



**Vivekanand Education Society's
College of Arts, Science and Commerce
(Autonomous)**

Sindhi Society, Chembur, Mumbai, Maharashtra - 400 071.

Accredited by NAAC "A Grade" in 3rd Cycle-2017

Best College Award- Urban Area, University of Mumbai (2012-13)

Recipient of FIST Grant (DST) and STAR College Grant (DBT)

**Affiliated to the
University of Mumbai**

Credit Based System for Holistic Development

Syllabus for **FYBSc Computer Science**

Program: B.Sc. Computer Science(Major)
(Program code: VESUSCS)

As per NEP 2020

with effect from Academic Year 2026-2027

PREFACE

The NEP-2020 is aimed to make India a global knowledge superpower with equitable access to the highest-quality education for all learners. The holistic and multidisciplinary education proposed under NEP-2020 is expected to facilitate the all-round development of learners with enhancement in employability potential and skills for new jobs in emerging fields. NEP envisages the development of guidelines for curriculum and credit framework for four year undergraduate programmes, regulations prescribing a minimum standard and the procedure for the award of the one year Certificate, two year Diploma, three years Bachelor Degree, four years Bachelor Degree (Research/ Honors) and Master's degree with multiple entry and exit options and transformation of HEIS into multidisciplinary institutions.

From this academic year, VESASC as an autonomous college, is going to implement NEP for the first year students as per the guidelines given by Government of Maharashtra through the 20th April 2023 GR. This model can be implemented in various ways out of which the **Department of Computer Science would be following the Department/ Subject Specific(DSC) model for Computer Science under which computer science should be pursued by the students as a mandatory requirement. DSCs shall be the core credit** courses which will be appropriately arranged and graded across all the semesters of the study.

Computer Science (CS) has been evolving as an important branch of science throughout the world in the last couple of decades. 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.

Computer Science education at undergraduate level (+3) will result in earning a Bachelor of Science (BSc) degree in CS. BSc with CS and BSc(Hons) in CS are aimed at undergraduate level training, laying a strong foundation of CS at an early stage of the career and facilitating multiple career paths. Students so graduated, can take up postgraduate programmes in CS leading to research as well as R&D, can be employable at IT industries(as Web Developer, Software Engineer, Network Engineer, Data Scientist, or AI/ML personnel), or can pursue a teachers' training programme such BEd in Computer Education, or can adopt a business management career.

Program Learning Outcomes

- To develop an understanding and knowledge of the basic theory of Computer Science with a good foundation on theory, systems and applications such as algorithms, data structures, data handling, data communication and computation.
- To develop the ability to use this knowledge to analyse new situations
- To acquire necessary and state-of-the-art skills to take up industry challenges. The objectives and outcomes are carefully designed to suit the above-mentioned purpose.
- The ability to synthesize the acquired knowledge, understanding and experience for a better and improved comprehension of the real-life problems
- To learn skills and tools like mathematics, statistics, IoT to find the solution, interpret the results and make predictions for the future developments.

FYBSc Computer Science

MAJOR COURSES

Sem.	Theory / Practical	Course Title	No of Credits	No. of Hours	Total Credits
I	Theory	Computer Fundamentals	2	30	6
	Theory	Programming using Python	2	30	
	Practical	Computer Science Practical 1	2	60	
II	Theory	Design and Analysis of Algorithms	2	30	6
	Theory	Database Management System	2	30	
	Practical	Computer Science Practical 2	2	60	

MINOR COURSES

Sem.	Theory / Practical	Course Title	No of Credits	No. of Hours	Total Credits
II	Theory	Mathematical Statistics	2	30	2

OPEN ELECTIVE(OE/GE) COURSE BASKET(Total Credits 4 per sem)

GROUP A	GROUP B	CREDITS per course
Financial Literacy	Foundation of Human Skills	02
Fundamentals of Banking	Travel and Tourism	02
Art of Leadership and Management	Introduction to Stock Market	02
Advertising	Digital Marketing	02
Neuro Marketing	Event management	02
Quantitative Aptitude	Personality Development	02
Networking(Not for CS)	Introduction to Photography	02
Lifestyle Related Disorder	Poisons in food	02
-	Python for Everybody(Not for CS)	02

Vocational Skill Courses (VSC)

Sem.	Theory / Practical	Course Title	No of Credits	No. of Hours	Total Credits
I	Practical	Web Designing	2	60	2
II	Practical	Application Designing using Python	2	60	2

Skill Enhancement Courses (SEC)

Sem.	Theory / Practical	Course Title	No of Credits	No of Hours	Total Credits
I	Practical	Linux Operating System	2	60	2
II	Practical	Statistical Analysis	2	60	2

Ability Enhancement Courses (AEC)

Sem.	Theory / Practical	Course Title	No of Credits	No of Hours	Total Credits
I	Theory	AEC : Business Communication 1	2	30	6
I	Theory	VEC : Indian Constitution	2	30	
I	Theory	IKS : Vedic Mathematics	2	30	
II	Theory	AEC : Business Communication 2	2	30	4
II	Theory	VEC : Environmental Science	2	30	

Co-Curricular Courses (CC)

Sem.	Theory / Practical	Course Title	No of Credits	No of Hours	Total Credits
I	Activity Based	CC : NSS / Health & Wellness / Sports / Music / Cultural Activities / Sunday School / Department Activities etc	2	60	4
II	Activity Based	CC : NSS / Health & Wellness/ Sports / Music / Cultural Activities / Sunday School / Department Activities etc	2	60	

Semester I

Course Code	Course Title	Credits	Lectures/ Week
UMMCS S1-101	Computer Fundamentals	2	2
About the course: This course introduces the principles of computer organization and the basic architecture concepts. The course emphasizes instruction set design, pipelining, memory hierarchy, virtual memory management, and I/O systems. In particular, the course will cover an overview of computer operating systems, processes, CPU scheduling.			
Course Objectives: - To have an understanding of Digital systems and operation of a digital computer. - To learn different architectures & organizations of memory systems, processor organization and control unit. - Principles of multiprocessor and parallel organization's as advanced computer architectures - To learn basic concepts and structure of operating systems. - To learn about process - To learn CPU scheduling.			
Learning Outcomes: After successful completion of this course, students would be able to - To learn about how computer systems work and underlying principles - To understand the basics of digital electronics needed for computers - To understand the basics of instruction set architecture for reduced and complex instruction sets - Work with any type of operating system - Work with Linux file system structure, Linux Environment			
Unit	Topic	No. of lectures	
I	Fundamentals of Digital Logic: Number System, Boolean algebra, Logic Gates, Simplification of Logic Circuits: Algebraic Simplification, Karnaugh Maps. Combinational Circuits: Adders, Mux, De-Mux, Sequential Circuits: Flip Flops (SR, JK & D), Counters: synchronous and asynchronous Counter Computer System: Comparison of Computer Organization & Architecture, Von Neumann Architecture Computer Components and Functions, Interconnection Structures.	10	
II	Processor Organization: Instruction Formats, Instruction Sets, Addressing Modes, Addressing Modes Examples with Assembly Language [8085/8086 CPU], Processor Organization, Structure and Function. Register Organization, Basic Microprocessor operations: Data Transfer (Register / Memory) Operations, Arithmetic & Logical Operations, Instruction Cycle, Instruction Pipelining. Introduction to RISC and CISC Architecture, Instruction Level Parallelism, Flynn's Taxonomy, Multiprocessor Systems Memory System Organization: Classification and design parameters, Memory Hierarchy, Internal Memory: RAM, SRAM and DRAM, Cache	10	

	Memory: Design Principles, Memory mappings, Cache performance, Cache Coherence. Virtual Memory	
III	Introduction to Operating-Systems: Definition of Operating System, Operating System's role, Operating-System Operations, Functions of Operating System, Computing Environments Processes: Process Concept, Process Scheduling, Operations on Processes, Inter process Communication CPU Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms (FCFS, SJF, SRTF, Priority, RR, Multilevel Queue Scheduling, Multilevel Feedback Queue Scheduling)	10

Text Books :

1. M. Mano, Computer System Architecture 3rd edition, Pearson
2. Carl Hamacher et al., Computer Organization and Embedded Systems, 6 ed., McGraw-Hill 2012
3. R P Jain, Modern Digital Electronics, Tata McGraw Hill Education Pvt. Ltd. , 4th Edition, 2010
4. Abraham Silberschatz, Peter Galvin, Greg Gagne, Operating System Concepts, Wiley, 2021

Additional References:

1. William Stallings (2010), Computer Organization and Architecture- designing for performance, 8th edition, Prentice Hall, New Jersey.
2. Anrew S. Tanenbaum (2006), Structured Computer Organization, 5th ed. Pearson Education Inc,
3. John P. Hayes (1998), Computer Architecture and Organization, 3rd edition, Tata McGrawHil
4. Achyut S. Godbole, Atul Kahate, Operating Systems, Tata McGraw Hill, 2017 2.
- Naresh Chauhan, Principles of Operating Systems, Oxford Press, 2014
5. Andrew S Tanenbaum, Herbert Bos, Modern Operating Systems, 4e Fourth Edition, Pearson Education, 2016

Course Code	Course Title	Credits	Lectures/ Week
UMMCSS 1-102	Introduction to Programming using Python	2	2

About the course:

This course is aimed at introducing one of the fastest growing programming languages of the current time and enables learners to understand the fundamentals of programming with Python. Learners will be able to write programs to solve real-world problems, and produce quality code. It will help to develop strong skills of programming for implementing applications for emerging fields including Artificial Intelligence ,Data Science and Machine Learning.

