Academic Council Meeting No. and Date : 08 / September 04, 2023

Agenda Number : 02 Resolution Number : 34, 35 / 2.13, 2.34

Vidya Prasarak Mandal's
B. N. Bandodkar College of Science (Autonomous), Thane

Syllabus for

Programme Code : BUCS

Programme : Bachelor of Science

Specific Programme : Computer Science

[F.Y.B.Sc. (Computer Science)]

Level 4.5

CHOICE BASED GRADING SYSTEM

Revised under NEP

From academic year 2023 - 2024

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Preamble

The aim of the BSc Computer Science Syllabus is to lay the theoretical foundations of software and hardware equally supplemented by the practical techniques. With this foundation of computer science along with core subjects like Mathematics, Statistics etc, the computer science students are expected to contribute efficient solutions for the various problems that are given to them.

Over this period of time, computer science students have proved this fact and have done well in Industries (mainly software) which have offered plenty of opportunities to them. With the advancement in software industry and technological innovations, the industry demands from graduate and postgraduate students are changing. The syllabus is been designed to meet the industry expectations, to inspire the students to take-up higher education as well as research, to attract student over other courses and finally to fulfill the expectations of Credit system.

The syllabus will be designed keeping these challenges in mind. The syllabus aims to cover core concepts of Computer Science and also to cover the latest technologies which can be accommodated at BSc level. One such step is that we would like to promote Open Source Technologies as much as possible.

Abhijeet A. Kale
Chairman
Board of Studies in Computer Science

PROGRAMME OUTCOMES (PO)

The Undergraduate Programmes of Science are intended to cater quality education and attain holistic development of learners through the following programme outcomes:

- **BACHELOR OF SCIENCE (B.Sc.)**

PO1 - Disciplinary Knowledge
Lay strong foundation of conceptual learning in science. Instil ability to apply science in professional, social and personal life.

PO2 - Inculcation of Research Aptitude
Ignite spirit of inquiry, critical thinking, analytical skills and problem-solving approach which will help learner to grasp concepts related to research methodology and execute budding research ideas.

PO3 - Digital Literacy
Enhance ability to access, select and use a variety of relevant information e-resources for curricular, co-curricular and extracurricular learning process.

PO4 - Sensitization towards Environment
Build cohesive bond with nature by respecting natural resources, encouraging eco-friendly practices and creating awareness about sustainable development.

PO5 - Individuality and Team work
Encourage learner to work independently or in collaboration for achieving effective results through practical experiments, project work and research activities.

PO6 - Social and Ethical Awareness
Foster ethical principles which will help in developing rational thinking and becoming socially aware citizens. Build attitude of unbiased, truthful actions and avoid unethical behaviour in all aspects of life.

Program Specific Outcomes

- Prepare the students ready for industry usage by providing required training in cutting edge technologies. (Level 4)
- Design and develop optimized computing mechanisms by integrating core computing concepts and advanced optimization techniques. (Level 6)
- Evaluate ethical, social, and professional challenges and justify appropriate communication and entrepreneurial decisions. (Level 5)
- Demonstrate basic knowledge of computer applications and apply standard practices in software project development. (Level 3)
- Understand Analyze and Develop computer programs for efficient design of computer-based systems of varying complexity. (Level 2)
- Understand various concepts of Computing, Statistics, Mathematics and Electronics appropriately to the discipline. (Level 2).

VPM's B.N.Bandodkar College of Science (Autonomous), Thane

F.Y.B.Sc. (Computer Science) Revised under NEP

Structure of Programme

Semester I

	Course Code	Course Title	No. of lectures	Credits
Major	23BUCS1T01	Computer Organization	30	**2**
	23BUCS1T02	Systems Programming and Digital Logic	30	**2**
	23BUCS1P01	Practicals based upon 23BUCS1T01 and 3BUCS1T02	60	**2**
Minor	23BUCS1T03	Discrete Mathematics	30	**2**
	23BUCS1T04	Object Oriented Programming	30	**2**
	23BUCS1P02	Practicals based upon 23BUCS1T01 and 23BUCS1T02	60	**2**
Generic	23BUCS1T05	Descriptive Statistics and Introduction to Probability	30	**2**
ID	23BUID1T02	Introduction to Soft Skills	30	**2**
VSC	23BU1VSC07	Introduction to Programming	30	**2**
AEC	23BUEN1T01	Basic English Learning Course	30	**2**
IKS	23BUIK1T03	Science and Technology	30	**2**
Total				**22**

Semester II

	Course Code	Course Title	No. of lectures	Credits
Major	23BUCS2T01	Operating System	30	**2**
	23BUCS2T02	Introduction to Python Programming	30	**2**
	23BUCS2P01	Practicals based upon 23BUCS2T01 and 3BUCS2T02	60	**2**
Minor	23BUCS2T03	Data Structures	30	**2**
	23BUCS2T04	Database Systems	30	**2**
	23BUCS2P02	Practicals based upon 23BUCS2T03 and 3BUCS2T04	60	**2**
Generic	23BUCS2T05	Statistical Method & Testing of Hypothesis	30	**2**
VEC	23BUID2T03	Professional Ethics	30	**2**
AEC	23BUEN2T03	Introduction to Technical Writing	30	**2**
IKS	23BUIK2T03	Quick Mathematics	30	**2**
Field Project	23BUCS2P03	Green Technologies	30	**2**
Total				**22**

Semester I

Course Code	Course Title	Credits	No. of lectures
23BUCS1T01	**Major: Computer Organization**	**02**	**30**

CO1	Understand working of computer systems and underlying principles	L2
CO2	Elaborate the basics of digital electronics needed for computers	L2
CO3	Analyze instruction set architecture for reduced and complex instruction sets	L4
CO4	Analyze transfer of data between the processor and I/O devices	L4

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	-	1	1
CO2	3	2	2	-	1	1
CO3	3	3	2	-	1	1
CO4	3	3	2	-	2	1

