsheets:**Excel– opening,enteringtextanddata,formatting,navigating;F ormulas–entering,handlingand copying;Charts– creating,formatting and	**6**

	printing,analysistables,preparationoffinancialstatements,introductiontodataanalytics.	
IV	**Database Concepts:** 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 applicationsinquerylanguage(MS–Access).	**6**
V	**Power point:** Introduction to Power point - Features – Understanding slide typecasting & viewingslides – creating slide shows. Applying special object – including objects & pictures – Slidetransition– Animationeffects,audioinclusion,timers.	**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/others 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 Transferrable Skill	

LearningResources:

- **RecommendedTexts**

1.PeterNorton,"IntroductiontoComputers"–TataMcGraw-Hill.

- **ReferenceBooks**

1. JenniferAckermanKettel,GuyHat-Davis,CurtSimmons,"Microsoft2003",TataMcGraw-Hill.

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

FIRST YEAR I SEMESTER			
CourseCode: FC	**Problem Solving Techniques**		**Credits: 2**
LectureHours:(L) Perweek: 2	**TutorialHours: (T)perweek**	**LabPractice Hours: (P)perweek**	**Total:(L+T+P) Perweek: 2**
CourseCategory:Foundation Course	**Year : I , Semester: I**	**AdmissionYear:2023-2024**	
Pre-requisite	Basic of Problem-solving skills		

LearningObjectives:

- To understand the importance of algorithms and programs, and to know of the basic problem solving strategies.
- To learn efficient strategies and algorithms to solve standard problems, thus laying a firm foundation for designing algorithmic solutions to problems.

CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)

CO1: Understand the systematic approach to problem solving.

CO2: Know the approach and algorithms to solve specific fundamental problems.

CO3: Understand the efficient approach to solve specific factoring-related problems.

CO4: Understand the efficient array-related techniques to solve specific problems.

CO5: Understand the efficient methods to solve specific problems related to text processing.

Understand how recursion works.		
Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)		
Units	**Contents**	**RequiredHours**
I	**Introduction:** 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.	**6**
II	**Fundamental Algorithms**: 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.	**6**
III	**Factoring Methods**: 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.	**6**
IV	**Array Techniques**: 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^{th} smallest element – Longest	**6**

	monotone subsequence.	
V	**Text Processing and Pattern Searching**: Text line length adjustment – Left and right justification of text – Keyword searching in text – Text line editing – Linear pattern search. **Recursive algorithms**: Towers of Hanoi – Permutation generation.	**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/others 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 Transferrable Skill	

LearningResources:

- **RecommendedTexts**

1. R. G. Dromey, *How to Solve it by Computer*, Pearson India, 2007.

- **ReferenceBooks**

1. George Polya, Jeremy Kilpatrick, *The Stanford Mathematics Problem Book: With Hints and Solutions*, Dover Publications, 2009 (Kindle Edition 2013).
2. Greg W. Scragg, *Problem Solving with Computers*, Jones & Bartlett 1st edition, 1996.

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

FIRST YEAR II SEMESTER			
CourseCode :CC3	**Data Structures & Algorithms**		**Credits :5**
LectureHours:(L) Perweek : 5	**TutorialHours: (T)perweek**	**LabPractice Hours: (P)perweek**	**Total:(L+T+P) Perweek : 5**
CourseCategory: Core	**Year : I Semester: II**	**AdmissionYear:2023-2024**	
Pre-requisite	Basic knowledge in data and representations		
Linksto otherCourses			

LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)

- To impart the basic concepts of data structures and algorithms.
- To acquaint the student with the basics of the various data structures and make the students knowledgeable in the area of data structures.
- This course also gives insight into the various algorithm design techniques .

CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)

CO1: To introduce the concepts of Data structures and to understand simple linear data structures.

CO2: Learn the basics of stack data structure, its implementation and application.

CO3: Use the appropriate data structure in context of solution of given problem and demonstrate a familiarity with major data structures.

CO4: To introduce the basic concepts of algorithms

CO5: To give clear idea on algorithmic design paradigms like Dynamic Programming, Backtracking, Branch and Bound

Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)

Units	Contents	RequiredHours
I	INTRODUCTION TO DATA STRUCTURES: Data Structures: Definition- Time & Space Complexity,Arrays: Representation of arrays, Applications of arrays, sparse matrix and its representation. Linear list: Singly linked list implementation, insertion, deletion and searching operations on linear list . Circular linked list: implementation, Double linked list implementation, insertion, deletion and searching operations. Applications of linked lists-Dynamic Storage management.	**15**

II	STACKS: Operations, array and linked representations of stack, stack applications, infix to postfix conversion, postfix expression evaluation, recursion implementation.	**15**
III	QUEUES, TREES & GRAPHS: Queues: operations on queues, array and linked representations.Circular Queue: operations,, applications of queues.Trees: Definitions and Concepts- Representation of binary tree, Binary tree traversals (Inorder, Postorder , preorder), Binary search trees Graphs : Representation of Graphs- Types of graphs -Breadth first traversal – Depth first traversal- -Applications of graphs .	**15**
IV	INTRODUCTION TO ALGORITHMS: INTRODUCTION: Definition of Algorithms- Overview and importance of algorithms- pseudocode conventions, Asymptotic notations, practical complexities.Divide-and-Conquer: : General Method – Binary Search- Quick Sort- Merge Sort.Greedy Method: General method- Knapsack problem- Tree vertex splitting- Job sequencing with deadlines.	**15**
V	DYNAMIC PROGRAMMING, BACKTRACKING & BRANCH &BOUND :Dynamic programming: General method, Multistage Graphs, All pairs shortest path, Single source shortest path.Backtracking: General method, 8 Queens, Graph coloring, Hamiltonian cycle. Branch & Bound: General method, Travelling salesperson problem.	**15**
Extended Professional Component (is a part of internal component only, Not to be included	Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC– CSIR/GATE/TNPSC/others to be solved (To be discussed during the Tutorial hour)	

in the External Examination question paper)		
Skills acquired from the course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill	

LearningResources:

- **RecommendedTexts**

  1. Ellis Horowitz , SartajSahni, Susan Anderson Freed, Second Edition , "Fundamentals of Data in C", Universities Press

  2. E. Horowitz, S. Sahni and S. Rajasekaran, Second Edition ,"Fundamentals of Computer Algorithms " Universities Press

- **ReferenceBooks:**

  1. Seymour Lipschutz ,"Data Structures with C", First Edition, Schaum's outline series in computers, Tata McGraw Hill.
  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. A.V. Aho, J.E. Hopcroft, J.D. Ullmann,, "The design and analysis of Computer Algorithms", Addison Wesley, Boston, 1974
  6. Thomas H. Cormen, C.E. Leiserson, R L.Rivest and C. Stein, Introduction to Algorithms, Third edition, MIT Press, 2009
  7. SanjoyDasgupta, C.Papadimitriou and U.Vazirani , Algorithms , Tata McGraw-Hill, 2008.

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

FIRST YEAR II SEMESTER			
CourseCode: CC4	**CC4 : Practical : Data Structures & Algorithms Lab With C/C++**		**Credits: 5**
LectureHours:(L) Perweek	**TutorialHours: (T)perweek**	**LabPractice Hours: (P)perweek: 5**	**Total:(L+T+P) Perweek: 5**
CourseCategory: Core	**Year&: I Year Semester: II**	**AdmissionYear:2023-204**	
Pre-requisite	Basic skills in problem solving		

LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)

- To understand and implement basic data structures using C
- To apply linear and non-linear data structures in problem solving.
- To learn to implement functions and recursive functions by means of data structures
- To implement searching and sorting algorithms

CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)

CO1: Implement data structures using C

CO2: Implement various types of linked lists and their applications

CO3: Implement Tree Traversals

CO4: Implement various algorithms in C

CO5: Implement different sorting and searching algorithms

Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)

	List of Exercises:	**Required Hours**
	Implement the following exercises using C Programming language: 1. Array implementation of stacks 2. Array implementation of Queues 3. Linked list implementation of stacks 4. Linked list implementation of Queues 5. Binary Tree Traversals (Inorder, Preorder,	**75**

	Postorder) 6. Implementation of Linear search and binary search 7. Implementation Insertion sort, Quick sort and Merge Sort 8. Implementation of Depth-First Search & Breadth-First Search of Graphs. 9. Finding all pairs of Shortest Path of a Graph. 10. Finding single source shortest path of a Graph.	
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/others 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 Transferrable Skill	

LearningResources:

- **RecommendedTexts**

  1. Ellis Horowitz , SartajSahni, Susan Anderson Freed, Second Edition , "Fundamentals of Data in C", Universities Press

  2. E. Horowitz, S. Sahni and S. Rajasekaran, Second Edition ,"Fundamentals of Computer Algorithms " Universities Press

- **ReferenceBooks:**

  1. Seymour Lipschutz ,"Data Structures with C", First Edition, Schaum's outline series in computers, Tata McGraw Hill.

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. A.V. Aho, J.E. Hopcroft, J.D. Ullmann,, “The design and analysis of Computer Algorithms”, Addison Wesley, Boston, 1974

6. Thomas H. Cormen, C.E. Leiserson, R L.Rivest and C. Stein, Introduction to Algorithms, Third edition, MIT Press, 2009

7.SanjoyDasgupta, C.Papadimitriou and U.Vazirani , Algorithms , Tata McGraw-Hill, 2008.