Learning Outcomes:

After successful completion of this course, students would be able to:

- Ability to store, manipulate and access data in Python
- Ability to implement basic Input / Output operations in Python
- Ability to define the structure and components of a Python program.
- Ability to learn how to write decision statements and loops in Python.

- Ability to learn how to write functions and pass arguments in Python.

Unit	Topic	No. of lectures
I	Overview of Python: History & Versions, Features of Python, Execution of Python Program, Flavors of Python, Installing Python, Writing and Executing First Python Program, Getting Help, IDLE. Data Types, Variables and Other Basic Elements: Comments, Docstrings, Data types- Numeric Data type, Compound Data Type, Boolean Data type, Basic Elements of Python. Variables, Operators: Arithmetic operators, Assignment operators, Input Function, Output Statements, The print() function, Unary minus operator, Relational operators, Logical operators, Bitwise operators, Membership operators, Identity operators, Precedence of Operators, Associativity of Operators. Control Statements: The if statement, The if ... else Statement, The if ..elif ... else Statement, Loop Statements- while loop, for loop, Infinite loop, Nested loop, loops with else, break statement, continue statement, pass statement.	10
II	Functions: Built-in Functions, Function definition and call, Returning Results, Returning Multiple Values from a Function, Parameters and Arguments, Formal and Actual Arguments, Positional Arguments, Keyword Arguments, Default Arguments, Arbitrary Arguments, Anonymous or Lambda Function. Strings: Creating Strings, Functions of Strings, Working with Strings, Length of a String, Indexing and Slicing, Repeating and Concatenating Strings, Checking Membership, Comparing Strings, Removing Spaces, Finding Substrings, Counting Substrings, Immutability, Splitting and Joining Strings, Changing Case, Checking Starting and Ending of a String, Sorting Strings, Searching in the Strings, Testing Methods, Formatting Strings, Finding the Number of Characters and Words, Inserting Substrings into a String List Tuples and Sets: Lists, List Functions and Methods, List Operations, List Slices, Nested Lists, Tuples, Functions in Tuple Dictionaries: Creating a Dictionary, Operators in Dictionary, Dictionary Methods, Using for Loop with Dictionaries, Operations on Dictionaries, Converting Lists into Dictionary, Converting Strings into Dictionary, Passing Dictionaries to Functions	10

III	Modules: Introduction to Modules in Python Date and time in Python: Date and time now, combining date and time, formatting dates and times, finding durations using “time delta”, comparing two dates, sorting dates, stopping execution temporarily, knowing the time taken by a program, calendar module Arrays: Creating Arrays, Indexing and Slicing of Arrays, Basic Array Operations, Arrays Processing, Mathematical Operations on Array, Aliasing Arrays, Slicing and Indexing in NumPy Arrays, Basic slicing, Advanced Indexing, Dimensions of Arrays, Attributes of an Array, The ndim Attribute, The shape Attribute, The size Attribute, The itemsize Attribute.	10
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Text Books :

1. Practical Programming: An Introduction to Computer Science Using Python 3, Paul Gries , Jennifer Campbell, Jason Montojo, Pragmatic Bookshelf, 2nd Edition
2. Beginning Python: From Novice to Professional, Magnus Lie Hetland, Apress, 2017
3. Let Us Python, Yashwant. B. Kanetkar, BPB Publication, 2019.

Additional References:

1. Programming through Python, M. T Savaliya, R. K. Maurya & G M Magar, Sybgen Learning India, 2020
2. Python: The Complete Reference, Martin C. Brown, McGraw Hill, 2018
3. Programming in Python, Mark Summerfield, Pearson Education, 2nd Ed, 2018
4. Python Programming: Using Problem Solving Approach, Reema Thareja, Oxford University Press, 2017

Course Code	Course Title	Credits	Practicals/ Week
UMMCSS1-103	Practicals Based on UMMCSS1-101 and UMMCSS1-102 (Computer Science Practical 1)	2	4

Practical of Computer Fundamentals :

1. Study and verify the truth table of various logic gates (NOT, AND, OR, NAND, NOR, EX-OR, and EX-NOR).
2. Simplify the given Boolean Expression and realize it.
3. Design and verify a half/full adder
4. Design and verify half/full subtractor
5. Design and verify the operation of flip-flops using logic gates.
6. Design and implement expressions using multiplexers / demultiplexers.
7. Verify the operation of Counter.
8. Verify the operation of a 4 bit shift register

Practical of Introduction to Programming using Python :

1. Write a program to design and develop simple python program and to implement various control statement using suitable examples
2. Write a Python program to demonstrate the precedence and associativity of operators.

3. Write a program to implement a list in Python for suitable problems. Demonstrate various operations on it.
4. Write a program to implement tuples in Python for suitable problems. Demonstrate various operations on it.
5. Write a program to implement a dictionary in Python for suitable problems. Demonstrate various operations on it.
6. Write a program in Python to define and call functions for suitable problems.
7. Write a Python program to demonstrate different types of function arguments.
8. Write a suitable Python program to implement Fibonacci series, Factorial of a number and more such problems using User Defined Functions.
9. Write a Python program to implement and use lambda function in python
10. Write a python program to create and manipulate arrays in Python. Demonstrate the use of slicing and indexing and various other functions for accessing the elements from the array.

Course Code	Course Title	Credits	Lectures/ Week
UOECSS1-15 3	Logical Reasoning and Aptitude	2	2

About the course:

Everyone has a desire to improve their aptitude and reasoning skills because nowadays wherever you want to succeed, Aptitude and Reasoning are weapons to seal it, because aptitude is a basic topic which is used to determine any person's problem solving skills and numerical ability. Anything in life can be achieved by continuous practice because practice makes man intelligent. Key for developing any sort of skill is passionate handwork following a well-planned strategy.

Course Objectives:

The entire objective of the 30 hours aptitude development is to develop the basics of the students towards two segments of aptitude that are Logical Reasoning and Quantitative Aptitude. The subject is hosted in order to make the students corporate ready and to help them understand the need to improve on the areas of aptitude.

Learning Outcomes:

1. To develop basic skills related to aptitude.
2. To understand the use of aptitude in all the spheres of career and prepare for them precisely.
3. Common methodologies of solving questions related to Logical Reasoning and Quantitative Aptitude.
4. Learn the various question types and their basic approaches.
5. Create a bridge for the advanced levels of aptitude and prepare a base for the Employability Enhancement Program.