Unit I	**Computer Abstractions and Technology:** Basic structure and operation of a computer, functional units and their interaction. Representation of numbers and characters. **Logic circuits and functions:** Combinational circuits and functions: Basic logic gates and functions, truth tables; logic circuits and functions. NAND gate, NOR gates, Universal Building Blocks, RS Flip Flop, JK Flip Flop, D latches, edge-triggered D latch. Shift registers, Decoders, multiplexers. **Instruction set architectures:** Memory organization, addressing and operations; word size, big-endian and little-endian arrangements. Instructions, sequencing. Instruction sets for RISC and CISC	**15** **[CO1, CO2, CO3]**
Unit II	Operand addressing modes; pointers; indexing for arrays. Machine language, assembly language, assembler directives. Function calls, processor runtime stack, stack frame. Types of machine instructions: arithmetic, logic, shift, etc. Instruction sets, RISC and CISC examples. **Basic Processor Unit:** Main components of a processor: registers and register files, ALU, control unit, instruction fetch unit, interfaces to instruction and data memories. Datapath. Instruction fetch and execute; executing arithmetic/logic, memory access and branch instructions; hardwired and micro-programmed control for RISC and CISC. **Basic I/O:** Accessing I/O devices, data transfers between processor and I/O devices. Interrupts and exceptions: interrupt requests and processing.	**15** **[CO1, CO2, CO4]**

References:

1. Carl Hamacher et al. Computer Organization & Embedded Systems, 6 ed, McGraw-Hill 2012
2. Patterson and Hennessy, Computer Organization and Design, Morgan Kaufmann, ARM Edition, 2011
3. R P Jain, Modern Digital Electronics, Tata McGraw Hill Education Pvt. Ltd. , 4th Edition, 2010

Course Code	Course Title	Credits	No. of lectures
23BUCS1T02	**Major: Systems Programming and Digital Logic**	**02**	**30**

CO1	Understand the basic concepts in system programming, system software and different machine structures	L2
CO2	Illustrate the principles of Linkers, loaders, compilers, assemblers, stack	L4
CO3	Analyze types of memories, working of memories	L4
CO4	Understand Programmable Logic Arrays (PLAs), PLAs, CPLDs, FPGAs	L2

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	-	1	1
CO2	3	2	2	-	1	1
CO3	3	2	2	-	1	1
CO4	3	3	3	-	2	1

Unit I	Systems Programming: System Hardware And Software Interaction, Language Issues, Translation Of Low-Level Languages And High-Level Languages, Assemblers, Tools, Microprocessors, Linking And Loading, Compilers, Stack	**15** **[CO1, CO2]**
Unit II	Memory Devices; RAM, ROM, PROM, EPROM, EEPROM, Flash Memory, Memory Sticks, Cache memory, Virtual Memory, Scratch pad memory Programmable Logic Arrays (PLAs), Programmable array logic (PAL), Complex Programmable Logic devices (CPLDs), Field programmable Gate arrays (FPGAs)	**15** **[CO3, CO4]**

References:

1. Systems Programming by John Donovan, Tata McGraw Hill Edition
2. Digital Circuit Analysis and Design by Steven T. Karris, Orchard Publications
3. Systems Programming by Srimanta Pal, Oxford University Press, 2011.

Course Code 23BUCS1P01	Course Title Practical Based on 23BUCS1T01 and 23BUCS1T02	Credits 02	No. of lectures 60

CO1	Analyze the logic gates and basic digital sequential and combinational circuits	L4
CO2	Understand the working of processor using basic 8085 processor	L2
CO3	Understand working of memory	L2
CO4	Analyze working of assembler, compiler	L4

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	-	2	1
CO2	3	2	2	-	1	1
CO3	3	2	2	-	1	1
CO4	3	3	3	-	2	1

Practical 1	Study of Logic Gates, Universal Building Blocks
Practical 2	Study of RS, JK Flip Flop
Practical 3	Study of Encoder and Decoder
Practical 4	Study of Half adder and Full Adder
Practical 5	Study of RS Flip Flop
Practical 6	Study of JK Flip Flop
Practical 7	Realization of logic functions with the help of logic and universal gates.
Practical 8	Study of Multiplexer and De-multiplexer
Practical 9	Write an 8085-microprocessor program to perform addition of two 8-bit numbers.
Practical 10	Write an 8085-microprocessor program to perform subtraction of two 8-bit numbers
Practical 11	Write an 8085-microprocessor program to perform multiplication of two 8-bit numbers
Practical 12	Write an 8085-microprocessor program to perform addition of two 16-bit numbers
Practical 13	Write an 8085-microprocessor program to divide a 1 byte dividend by 1 byte divisor
Practical 14	Write an 8085-microprocessor program to find absolute difference between two numbers
Practical 15	Write an 8085-microprocessor program to transfer the data in reverse order
Practical 16	Write an 8085-microprocessor program to exchange the contents of two blocks
Practical 17	Write an 8085-microprocessor program to find the smallest number from given block using Linear Search
Practical 18	Write an 8085-microprocessor program to find the greatest number from given block using Linear Search
Practical 19	Write a program to create, read and write into a file having record of the student.
Practical 20	Write a program for the creation of symbol table in assembly language.
Practical 21	Implementation of a single pass assembler.
Practical 22	Write a program for checking the operator precedence
Practical 23	Design combinational circuits for Half Subtractor
Practical 24	Design combinational circuits for Full Subtractor
Practical 25	Design combinational circuits for 4 bit Parallel Adder
Practical 26	Design combinational circuits to implement given truth table
Practical 27	Design a 4-bit counter
Practical 28	Design a 8-bit counter
Practical 29	Demonstrate malloc, calloc
Practical 30	Design a traffic light controller

Course Code	Course Title	Credits	No. of lectures
23BUCS1T03	**Minor: Discrete Mathematics**	**02**	**30**

CO1	Understand theory of discrete objects, starting with relations and partially ordered sets	L2
CO2	Analyze the working of recurrence relations, generating function & operations on them	L4
CO3	Understand the theory of graphs and trees for Data Structures	L2
CO4	Understand the models of automata theory and the corresponding formal languages.	L2

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	-	1	1
CO2	3	3	2	-	1	1
CO3	3	2	2	-	2	1
CO4	3	3	2	-	1	1