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

FIRST YEAR II SEMESTER			
CourseCode-EC-2	**NUMERICAL METHODS**		**Credits 3**
LectureHours:(L) Perweek-4	**TutorialHours: (T)perweek**	**LabPractice Hours: (P)perweek**	**Total:(L+T+P) Perweek: 4**
CourseCategory: Generic / Discipline Specific	**Year : I Semester: II**	**AdmissionYear: 2023-2024**	
Pre-requisite	Basic Knowledge of mathematics		

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.
3. To apply interpolation and approximation on examples.

4. To solve problems using numerical differentiation and integration.

5. To solve linear systems, numerical solution of ordinary differential equations.

CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)

CO1: Know how to solve various problems on numerical methods

CO2: Use approximation to solve problems

CO3: Differentiation and integration concept are applied

CO4: Apply , direct methods for solving linear systems

CO5: Numerical solution of ordinary differential equations

Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)

Units	Contents	RequiredHours
I	**FUNDAMENTALS OF ALGEBRAIC EQUATION**: 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 .	12
II	**Iterative, InterpolationAnd Approximation:** 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	12
III	**INTERPOLATION WITH EQUAL INTERVAL:** Difference operators and relations. -Interpolation with equal intervals – Newton's forward and backward difference formulae.	12

IV	**NUMERICAL DIFFERENTIATION AND INTEGRATION:** Approximation of derivatives using interpolation polynomials – Numerical integration using Trapezoidal, Simpson's 1/3 rule.	**12**
V	**INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS:** 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	**12**
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/others 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 Transferrable Skill	

LearningResources:

- **RecommendedTexts**

1.Numerical Methods, Second Edition, S.Arumugam, A.ThangapandiIssac, A.Somasundaram, SCITECH publications, 2009.

- **ReferenceBooks**

1. Mathews J.H. Numerical Method for Maths, Science and Engineering; PHI, New Delhi, 2001.
2. Iqbal H. Khan & Q. Hassan Numerical Methods for Engineers and Scientist -

GalgotiaPublications (P) Ltd., New Delhi – 1997.

3. M.K. Jain, S.R.K. Iyengar&R.K.Jain - Numerical Methods for Scientific and Engineering Computation - New Age International(P) Ltd., New Delhi – 1996.

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

FIRST YEAR II SEMERSTER			
CourseCode: SEC-2	**Quantitative Aptitude**		**Credits: 2**
LectureHours:(L) Perweek: 2	**TutorialHours: (T)perweek**	**LabPractice Hours: (P)perweek**	**Total:(L+T+P) Perweek: 2**
CourseCategory:Skill Enhancement Course	**Year : ISemester:II**	**AdmissionYear:2023-2024**	
Pre-requisite	Basic knowledge in numerical ability		

LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)

- Toimprovethequantitativeskillsofthestudents
- Topreparethestudentsforvariouscompetitiveexams

CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)

CO1: To gain knowledge on LCM and HCF and its related problems

CO2: To get an idea of age, profit and loss related problem solving.

CO3: Able to understand time series simple and compound interests

CO4: Understanding the problem related to probability, and series.

CO5: Able to understand graphs, charts

Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)

Units	**Contents**	**RequiredHours**

I	Numbers-HCFandLCMofnumbers-Decimalfractions-Simplification-Squarerootsandcuberoots-Average-problemsonNumbers	**6**
II	Problems on Ages - Surds and Indices - percentage - profits and loss - ratio andproportion-partnership-Chainrule.	**6**
III	Time and work - pipes and cisterns - Time and Distance - problems on trains -Boats and streams - simple interest - compound interest - Logarithms - Area –Volumeandsurfacearea-racesandGamesofskill.	**6**
IV	Permutationandcombination-probability-TrueDiscount-BankersDiscountHeightandDistances-Oddmanout&Series.	**6**
V	Calendar - Clocks - stocks and shares - Data representation - Tabulation – BarGraphs-Piecharts-Linegraphs	**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/others 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 Transferrable Skill	

LearningResources:

- **RecommendedTexts**

1. .“QuantitativeAptitude”,R.S.AGGARWAL.,S.Chand&CompanyLtd.,

- **Webresources:** Authentic Web resources related to Competitive examinations

CourseCode SEC-3	**Digital Computer Fundamentals**		**Credits 2**
LectureHours:(L) Perweek : 2	**TutorialHours: (T)perweek**	**LabPractice Hours: (P)perweek**	**Total:(L+T+P) Perweek 2**
CourseCategory: Skill Enhancement Course	**Year&Semester:II Year II semester**		**AdmissionYear: 2023-2024**
Pre-requisite	Basic Mathematics		
Linksto otherCourses			

LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)

- ItaimstotrainthestudenttothebasicconceptsofDigitalComputerFundamentals
- To impart the in-depth knowledge of logic gates, Boolean algebra,combinationalcircuitsandsequentialcircuits.

CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)

CO1: Identify the logic gates and their functionality.

CO2: Perform number conversions from one system to another system

CO3: Understand the functions of combinational circuits

CO4: Perform number conversions.

CO5: Perform Counter design and learn its operations.

Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)

Units	**Contents**	**RequiredHours**
I	NumberSystemsandCodes:NumberSystem– BaseConversion – BinaryCodes – Code Conversion. Digital Logic: Logic Gates – Truth Tables – UniversalGates.	**6**
II	Boolean Algebra: Laws and Theorems – SOP, POS Methods – Simplification	**6**

	ofBooleanFunctions–UsingTheorems,K-Map,Prime–ImplicantMethod–Binary Arithmetic: Binary Addition – Subtraction – Various Representations ofBinaryNumbers–ArithmeticBuildingBlocks–Adder–Subtractor.	
III	Combinational Logic: Multiplexers – Demultiplexers – Decoders – Encoders – CodeConverters–ParityGeneratorsandCheckers.	**6**
IV	SequentialLogic:RS,JK,D,andTFlip-Flops–Master-Slave Flip-Flops.Registers:ShiftRegisters–TypesofShiftRegisters.	**6**
V	Counters: Asynchronous and Synchronous Counters - Ripple, Mod, Up-DownCounters–Ring Counters. Memory: Basic Terms and Ideas –Types of ROMs –TypesofRAMs.	**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/others 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 Transferrable Skill	

LearningResources:

- **RecommendedTexts**
  1. D.P.LeachandA.P.Malvino,*DigitalPrinciplesandApplications*–TMH–FifthEdition–2002.
  2. M.MorisMano,*DigitalLogicandComputerDesign*,PHI,2001.

- **ReferenceBooks**
  1. V.RajaramanandT.Radhakrishnan,*Digital Computer Design*, Prentice HallofIndia,2001

2.T.C.Bartee,*DigitalComputerFundamentals*,6th Edition,TataMc GrawHill,1991.

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

SECOND YEAR - III SEMESTER			
CourseCode-CC5	**Python Programming**		**Credits 5**
LectureHours:(L) Perweek – 5	**TutorialHours:75 (T)perweek**	**LabPractice Hours: (P)perweek**	**Total:(L+T+P) Perweek: 5**
CourseCategory: Core	**Year : II Semester: III**	**AdmissionYear: 2023-2024**	
Pre-requisite	Basic Knowledge of Programming concept		

LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)

- Describe the core syntax and semantics of Python programming language.
- Discover the need for working with the strings and functions.
- Illustrate the process of structuring the data using lists, dictionaries, tuples and sets.
- Understand the usage of packages and Dictionaries

CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)

CO1: Develop and execute simple Python programs

CO2: Write simple Python programs using conditionals and looping for solving problems

CO3: Decompose a Python program into functions

CO4: Represent compound data using Python lists, tuples, dictionaries etc.

CO5: Read and write data from/to files in Python programs

Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)

Units	**Contents**	**RequiredHours**
I	**Introduction**: The essence of computational problem solving – Limits of computational problem solving-Computer	**15**

	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.	
II	**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,Understandig and using ranges.	**15**
III	**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	**15**
IV	**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	**15**
V	**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.	**15**

Extended Professional Component (is a part of internal component only, Not to beincludedin the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/others 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 Transferrable Skill	

LearningResources:

- **RecommendedTexts**

  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

- **ReferenceBooks**

  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 Beginers" , Third Edition, Course Technology Cengage Learning Publications, 2013, ISBN 978-1435455009.