Unit	Topic	No. of lectures
I	Number System Number Series, Symbol Series, Analogies, Direction Sense and puzzles, Profit and Loss	10
II	Percentages and Ratios, Averages and Ages, Blood Relations and Arrangements, Calendars and clock Time, Speed and Distance	10

III	Time and Work, Permutations and Combinations, Seating Arrangements, Basic Geometry and Logarithm, Logical Set Theory and Venn Diagrams	10
Text Books : 1. Quantitative aptitude for Competitive examination By R S Agarwal Additional References: 1. A Modern Approach to Verbal & Non Verbal Reasoning By R S Agarwal 2. Analytical and Logical reasoning By Sijwali B S 3. Analytical and Logical reasoning for CAT and other management entrance test By Sijwali B S 4. Quantitative Aptitude by Competitive Examinations by Abhijit Guha 4 th edition		

Course Code	Course Title	Credits	Lectures/ Week
UOECSS1-16 7	Python for Everybody	2	2
About the course: This course is aimed at introducing one of the fastest growing programming languages of the current time and enables learners to understand the fundamentals of programming through it. It also aims to cover various fields where python can be used.			
Course Objectives: - To introduce to the fundamentals of programming - To introduce the syntax of python to write programs - To cover various fields as applications of python			
Learning Outcomes: - Learners should be able to understand the syntax of programming and execute programs - Learners should be able to solve basic problems from various domains using programs - Learners should be able to explore and use specialised python modules used in their domain			
Unit	Topic	No. of lectures	
I	Introduction - What is a program & Software, Programming & Computer Languages, About Python Language Basics of Programming - Data Types & Variables, Arithmetic Operators, Input-Output & Different types of programming statements, Logical Operators, Using Strings and Lists with subscripts	10	
II	Programming Constructs - Sequence, Selection - if & nested if, Iteration - while & break, Basics of Function - What is a function, defining and calling a function, Parameters and return types Modules - What is a module, Using dot operator, using in-built modules like math, random, os, datetime etc.	10	

III	Data Analysis & Visualization - Basic data analysis using numpy, pandas and matplotlib or any other suitable modules Exploring modules like pygame for game designing, pytorch for image processing	10
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Text Books :

1. PYTHON PROGRAMMING 2E by Reema Thareja, Oxford Publications, Feb 2023
2. Data Analysis with Python Rituraj Dixit

Additional References:

1. <https://www.w3schools.com/python/>
2. <https://realpython.com/pygame-a-primer/>
3. Python for Data Science for Dummies, Luca Massaron John Paul Mueller, 2ed Paperback, 1 January 2019

Course Code	Course Title	Credits	Practical/ Per Week
UVSCSS1-126	Web Designing	2	4

About the Course:
The course provides an insight into emerging technologies to design and develop state of the art web applications using client-side scripting, server-side scripting, and database connectivity

Course Objectives:

- To understand the concepts of HyperText Markup Language and Cascading Style Sheets.
- To learn JavaScript for creating dynamic websites.
- To learn various operations performed on data among web applications using XML
- To learn Server-Side Programming using PHP.

Learning Outcomes:

- After successful completion of this course, students would be able to Design valid, well-formed, scalable, and meaningful pages using emerging technologies.
- Understand the various platforms, devices, display resolutions, viewports, and browsers that render websites.
- Develop and implement client-side and server-side scripting language Programs.
- Develop and implement Database Driven Websites.

List of Practicals:

1. Design a webpage that makes use of
 - a. Document Structure Tags
 - b. Various Text Formatting Tags
 - c. List Tags
 - d. Image and Image Maps
2. Design a webpage that makes use of
 - a. Table tags
 - b. Form Tags (forms with various form elements)
 - c. Navigation across multiple pages
 - d. Embedded Multimedia elements
3. Design a webpage that make use of Cascading Style Sheets with

- a. CSS properties to change the background of a Page
- b. CSS properties to change Fonts and Text Styles
- c. CSS properties for positioning an element
- 4. Write JavaScript code for
 - a. Performing various mathematical operations such as calculating factorial / finding Fibonacci Series / Displaying Prime Numbers in a given range / Evaluating Expressions / Calculating reverse of a number
 - b. Validating the various Form Elements
- 5. Write JavaScript code for
 - a. Demonstrating different JavaScript Objects such as String, RegExp, Math, Date.
 - b. Demonstrating different JavaScript Objects such as Window, Navigator, History, Location, Document,
 - c. Storing and Retrieving Cookies
- 6. Write a PHP scripts for performing certain mathematical operations such as calculating factorial / finding Fibonacci Series / Displaying Prime Numbers in a given range / Evaluating Expressions / Calculating reverse of a number
- 7. Write PHP scripts for
 - a. Retrieving data from HTML forms
 - b. Working with Arrays
 - c. Working with Files (Reading / Writing)
- 8. Write PHP scripts for
 - a. Storing and Retrieving Cookies
 - b. Storing and Retrieving Sessions

Textbooks:

- 1 HTML 5 Black Book, Covers CSS 3, JavaScript, XML, XHTML, AJAX, PHP and jQuery, 2ed, Dreamtech Press, 2016
2. Web Programming and Interactive Technologies, scriptDemics, StarEdu Solutions India, 2018
3. PHP: A Beginners Guide, Vikram Vaswani, TMH

Additional References:

1. HTML, XHTML, and CSS Bible Fifth Edition, Steven M. Schafer, WILEY, 2011
2. Learning PHP, MySQL, JavaScript, CSS & HTML5, Robin Nixon, O'Reilly, 2018
3. PHP, MySQL, JavaScript & HTML5 All-in-one for Dummies, Steve Suehring, Janet Valade Wiley, 2018

Course Code	Course Title	Credits	Practical/ Per Week
USECSS1-1 31	Linux Operating System	2	4

About the Course:

This syllabus will help to train students in fundamental skills and build-up sustainable interest in Linux Operating System. It will improve the necessary knowledge base to understand Linux Operating System and its practical implementation, it will also help to develop Linux based solutions for real life problems.

Course Objectives:

- To learn basic concepts of Linux in terms of operating system
- To learn use of various shell commands with regular expressions
- To set Linux Environment variables and learn setting file permissions to maintain Linux security implementation
- To learn various editors available in Linux OS
- To learn shell scripting.
- To learn installation of compilers and programming using C and Python languages on Linux platform

Learning Outcomes:

After successful completion of this course, students would be able to

- Work with Linux file system structure, Linux Environment
- Handle shell commands for scripting, with features of regular expressions, redirections
- Implement file security permissions
- Work with vi, sed and awk editors for shell scripting using various control structures
- Install softwares like compilers and develop programs in C and Python programming languages on Linux Platform

List of Practicals:**1. Installation of Ubuntu Linux operating system.**

- a) Booting and Installing from (USB/DVD)
- b) Using Ubuntu Software center / Using Synaptic
- c) Explore useful software packages.

2. Becoming an Ubuntu power user

- a) Administering system and User setting
- b) Learning Unity keyboard
- c) Using the Terminal
- d) Working with windows programs

3. File System Commands: touch, help, man, more, less, pwd, cd, mkdir, rmdir, ls, find, ls, etc

File handling Commands: cat, cp, rm, mv, more, file, wc, od, cmp, diff, comm, chmod, chown, chgrp, gzip and gunzip, zip and unzip, tar, ln, unmask,, chmod, chgrp, chown, etc

4. General purpose utility Commands: cal, date, echo, man, printf, passwd, script, who, uname, tty, stty, etc

Simple Filters and I/O redirection: head, tail, cut paste, sort, grep family, tee, uniq, tr, etc.

Networking Commands: who, whoami, ping, telnet, ftp, ssh, etc

5. Editors: vi, sed, awk

6. Working and Managing with processes- sh, ps, kill, nice, at and batch etc.

7. Shell scripting I: Defining variables, reading user input, exit and exit status commands, , expr, test, [], if conditional, logical operators

8. Shell scripting II: Conditions (for loop, until loop and while loop) arithmetic operations, examples

9. Shell scripting III: Redirecting Input / Output in scripts, creating your own Redirection

10. Installation of C/C++/Java/Python Compiler and creating an environment for app development. Basic programming using C and Python Languages.

TextBooks : 1. “Linux Command line and Shell Scripting Bible”, Richard Blum, Wiley India. 2. “Unix: Concepts and Applications”, Sumitabha Das, 4th Edition, McGraw Hill. 3. “Official Ubuntu Book”, Matthew Helmke& Elizabeth K. Joseph with Jose Antonio Rey and Philips Ballew, 8th Ed. Additional References: 1. “Linux Administration: A Beginner's Guide”, Fifth Edition, Wale Soyinka, Tata McGraw-Hill, 2008. 2. “Linux: Complete Reference”, Richard Petersen, 6th Edition, Tata McGraw-Hill 3. “Beginning Linux Programming”, Neil Mathew, 4th Edition, Wiley Publishing, 2008.	