Unit I	**Functions:** Definition of function. Domain, co domain and the range of a function. Direct and inverse images. Injective, surjective and bijective functions. Composite and inverse functions. **Relations**: Definition and examples. Properties of relations, Partial Ordering sets, Linear Ordering Hasse Diagrams, Maximum and Minimum elements **Recurrence Relations:** Definition of recurrence relations, Formulating recurrence relations, solving recurrence relations- Back tracking method, Linear homogeneous recurrence relations with constant coefficients. Solving linear homogeneous recurrence relations with constant coefficients of degree two when characteristic equation has distinct roots and only one root, Particular solutions of non linear homogeneous recurrence relation Applications- Formulate and solve recurrence relation for Fibonacci numbers, Tower of Hanoi	**15** **[CO1, CO2]**
Unit II	**Permutations and Combinations:** Partition and Distribution of objects, Permutation with distinct and indistinct objects, Binomial numbers, Combination with identities: Pascal Identity, Vandermonde's Identity, Pascal triangle, Binomial theorem **Graphs :** Definition and elementary results, Adjacency matrix, path matrix, Representing relations using diagraphs, Warshall's algorithm-shortest path , Linked representation of a graph, Operations on graph with algorithms – searching in a graph; Insertion in a graph, Deleting from a graph, Traversing a graph-Breadth-First search and Depth-First search **Trees:** Definition and elementary results. Ordered rooted tree, Binary trees, Complete and extended binary trees, representing binary trees in memory, traversing binary trees, binary search tree, Algorithms for searching and inserting in binary search trees, Algorithms for deleting in a binary search tree	**15** **[CO3, CO4]**

References:

1. Discrete Mathematics and Its Applications, Seventh Edition by Kenneth H. Rosen, McGraw Hill Education (India) Private Limited. (2011)
2. Norman L. Biggs, Discrete Mathematics, Revised Edition, Clarendon Press, Oxford 1989.
3. Data Structures Seymour Lipschutz, Schaum's out lines, McGraw- Hill Inc.

Course Code	Course Title	Credits	No. of lectures
23BUCS1T04	**Minor: Object Oriented Programming**	**02**	**30**

CO1	Understand the procedural and object oriented paradigm	L2
CO2	Analyze the use of various OOPs concepts with the help of programs	L4
CO3	Illustrate the concepts of function overloading, operator overloading, virtual functions, polymorphism, inheritance	L4
CO4	Describe the use of constructors, destructors, exception handling	L1

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	-	1	1
CO2	3	3	2	-	2	1
CO3	3	3	2	-	2	1
CO4	3	2	2	-	2	1

Unit I	**Object Oriented Methodology:** Introduction, Advantages and Disadvantages of Procedure Oriented Languages, Introduction to Object Oriented, Object Oriented Development, Object Oriented Themes, Benefits and Application of OOPS. **Principles of OOPS:** OOPS Paradigm, Basic Concepts of OOPS: Objects, Classes, Data Abstraction and Data Encapsulation, Inheritance, Polymorphism, Dynamic Binding, Message Passing **Classes and Objects:** Simple classes (Class specification, class members accessing), Defining member functions, passing object as an argument, Returning object from functions, friend classes, Pointer to object, Array of pointer to object. **Constructors and Destructors:** Introduction, Default Constructor, Parameterized Constructor and examples, Destructors	**15** **[CO1, CO2, CO4]**
Unit II	**Polymorphism:** Concept of function overloading, overloaded operators, overloading unary and binary operators, overloading comparison operator, overloading arithmetic assignment operator, Data Conversion between objects and basic types, **Virtual Functions:** Introduction and need, Pure Virtual Functions, Static Functions, this Pointer, abstract classes, virtual destructors. **Inheritance:** Introduction, understanding inheritance, Advantages provided by inheritance, choosing the access specifier, Derived class declaration, derived class constructors, class hierarchies, multiple inheritance, multilevel inheritance, containership, hybrid inheritance. **Exception Handling:** Introduction, Exception Handling Mechanism, Concept of throw & catch with example	**15** **[CO1, CO2, CO3, CO4]**

References:

1. Object Oriented Analysis and Design by Timothy Budd, TMH Publisher, 3rd edition
2. Object Oriented Programming with C++ by E. Balagurusamy, Tata McGraw Hill

Course Code	Course Title	Credits	No. of
23BUCS1P02	Practical Based on 23BUCS1T03 and 23BUCS1T04	02	lectures

CO1	Understand graphs, trees, sorting using computer coding	L2
CO2	Implement Stack, queues and analyze its use.	L3
CO3	Understand OOPs concepts using programming language	L2
CO4	Develop programs using OOPs concepts	L6

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	-	1	1
CO2	3	3	3	-	2	1
CO3	3	2	2	-	2	1
CO4	3	3	3	-	3	1

Practical 1	Graphs of standard functions such as absolute value function, inverse function
Practical 2	Graph of logarithmic and exponential functions, flooring and ceiling functions, trigonometric functions over suitable intervals
Practical 3	Partial ordering sets, Hasse diagram and Lattices
Practical 4	Different counting principles.
Practical 5	Write a program to generate Fibonacci series using recurrence relation
Practical 6	Implementation of sorting algorithms Non Recursive
Practical 7	Implementation of sorting algorithms Recursive
Practical 8	Implementation of Stack using Array
Practical 9	Implementation of queue using Array
Practical 10	Implementation of Tree structure, Binary Tree
Practical 11	Write a program Illustrating Class Declarations, Definition, Accessing Class Members.
Practical 12	Write a C++ code to demonstrate working with Classes and methods
Practical 13	Write a C++ code to demonstrate use of friend functions.
Practical 14	Write C++ program to implement inline function.
Practical 15	Write a C++ code to demonstrate Operator Overloading
Practical 16	Write a C++ code to demonstrate Function Overloading
Practical 17	Write a C++ code to illustrate default constructor, parameterized constructor and copy constructors
Practical 18	Write a C++ code to explain Single inheritance
Practical 19	Write a C++ code to explain multiple inheritance
Practical 20	Write a C++ program to implement multilevel inheritance
Practical 21	Write a C++ code explain virtual functions
Practical 22	Write a C++ code to demonstrate exception handling
Practical 23	Write a C++ program to implement the concept of virtual base class
Practical 24	Write a C++ program to implement the concept of class template
Practical 25	Write a C++ program for swapping two values using function templates

Course Code	Course Title	Credits	No. of lectures
23BUCS1T05	**GE: Descriptive Statistics and Introduction to Probability**	**02**	**30**

CO1	Understand data types, data classification and Present data using appropriate statistical techniques	L2
CO2	Compute and analyze measures of central tendency and Interpret skewness and kurtosis of distributions	L2
CO3	Analyze correlation between variables and apply linear regression techniques	L4
CO4	Apply statistical concepts to real-life data	L3