- **Webresources**

  1. https://onlinecourses.swayam2.ac.in/cec22_cs20/preview

<table>
<tr><td colspan="4">SECOND YEAR - III SEMESTER</td></tr>
<tr><td>CourseCode: CC6</td><td colspan="2">CC6: Practical : Python Programming Lab</td><td>Credits : 5</td></tr>
<tr><td>LectureHours:(L) Perweek:</td><td>TutorialHours: (T)perweek</td><td>LabPractice Hours: 5 perweek</td><td>Total:(L+T+P) Perweek: 5</td></tr>
<tr><td>CourseCategory:Core practical</td><td colspan="2">Year&Semester: II Year III Semester</td><td>AdmissionYear:2023-2024</td></tr>
<tr><td>Pre-requisite</td><td colspan="3">Basic of programming skill</td></tr>
<tr><td colspan="4">LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)
• Acquire programming skills in core Python.
• Acquire Object-oriented programming skills in Python.
• Develop the skill of designing graphical-user interfaces (GUI) in Python.
• Develop the ability to write database applications in Python.
• Acquire Python programming skills to move into specific branches.</td></tr>
<tr><td colspan="4">CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)
CO1:To understand the problem solving approaches
CO2:To learn the basic programming constructs in Python
CO3:To practice various computing strategies for Python-based solutions to real world problems
CO4: To use Python data structures - lists, tuples, dictionaries.
CO5: To do input/output with files in Python.</td></tr>
<tr><td colspan="4">Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)</td></tr>
<tr><td></td><td colspan="2">List of Exercises:</td><td>RequiredHours</td></tr>
<tr><td></td><td colspan="2">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</td><td>75</td></tr>
</table>

following criteria:

Grade A: Percentage >=80 Grade B: Percentage >=70 and 80

Grade C: Percentage >=60 and <70 Grade D: Percentage >=40 and <60

Grade E: Percentage < 40

3. Program, to find the area of rectangle, square, circle and triangle by accepting suitable input parameters from user.

4. Write a Python script that prints prime numbers less than 20.
5. Program to find factorial of the given number using recursive function.
6. Write a Python program to count the number of even and odd numbers from array of N numbers.
7. Write a Python class to reverse a string word by word.
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)
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).
10. Write a Python program to construct the following pattern, using a nested loop

```
*
**
***
****
*****
****
```

	*** ** * 11. Read a file content and copy only the contents at odd lines into a new file. 12. Create a Turtle graphics window with specific size. 13. Write a Python program for Towers of Hanoi using recursion 14. Create a menu driven Python program with a dictionary for words and their meanings. 15. Devise a Python program to implement the Hangman Game.	
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/others 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 Transferrable Skill	

LearningResources:

- **RecommendedTexts**

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

- **ReferenceBooks**

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 Beginers” , Third Edition, Course Technology Cengage Learning Publications, 2013, ISBN 978-1435455009

SECOND YEAR – III SEMESTER			
CourseCode –EC 3	**Probability and Statistics**		**Credits 3**
LectureHours:(L) **Perweek – 4**	**TutorialHours:** **(T)perweek**	**LabPracticeHours:** **(P)perweek:**	**Total:(L+T+P)** **Perweek: 4**
CourseCategory: Elective Course 3 (Generic / Discipline Specific)	**Year : II Semester: III**	**AdmissionYear: 2023-2024**	
Pre-requisite	Basic Knowledge of Mathematical foundation		

- **LearningObjectives:**(forteachers:whattheyhavetodointheclass/lab/field)
- Organizing and summarizing the data. Analyzing the data and drawing conclusions from it. Assessing the strengths of the conclusions and evaluating their uncertainty.
- Define the principal concepts about probability.
- Explain the concept of a random variable and the probability distributions.

CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)

CO1: understand basic probability axioms and rules and the moments of discrete and continuous random variables as well as be familiar with common named discrete and continuous random variables

CO2: - derive the probability density function of transformations of random variables and use these techniques to generate data from various distributions

CO3: derive the marginal and conditional distributions of random variables, translate real-world problems into probability models

CO4 :Analyze the different Statistical measures of data

CO5: - test hypothesis of different types

Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)

Units	**Contents**	**RequiredHours**
I	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.	**12**
II	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.	**12**
III	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	**12**
IV	Events and sets – sample space – concept of probability – addition and multiplications Theorem on probability –	**12**

	conditional probability and independence of evens – Baye‘s Theorem – concept of random variable – Mathematical Expectation.	
V	Concept of sampling distributions – standard error – Tests of significance based on t, Chi- square and F distributions with respect to mean, variance.	**12**
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/others 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 Transferrable Skill	

LearningResources:

- **RecommendedTexts**

  Statistical Methods, S.P.Gupta, Sultan Chand and sons Publications,4th Edition 2011.

- **ReferenceBooks**

1. Statistics, Dr. S.Arumugam and A.ThangapandiIssac, New Gamma Publication house, 2002.
2. KishorS. Trivedi - Probability and statistics with reliability queuing and Computer Science Applications - Prentice Hall of India (P) Ltd., New Delhi -1997.

- 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:**https://onlinecourses.swayam2.ac.in/cec22_cs20/preview

SECOND YEAR – III SEMESTER			
CourseCode: SEC4	**PHP ProgrammingLab**		**Credits : 1**
LectureHours:(L) Perweek	**TutorialHours: (T)perweek**	**LabPractice Hours: (P)perweek : 1**	**Total:(L+T+P) Perweek 1**
CourseCategory: Skill Enhancement Course	**Year : II Semester: III**	**AdmissionYear:2023-2024**	
Pre-requisite	Basic knowledge of programming language.		
Linksto otherCourses	NIL		

LearningObjectives: (forteachers:whattheyhavetodointheclass/lab/field)

- The objective of this course is to teach the fundamentals of quantum information processing, including quantum computation, quantum cryptography, and quantum information theory.

CourseOutcomes: (forstudents:Toknowwhattheyaregoingtolearn)
CO1: Use PHP in-built functions and string functions.
CO2: Assessment of using files
CO3 : Practice passing of parameters from HTML to PHP.
CO4 : Audit the usage of COOKIES and SESSIONS.
CO5 : Design web pages for personal and business applications.

Recap: (notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)

Units	Contents	RequiredHours
I	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 6. Simple and parameterized functions. 7. To process personal details using File 8. To design an student mark database using HTML Form and process using PHP	**15**

	9. Programs using OOPS concepts 10. Program to design a web page using various form controls 11. Data validation in web pages. 12. 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)	Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminationsUPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/otherstobesolved(Tobe discussedduringtheTutorialhour)	
Skills acquired from the course	Knowledge,ProblemSolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferrable Skill	

LearningResources:

- **ReferenceBooks**

  1. Paul Deitel, Harvey Deitel, & Abbey Deitel. (2018). Internet and World Wide Web –How to Program, 5 th Edition. India: Pearson India Education.

- **Webresources**

  1. https://www.w3schools.com/php/
  2. https://www.javatpoint.com/php-tutorial

SECOND YEAR – III SEMESTER

CourseCode: SEC-5	Advanced Excel		Credits: 2
LectureHours:(L) Perweek: 2	TutorialHours: (T)perweek	LabPractice Hours: (P)perweek	Total:(L+T+P) Perweek: 2
CourseCategory: Skill Enhancement Course	Year&Semester: II Year III Semester		AdmissionYear:2023-2024
Pre-requisite	Basic knowledge in office automation / Excel		

LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)

The objective of this course is to help the students learn the advanced features of Excel, to summarise, analyse, explore, and present visualisations of data in the form of charts, graphs.

CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)

CO1: Handle large amounts of data

CO2: Aggregate numeric data and summarise into categories and subcategories

CO3: Filtering, sorting, and grouping data or subsets of data

CO4: Create pivot tables to consolidate data from multiple files

CO5: Presenting data in the form of charts and graphs

Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)

Units	Contents	RequiredHours
I	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	6

II	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.	**6**
III	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.	**6**
IV	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.	**6**
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)	Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminationsUPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/otherstobesolved(Tobediscussedduringthe Tutorialhour)	
Skills acquired from the course	Knowledge,ProblemSolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferrable Skill	

LearningResources:

- **RecommendedText**

  Excel 2019 All-in-One For Dummies – 2018- Greg Harvey

- **ReferenceBooks**

  Microsoft Excel 2019 Pivot Table Data Crunching-2019,Bill Jelen and Michael Alexander

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

SECOND YEAR IV SEMESTER			
CourseCode: CC7	**Industry Module –Java Programming**		**Credits: 5**
LectureHours:(L) Perweek: 5	**TutorialHours: (T)perweek**	**LabPractice Hours: (P)perweek**	**Total:(L+T+P) Perweek: 5**
CourseCategory:Core	**Year : II Semester: IV**	**AdmissionYear:2023-2024**	
Pre-requisite	Basic Programming skill		
LearningObjectives: (forteachers:whattheyhavetodointheclass/lab/field)			

- To provide fundamental knowledge of object-oriented programming.
- To equip the student with programming knowledge in Core Java from the basics up.
- To enable the students to use AWT controls, Event Handling and Swing for GUI.