Course Code	Course Title	Credits	Lects/ Week
UAECSS1-14 1	Business Communication 1	2	2
About the course: Communication is the most important aspect of a learner's journey through education and profession. This course aims to develop basic English proficiency and how to use it effectively at profession level.			
Course Objectives: With this paper - ● Instill basic knowledge of English ● The learners are expected to learn to understand and interpret any text they are reading from different perspectives. ● Learners should be able to acquire proficiency in the skills of listening, speaking, reading and writing that will help them meet the challenges of the world. ● The learners are expected to develop good oral and written skills of communication in the English language. ● The learner is expected to enhance the desired purpose and follow certain parameters to make communication more effective in their professional life.			
Learning Outcomes: The Learners will learn to - ● Improve proficiency on English language. ● Understand and interpret any text they are reading from different perspectives. ● Use the concepts of reading and understanding various forms of communication and be able to become excellent communicators... ● Develop the concept of summarizing research paragraphs. ● Understand the concepts of effective oral, listening and writing skills ● Understand the importance of communication in management and be able to increase managerial efficiency.			
Unit	Topic	No. of lectures	

I	Basic English Language Skills Grammar: • Articles, prepositions, conjunctions • Transformation of Sentences (Simple, Compound, Complex) • Tenses • Subject-Verb agreement • Question Tags • Direct and Indirect Speech • Voice • Antonyms, Synonyms • Suffixes, Prefixes, Root words • Homophones, homonyms • Collocation • Changing the Class of Words Vocabulary Building: • Useful words for Different Expressions • Idiomatic Expressions	10
II	Reading & Writing Skills Reading Skills: The following skills to be acquired: • Reading with fluency and speed • Skimming and scanning • Identifying relevant information • Isolating fact from opinion • Understanding concepts and arguments • Identifying distinctive features of language Writing Skills: Essay • Expository • Persuasive • Analytical • Reflective/Descriptive Editing & Summarization • Heading/ Headlines/ Title/Use of Capital Letters • Punctuation: full stop, comma, colon, semi-colon, dash, ellipsis, Exclamation and question marks • Spelling • Substitution of words • Use of link words and other cohesive devices • Removing repetitive or redundant elements	10
III	Introduction to Business Communication : Definition and importance of business communication Functions and objectives of business communication Types and forms of business communication, Communication Process,	10

	Elements of communication : Sender, message, receiver, and feedback Communication barriers and how to overcome them, Use of technology in communication, Ethics in business communication	
Text Books : 1. A Comprehensive Book of Synonyms and Antonyms By B.N.Aggarwal, Sunrise Publishers, Delhi 2. A course in English Grammar by R N Bakshi, Orient Blackswan Pvt Ltd, Kolkata 3. Successful Writing Skills by Lawrence Shaffer, IVY Publishing house, Delhi 4. Business Communication Today by Courtland L. Bovee and John V. Thill 5. Effective Business Communication by Herta A. Murphy, Herbert W.Hildebrandt, and Jane P. Thomas Additional References: 1. Academic Writing : A practical Guide for Students by Stephen Bailey Foundation Books 2. Bellare, Nirmala. Reading Strategies. Vols.1 & 2 New Delhi. Oxford University Press, 1998. 3. Bhasker, W. W. S & Prabhu, N. S.: English through Reading, Vols.1& 2. Macmillan, 1975.		

Course Code	Course Title	Credits	Lectures/ Week
UIKCSS1-125	Vedic Mathematics	2	2
About the course: Vedic Mathematics is a super-fast way of calculation. There are just 16 Sutras or Word Formulae which solve all known mathematical problems in the branches of Arithmetic, Algebra, Geometry and Calculus. They are easy to understand, easy to apply and easy to remember.			
Course Objectives: ● To enable the learners to explore the power of Vedic Mathematics. ● To make learners strong in Numerical Mathematics. ● To enable learners to recognize and understand simple techniques of Arithmetic Calculations. ● To train learners to use the ideas of Vedic Mathematics in daily calculations and make those calculations with accuracy and speed.			
Learning Outcomes: By successfully completing this course, the learner will be able to: ● Perform simple arithmetic calculations with speed and accuracy ● Will be able to generate tables of any number ● To perform products of large numbers quickly ● Develop confidence in calculating square roots and cube roots of integers ● Perform difficult calculations speedily. ● Face Numerical Aptitude part of any Competitive Examination confidently.			
Unit	Topic	No. of lectures	
I	Introduction, What is Vedic Mathematics?	15	

	SUTRAS: Ekadhikina Purvena Meaning: By one more than the previous one, Nikhilam Navatashcaramam Dashatah Meaning: All from 9 and the last from 10, Urdhva-Tiryagbyham Meaning: Vertically and crosswise, Paraavartya Yojayet Meaning: Transpose and adjust, Shunyam Saamya samuccaye Meaning: When the sum is the same that sum is zero, (Anurupye) Shunyamanyat Meaning: If one is in ratio, the other is zero.	
II	Sankalana-vyavakalanabhyam Meaning: By addition and by subtraction, Puranapuranaabhyam Meaning: By the completion or non-completion, Chalana-Kalanabyham Meaning: Differences and Similarities, Yaavadunam Meaning: Whatever the extent of its deficiency, Vyashtisamanstih Meaning: Part and Whole, Shesanyankena Charamena Meaning: The remainders by the last digit, Sopaantyadvayamantyam Meaning: The ultimate and twice the penultimate, Ekanyunena Purvena Meaning: By one less than the previous one, Gunitasamuchyah Meaning: The product of the sum is equal to the sum of the product, Gunakasamuchyah Meaning: The factors of the sum is equal to the sum of the factors	15

Text Books :

1. Bhatiya Dhaval, Vedic Mathematics Made Easy, Jaico Publishing House

Additional References:

1. Thakur Rajesh Kumar, Vedic Mathematics for students taking Competitive Examinations. Unicorn Books 2015 or Later Edition
2. Gupta Atul, Power of Vedic Mathematics with Trigonometry, Jaico Books
3. V. G. Unkalkar, Magical World of Mathematics (Vedic Mathematics), Vandana Publishers, Bangalore

Course Code	Course Title	Credits	Lectures/ Week
UVECSS1-146	Indian Constitution	2	2
About the course: The paper introduces the concepts of the Indian Constitution			
Course Objectives: This course attempts to - ● To understand the concepts and philosophy of the Constitution. ● To understand the role and significance of the Indian Political System. ● To acquaint students to the concept of Human Rights.			
Learning Outcomes: ● To analyze and understand the Philosophy of the Constitution as set out in the Preamble ● To ensure critical and active participation in the Indian democratic system. ● To get an idea about the basis of Human Rights and how it should be used.			
Unit	Topic	No. of lectures	

I	The Indian Constitution, Fundamental duties and its role in understanding India: Philosophy of the Constitution as set out in the Preamble; The structure of the Constitution-the Preamble, Main Body and Schedules; Basic features of the Constitution, tolerance, peace and communal harmony as crucial values in strengthening the social fabric of Indian society	10
II	Significant Aspects of Political Processes: Party system in Indian politics, local self government (urban & rural), 73 rd & 74 th Amendments and their implications for inclusive politics, role and significance of women in Indian politics, Role and significance of media in politics	10
III	Human Rights Concept of Human Rights; origin and evolution of the concept; The Universal Declaration of Human Rights; Human Rights constituents with special reference to Fundamental Rights stated in the Constitution	10
Text Books : 1. "The Constitution of India(Brief)" by Pranay Pillewan 2. "Indian Administration" by Hoshiar Singh 3. "Indian Polity" by M Laxmikanth 4. "Concise Encyclopedia of Indian Constitution" by Subhash Kashyap 5. "Politics of Inclusion: Castes, Minorities and Affirmative Action" by Zoya Hasan 6. "Local Governance in India: Decentralization and Beyond" by Pradeep Sharma and Jayal		

Course Code	Course Title	Credits	Activity Based Hours
UCCCSS1-176	Co-curricular Courses	2	
NSS / Sports / Health & Wellness / Music / Cultural Activities / Sunday School / Department Activities etc			

SEMESTER II

Course Code	Course Title	Credits	Lectures/ Week
UMMCSS 2-101	Design & Analysis of Algorithms	2	2

About the course:

To master the skill of programming, one must know the efficient ways of performing various types of processing on the data. The course aims to cover the essentials of algorithms using basic data structures like stack, list and queue without programmatically creating them. The course covers the concepts of - (i) calculating complexity of algorithms, (ii) the essential operations like searching, sorting, selection, pattern matching & recursion, and (iii) various algorithmic strategies like greedy, divide-n-conquer, dynamic programming, backtracking and implementations of all these on basic data structures like array, list and stack.

Course Objectives: The objectives of this course are:

- To make students understand the basic principles of algorithm design
- To give idea to students about the theoretical background of the basic data structures
- To familiarize the students with fundamental problem-solving strategies like searching, sorting, selection, recursion and help them to evaluate efficiencies of various algorithms
- To teach students the important algorithm design paradigms and how they can be used to solve various real world problems.