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	-	1	1
CO2	3	3	2	-	1	1
CO3	3	3	2	-	1	1
CO4	3	3	3	-	2	2

Unit I	**Data Presentation:** Data types: attribute, variable, discrete, continuous variable Data presentation: frequency distribution, histogram o give, curves, stem, leaf **Data Aggregation**: Measures of Central tendency: Mean, Median, mode for raw data, discrete, grouped frequency distribution. Measures dispersion: Variance, standard deviation, coefficient of variation, discrete and grouped frequency distribution, quartiles, quintiles Real life examples **Moments:** raw moments, central moments, relation between raw and central moments **Measures of Skewness and Kurtosis:** based on moments, quartiles, relation between mean, median, mode for symmetric, asymmetric frequency curve.	**15** **[CO1, CO2]**
Unit II	**Correlation and Regression:** bivariate data, scatter plot, correlation, nonsense correlation, Karl pearson's coefficients of correlation, independence. **Linear regression:** fitting of linear regression using least square regression, coefficient of determination, properties of regression coefficients **Probability :** Random experiment, sample space, events types and operations of events **Probability definition :** classical, axiomatic, Elementary Theorems of probability (without proof) • $0 \leq P(A) \leq 1$, • $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ • $P(A') = 1 - P(A)$ • $P(A) \leq P(B)$ if $A \in B$ Conditional probability, 'Bayes' theorem, independence, Examples on Probability	**15** **[CO3, CO4]**

References:

1. Trivedi, K.S.(2001) : Probability, Statistics, Design of Experiments and Queuing theory, with applicationsof Computer Science, Prentice Hall of India, New Delhi
2. Ross, S.M. (2006): A First course in probability. 6th Ed^{n} Pearson
3. Kulkarni, M.B., Ghatpande, S.B. and Gore, S.D. (1999): common statistical tests. Satyajeet Prakashan, Pune
4. Gupta, S.C. and Kapoor, V.K. (1987): Fundamentals of Mathematical Statistics,
S. Chand and Sons, New Delhi
5. Gupta, S.C. and Kapoor, V.K. (1999): Applied Statistics, S. Chand and Son's, New Delhi
6. Montgomery, D.C. (2001): Planning and Analysis of Experiments, wiley

Course Code	Course Title	Credits	No. of lectures
23BUID1T02	**ID: Introduction to Soft Skills**	**02**	**30**

CO1	Demonstrate effective verbal communication and active listening skills during discussions and presentations	L3
CO2	Write precise briefs or reports and technical documents	L1
CO3	Explain the purpose, structure, and key elements of group discussions, meetings, interviews, and presentations	L2
CO4	Summarize the importance of setting targets, staying motivated, and practicing creative thinking for individual effectiveness	L2

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	-	3	2
CO2	3	2	3	-	2	2
CO3	3	2	2	-	3	2
CO4	2	2	1	-	3	2

Unit I	**Personality Development:** Knowing Yourself, Positive Thinking, Johari's Window, Communication Skills, Non-verbal Communication, Physical Fitness **Emotional Intelligence**: Meaning and Definition, Need for Emotional Intelligence, Intelligence Quotient versus Emotional Intelligence Quotient, Components of Emotional Intelligence, Competencies of Emotional Intelligence, Skills to Develop Emotional Intelligence **Etiquette and Mannerism**: Introduction, Professional Etiquette, Technology Etiquette **Communication Today:** Significance of Communication, GSC's 3M Model of Communication, Vitality of the Communication Process, Virtues of Listening, Fundamentals of Good Listening, Nature of Non-Verbal Communication, Need for Intercultural Communication, Communicating Digital World **Employment Communication:** Introduction, Resume, Curriculum Vitae, Scannable Resume, Developing an Impressive Resume, Formats of Resume, **Professional Presentation:** Nature of Oral Presentation, Planning a Presentation, Preparing the Presentation, Delivering the Presentation	**15** **[C01, CO2, CO4]**
Unit II	**Job Interviews:** Introduction, Importance of Resume, Definition of Interview, Background Information, Types of Interviews, Preparatory Steps for Job Interviews, Interview Skill Tips, Changes in the Interview Process **Group Discussion:** Introduction, Ambience/Seating Arrangement for Group Discussion, Importance of Group Discussions, Difference between Group Discussion, Panel Discussion and Debate, Traits, Types of Group Discussions,	**15** **[CO1, CO2, CO3, CO4]**

	topic based and Case based Group Discussion, Individual Traits **Creativity at Workplace:** Introduction, Current Workplaces, Creativity, Motivation, Nurturing Hobbies at Work, The Six Thinking Hat Method **Ethical Values:** Ethics and Society, Theories of Ethics, Correlation between Values and Behavior, Nurturing Ethics, Importance of Work Ethics, Problems in the Absence of Work Ethics **Capacity Building: Learn, Unlearn and Relearn:** Capacity Building, Elements of Capacity Building, Zones of Learning, Ideas for Learning, Strategies for Capacity Building **Leadership and Team Building:** Leader and Leadership, Leadership Traits, Culture and Leadership, Leadership Styles and Trends, Team Building, Types of Teams, **Decision Making and Negotiation:** Introduction to Decision Making, Steps for Decision Making, Decision Making Techniques, Negotiation Fundamentals, Negotiation Styles, Major Negotiation Concepts	

References:

1. Soft Skills: an Integrated Approach to Maximise Personality Gajendra Chauhan, Wiley India
2. Personality Development and Soft Skills, Barun K. Mitra, Oxford Press
3. Business Communication, Shalini Kalia, Shailja Agrawal, Wiley India
4. Soft Skills - Enhancing Employability, M. S. Rao, I. K. International
5. Cornerstone: Developing Soft Skills by Sher field , Pearson India

Course Code	Course Title	Credits	No. of lectures
23BU1VSC07	**VSC: Introduction to Programming**	**02**	**30**

CO1	Study the concept of programming, high level and low level languages. flow chart, algorithm	L1
CO2	Understand the need of logic for writing the codes	L2
CO3	Analyze different programming paradigms by examining and comparing the structure, use, and mathematical foundations of loops, arrays, and functions.	L4
CO4	Apply programming concepts and development tools to build basic software applications	L3