CourseOutcomes: (forstudents:Toknowwhattheyaregoingtolearn)

CO1: Understand the basic Object-oriented concepts and Implement the basic constructs of Core Java

CO2: Implement inheritance, packages, interfaces and exception handling of Core Java.

CO3: Implement multi-threading and I/O Streams of Core Java

CO4: Implement AWT and Event handling.

CO5: Use Swing to create GUI.

Recap: (notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)

Units	Contents	Required Hours
I	**Introduction:**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	**15**
II	**Inheritance**: 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 keyword.**Packages**:Definition-AccessProtection - ImportingPackages.**Interfaces**:Definition– Implementation–Extending Interfaces.**Exception**	**15**

	Handling: *try – catch - throw - throws – finally* – Built-inexceptions - Creating own Exception classes.	
III	**Multithreaded Programming**: Thread Class - Runnable interface –Synchronization– Usingsynchronizedmethods– Using*synchronized*statement-InterthreadCommunication –Deadlock. **I/O Streams:** Concepts of streams - Stream classes- Byte and Character stream - Reading console Input and Writing Console output - File Handling.	**15**
IV	**AWT Controls:** 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. **Event Handling:** Events - Event sources - Event Listeners - Event Delegation Model (EDM) - Handling Mouse and Keyboard Events - Adapter classes - Inner classes.	**15**
V	**Swing:** Introduction to Swing - Hierarchy of swing components. Containers - Top level containers - JFrame - JWindow - JDialog - JPanel - JButton - JToggleButton - JCheckBox - JRadioButton - JLabel,JTextField - JTextArea - JList - JComboBox–JscrollPane	**15**
Extended Professional Component (is a part of internal component only, Not to beincludedin theExternal Examination question	Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminationsUPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/otherstobesolved(TobediscusseddduringtheTutorialhour)	

paper)		
Skills acquired from the course	Knowledge,ProblemSolving,Analyticalability,ProfessionalCompetency,ProfessionalCommunicationandTransferrable Skill	

LearningResources:

- **RecommendedTexts**
  1. Herbert Schildt, The Complete Reference, Tata McGraw Hill, New Delhi, 7th Edition, 2010.
  2. Gary Cornell, Core Java 2 Volume I – Fundamentals, Addison Wesley, 1999.
- **ReferenceBooks**

1. Head First Java, O'Rielly Publications,
2. Y. Daniel Liang, *Introduction to Java Programming*, 7th Edition, Pearson Education India, 2010.

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

SECOND YEAR IV SEMESTER			
CourseCode: CC8	**CC8 - Practical: Java Programming Lab**		**Credits: 5**
LectureHours:(L) Perweek	**TutorialHours: (T)perweek**	**LabPractice Hours: (P)perweek:5**	**Total:(L+T+P) Perweek: 5**
CourseCategory:CC8	**Year: II Year Semester: IV**		**AdmissionYear:2023-2024**
Pre-requisite	Basic Programming debugging skills		

LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)

- To gain practical expertise in coding Core Java programs
- To become proficient in the use of AWT, Event Handling and Swing.

CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)

CO1: Code,debugand execute Javaprogramstosolvethegivenproblems

CO2: Implement multi-threading and exception-handling

CO3: Implement functionality using String and StringBuffer classes

CO4: Demonstrate Event Handling.

CO5: Createapplicationsusing SwingandAWT

Recap(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)

	List of Exercises:	**RequiredHours**
	1. Write a Java program that prompts the user for an integer and then prints out all the prime numbers up to that Integer? 2. Write a Java program to multiply two given matrices. 3. Write a Java program that displays the number of characters, lines and words in a text? 4. Generaterandomnumbersbetweentwogivenlimitsusing Random classandprintmessagesaccordingtotherangeofthevaluegenerated. 5. WriteaprogramtodoStringManipulationusingCharacter Arrayand performthefollowingstringoperations: a. Stringlength b. Findingacharacterataparticularposition c. Concatenatingtwostrings 6. Writeaprogramtoperformthefollowingstringoperations usingString class: a. StringConcatenation b. Searchasubstring c. Toextractsubstringfromgivenstring 7. Writeaprogram toperform stringoperationsusingStringBufferclass: a. Lengthof astring	**75**

	b. Reverseastring c. Deleteasubstringfrom thegiven string 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. 9. Writeathreadingprogramwhichusesthesamemethodasynchronouslytoprintthenumbers1to10usingThread1andtoprint90to100using Thread2. 10. Writeaprogram to demonstrate the useoffollowingexceptions. a. ArithmeticException b. NumberFormatException c. ArrayIndexOutofBoundException d. NegativeArraySizeException 11. Write a Java program that reads on file name from the 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? 12. Writeaprogramtoacceptatextandchangeitssizeandfont.Include bolditalicoptions.Useframesandcontrols. 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). 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. 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.	

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	QuestionsrelatedtotheabovetopicsfromvariouscompetitiveexaminationsUPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/otherstobesolved(TobediscussedduringtheTutorialhour)	
Skills acquired from the course	Knowledge,ProblemSolving,Analyticalability,ProfessionalCompetency,ProfessionalCommunicationandTransferrable Skill	

LearningResources:

- **RecommendedTexts**
  3. Herbert Schildt, The Complete Reference, Tata McGraw Hill, New Delhi, 7th Edition, 2010.
  4. Gary Cornell, Core Java 2 Volume I – Fundamentals, Addison Wesley, 1999.
- **ReferenceBooks**

3. Head First Java, O'Rielly Publications,
4. Y. Daniel Liang, *Introduction to Java Programming*, 7th Edition, Pearson Education India, 2010.

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

CourseCode: EC-4	**Database Management Systems**		**Credits:3**
LectureHours:(L) Perweek: 3	**TutorialHours: (T)perweek**	**LabPractice Hours: (P)perweek**	**Total:(L+T+P) Perweek: 3**
CourseCategory: Elective course	**Year&Semester: II YEAR IV SEMESTER**		**AdmissionYear: 2023-2024**
Pre-requisite	Basic knowledge on Data and its relations		

LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)

- To enable the students to learn the designing of data base systems, foundation on the relational model of data and normal forms.

- To understood the concepts of data base management system, design simple Database models
- To learn and understand to write queries using SQL, PL/SQL.

CourseOutcomes: (forstudents:Toknowwhattheyaregoingtolearn)

CO1: Understand the various basic concepts of Data Base System. Difference between file system and DBMS and compare various data models.

CO2: Define the integrity constraints. Understand the basic concepts of Relational Data Model, Entity-Relationship Model.

CO3: 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).

CO4: Classify the different functions and various join operations and enhance the knowledge of handling multiple tables.

CO5: Learn to design Data base operations and implement using PL/SQL programs. Learn basics of PL/SQL and develop programs using Cursors, Exceptions

Recap: (notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)

Units	Contents	RequiredHours
I	**Database Concepts:**Database Systems - Data vs Information - Introducing the database -File system - Problems with file system – Database systems. Data models - Importance - Basic Building Blocks - Business rules - Evolution of Data models - Degrees of Data Abstraction	9
II	**Design Concepts:** 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	9
III	**Normalization of Database Tables**: Database tables and	9

	Normalization – The Need for Normalization –The Normalization Process – Higher level Normal Form. **Introduction to SQL**: Data Definition Commands – Data Manipulation Commands – SELECT Queries – Additional Data Definition Commands – Additional SELECT Query Keywords – Joining Database Tables.	
IV	**Advanced SQL**:Relational SET Operators: UNION – UNION ALL – INTERSECT - MINUS.SQL Join Operators: Cross Join – Natural Join – Join USING Clause – JOIN ON Clause – Outer Join.**Sub Queries and Correlated Queries**: WHERE – IN – HAVING – ANY and ALL – FROM. SQL Functions: Date and Time Function – Numeric Function – String Function – Conversion Function	**9**
V	**PL/SQL**:A Programming Language: History – Fundamentals – Block Structure – Comments – Data Types – Other Data Types – Variable Declaration – Assignment operation – Arithmetic operators.**Control Structures and Embedded SQL**: Control Structures – Nested Blocks – SQL in PL/SQL – Data Manipulation – Transaction Control statements. **PL/SQL Cursors and Exceptions**: 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.	**9**

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminationsUPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/otherstobesolved(Tobediscussedduringthe Tutorialhour)	
Skills acquired from the course	Knowledge,ProblemSolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferrable Skill	

LearningResources:

- **RecommendedTexts**
  1. Coronel, Morris, Rob, "Database Systems, Design, Implementation and Management", Ninth Edition
  2. Nilesh Shah, "Database Systems Using Oracle", 2nd edition, Pearson Education India, 2016
- **ReferenceBooks**

1. Abraham Silberschatz, Henry F.Korth and S.Sudarshan,"Database System Concepts", McGraw Hill International Publication ,VI Edition.
2. Shio Kumar Singh , "Database Systems ",Pearson publications ,II Edition

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

courseCode: SEC-6	**DATABASE MANAGEMENT SYSTEMS LAB**	**Credits:2**

LectureHours:(L) Perweek	**TutorialHours: (T)perweek**	**LabPractice Hours: (P)perweek: 2**	**Total:(L+T+P) perweek:2**
CourseCategory:Skill Enhancement course	**Year&Semester: II Year IV semester**		**AdmissionYear:2023-2024**
Pre-requisite	Basic Knowledge on Database Tools		

LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)

Students can learn various SQL and PL/SQL commands, cursor and various applicationprograms.

CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)

CO1: Understand the various basic concepts of Data Base System. Difference between file system and DBMS and compare various data models.

CO2: Define the integrity constraints. Understand the basic concepts of Relational Data Model, Entity-Relationship Model.

CO3: 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).

CO4: Classify the different functions and various join operations and enhance the knowledge of handling multiple tables.

CO5: Learn to design Data base operations and implement using PL/SQL programs. Learn basics of PL/SQL and develop programs using Cursors, Exceptions

Recap: (notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)

	List of Exercises:	**RequiredHours**
	I. SQL 1. DDLCOMMANDS 2. DMLCOMMANDS 3. TCLCOMMANDS	**30**

	II. PL/SQL 4. FIBONACCISERIES 5. FACTORIAL 6. STRINGREVERSE 7. SUM OFSERIES 8. TRIGGER ***III. CURSOR*** 9. STUDENT MARK ANALYSIS USINGCURSOR ***IV. APPLICATION*** 10. LIBRARY MANAGEMENTSYSTEM 11. STUDENT MARKANALYSIS	
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminationsUPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/otherstobesolved(Tobediscussedduringthe Tutorialhour)	
Skills acquired from the course	Knowledge,ProblemSolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferrable Skill	

LearningResources:

- **RecommendedTexts**
  1. Coronel, Morris, Rob, "Database Systems, Design, Implementation and Management", Ninth Edition
  2. Nilesh Shah, "Database Systems Using Oracle", 2nd edition, Pearson Education India, 2016
- **ReferenceBooks**
  1. Abraham Silberschatz, Henry F.Korth and S.Sudarshan,"Database System Concepts", McGraw Hill International Publication ,VI Edition.
  2. Shio Kumar Singh , "Database Systems ",Pearson publications ,II Edition
  3. Albert Lulushi, "Developing ORACLE FORMS Applications", Prentice Hall ,1997

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

SECOND YEAR IV SEMESTER			
CourseCode-SEC-7	**Resource Management Techniques**		**Credits : 2**
LectureHours:(L)perweek : 2	**TutorialHours (T)perweek**	**LabPractice Hours: (P)perweek**	**Total:(L+T+P) Perweek: 2**
CourseCategory:Skill Enhancement Course	**Year&Semester: II Year IV Semester**		**AdmissionYear:2023-2024**
Pre-requisite	Basic Knowledge of Mathematics		

LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)

- Gaining knowledge about managing production processes.
- How to run operations effectively.
- Better understanding of modern production techniques.
- Better understanding of quality management.

CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)

CO1: Define and formulate linear programming problems and appreciate their limitations.

CO2: Solve linear programming problems using graphical method

CO3: Solve linear programming problems using Simplex & Big-M methods

CO4: Solve Assignment Problems.

CO5: Solve Transportation problems

Recap: (notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)

Units	**Contents**	**RequiredHours**
I	Development of OR: Definition of OR – Modeling - Characteristics and Phases - Tools, Techniques & Methods - scope of OR. Linear Programming Problem: Formulation - Slack & surplus variables	6
II	Linear Programming Problem: Formulation - Slack & surplus variables - Graphical solution of LPP.	6
III	Simplex Method: Computational Procedure - Big-M method .	6
IV	Mathematical formulation of assignment problem - Method for solving assignment problem.	6
V	Mathematical formulation of Transportation Problem: Methods for finding IBFS for the Transportation Problems.	6
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination	Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminationsUPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/otherstobesolved(TobediscussedduringtheTutorialhour)	

question paper)		
Skills acquired from the course	Knowledge,ProblemSolving,Analyticalability,ProfessionalCompetency,ProfessionalCommunicationandTransferable Skill	

LearningResources:

- **RecommendedTexts**

  1. Operations Research, S.D.Sharma, KedarNath Ram Nath& Co

- **ReferenceBooks**

  1. Operation Research An Introduction, Tenth Edition Global Edition, HamdyA.Taha, Pearson Publication,2017
  2. Operation Research, Nita H.Shah, Ravi M.GorHardiksoni, Prentice Hall of India Pvt. Ltd., New Delhi, 2008.
  3. Operation Research, R.Sivarethinamohan, Tata McGraw Hill, 2005
  4. Operations Research – An Introduction b HamdyA.Taha Ninth Edition, Dorling Kindersley Pvt. Ltd., Noida, India, 2012

THIRD YEAR V SEMESTER			
CourseCode: CC9	**Software Engineering**		**Credits: 4**
LectureHours:(L) Perweek: 5	**TutorialHours: (T)perweek**	**LabPractice Hours: (P)perweek**	**Total:(L+T+P) Perweek: 5**
CourseCategory:Core	**Year : III Semester: V**	**AdmissionYear:2023-2024**	
Pre-requisite	Basic Knowledge on Software Applications		
LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)• To understand the			

software engineering concepts and to create a system model in real life applications.		
CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn) **CO1:**Gain basic knowledge of analysis and design of systems **CO2:** Ability to apply software engineering principles and techniques **CO3:**Model a reliable and cost-effective software system **CO4:** Ability to design an effective model of the system **CO5:** Perform Testing at various levels and produce an efficient system.		
Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)		
Units	**Contents**	**RequiredHours**
I	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. 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.	**15**
II	**Requirements Analysis and Specification:** Requirements gathering and analysis, Software requirements specification (SRS). **Software Design**: Good software design, cohesion and coupling, neat arrangement, software design approaches, object- oriented vs function-oriented design	**15**
III	Function-Oriented Software Design: Overview of SA/SD methodology, structured analysis, data flow diagrams (DFD's), structured design, detailed design.User-Interface design: Characteristics of a good interface; basic concepts;	**15**

	types of user interfaces; component based GUI development, a user interface methodology.	
IV	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. Software Reliability and Quality Management: Software reliability; statistical testing; software quality; software quality management system; SEI capability maturity model; personal software process.	**15**
V	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. Software Maintenance: Characteristic of software maintenance; software reverse engineering; software maintenance process models; estimation of maintenance cost;	**15**
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminationsUPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/otherstobesolved(TobediscussedduringtheTutorialhour)	

Skills acquired from the course	Knowledge,ProblemSolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferrable Skill	

LearningResources:

- **RecommendedTexts**
  1. Rajib Mall, Fundamentals of Software Engineering, Fifth Edition, Prentice-Hall of India, 2018
- **ReferenceBooks**
  1. Richard Fairley, Software Engineering Concepts, Tata McGraw-Hill publishing company Ltd, Edition 1997.
  2. Roger S. Pressman, Software Engineering, Seventh Edition, McGraw-Hill.

  James A. Senn, Analysis & Design of Information Systems, Second Edition, McGraw-Hill International Editions.

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

THIRD YEAR V SEMESTER			
CourseCode: CC10	**Data Preparation and Visualization**		**Credits: 4**
LectureHours:(L) Perweek: 5	**TutorialHours: (T)perweek**	**LabPractice Hours: (P)perweek**	**Total:(L+T+P) Perweek: 5**
CourseCategory:Core	**Year : III Semester: V**	**AdmissionYear:2023-2024**	
Pre-requisite			

LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)

- Good data preparation allows for efficient data analysis, limits errors and inaccuracies that can occur to data during processing, and makes all processed data more accessible to users
- Data visualization helps to tell stories by curating data into a form easier to understand, highlighting the trends and outliers

CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn) **CO1:** To learn about data preprocessing **CO2:**To learn about data preparation tools **CO3:** To learn about data exploration & NOSQL **CO4:**To learn about data transformation & data blending **CO5:**To learn about plotting various charts & graphs		
Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)		
Units	**Contents**	**RequiredHours**
I	DataPreparation:ImportingData-Textfiles-Excelspreadsheets-Statisticalpackages - Databases - Cleaning Data : Selecting variables - Selecting observations - Creating/Recodingvariables - Summarizing data - Using pipes - Reshaping data - Missing data - Introduction toggplot2 -ggplot- geoms - grouping scales - facets -labels- themes - Placing the data and mappingoptions-Graphsas objects.	**15**
II	Data Preparation Basics - Data Preparation Defined - Historical Perspective – HowDid We Get Here? - The Need for Self-Service Data Preparation - Historical Perspective -**Introduction to Data Preparation Tools** :Types of tools o Programming/scripting vs. visualinterface - Standalone vs. integrated into analytics platforms - Cloud, on-premises, and hybriddeployment - Machine learning and data preparation - **Users of Data Preparation Tools** : Datascientists - Data engineers - Business analysts - Data analysts o Information workers - DataPreparationinAnalyticsArchitecture-	**15**