Learning Outcomes: After successful completion of this course -

- Students should be able to understand and evaluate efficiency of the programs that they write based on performance of the algorithms used.
- Students should be able to appreciate the use of various data structures as per need to select, decide and apply appropriate design principle by understanding the requirements of any real life problems

Unit	Topic	No. of lectures
I	Introduction to algorithms - What is algorithm, analysis of algorithm, Types of complexity, Running time analysis, How to Compare Algorithms, Rate of Growth, Types of Analysis, Asymptotic Notation, Big-O Notation, Omega- Ω Notation, Theta- Θ Notation, Asymptotic Analysis, Performance characteristics of algorithms, Estimating running time / number of steps of executions on paper, Idea of Computability Introduction to Data Structures - What is data structure, types, Introduction to Array(1-d & 2-d), Stack and List data structures, operations on these data structures, advantages disadvantages and applications of these data structures like solving linear equations, Polynomial Representation, Infix-to-Postfix conversion	10
II	Recursion - What is recursion, Recursion vs Iteration, recursion applications like Factorial of a number, Fibonacci series & their comparative analysis with respect to iterative version, Tower of hanoi problem	10

	Basic Sorting Techniques - Bubble, Selection and Insertion Sort & their comparative analysis Searching Techniques - Linear Search and its types, Binary Search and their comparative analysis Selection Techniques - Selection by Sorting, Partition-based Selection, Algorithm, Finding the Kth Smallest Elements in Sorted Order & their comparative analysis String Algorithms - Pattern matching in strings, Brute Force Method & their comparative analysis	
III	Algorithm Design Techniques - Introduction to various types of classifications/design criteria and design techniques Greedy Technique - Concept, Advantages & Disadvantages, Applications, Implementation using problems like - file merging problem Divide-n-Conquer - Concept, Advantages & Disadvantages, Applications, Implementation using problems like - merge sort, Strassen's Matrix Multiplication Dynamic Programming - Concept, Advantages & Disadvantages, Applications, Implementation using problems like - Fibonacci series, Factorial of a number, Longest Common subsequence Backtracking Programming - Concept, Advantages & Disadvantages, Applications, Implementation using problems like N-Queen Problem	10

Text Books :

1. "Data Structure and Algorithm Using Python", Rance D. Necaie, Wiley India Edition, 2016.
2. "Data Structures and Algorithms Made Easy", Narasimha Karumanchi, CareerMonk Publications, 2016.
2. "Introduction to Algorithms", Thomas H. Cormen, 3rd Edition, PHI.

Additional References:

1. "Introduction to the Design and Analysis of Algorithms", Anany Levitin, Pearson, 3rd Edition, 2011.
2. "Design and Analysis of Algorithms", S. Sridhar, Oxford University Press, 2014.

Course Code	Course Title	Credit	Lectures/ Week
UMMCSS2-102	Database Management System	2	2
About the course: ● The course introduces the core principles and techniques required in the design and implementation of database systems. ● It includes ER Model, Normalization, Relational Model, and Relational Algebra. ● It also provides students with theoretical knowledge and practical skills of creating and manipulating data with an interactive query language (MySQL). ● It also provide student knowledge and importance of data protection.			

Course Objectives:

- Understand and explain fundamental concepts of DBMS, including architecture, data models, levels of abstraction, and entity-relationship modeling.
- Design ER diagrams and convert them into relational tables while applying appropriate constraints and relationships.
- Apply SQL commands (DDL and DML) to create, manipulate, and query databases effectively using clauses, functions, and aggregate operations.
- Analyze relational database concepts including relational model, constraints, and perform operations using joins and built-in SQL functions.
- Apply normalization techniques (1NF, 2NF, 3NF, BCNF) and functional dependencies to design efficient and consistent database schemas.
- Implement advanced SQL concepts such as subqueries, sequences, transaction control, DCL commands, and understand basic index structures.
-

Learning Outcomes:

- After successful completion of this course, students would be able to appreciate the importance of database design.
- Analyze database requirements and determine the entities involved in the system and their relationship to one another.
- Write simple queries to MySQL related to String, Maths and Date Functions.
- Create tables and insert/update/delete data, and query data in a relational DBMS using MySQL commands.
- Understand the normalization and its role in the database design process.
- Create indexes and understand the role of Indexes in optimization search.

Unit	Topic	No. of lectures
I	Introduction to DBMS – Database, DBMS – Definition, Overview of DBMS, Advantages of DBMS, Levels of abstraction, Data independence, DBMS Architecture Data models - Client/Server Architecture, Object Based Logical Model, Record Based Logical Model (relational, hierarchical, network) Entity Relationship Model - Entities, attributes, entity sets, relations, relationship sets, Additional constraints (key constraints, participation constraints, weak entities, aggregation / generalization, Conceptual Design using ER (entities VS attributes, Entity Vs relationship, binary Vs ternary, constraints beyond ER) ER to Table- Entity to Table, Relationship to tables with and without key constraints.	10

	DDL Statements - Creating Databases, Using Databases, data types, Creating Tables Altering Tables, Renaming Tables, Dropping Tables, Truncating Tables DML Statements – Viewing the structure of a table insert, update, delete, Select all columns, specific columns, unique records, conditional select, in clause, between clause, limit, aggregate functions (count, min, max, avg, sum), group by clause, having clause	
II	Relational data model– Domains, attributes, Tuples and Relations, Relational Model Notation, Characteristics of Relations, Relational Constraints - primary key, referential integrity, unique constraint, Null constraint, Check constraint. Functions – String Functions (concat, instr, left, right, mid, length, lcase/lower, ucase/upper, replace, strcmp, trim, ltrim, rtrim), Math Functions (abs, ceil, floor, mod, pow, sqrt, round, truncate) Date Functions (adddate, datediff, day, month, year, hour, min, sec, now, reverse) Joining Tables – inner join, outer join (left outer, right outer, full outer)	10
III	Schema refinement and Normal forms: Functional dependencies, first, second, third, and BCNF normal forms based on primary keys, lossless join decomposition. Subqueries – subqueries with IN, EXISTS, subqueries restrictions, Nested subqueries, ANY/ALL clause, correlated subqueries. Sequence (Creating Sequence, Using Sequence in SQL Query) DCL Statements (creating/dropping users, privileges introduction, granting/revoking privileges, viewing privileges), Transaction control commands – Commit, Rollback Index Structures of Files: Introduction, Primary index, Clustering Index, Multilevel indexes	10

Text Books :

1. “Fundamentals of Database System”, ElmasriRamez, NavatheShamkant, Pearson Education, Seventh edition, 2017
2. “Database Management Systems”, Raghu Ramakrishnan and Johannes Gehrke, 3rd Edition, 2014
3. “Murach's MySQL”, Joel Murach, 3rd Edition, 3rd Edition, 2019

Additional References:

1. “Database System Concepts”, Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw Hill, 2017
2. “MySQL: The Complete Reference”, Vikram Vaswani, McGraw Hill, 2017
3. “Learn SQL with MySQL: Retrieve and Manipulate Data Using SQL Commands with Ease”, Ashwin Pajankar, BPB Publications, 2020.

Course Code	Course Title	Credits	Practicals/ Week
UMMCSS2-103	Practicals Based on UMMCSS2-101 and UMMCSS2-102 (Computer Science Practical-2)	2	4

Practical of Design and Analysis of Algorithms:

1. Programs on 1-d arrays like - sum of elements of array, searching an element in array, finding minimum and maximum element in array, count the number of even and odd numbers in array. For all such programs, also find the time complexity, compare if there are multiple methods
2. Programs on 2-d arrays like row-sum, column-sum, sum of diagonal elements, addition of two matrices, multiplication of two matrices. For all such programs, also find the time complexity, compare if there are multiple methods
3. Program to create a list-based stack and perform various stack operations.
- 4 Program to perform linear search and binary search on list of elements. Compare the algorithms by calculating time required in milliseconds using readymade libraries.
5. Programs to sort elements of list by using various algorithms like bubble, selection sort, and insertion sort. Compare the efficiency of algorithms.
6. Programs to select the Nth Max/Min element in a list by using various algorithms. Compare the efficiency of algorithms.
7. Programs to find a pattern in a given string - general way and brute force technique. Compare the efficiency of algorithms.
8. Programs on recursion like factorial, fibonacci, tower of hanoi. Compare algorithms to find factorial/fibonacci using iterative and recursive approaches.
9. Program to implement file merging, coin change problems using Greedy Algorithm and to understand time complexity.
10. Program to implement merge sort, Strassen's Matrix Multiplication using D-n-C Algorithm and to understand time complexity.
11. Program to implement fibonacci series, Longest Common Subsequence using dynamic programming and to understand time complexity. Compare it with the general recursive algorithm.
12. Program to implement N-Queen Problem, Binary String generation using Backtracking Strategy and to understand time complexity.