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	-	1	1
CO2	3	3	2	-	1	1
CO3	3	3	2	-	2	1
CO4	3	3	3	-	3	1

Unit I	Introduction, A program, programming languages, The Role of Programming Language, Language Description, elements of program, variable, constants, compilation, compilers, assemblers, Data types, flow chart, DFD, algorithm, Sequence Control and Subprogram Control	**15** [CO1, CO2, CO3]
Unit II	Condition checking, loops, functions, Arrays and Basic Algorithms, Pointers and File Handling, Imperative Programming, Object Oriented Programming, Functional Programming, Logic Programming, Concurrent and Network Programming	**15** [CO2, CO3, CO4]

References:

1. Introduction to Programming by Deepak Gupta Kataria, S. K., & Sons
2. Principles of Programming Language by Dr. Sachin Kumar, Kadambari Agarwal, S.K.Kataria and Sons

Course Code	Course Title	Credits	No. of lectures
23BUEN1T01	AEC: **Basic English Learning Course**	02	30

CO1	Explain the concepts and rules related to sentences and their kinds, parts of speech, infinitives and participles, commands, requests, and questions, and punctuation (full stop, comma, colon, semicolon, dash) with appropriate examples	L2
CO2	Describe & discuss usage of verbs and their kinds, articles, prepositions, conjunctions, tenses and their kinds, and the use of correct verb forms in English grammar	L2
CO3	Explain the concepts, rules, and usage of sentence transformation, antonyms, synonyms, homophones, homonyms, collocations, active and passive voice, and degrees of comparison with suitable examples	L2
CO4	Describe and discuss the principles and techniques of reading comprehension, vocabulary learning, conversation skills, essay writing, short speeches, dialogue writing, and mock interview preparation for effective communication	L2

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	-	1	1
CO2	3	2	2	-	1	1
CO3	3	2	2	-	2	1
CO4	3	3	3	-	3	2

Unit I	**1.1 Basic English grammar** Noun, pronoun, verb, adverb, adjective, preposition, conjunction, interjection, Tenses, kinds of tenses, Using of correct verb forms **1.2 Sentences:** a. Subject predicate and kinds (assertive, declarative, interrogative, Imperative, exclamatory) b. Types of sentences (simple, compound, complex) c. Sentence-Fragment (link) d. Run-on sentence and Comma splices, semicolon(link) e. Punctuations. f. articles-a, an, the g. Vocabulary: Word Formation: Prefix, Suffix, Conversion, compounding, abbreviation, idioms **1.3 Clause and phrase:** a. Voice-Active & passive(identify and change) b. Clauses- Independent and dependent; coordination and subordination **1.4 Transformation** - Antonyms, Synonyms - Homophones, Homonyms - Collocation - Active and passive voices - Degree of comparison	**15** [CO1, CO2, CO3]
Unit II	**2.1 Figures of speech** Simile, metaphor, personification, apostrophe, Antithesis, epigram,	**15** [CO2,

	Metonymy, Synec doche, Hyperbole, Euphimism, Irony, Pun, Interrogation, Exclamation, Climax and anticlimax **2.2 Tutorial activities** a. Reading b. Vocabulary learning c. Conversation d. Essay writing e. Short speeches f. Dialogues Writing g. Mock interviews h. Visual data interpretation-graphs, charts, figures, maps, animations Drafting formal mail	CO3, CO4]

References:

1. English Grammar & Composition – P.C. Wren & H. Martin
2. Practical English Grammar – A.J. Thomson & A.V. Martinet
3. Wren & Martin – High School English Grammar & Composition
4. Effective English Communication – M. Ashraf Rizvi

Course Code	Course Title	Credits	No. of lectures
23BUIK1T03	**IKS: Science and Technology**	**02**	**30**

CO1	Understand and appreciate the rich heritage that resides in our traditions	L2
CO2	Understand of the history and evolution of Indian Intelligence	L2
CO3	Describe the nature of IKS in the contemporary society.	L1
CO4	Understand inspiration for innovation, the environmental data that IT processes, and a constant source of real-world applications that drive technological advancement.	L2

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	1	2	1	3
CO2	2	2	1	1	1	3
CO3	2	2	2	1	1	3
CO4	3	3	2	3	2	2

Unit I	**Introduction:** Importance of Ancient Knowledge, Defining Indian Knowledge system, IKS Corpus, Unique aspects of IKS **Foundational Concepts for Science and Technology:** Number system and Units of Measurement, Knowledge: Framework and classification, Science, Engineering and Technology in IKS: Mathematics, Astronomy	**15** **[CO1, CO2, CO4]**
Unit II	**Space,** The future of Space Exploration, Evolving Space Technologies **The Earth,** Earth and its Resources, The Biosphere **Life**, Food, Energy, Electricity, Water, Health Care	15 [CO1, CO3, CO4]

References:

1. Introduction to Indian Knowledge System, Concepts and Applications, PHI by B. Mahadevan, Vinayak Bhat, Nagendra Pavana R.N.
2. The Scientific Indian by A.P.J. Abdul Kalam and Y.S.Rajan

Semester II

Course Code 23BUCS2T01	Course Title **Major: Operating System**	Credits 02	No. of lectures

CO1	Understand the basic concepts and functions of operating systems	L2
CO2	Understand Processes, Threads and Deadlocks	L2
CO3	Analyze Scheduling algorithms	L4
CO4	Analyze memory management schemes, I/O management and File systems	L4

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	-	1	1
CO2	3	3	2	-	2	1
CO3	3	3	2	-	2	1
CO4	3	3	3	-	2	1

Unit I	**Introduction:** Timeline of Operating Systems, History of operating system, computer hardware, different operating systems, operating system concepts, system calls, operating system structure. **Processes and Threads:** Processes, threads, inter process communication, scheduling, IPC problems. **Memory Management:** No memory abstraction, memory abstraction: address spaces, virtual memory, page replacement algorithms, design issues for paging systems, implementation issues, segmentation	**15** **[CO1, CO2, CO3, CO4]**
Unit II	**File Systems:** Files, directories, file system implementation, file-system management and optimization, MS-DOS file system, UNIX file system **Input-Output:** Principles of I/O hardware, Principles of I/O software, I/O software layers, disks, clocks, user interfaces: keyboard, mouse, monitor, thin clients, power management **Deadlocks**: Resources, introduction to deadlocks, the ostrich algorithm, deadlock detection and recovery, deadlock avoidance, deadlock prevention, issues **Multiple Processor Systems** Multiprocessors, multicomputer, distributed systems	**15** **[CO1, CO2, CO3, CO4]**