	DataPreparationandAnalyticsLifeCycle:Continuou sexploration and discovery-Iterativeandadaptive.	
III	Data Discovery - **Data Sources** : Enterprise databases - Local data - Desktop data -Cloud data - Web data - Files - NoSQL - Geospatial - Media - **Data Sourcing** : Choosing datasources-Physicaldatasourceconnections-Virtualdatasourceconnections-**DataExploration** : Understanding content - Estimating quality - Discovering patterns - Discovering data types -Discovering data structure - Discovering data relationships - Data enrichment opportunities -Developingdata profiles-Capturingmetadata	**15**
IV	DataTransformation-**TheScopeofDataPreparation**:ImprovingData-Standardization and conforming - Cleansing and quality - De-duplication - **Enriching Data :**Derivation- Appending-Aggregation-FormattingData-Aggregation- Sortingandsequencing -Pivoting/ de-pivoting-Samplingandfiltering - Maskingsensitive data- Constructingrecords-**DataBlending**: Blendingdefined-Blendvs. join-Blendingvs.warehousing.	**15**
V	Univariate Graphs - Categorical : Bar Chart -Pie Chart - TreeMap- Quantitative -Histogram - Kernel Density plot-DotChart- Bivariate Graphs - Categorical vs. Categorical :Stacked bar chart - Grouped bar chart - Segmented bar chart - Improving the color and labeling -Other plots - Quantitative vs. Quantitative :Scatterplot - Line plot- Categorical vs. Quantitative:Bar chart (on summary statistics) - Grouped kerneldensityplots - Box plots - Violin plots -Ridgeline plots - Mean/SEM plots - Strip plots - Beeswarm Plots -Cleveland Dot Charts -MultivariateGraphs -	**15**

	Grouping– Faceting.	
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminationsUPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/otherstobesolved(Tobediscussedduringthe Tutorialhour)	
Skills acquired from the course	Knowledge,ProblemSolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferrable Skill	

LearningResources:

RecommendedTexts

1. DataPreparationforDataMining–DorianPyle–MorganKaufmannpublishers(US)–1999.
2. MakingSenseofData:APracticalGuidetoExploratoryDataAnalysisandDataMining, byGlenn J.Myatt
3. TheVisual Displayof QuantitativeInformation,byEdwardR.Tufte.
4. VisualizingData:ExploringandExplainingDatawiththeProcessingEnvironment,byBen Fry.
5. ExploratoryData Mining and DataCleaning, byTamraparniDasu
6. RobKabacoff, DataVisualizationwith R,Bookdown,2018.Chapters:1-13 https://rkabacoff.github.io/datavis /

- **ReferenceBooks**

1. KirthiRaman-MasteringPythonDataVisualization-PacktPublishing–2015.

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

THIRD YEAR V SEMESTER			
CourseCode: CC11	**CC11 - Practical: Data Preparation and Visualization Lab**		**Credits: 4**
LectureHours:(L) Perweek:	**TutorialHours: (T)perweek**	**LabPractice Hours: (P)perweek : 5**	**Total:(L+T+P) Perweek: 5**
CourseCategory:Core	**Year: III Semester: V**	**AdmissionYear:2023-2024**	
Pre-requisite			

LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)

- To learn about plotting various charts & graphs

CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)

CO1: To learn about data preprocessing
CO2: To learn about data preparation tools
CO3: To learn about data exploration & NOSQL
CO4: To learn about data transformation & data blending
CO5: To learn about plotting various charts & graphs

Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)

Units	Contents	RequiredHours
	1. CreateaRetailGarmentsShopDataand Connecttoanexcelsheetandimportdatainto Tableau 2. Usemetadataandextracts, Handle NULLvalues inStudent Data Set 3. Cleanupthedatabefore theactualuseinPayrollData Set 4. PerformvariousjointechniquesinPayrollDataSet 5. Performdatablendingfrom morethan onesources inmedical DataSet 6. Createand edit setsusingMarksin InventoryData Set 7. Highlightdesireditems,MakegroupsinLibraryData Set 8. WorkingonExcelDatathroughTableau	**75**

	9. ConnectaMSAccess databaseinTableau 10. CreatingaPieChart 11. CreatingaPieChart 12. CreatingaLineGraph 13. DiscoveringScatterPlot 14. CreatingCombinationChart 15. CreatingDual AxisChart 16. CreatingHeatMap 17. CreatingTreeMap 18. CreatingBox Plot 19. CreatingKPIChart 20. CreatingWaterfallChart 21. CreatingBumpChart 22. CreatingLevelofDetails (LOD)	
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminationsUPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/otherstobesolved(TobediscussedduringtheTutorialhour)	
Skills acquired from the course	Knowledge,ProblemSolving,Analyticalability,ProfessionalCompetency,ProfessionalCommunicationandTransferrable Skill	

THIRD YEAR V SEMESTER			
CourseCode: EC5	**Business Analytics**		**Credits: 3**
LectureHours:(L) Perweek: 4	**TutorialHours: (T)perweek**	**LabPractice Hours: (P)perweek**	**LectureHours:(L) Perweek: 4**

CourseCategory: Elective Course	Year: III Semester: V	AdmissionYear:2023-2024
Pre-requisite	Basics of Statistics	

LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)

- To learn about the business value of data analytics

CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)

CO1: To learn about data preprocessing operations

CO2: To learn about Descriptive analytics

CO3: To learn about Predictiveanalytics

CO4: To learn about Prescriptive Analytics

CO5: To learn about Global perspective of Business Analytics

Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)

Units	Contents	RequiredHours
I	The business value of data analytics – Statistics for analytics - Data sources - RDBMS,unstructured data and other forms of data - Data extraction and cleaning - Dimensionality andoutlieranalysis.	**12**
II	**Descriptive analytics** : Appreciation of analytical reasoning and empirical findingsfrom data - Challenges in data visualisation and data interpretation - Interpretation of raw data - Interpretation of statistical summary of data, Experimentation : Identifying a business problem- Creating a hypothesis to solve the business problem - Defining parameters that validate thehypothesis- Testingthehypothesisthroughanalysis- Interpretingtheresults oftheanalysis.	**12**

III	**Predictiveanalytics**:Businessforecastingprinciplesandissues-ArtificialIntelligence and Machine Learning in decision-making – the role of supervised learning - Role ofsupervised and unsupervised learning in decision-making - Time series analysis based decision-making-Combininghuman-expertisewithdata-drivenintelligencefordecision-making-Artificialneural networkand deep learningindecision-making	**12**
IV	**Prescriptive Analytics** : Learning through simulation and games - Individual andgroup decisionmakingissues- Use of discreteoptimisation conceptsindecision-making -Insightsfromgame-theoreticsituations, networkexternalitiesandnetworkeffectontheeconomy -Informationcascadeeffectsindecision-making.	**12**
V	**Global perspective of Business Analytics** : Business analytics case studies fromEurope,NorthAmerica,China,Japan,Asia-GDPRandemergingdataprivacylawsandconcernsacross theglobe -Data securityconcerns andbestpractices across the globe.	**12**
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminationsUPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/otherstobesolved(Tobediscussedduringthe Tutorialhour)	

Skills acquired from the course	Knowledge,ProblemSolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferrable Skill	

Learning Resources:

- **Recommended Texts**

1. BusinessAnalyticsData AnalysisDecisionMakingbyS.ChristianAlbrightWayne L.Winston

- **Reference Books**

1. Data Science for Business: What you need to know about data mining and data-analytic thinking by Foster Provost & Tom Fawcett

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

THIRD YEAR V SEMESTER			
CourseCode: EC6	**Practical: Business Analytics Programming Lab**		**Credits: 3**
LectureHours:(L) Perweek:	**TutorialHours: (T)perweek**	**LabPractice Hours: (P)perweek : 4**	**Total:(L+T+P) Perweek: 4**
CourseCategory: Elective course	**Year: III Semester: V**	**AdmissionYear:2023-2024**	
Pre-requisite			

LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)

- To learn about **Business Analytics Programming using R**

CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)

CO1:.To learn about Numerical operations

CO2: To learn about Matrix operations

CO3:. To learn about Statistical operations

CO4:. To learn about programming about classification & clustering

CO5:.. To learn about programming about Association rule mining

Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)