Practical of Database Management System:

1. Conceptual Designing using ER Diagrams (Identifying entities, attributes, keys and relationships between entities, cardinalities, generalization, specialization etc.)
2. Perform the following:
 - Viewing all databases
 - Creating a Database
 - Viewing all Tables in a Database

- Creating Tables (With and Without Constraints)
 - Inserting/Updating/Deleting Records in a Table
3. Perform the following:
 - Altering a Table
 - Dropping/Truncating/Renaming Tables
 - Backing up / Restoring a Database
 4. Perform the following:
 - Simple Queries
 - Simple Queries with Aggregate functions
 5. Queries involving
 - Date Functions
 - String Functions
 - Math Functions
 6. Join Queries
 - Inner Join
 - Outer Join
 7. Subqueries
 - With IN clause
 - With EXISTS clause
 8. Views & Sequence
 - Creating Views (with and without check option)
 - Dropping views
 - Selecting from a view
 - Creating Sequence
 9. DCL statements
 - Granting and revoking permissions
 - Saving (Commit) and Undoing (rollback)
 10. Index Structures
 - Primary Index
 - Clustering Index

Course Code	Course Title	Credits	Lectures/ Week
UMNCSS2-116	Mathematical Statistics	2	2

About the course:

This course is designed to provide learners with an understanding of the data and to develop an understanding of the quantitative techniques from Statistics. It also provides the knowledge of different statistical tools used for primary statistical analysis of data.

Course Objectives:

- To develop the learner's ability to deal with different types of data.
- To enable the use of different measures of central tendency and dispersion wherever relevant.
- To make learners aware about the techniques to check the Skewness and Kurtosis of data.
- To make learner enable to find the correlation between different variables and further apply the regression analysis to find the exact relation between them.

- To develop the ability to analyze statistical data through R software.

Learning Outcomes:

After successful completion of this course, learners would be able to

- Organize, manage and present data.
- Analyze Statistical data using measures of central tendency and dispersion.
- Analyze Statistical data using basic techniques of R.
- Study the relationship between variables using techniques of correlation and regression.

Unit	Topic	No. of lectures
I	Data Types and Data Presentation: Data types: Attribute Variable, Discrete and Continuous variable, Univariate and Bivariate distribution. Types of Characteristics, Different types of scales: nominal, ordinal, interval and ratio. Data presentation: Frequency distribution, Histogram, Ogive curves. Measures of Central tendency: Concept of average/central tendency, characteristics of good measure of central tendency. Arithmetic Mean (A.M.), Median, Mode - Definition, examples for ungrouped and grouped data, effect of shift of origin and change of scale, merits and demerits. Combined arithmetic mean. Partition Values: Quartiles, Deciles and Percentiles – examples for ungrouped and grouped data	10
II	Measures dispersion: Concept of dispersion, Absolute and Relative measure of dispersion, characteristics of good measure of dispersion. Range, Semi-interquartile range, Quartile deviation, Standard deviation - Definition, examples for ungrouped and grouped data, effect of shift of origin and change of scale, merits and demerits. Combined standard deviation, Variance. Coefficient of range, Coefficient of quartile deviation and Coefficient of variation (C.V.) Moments: Concept of Moments, Raw moments, Central moments, Relation between raw and central moments. Measures of Skewness and Kurtosis: Concept of Skewness and Kurtosis, measures based on moments, quartiles.	10
III	Correlation: Concept of correlation, Types and interpretation, Measure of Correlation: Scatter diagram and interpretation; Karl Pearson's coefficient of correlation (r): Definition, examples for ungrouped and grouped data, effect of shift of origin and change of scale,	10

	properties; Spearman's rank correlation coefficient: Definition, examples of with and without repetition. Concept of Multiple correlation. Regression: Concept of dependent (response) and independent (predictor) variables, concept of regression, Types and prediction, difference between correlation and regression, Relation between correlation and regression. Linear Regression - Definition, examples using least square method and regression coefficient, coefficient of determination, properties. Concept of Multiple regression and Logistic regression.	
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Text Books :

1. Goon, A. M., Gupta, M. K. and Dasgupta, B. (1983). Fundamentals of Statistics, Vol. 1, Sixth Revised Edition, The World Press Pvt. Ltd., Calcutta.
2. Gupta, S.C. and Kapoor, V.K. (1987): Fundamentals of Mathematical Statistics, S. Chand and Sons, New Delhi

Additional References:

1. Sarma, K. V. S. (2001). Statistics Made it Simple: Do it yourself on PC. Prentice Hall of India, New Delhi.
2. Agarwal, B. L. (2003). Programmed Statistics, Second Edition, New Age International Publishers, New Delhi.
3. Purohit, S. G., Gore S. D., Deshmukh S. R. (2008). Statistics Using R, Narosa Publishing House, New Delhi.
4. Schaum's Outline of Theory and Problems of Beginning Statistics, Larry J. Stephens, Schaum's Outline Series McGraw-Hill

Course Code	Course Title	Credits	Lectures/ Week
UOECSS2-15 3	Quantitative Aptitude Development	2	2

About the course:

Everyone has a desire to improve their aptitude and reasoning skills because nowadays wherever you want to succeed, Aptitude and Reasoning are weapons to seal it, because aptitude is a basic topic which is used to determine any person's problem solving skills and numerical ability. Anything in life can be achieved by continuous practice because practice makes man intelligent. Key for developing any sort of skill is passionate handwork following a well-planned strategy.

Course Objectives:

The entire objective of the 30 hours aptitude development is to develop the basics of the students towards two segments of aptitude that are Logical Reasoning and Quantitative Aptitude. The subject is hosted in order to make the students corporate ready and to help them understand the need to improve on the areas of aptitude.

Learning Outcomes:

1. To develop basic skills related to aptitude.
2. To understand the use of aptitude in all the spheres of career and prepare for them precisely.
3. Common methodologies of solving questions related to Logical Reasoning and Quantitative Aptitude.
4. Learn the various question types and their basic approaches.
5. Create a bridge for the advanced levels of aptitude and prepare a base for the Employability Enhancement Program.

Unit	Topic	No. of lectures
I	Number System Number Series, Symbol Series, Analogies, Direction Sense and puzzles, Profit and Loss	10
II	Percentages and Ratios, Averages and Ages, Blood Relations and Arrangements, Calendars and clock Time, Speed and Distance	10
III	Time and Work, Permutations and Combinations, Seating Arrangements, Basic Geometry and Logarithm, Logical Set Theory and Venn Diagrams	10

Text Books :

1. Quantitative aptitude for Competitive examination By R S Agarwal

Additional References:

1. A Modern Approach to Verbal & Non Verbal Reasoning By R S Agarwal
2. Analytical and Logical reasoning By Sijwali B S
3. Analytical and Logical reasoning for CAT and other management entrance test By Sijwali B S
4. Quantitative Aptitude by Competitive Examinations by Abhijit Guha 4th edition

Course Code	Course Title	Credits	Lectures/ Week
UOECSS2-16 7	Python for Everybody	2	2

About the course:

This course is aimed at introducing one of the fastest growing programming languages of the current time and enables learners to understand the fundamentals of programming through it. It also aims to cover various fields where python can be used.

Course Objectives:

- To introduce to the fundamentals of programming
- To introduce the syntax of python to write programs
- To cover various fields as applications of python

Learning Outcomes:

- Learners should be able to understand the syntax of programming and execute programs
- Learners should be able to solve basic problems from various domains using programs
- Learners should be able to explore and use specialised python modules used in their domain

Unit	Topic	No. of lectures
I	Introduction - What is a program & Software, Programming & Computer Languages, About Python Language Basics of Programming - Data Types & Variables, Arithmetic Operators, Input-Output & Different types of programming statements, Logical Operators, Using Strings and Lists with subscripts	10
II	Programming Constructs - Sequence, Selection - if & nested if, Iteration - while & break, Basics of Function - What is a function, defining and calling a function, Parameters and return types Modules - What is a module, Using dot operator, using in-built modules like math, random, os, datetime etc.	10
III	Data Analysis & Visualization - Basic data analysis using numpy, pandas and matplotlib or any other suitable modules Exploring modules like pygame for game designing, pytorch for image processing	10

Text Books :

1. PYTHON PROGRAMMING 2E by Reema Thareja, Oxford Publications, Feb 2023
2. Data Analysis with Python Rituraj Dixit

Additional References:

3. <https://www.w3schools.com/python/>
4. <https://realpython.com/pygame-a-primer/>
5. Python for Data Science for Dummies, Luca Massaron John Paul Mueller, 2ed Paperback, 1 January 2019

Course Code	Course Title	Credits	Practical/ Week
UVSCSS2-126	Application Designing using Python	2	4

About the course:

This course aims to explore and enable learners to master the skills of advanced topics in Python Programming. It helps learners develop advanced skills such as working with databases, matching patterns, implementing threads and exception handling and GUI in Python. It also highlights that why Python is a useful scripting language for all developers.