References:

1. Modern Operating Systems by Andrew S. Tanenbaum, Herbert Bos by Pearson, 4th edition
2. Operating Systems by Godbole and Kahate, McGraw Hill, 3rd edition

Course Code	Course Title	Credits	No. of lectures
23BUCS2T02	**Major: Introduction to Python Programming**	**02**	**30**

CO1	Interpret fundamental Python syntax and the use of Python control flow statements.	L5
CO2	Interpret the concepts of OOPs used in Python	L5
CO3	Examine the data structures like lists, dictionaries, tuples and sets in Python	L4
CO4	Understand the Use Python libraries and modules for specific tasks	L2

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	3	-	2	1
CO2	3	3	3	-	3	1
CO3	3	3	3	-	2	1
CO4	3	3	3	-	2	1

Unit I	**Basic concepts:** interpreting and the interpreter, compilation and the compiler, language elements, syntax and semantics, Python keywords, instructions, indenting, literals: Boolean, integer, floating-point numbers, scientific notation, strings, operators: unary and binary, priorities and binding, numeric operators: ** * / % // + – **Bitwise operators:** ~ & ^ | <<, >>, string operators: * +, Boolean operators: not and or relational operators (== != > >= < <=), building complex Boolean expressions assignments and shortcut operators, accuracy of floating-point numbers basic input and output: input(), print(), int(), float(), str() functions, formatting print() output with end= and sep= arguments **Conditional Statements:** if, if-else, if-elif, if-elif-else, the pass instruction simple lists: constructing vectors, indexing and slicing, the len() function simple strings: constructing, assigning, indexing, slicing comparing, immutability, **Building loops:** while, for, range(), in, iterating through sequences, expanding loops: while-else, for-else, nesting loops and conditional statements, controlling loop execution: break, continue	**15** **[CO1, CO2, CO3, CO4]**
Unit II	Immutability, escaping using the \ character, quotes and apostrophes inside strings, multiline strings, copying vs. cloning, advanced slicing, string vs. string, string vs. nonstring, basic string methods, upper(), lower(), isxxx(), capitalize(), split(), join(), etc. and functions (len(), chr(), ord()), escape characters, **Lists:** indexing, slicing, basic methods (append(), insert(), index()) and functions (len(), sorted(), etc.), del instruction, iterating lists with the for loop, initializing, in and not in operators, list comprehension, copying and cloning lists in lists: matrices and cubes **tuples:** indexing, slicing, building, immutability, tuples vs. lists: similarities and differences, lists inside tuples and tuples inside lists **Dictionaries:** building, indexing, adding and removing keys, iterating through dictionaries as well as their keys and values, checking key existence, keys(), items() and values() methods	**15** **[CO1, CO2, CO3, CO4]**

References:

1. Beginning Python: From Novice to Professional by Magnus Lie Hetland, Apress 3rd edition

Course Code 23BUCS2P01	Course Title Practical Based on 23BUCS2T01 and 23BUCS2T02	Credits 02	No. of lectures 30

CO1	Understand the MS-DOS commands	L2
CO2	Understand the Linux commands	L2
CO3	Write, test, and debug simple Python programs with conditions, loops, functions	L1
CO4	Develop the application specific codes using python	L6

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	3	-	1	1
CO2	3	2	3	-	1	1
CO3	3	3	3	-	3	1
CO4	3	3	3	-	3	1

Practical 1	Linux commands: pwd, cd, absolute and relative paths, ls, mkdir, rmdir,
Practical 2	Linux commands: file, touch, rm, cp. mv, rename, head, tail, cat, tac, less
Practical 3	Linux commands: more, strings, chmod, ps, top, kill, pkill, bg
Practical 4	Linux commands: fg, grep, locate, find, date, cal, uptime, w, whoami
Practical 5	Linux commands: finger, uname, man, df, du, free, whereis, which
Practical 6	Windows (DOS) Commands: Date, time, prompt, md, cd, rd, path, cls
Practical 7	Windows (DOS) Commands: Chkdsk, copy, xcopy, format, fidsk, del
Practical 8	Windows (DOS) Commands: defrag, move, echo, Edit, fc, find
Practical 9	Windows (DOS) Commands: Diskcomp, diskcopy, diskpart, doskey,
Practical 10	Windows (DOS) Commands: rename, set, type, ver
Practical 11	To write a C program for implementation of Round Robin scheduling algorithms
Practical 12	To write a C program for implementation of FCFS scheduling algorithms
Practical 13	To write a C program for implementation of SJF scheduling algorithms
Practical 14	Write a program to demonstrate different number data types in Python
Practical 15	Write a program to perform different Arithmetic Operations on numbers in Python
Practical 16	Write a Python code to find the biggest number among three numbers.
Practical 17	Write a Python code to print sum of N natural numbers
Practical 18	Write a Python code to print factorial of a number
Practical 19	Write a Python program to construct the stars(*) pattern, using a nested for loop
Practical 20	Write a Python Program to find square root of number.
Practical 21	Write a Python Program to find the sum of all the primes below hundred.
Practical 22	Write a program to calculate the length of a string.
Practical 23	Write a function to reverse a given string.
Practical 24	Write a program to create, append, and remove lists in python.
Practical 25	Write a program to demonstrate working with tuples in python.
Practical 26	Write a program to demonstrate working with dictionaries in python.
Practical 27	Write a python program to find factorial of a number using Recursion.
Practical 28	Write a python program to prints prime numbers less than 20.
Practical 29	Write a python class to implement pow(x, n)
Practical 30	Write a python program to define a module to find Fibonacci numbers

Course Code	Course Title	Credits	No. of
23BUCS2T03	**Minor: Data Structures**	02	lectures

CO1	Understand Abstract Data Types, sets, array-based data structures, linked data structures	L2
CO2	Understand the concepts of Stacks and Queues with their applications.	L2
CO3	Analyze and implement advanced linked list structures, recursion, hash tables	L4
CO4	Solve real-world problems using data structures	L3