Units	**Contents**	**RequiredHours**
	1. Togettheinputfromuserandperformnumericaloperations(MAX,MIN,AVG,SUM,SQRT, ROUND)usingin R. 2. Toperformdataimport/export(.CSV,.XLS,.TXT)operationsusingdataframesinR. 3. Togettheinputmatrixfromuserandperform Matrixaddition,subtraction,multiplication,inversetransposeand divisionoperations usingvector concept inR. 4. Toperformstatisticaloperations(Mean,Median, ModeandStandarddeviation)usingR. 5. Toperformdatapre-processingoperationsi)HandlingMissingdataii)Min-Maxnormalization 6. Toperformdimensionalityreductionoperationusing PCAforHousesData Set 7. ToperformSimple LinearRegressionwithR. 8. ToperformK-Meansclusteringoperationand visualizeforiris dataset 9. WriteR scriptto diagnoseanydiseaseusingKNNclassification andplot the results. 10. ToperformmarketbasketanalysisusingAssociationRules(Apriori).	**60**

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminationsUPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/otherstobesolved(TobediscussedduringtheTutorialhour)	
Skills acquired from the course	Knowledge,ProblemSolving,Analyticalability,ProfessionalCompetency,ProfessionalCommunicationandTransferrable Skill	

THIRD YEAR VI SEMESTER			
CourseCode: CC13	**Computer Networks**		**Credits: 4**
LectureHours:(L) Perweek: 6	**TutorialHours: (T)perweek**	**LabPractice Hours: (P)perweek**	**Total:(L+T+P) Perweek: 6**
CourseCategory:Core	**Year: IIISemester: VI**	**AdmissionYear:2023-2024**	
Pre-requisite	Basic Knowledge on Networking		

LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)

- To understand the concept of Data communication and Computer network
- To get a knowledge on routing algorithms.
- To impart knowledge about networking and inter networking devices

To gain the knowledge on Security over Network communication

CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)

CO1: To Understand the basics of Computer Network architecture, OSI and TCP/IP reference models

CO2: To gain knowledge on Telephone systems and Satellite communications

CO3: To impart the concept of Elementary data link protocols

CO4: To analyze the characteristics of Routing and Congestion control algorithms

CO5: To understand network security and define various protocols such as FTP, HTTP, Telnet, DNS

Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)

Units	Contents	RequiredHours
I	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	**18**
II	Wireless Transmission - Communication Satellites – Telephone System: Structure, Local Loop, Trunks and Multiplexing and Switching. Data Link Layer: Design Issues – Error Detection and Correction.	**18**
III	Elementary Data Link Protocols - Sliding Window Protocols – Data Link Layer in the Internet - Medium Access Layer – Channel Allocation Problem – Multiple Access Protocols – Bluetooth	**18**
IV	Network Layer - Design Issues - Routing Algorithms - Congestion Control Algorithms – IP Protocol – IP Addresses – Internet Control Protocols.	**18**
V	Transport Layer - Services - Connection Management -	**18**

	Addressing, Establishing and Releasing a Connection – Simple Transport Protocol – Internet Transport Protocols (ITP) - Network Security: Cryptography.	
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminationsUPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/otherstobesolved(Tobediscussedduringthe Tutorialhour)	
Skills acquired from the course	Knowledge,ProblemSolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferrable Skill	

Learning Resources:

- **Recommended Texts**
  1. A. S. Tanenbaum, "Computer Networks", 4th Edition, Prentice-Hall of India, 2008.
- **Reference Books**
  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. Gallagher, "Data Networks", 2nd Edition, PHI, 2008.
  4. Lamarca, "Communication Networks", Tata McGraw- Hill, 2002

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

CourseCode: CC-14	Big Data Analytics		Credits: 4
LectureHours:(L) Perweek : 6	TutorialHours: (T)perweek	LabPractice Hours: (P)perweek	Total:(L+T+P) Perweek: 6
CourseCategory:Core	III Year VI Semester	AdmissionYear: 2023-2024	
Pre-requisite	Basic knowledge on Data handlings		

LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)

1. To know the fundamental concepts of big data and analytics.
2. To explore tools and practices for working with big data.

CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)

CO1: Work with big data tools and its analysis techniques.

CO2: Analyze data by utilizing clustering and classification algorithms.

CO3: Learn and apply different mining algorithms and recommendation systems for large volumes of data.

CO4: Perform analytics on data streams.

CO5: LearnNoSQL databases and management.

Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)

Units	Contents	Required Hours
I	**Data Explosion and Big Data Analytics**: An Overview: Introduction, Evolution of Database Technology and Big Data, Elements of Big Data, Big Data System Components, Big Data Analytics – Data Analytics. Types of Big Data Analytics, Applications of Big Data Technology, Challenges and Skills required with Big Data Technology.	18
II	**Analytical Theory:** Introduction about Classification Algorithms, Regression Techniques, Domain Specific Analytic Techniques: In	18

	Database Analytics, Text Analytics. **Real – Time Analysis:** Introduction: Real-time System, Types of Real-time System, Characteristics of Real-time Systems, Real-time Processing Systems for Big Data: Introduction, Data Integration and Analytics, Big Data Engine-Hadoop, Real-time System Architecture, Real-time Data Analytics.	
III	**Big Data: Hardware, Technology Foundations**: Introduction, Big Data Stack, Virtualization and Big Data. **Understanding NoSQL and Hadoop Ecosystem**: Introduction, NoSQL: CouchDB, MongoDB, Hadoop Ecosystem – HDFS, HBase, Yarn.	**18**
IV	**High Dimensional Data: A Big Data Perspective:** Introduction – What is Dimensionality? Dimensionality Reduction: Approaches for Dimensionality Reduction, Dimensionality Reduction Techniques. **User Interface and Visualization:** Desirable Properties, Visualization Techniques. **R Programming Basics:** Introduction, Data Types, Data Structures and Operators – Basic Data Types in R, R Operators, Vectors, List, Factor, Arrays and Matrix, Data Frame, R Programming Structure – Control Statements of R: if, if-else, if-else ladder, Switch-Case, Return, Loops and Loop Control Statements.	**18**

V	Interfacing R - Interfacing R to other languages – Parallel R–Basic Statistic s– Linear Model– Generalized Linear models–Non-linear Models– Time Series and Auto-Correlation– Clustering.	**18**
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminationsUPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/otherstobesolved(TobediscussedduringtheTutorialhour)	
Skills acquired from the course	Knowledge,ProblemSolving,Analyticalability,ProfessionalCompetency,ProfessionalCommunicationandTransferrable Skill	

LearningResources:

1. Big Data Analytics – Concepts, Techniques, Tools and Technologies – First Edition, Dr.M.Thangaraj,Dr. S. Suguna, G. Sudha, PHI Learning Private Limited, Delhi,2022.

Unit I : Chapter 1

Unit II : Chapter 2.2.2, 2.2.4, 2.3.2, 2.3.2

Chapter 3 (3.1.1, 3.1.2, 3.2, 3.3.1 – 3.3.4, 3.4)

Unit III : Chapter 4 (4.1 – 4.3)

Chapter 5 (5.1, 5.2, 5.3.1 - 5.3.3)

Unit IV : Chapter 6.1, 6.3

Chapter 7.3

Chapter 8 (8.1 – 8.3)

Unit V : Chapter 8 (8.4 – 8.7)

REFERENCE BOOKS:

1. Data Mining Concepts and Techniques – Jiawei Han, MichelineKamber& Jain Pei, Morgan Kaufmann Publishers, Third edition 2012.
2. DT Editorial Services, *Big Data Black Book: Covers Hadoop 2, MapReduce, Hive, Yarn, Pig, R and Data Visualization*, Publisher: Dreamtech Press India Pvt. Ltd, January 2016.
3. Krishna Rungta (R-tutorial), *Learn R Programming in 1 Day (Complete Guide for Beginners)*, 1st Edition, 2019.
4. Insight into Data mining Theory and Practice, K.P. Soman, ShyamDiwakar and V. Ajay, Easter Economy Edition, Prentice Hall of India, 2006.
5. Introduction to Data Mining with Case Studies, G. K. Gupta, Easter Economy Edition, Prentice Hall of India, 2006

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

THIRD YEAR VI SEMESTER			
CourseCode: CC15	**Statistical data Analysis**		**Credits: 4**
LectureHours:(L) Perweek: 6	**TutorialHours: (T)perweek**	**LabPractice Hours: (P)perweek**	**LectureHours:(L) Perweek: 6**
CourseCategory: Elective course	**Year: III Semester: VI**	**AdmissionYear:2023-2024**	
Pre-requisite	Basic knowledge of statistics		
LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)			

- To learn about the tool SAS, Which is an integrated software suite for advanced analytics, business intelligence, data management, and predictive analytics

CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)

CO1: To learn about SAS Data Libraries

CO2: To learn about SAS procedures

CO3: To learn about SET statement

CO4: To learn about SAS macro concepts

CO5: To learn about some specific procedures

Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)