Programming for implementing applications for emerging fields including data science and machine learning.

Course Objectives:

- To learn how to design object-oriented programs with Python classes.
- To learn about reading, writing and implementing other operations on files in Python.
- To implement threading concept and multithreading in Python
- To design GUI Programs and implement database interaction using Python.
- To know about the use of regular expressions and handling exceptions for writing robust python programs.

Learning Outcomes:

After successful completion of this course, students would be able to-

- Ability to implement OOP concepts in Python including Inheritance.
- Ability to work with files and perform operations on it using Python.
- Ability to implement regular expression and concept of threads for developing efficient program
- Ability to implement exception handling in Python applications for error handling.
- Knowledge of working with databases, designing GUI in Python and implement networking in Python

List of Practicals -

1. A. Write a Python program to implement various file operations like read(), readline(), readlines(), writelines()

B. Execute the various file operations with various modes like 'r', 'w', 'x', 'b', 'a' for various problem statements
2. A. Write a Python program to demonstrate the use of regular expressions for suitable applications.
B. Write Python programs to execute applications using various metacharacters
3. Write a Python program to work with databases in Python to perform operations such as
A. Connecting to database
B. Creating and dropping tables
C. Inserting , updating and deleting records from tables.
4. A. Write Python programs to demonstrate different types of exception handling.

B. Execute Python programs to use assert statement to handle exceptions
5. Write a GUI Program in Python to design application that demonstrates

A. Different fonts and colors

B. Different Layout Managers and widgets
6. Write a GUI Program in Python to design an application that demonstrates Event Handling using various widgets.
7. Write a Python Program to create an application which uses date, time and calendar modules in Python.
8. Write a Python program to create server-client and exchange basic information.

9. Write a Pandas program to convert a NumPy array to a Pandas series and to convert a Panda module Series to Python list along with demonstration of data visualization using Pandas.
10. Data Representation using Matplotlib/Seaborn/Polar to demonstrate the data visualization.

Text Books :

1. Paul Gries , Jennifer Campbell, Jason Montojo, Practical Programming: An Introduction to Computer Science Using Python 3, Pragmatic Bookshelf, 3rd Edition, 2018
2. Python: Data Analytics and Visualization , O'Reilly Media

Additional References:

1. Advanced Python Programming, Dr. Gabriele Lanaro, Quan Nguyen, SakisKasampalis, Packt Publishing, 2019
2. Programming in Python 3, Mark Summerfield, Pearson Education, 2nd Ed, 2018
3. Python: The Complete Reference, Martin C. Brown, McGraw Hill, 2018
4. Beginning Python: From Novice to Professional, Magnus Lie Hetland, Apress, 2017 5. Programming in Python 3, Mark Summerfield, Pearson Education, 2nd Ed, 2018

Course Code	Course Title	Credits	Practicals/ Week
USECSS2-131	Statistical Analysis	2	4

About the course:

Any data analysis is incomplete without statistics. After getting the data, any statistical analysis starts with descriptive statistics which aims to extract the information hidden inside the data. The tools of descriptive statistics are based on mathematical and statistical functions which are to be evaluated using the software. The statistical softwares are paid as well as free. Most of the statistical softwares are paid software. A popular free statistical software is R. What are the basic tools of descriptive statistics and how to use the R software for descriptive statistical analysis is the objective of the course to be taught

Course Objectives:

- Demonstrate use of basic functions
- Create their own customized functions
- Construct tables and figures for descriptive statistics
- Learn to understand new data sets and functions by yourself
- Work on built in real time cases for analysis and visualization
- To develop the ability to analyze statistical data through R software.

● **Learning Outcomes:**

- After successful completion of this course, learners would be able to
- ● Organize, manage and present data.
- ● Analyze Statistical data using measures of central tendency and dispersion.
- ● Enable to build programming logic and thereby developing skills in Programming
- ● Clear understanding on how to organize data and analyze data using real time examples
- ● Study the relationship between variables using techniques of correlation and regression.

1. Introduction To R

2. Calculations with R-math-operation

- a) vector-operation b) built-in-functions
- c) matrix-operations

3. Introduction to Descriptive Statistics

- a) Objectives, Steps, Basic Definitions b) Introduction to Descriptive Statistics
- c) Variables and Data

4. frequency-distribution

- a) Absolute Frequency b) Relative Frequency
- c) Frequency Distribution

5. Graphics

- a) Bar Diagrams b) Subdivided Bar-Pie Diagrams
- c) 3DPieDiagram-Histogram

6. Measures OF Central Tendency

- a) Arithmetic Mean b) Median
- c) Quantile d) Mode-GM-HM

7. Measures of Variation

- a) Range, b) Interquartile -Range c) Quartile Deviation
- d) Absolute Deviation e) Absolute Mean Deviation f) Mean Squared Error-
- g) Variance-Standard Deviation h) Coefficient Variation-Boxplots

8. Moments

- a) Raw Moments
- b) Central Moments

9. a) Skewness

- b) Kurtosis

10. a) Association of Two Variables -Correlation Coefficient Using R

- b) Association of Two Variables-Rank Correlation
- c) Association of Two Variables -Regression Using R

Text Books :

1. Goon, A. M., Gupta, M. K. and Dasgupta, B. (1983). Fundamentals of Statistics, Vol. 1, Sixth Revised Edition, The World Press Pvt. Ltd., Calcutta.
2. Gupta, S.C. and Kapoor, V.K. (1987): Fundamentals of Mathematical Statistics, S. Chand and Sons, New Delhi

Additional References:

1. Sarma, K. V. S. (2001). Statistics Made it Simple: Do it yourself on PC. Prentice Hall of India, New Delhi.
2. Agarwal, B. L. (2003). Programmed Statistics, Second Edition, New Age International Publishers, New Delhi.
3. Purohit, S. G., Gore S. D., Deshmukh S. R. (2008). Statistics Using R, Narosa Publishing House, New Delhi.
4. Schaum's Outline of Theory and Problems of Beginning Statistics, Larry J. Stephens, Schaum's Outline Series McGraw-Hill

Course Code	Course Title	Credits	Lect/ Week
UAECSS 2-141	Business Communication 2	2	2

About the course: Communication is the most important aspect of a learner's journey through education and profession. This course aims to develop professional writing and presentation skills among students.

Course Objectives: With this paper -

- Learners should be able to acquire proficiency in the skills of listening, speaking, reading and writing that will help them meet the challenges of the world.
- The learners are expected to develop good oral and written skills of communication in the English language.
- The learner is expected to enhance the desired purpose and follow certain parameters to make communication more effective in their professional life.
- The learner is expected to know and apply language skills for new digital age communication.

Learning Outcomes: On successful completion of this course students will be able to:

- Develop confidence in public speaking
- Practice writing as a process of motivated inquiry, and write using quotations, paraphrase, allusions and summary.
- Understand the concepts of effective oral, listening and writing skills.
- Understand the importance of communication in management and be able to increase managerial efficiency.