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	3	-	2	1
CO2	3	3	3	-	3	1
CO3	3	3	3	-	3	1
CO4	3	3	3	-	3	2

Unit I	**Abstract Data Types:** Introduction, The Date Abstract Data Type, Bags, Iterators. Application **Arrays:** Array Structure, Python List, Two Dimensional Arrays, Matrix Abstract Data Type, Application **Sets and Maps:** Sets-Set ADT, Selecting Data Structure, List based Implementation, Maps-Map ADT, List Based Implementation, Multi-Dimensional Arrays-Multi-Array ADT, Implementing Multiarrays, Application **Algorithm Analysis:** Complexity Analysis-Big-O Notation, Evaluating Python Code, Evaluating Python List, Amortized Cost, Evaluating Set ADT, Application **Searching and Sorting**: Searching-Linear Search, Binary Search, Sorting-Bubble, Selection and Insertion Sort, Working with Sorted Lists-Maintaining Sorted List, Maintaining sorted Lists. **Linked Structures**: Introduction, Singly Linked List-Traversing, Searching, Prepending and Removing Nodes, Bag ADT-Linked List Implementation. Comparing Implementations, Linked List Iterators, More Ways to Build Kinked Lists, Applications-Polynomials	**15** **[CO1, CO4]**
Unit II	**Stacks:** Stack ADT, Implementing Stacks-Using Python List, Using Linked List, Stack Applications-Balanced Delimiters, Evaluating Postfix Expressions **Queues:** Queue ADT, Implementing Queue-Using Python List, Circular Array, Using List, Priority Queues- Priority Queue ADT, Bounded and unbounded Priority Queues **Advanced Linked List:** Doubly Linked Lists-Organization and Operation, Circular Linked List-Organization and Operation, Multi Lists **Recursion:** Recursive Functions, Properties of Recursion, Its working, Recursive Applications **Hash Table:** Introduction, Hashing-Linear Probing, Clustering, Rehashing, Separate Chaining, Hash Functions	**15** **[CO1, CO2, CO3, CO4]**

References:

1. Data Structure and algorithm Using Python, Rance D. Necaise, 2016 Wiley India Edition
2. Data Structure and Algorithm in Python, Michael T. Goodrich, Robertom Tamassia, M. H. Goldwasser, 2016 Wiley India Edition

Course Code	Course Title	Credits	No. of lectures
23BUCS2T04	**Minor: Database Systems**	**02**	**30**

CO1	Understand importance of Data Models, Entity-Relationship diagrams, UML, Relational DBMS for enterprise level databases	L2
CO2	Create table, views, inserting records in tables, altering tables, update records, normalization, drop table and views and other DDL, DML, DQL, DCL, TCL statements	L6
CO3	Analyze working of views, NULL Values, relational algebra supporting databases, joining of tables	L4
CO4	Understanding ACID properties, Deadlocks	L2

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	3	-	2	1
CO2	3	2	3	-	2	1
CO3	3	3	3	-	2	1
CO4	3	3	3	-	2	1

Unit I	**Introduction to Databases and Transactions :** What is database system, purpose of database system, view of data, relational databases, database architecture, transaction management **DDL, DML, DCL statements** **Data Models:** The importance of data models, Basic building blocks, Business rules,The evolution of data models, Degrees of data abstraction. **Database Design, ER Diagram and Unified Modeling Language** Overview, ER Model, Constraints, ER Diagrams, ER Issues, weak entity sets, Codd's rules, Relational Schemas, Introduction to UML **Relational database model:** Logical view of data, keys, integrity rules, Relational Database design: features of good relational database design, atomic domainand Normalization (1NF, 2NF, 3NF, BCNF).	**15** **[CO1, CO2]**
Unit II	**Joining Tables** – inner join, outer join, left outer, right outer, full outer **Subqueries** – subqueries with IN, EXISTS, subqueries restrictions, Nested subqueries, ANY/ALL clause, correlated subqueries **Constraints, Views and SQL** Constraints, types of constrain, Integrity constraints, Views: Introduction to views, data independence, security, updates on views, comparison between tables and views SQL: data definition, aggregate function, Null Values, nested sub queries, Joined relations. Triggers **Transaction management and Concurrency** Control Transaction management: ACID properties, serializability and concurrency control, Lock based concurrency control (2PL, Deadlocks),Time stamping methods, optimistic methods, database recovery management	**15** **[CO2, CO3, CO4]**

References: 1. Database System and Concepts by A Silberschatz, H Korth, S Sudarshan McGraw Hill Fifth Edition
2. Database Systems by RobCoronel Cengage Learning Twelfth Edition
3. Introduction to Database System by C.J.Date Pearson First 2003

Course Code 23BUCS2P02	Course Title Practical Based on 23BUCS2T03 and 23BUCS2T04	Credits 02	No. of lectures 30

CO1	Demonstrate understanding of basic data structures (arrays, stacks, queues, linked lists) and SQL commands through implementation of simple programs and queries	L3
CO2	Implement searching and sorting algorithms, operations on arrays, stacks, queues, and linked lists to solve computational problems.	L3
CO3	Analyze data using SQL queries, sub-queries, views, group functions, and constraints to perform efficient data retrieval and management in relational databases.	L4
CO4	Design and develop programs using functions, procedures, packages, and triggers in SQL to build modular, maintainable, and reusable solutions for practical problems.	L6

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	3	-	2	-
CO2	3	3	3	-	3	-
CO3	3	3	3	-	2	-
CO4	3	3	3	-	3	-