Units	Contents	RequiredHours
I	Data step and Proc Step, SAS Data Libraries, Creating dataset using data lines,Importing data using INFILE statement, Importing data using Proc Import, Creating HTMLOutput, Sub setting observations using conditional statements, Sub setting variables usingKeep/Drop, Creating variables using IF-THEN else statements, Retain statement, FIRST. ,LAST., Date functions, Character functions.	**18**
II	SAS procedures, Sub setting in Procedures with the WHERE Statement, SortingData with PROC SORT, Printing Data with PROC PRINT, Summarizing Your Data UsingPROC MEANS, Writing Summary Statistics to a SAS Data Set, Counting Data with PROCFREQ,ProducingTabularReportswithPROCTABULATE,PROCSORT,PROCSUMMARY.	**18**
III	Modifying a Data Set Using the SET Statement, Stacking Data Sets Using theSET Statement, Interleaving Data Sets Using the SET Statement, Combining Data Sets UsingaOneto-OneMatchMerge,CombiningDataSetsUsingaOne-to-ManyMatchMerge,Merging Summary Statistics with the Original Data, Writing Multiple Data Sets Using theOUTPUTStatement, ChangingObservationstoVariables UsingPROC TRANSPOSE.	**18**
IV	SASMacro	**18**

	Concepts,SubstitutingTextwithMacroVariables,CreatingModularCode with Macros, Adding Parameters to Macros, Writing Macros with Conditional Logic,Writing Data-Driven Programs with CALL SYMPUT. Proc SQL, Using Proc SQL to createtables,Modifyingtables,Aggregatingtables, Stackingand Mergingtables.	
V	PROCUNIVARIATE,PROCMEANS,PROCCORR,PROCPLOT,PROCFREQ,PROCTTEST,PROCNPAR,PROCANOVA,PROCREG,PROCARIMA.	**18**
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminationsUPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/otherstobesolved(Tobediscussedduringthe Tutorialhour)	
Skills acquired from the course	Knowledge,ProblemSolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferrable Skill	

Learning Resources:

- **Recommended Texts**

1. TheLittleSASBook:APrimer,FourthEdition,LoraD.Delwiche,SusanJ.Slaughter.
2. SASInstituteLearningSASbyExample:AProgrammer'sGuide,RonCody,SASInstitute.

- **Reference Books**

1. SAS Essentials: Mastering SAS for Data Analytics by Alan C. Elliott & Wayne A. Woodward

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

THIRD YEAR VI SEMESTER			
CourseCode: EC7	**Machine Learning**		**Credits: 3**
LectureHours:(L) Perweek: 5	**TutorialHours: (T)perweek**	**LabPractice Hours: (P)perweek**	**Total:(L+T+P) Perweek: 5**
CourseCategory:Elective course	**Year: III, Semester: VI**		**AdmissionYear: 2023-2024**
Pre-requisite	Basic Knowledge on Networking		

LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)

- To provide strong foundation on fundamental concepts in Computing Intelligence
- To apply basic principles of Artificial Intelligence and solutions that require problem solving, influence, perception, knowledge representation and learning

CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)

CO1: Describe the fundamentals of artificial intelligence concepts and searching techniques.
CO2: Develop the fuzzy logic sets and membership function and defuzzification techniques.
CO3: Understand the concepts of Neural Network and analyze and apply the learning techniques
CO4: Understand the artificial neural networks and its applications
CO5: Understand the concept of Genetic Algorithm and Analyze the optimization problems using GAs.

Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)

Units	Contents	RequiredHours
I	Introduction to AI: Problem formulation – AI Applications – Problems – State Space and Search – Production Systems – Breadth First and Depth First – Travelling Salesman Problem – Heuristic search techniques: Generate and Test – Types of Hill Climbing.	**15**
II	Fuzzy Logic Systems: Notion of fuzziness – Operations on	**15**

	fuzzy sets – T-norms and other aggregation operators – Basics of Approximate Reasoning – Compositional Rule of Inference – Fuzzy Rule Based Systems – Schemes of Fuzzification – Inferencing – Defuzzification – Fuzzy Clustering – fuzzy rule-based classifier.	
III	Neural Networks: What is Neural Network, Learning rules and various activation functions, Single layer Perceptions, Back Propagation networks, Architecture of Back propagation (BP) Networks, Back propagation Learning, Variation of Standard Back propagation Neural Network, Introduction to Associative Memory, Adaptive Resonance theory and Self Organizing Map, Recent Applications	**15**
IV	**Artificial Neural Networks:** Fundamental Concepts – Basic Models of Artificial Neural Networks – Important Terminologies of ANNs – McCulloch-Pitts Neuron – Linear Separability – Hebb Network.	**15**
V	Genetic Algorithm: Introduction – Biological Background – Genetic Algorithm Vs Traditional Algorithm – Basic Terminologies in Genetic Algorithm – Simple GA – General Genetic Algorithm – Operators in Genetic Algorithm.	**15**
Extended Professional Component (is a part of internal component only, Not to be included in the External	Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminationsUPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/otherstobesolved(Tobediscussedduringthe Tutorialhour)	

Examination question paper)		
Skills acquired from the course	Knowledge,ProblemSolving,Analyticalability,Professional Competency,ProfessionalCommunicationandTransferrable Skill	

LearningResources:

- **RecommendedTexts**

1. S.N. Sivanandam and S.N. Deepa, "Principles of Soft Computing", 2nd Edition, Wiley India Pvt. Ltd.
2. Stuart Russell and Peter Norvig, "Artificial Intelligence - A Modern Approach", 2nd Edition, Pearson Education in Asia.
3. S. Rajasekaran, G. A. Vijayalakshmi, "Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications", PHI.

- **ReferenceBooks**

1. F. Martin, Mcneill, and Ellen Thro, "Fuzzy Logic: A Practical approach", AP Professional, 2000. Chin Teng Lin, C. S. George Lee," Neuro-Fuzzy Systems", PHI.
2. Chin Teng Lin, C. S. George Lee," Neuro-Fuzzy Systems", PHI.

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

THIRD YEAR VI SEMESTER			
CourseCode: EC-8	**Practical: StatisticsData AnalysisLab**		**Credits: 3**
LectureHours:(L) Perweek:	**TutorialHours: (T)perweek**	**LabPractice Hours: (P)perweek : 5**	**Total:(L+T+P) Perweek: 5**
CourseCategory: Core	**Year: III Semester: VI**	**AdmissionYear:2023-2024**	

Pre-requisite	Basics of Statistics & Excel

LearningObjectives:(forteachers:whattheyhavetodointheclass/lab/field)

- To learn about the tool SAS, Which is an integrated software suite for advanced analytics, business intelligence, data management, and predictive analytics.
-

CourseOutcomes:(forstudents:Toknowwhattheyaregoingtolearn)

With SAS software, you can complete these tasks:

CO-1: Access data in almost any format, including SAS tables, Microsoft Excel tables, and database files.

CO-2: Manage and manipulate your existing data to get the data that you need. For example, you can subset your data, combine it with other data, and create new columns.

CO-3: Analyze your data using statistical techniques ranging from descriptive measures like correlations to logistic regression and mixed models to sophisticated methods such as modern model selection and Bayesian hierarchical models.

CO-4: Present the results of your analyses in a meaningful report that you can share with others.

CO-5: The reports that you create can be saved in a wide variety of formats, including HTML, PDF, and RTF.

Recap:(notforexamination)Motivation/previouslecture/relevantportionsrequiredforthe course)[Thisisdoneduring2Tutorialhours)

Units	**Contents**	**RequiredHours**
	1. ImportData usingSAS 2. Applyfilteringtechniques onData Set inSAS 3. DrawHistogramforDataSet inSAS 4. ImportExcelfilesintoSAS 5. PerformSummaryStatistics in SAS 6. CreateDecisionTreesusingSAS 7. UsingSAScalculatethemeansofseveralspecifiedvariables,limitingtheoutputtotwodecimal places. 8. InSASusePROCMEANStocalculatemeansforanentiredatasetorbygrouping variables. Use two grouping variables and you want to produce a series of histograms to	**75**

	comparedistributions	
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questionsrelatedtotheabovetopics,fromvariouscompetitiveexaminationsUPSC/TRB/NET/UGC–CSIR/GATE/TNPSC/otherstobesolved(TobediscussedduringtheTutorialhour)	
Skills acquired from the course	Knowledge,ProblemSolving,Analyticalability,ProfessionalCompetency,ProfessionalCommunicationandTransferrable Skill	
LearningResources: **Reference Books: SAS Essentials: Mastering SAS for Data Analytics** by Alan C. Elliott & Wayne A. Woodward.		

Subject Code	**Subject Name**	**Category**	**L**	**T**	**P**	**S**	**Credits**	**Inst. Hours**	**Marks**		
									CIA	**External**	**Total**
SEC 8	**Quantitative Aptitude**	Skill Enha. Course (SEC)	2	-	-	-	2	2	25	75	100

Learning Objectives	
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 rule.	6
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
	Total	**60**
Course Outcomes		**Programme Outcome**
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
Text Book		
1	"QuantitativeAptitude",R.S.AGGARWAL.,S.Chand&CompanyLtd.,	
Reference Books		
1.		
Web Resources		
1.	https://www.javatpoint.com/aptitude/quantitative	
2.	https://www.toppr.com/guides/quantitative-aptitude/	