Unit	Topic	No. of lectures
I	1. Interviews - Definition, format and process of interviews - Selection interviews, assessment interviews, grievance interviews, exit interviews	10

	- Preparation and role of interviewers - Preparation and role of interviewees - Online interviews 2. Group Discussion - Meaning and types - Skills that are assessed during Group Discussion - Process of Group Discussion - Do's and don'ts of Group Discussion 3. Meetings - Meaning and definition - Types of meeting: formal and informal with examples - Conducting a meeting - Role of chairperson - Role of participants ● Online meetings: Skype, Zooms, Google Meet, MS Teams	
II	● Notice, agenda, minutes and resolution for meetings ● Letter of inquiry ● Complaint and claim letter – adjustment letter ● Sales letters and pamphlets ● Consumer Grievance letter	10

Text Books :

1. A Comprehensive Book of Synonyms and Antonyms By B.N.Aggarwal, Sunrise Publishers, Delhi
2. A course in English Grammar by R N Bakshi, Orient Blackswan Pvt Ltd, Kolkata
3. Successful Writing Skills by Lawrence Shaffer, IVY Publishing house, Delhi
4. Business Communication Today by Courtland L. Bovee and John V. Thill
5. Effective Business Communication by Herta A. Murphy, Herbert W.Hildebrandt, and Jane P. Thomas
6. Content Writing Handbook, Author: Kounal Gupta, 2020, Henry Harvin.

Additional References:

1. Academic Writing : A practical Guide for Students by Stephen Bailey Foundation Books
2. Bellare, Nirmala. Reading Strategies. Vols.1 & 2 New Delhi. Oxford University Press, 1998.
3. Bhasker, W. W. S & Prabhu, N. S.: English through Reading, Vols.1& 2. Macmillan, 1975.

Course Code	Course Title	Credits	Lectures/ Week
UVEC22-1 46	Environmental Science	2	2
About the course: The paper introduces students to the basics of environmental science and explores various aspects of issues concerning the environment & the need for Environment management for Sustainable society.			

Course Objectives: This course attempts to -

- Introduce the fundamental concepts and importance of environmental science and provide a comprehensive understanding of ecosystems, importance of biodiversity and its conservation measures.
- Highlight the importance and classification of natural resources, the impacts of degradation, and measures of conservation.
- Create an in-depth understanding of various regional and global issues, principles of effective waste management as well highlights the need for Environmental Management for achieving sustainable development.

Learning Outcomes: This course is expected to -

- Creates awareness among the students about environmental concepts and issues.
- Develops in-depth understanding of the environmental issues (local, national and global level)
- Inculcates awareness on various dimensions of the environment through knowledge, skill, critical thinking and problem-solving.
- Develops a sense of concern, commitment, and responsibility towards environment.
- Motivates participation in environment protection and conservation.

Unit	Topic	No. of lectures
I	Environment and Ecosystem : 1.1 Environmental Science –Definition, Nature, Scope and importance. 1.2 Components of Environment: Natural and Anthropogenic 1.3 Ecosystem: Concept, Types and Structure of Ecosystem 1.4 Function of Ecosystem: Food chain, Food web, Ecological pyramid, Bio-geochemical cycles (Hydrological and Carbon Cycle) Biodiversity: Levels, Threats, and Conservation	10
II	Natural resources and its conservation 2.1 Natural Resources: Definition, Importance and Classification 2.2 Factors influencing Resource utilization 2.3 Water Resource: Degradation and conservation 2.4 Forest Resource: Degradation and conservation Energy Resource: Energy Crisis and Conservation	10
	Environmental Issues and need for Sustainable Development : 3.1 Global Issues: Global Warming, Ozone layer depletion 3.2 Regional Issues: Acid rain, Land degradation 3.3 Solid waste management: 7R Principles 3.4 Concept and need for Environmental Management 3.5 Sustainable Development: Concept and Importance	10

Text Books :

1. Singh, Savindra, (2011) : Environmental Geography, PrayagPustakBhavan,Allahabad, India
2. Asthana, D. K. and Asthana, M. (2012). A Textbook of Environmental Studies, S. Chand & Company Ltd., New Delhi.
3. Jayamani, C. V. and Vasanthagopal, R. (2012). 'Environmental Management', New Century Publications, New Delhi.
4. C.J. Barrow (2002). Environment Management: Principles and Practice, Routledge, London.
5. ErachBharucha (2021): Text book Of Environmental Studies, University Grants Commission.
6. Odem. E.P. (1971) : Fundamental of Ecology, W.B. Saunders, Philadelphia.

Course Code	Course Title	Credits	Activity Based Hours
UCCSS2-176	Co-curricular Courses	2	
NSS / Sports / Health & Wellness / Music / Cultural Activities / Sunday School / Department Activities etc			

MODALITY OF ASSESSMENT

The performance of the learners for those exams having Semester End Examinations and Internal Assessment shall be evaluated in two parts as per the following ratio:

Semester End Examination: Internal Assessment [60:40]

The learner's performance shall be assessed by conducting the **Semester-end Examination with 60% marks** and **Continuous Internal Assessment (CIA) with 40% marks**. Practical Examination will consist of Semester-end examination.

Students will have to score 40% of marks INDIVIDUALLY in Internal assessment as well as Semester-end Examination to pass the course.

Internal Assessment: It is defined as the assessment of the learners on the basis of internal evaluation by way of participation of learners in various academic and correlated activities in the given semester of the programme.

Semester End Assessment: It is defined as the assessment of the learners on the basis of Performance in the Semester-end Theory/ Practical examination.

Table-1- Mode of Assessment under NEP 2020

Name of the course	Credits	Nature of Evaluation & Mode of Assessment	Duration	Marks
Major(Theory) OR Minor (Theory) OR Skill Enhancement Course (SEC)(Theory) OR	2 Credit	1. Internal (40%) (Table 2)		20
		2. Semester-end Theory Examination(60%) (Table 3)	90 mins	30

Ability Enhancement Course (AEC)(Theory) OR Value Education Course (VEC)				
Major(Practical) (2 subjects)	2 Credit	Semester-end Practical Examination (Table-4)	3 hours	50
Open Electives(OE) OR Indian Knowledge system (IKS)	2 Credit	Continuous Internal Evaluation - Assignments/ Presentations/ Group Discussion/ Case Studies etc. Any two modes of assessment with evaluation at Department level (25 M Each)	-	50
Vocation Skill Course (VSC)(Practical)	2 Credit	Practicals (Table-4)	2 horus	50
On Job training (OJT) /NSS/ NCC/ Co-curricular Course(CC)/ Field project (FP)/ Internship	2 Credit	Continuous Internal Evaluation --Tests, Essays, Articles, Group assignments/ Reports/ Journals/ Diaries/ Reviews/ Dissertations/ Observations of Students (As per the nature of the course)	-	

Note: CC-Co-curricular Courses include involvement/ participation in various areas such as Cultural Activities, Departmental activities, Fine/ Applied/ Visual/ Performing Arts, Sports and fitness, NSS/ NCC, DLLE, The Sunday School (TSS), Health & Wellness, Yoga education etc. Record of involvement /participation by students has to be documented with signatures of staff concerned in students' CC Cards.

Table - 2

Theory - Mode of assessment-Continuous Internal Assessment [40%]

Evaluation type
1. Assignments. 2. Project based learning activities (Group Discussion Research/ Case studies/ Reports / Assignments / Presentations / Skit / Poster / etc.). 3. Class Test (Objective - Multiple Choice Questions/ Subjective). 4. Active participation in class activities. 5. Overall conduct as a responsible student with respect to good behaviour, leadership qualities, interpersonal skills etc. For example - Depending on the subject - 15 Marks MCQ Test + 5 Marks Assignment/Presentation/Case Study OR 10 Marks MCQ Test + 10 Marks Assignment/Presentation/Case Study

Table-3

Paper Pattern for Semester-End Theory Examination	
- Each unit should have equal weightage - Minimum one question per unit - No MCQ/True-False type of questions should be asked, only descriptive questions are allowed - Each question should have extra sub-questions(max 100% option)	

Table-4

Semester End Examination for Practical Assessment -50 marks (2-Credit)-Major
[To be conducted at departmental level]

For 1 subject		For 2 subjects	
Any one/ more experiment/s	35	Min two experiments per subject	40
Viva	10	Viva	05
Journal	05	Journal	05
OR			
Practical	30		
Case-Study	20		
Total	50 M	Total	50 M

Evaluation Pattern for Environmental Science

Evaluation Pattern	Credits -2
Continuous Internal Evaluation	Out of 20 marks
Semester End Evaluation	Out of 30 marks
Total Marks	50 marks

Continuous Internal Evaluation

Class Test: 10 marks

Assignment : 10 marks

Question Paper Pattern

Maximum Marks: 30
Questions to be set: 03
Duration: 90 mins

Note: All questions are compulsory carrying 10 marks each

Q.1 Attempt any two - (10)

Q.2 Attempt any two - (10)

Q.3 Attempt any two - (10)

OR

Q.1 Attempt any two- (8)

Q.2 Attempt any two -(8)

Q.3 Attempt any two -(8)

Q.4 Attempt any three- (6)