Practical 1	Implement Linear Search to find an item in a list
Practical 2	Implement binary search to find an item in an ordered list.
Practical 3	Implement Sorting Algorithm: A Bubble sort
Practical 4	Implement Sorting Algorithm: Insertion sort
Practical 5	Implement Sorting Algorithm: Quick sort
Practical 6	Implement Sorting Algorithm: Merge Sort
Practical 7	Implement use of Sets and various operations on Sets.
Practical 8	Implement an Array and perform insertion, deletion, traversal in the array
Practical 9	Implement Queue and perform insertion, deletion, traversal in the array
Practical 10	Implement stack and perform insertion, deletion, traversal in the array
Practical 11	Write a program that uses functions to perform the following operations on singly linked list i) Creation ii) Insertion iii) Deletion iv) Traversal.
Practical 12	Write a program that uses functions to perform the following operations on doubly linked list i) Creation ii) Insertion iii) Deletion iv) Traversal.
Practical 13	Write a program that uses functions to perform the following operations on circular linked List i) Creation ii) Insertion iii) Deletion iv) Traversal
Practical 14	Implement stack using Linked list
Practical 15	Implement Queue using Linked list
Practical 16	Creating and Managing Tables
Practical 17	Creating and Managing Tables Including Constraints
Practical 18	Insert, Update, Delete rows
Practical 19	Alter table
Practical 20	Writing Basic SQL SELECT Statements
Practical 21	Restricting and Sorting Data
Practical 22	Single-Row Functions
Practical 23	Displaying Data from Multiple Tables
Practical 24	Aggregating Data Using Group Functions
Practical 25	Sub-queries
Practical 26	Creating and working with Views
Practical 27	Creating and working with Trigger
Practical 28	Creating and working with Trigger
Practical 29	Creating and working with Procedures
Practical 30	Creating and working with Packages

Course Code	Course Title	Credits	No. of
23BUCS2T05	**GE: Statistical Method and Testing of Hypothesis**	**02**	**lectures**

CO1	Explain random variables and standard probability distributions.	L5
CO2	Apply probability distributions to solve statistical problems	L3
CO3	Understand hypothesis testing and confidence interval estimation	L2
CO4	Analyze data using ANOVA techniques and justify non-parametric statistical tests for real data.	L4

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	3	-	1	1
CO2	3	3	3	-	2	1
CO3	3	3	3	-	2	1
CO4	3	3	3	-	2	1

Unit I	**Standard distributions**: random variable; discrete, continuous, expectation and variance of a random variable, pmf, pdf, cdf, reliability, Introduction and properties without proof for following distributions; binomial, normal, chi-square, t, F. Examples	**15** **[CO1, CO2]**
Unit II	**Hypothesis testing:** one sided, two sided hypothesis, critical region, p-value, tests based on t, Normal and F, confidence intervals. **Analysis of variance** : one-way, two-way analysis of variance **Non-parametric tests:** need of non-parametric tests, sign test, Wilicoxon's signed rank test, run test, Kruskal-Walis tests	**15** **CO3, CO4]**

References:

1. Trivedi, K.S.(2009) : Probability, Statistics, Design of Experiments and Queuing theory, with applications of Computer Science, Prentice Hall of India, New Delhi

Course Code 23BUID2T03	Course Title VEC: Professional Ethics	Credits 02	No. of lectures

CO1	Identify and analyze an ethical issue in the field	L4
CO2	Understand the moral of the profession, safety and risk and concern global issues.	L2
CO3	Develop individuals with desired qualities and humanistic approach	L6
CO4	Identify the multiple ethical interests at stake in a real-world situation	L4

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	3	-	1	1
CO2	3	3	3	-	2	1
CO3	3	3	3	-	2	1
CO4	3	3	3	-	2	1

Unit I	**Ethics and Human Values**: Ethics and Values, Ethical Vision, Nature of Ethics, Profession and Professionalism, Professional Ethics, Code of Ethics, Ethical Decisions, Human Values – Classification of Values, Universality of Values **Professional ethics** - Profession and its moral value in life, Profession- skill needed Profession and ethics- commitment, honesty, accountability, Professional integrity, transparency, confidentiality, objectivity, respect, obedience to the law and loyalty.	**15** **[CO1, CO2, CO3]**
Unit II	**Safety Social Responsibility and Rights:** Safety and Risk, moral responsibility for safety, case studies – Bhopal gas tragedy, Chernobyl disaster, Fukushima Nuclear disaster, Professional rights, Gender discrimination, Sexual harassment at work place **Global Issues:** Globalization and MNCs, Environmental Ethics, Computer Ethics, Cyber Crimes, Ethical living, concept of Harmony in life	**15** **[CO1, CO2, CO4]**

References:

1. Human Values for Managers by Chakraborty, S.K
2. Business Ethics, Vrinda Publications by Badi, R.V. and Badi, N.V
3. Values and Ethics for Organizations by Chakraborty
4. Perspectives in Business Ethics by Hartman, Chatterjee

Course Code	Course Title	Credits	No. of lectures
23BUEN2T03	**AEC: Introduction to Technical Writing**	02	

CO1	Elaborate the importance of communication, analyzing audience	L2
CO2	Identify and use appropriate formats of document writing	L1
CO3	Develop skills for writing applications, proposals, reports	L6
CO4	Develop the skills for Presentations	L6

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	-	3	2
CO2	3	2	3	-	2	2
CO3	3	2	3	-	3	2
CO4	3	2	3	-	3	2

Unit I	Introduction to Technical Communication, Understanding Ethical and Legal Considerations, Writing Technical Documents, Writing Collaboratively, Analyzing your audience and purpose, Researching your subject, Organizing your information	**15** **[CO1, CO2]**
Unit II	Writing correspondence, Writing job Application materials, Writing Proposals, Writing Informational Reports, Writing Definitions, Descriptions and Instructions, Making Oral Presentations	**15** **[CO1, CO3, CO4]**

References:

- Technical Communication by Mike Markel, 11th Edition, Launchpad

Course Code	Course Title	Credits	No. of lectures
23BUIK2T03	IKS: Quick Mathematics	02	30

CO1	Discuss the concepts of Vedic Mathematics and make Mathematics enjoyable.	L2
CO2	Develop fast and accurate mental calculation skills.	L6
CO3	Develop strong foundation for Competitive Examination	L6
CO4	Improve logical thinking.	L6

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	-	1	1
CO2	3	3	2	-	1	1
CO3	3	3	1	-	1	1
CO4	3	3	1	-	2	1

Unit I	Importance of learning Quick Mathematics, Origin and history, Basic Mathematical tricks to find Product of two numbers, division of two numbers, square root and cube root of a number, Square root of imperfect squares, Cubing Numbers, Base method for multiplication, squaring and Division	**15** **[CO1, CO2, CO3, CO4]**
Unit II	Digit sum method, Magic squares, Dates and Calendar, General and Simultaneous Linear equations, Working with Fractions, Simple and Compound Interest, Profit and loss, Time and Work, Time Distance and Speed.	**15** **[CO1, CO2, CO3, CO4]**

References:

- Vedic Mathematics made easy by Dhaval Bhatiya
- Vedic Mathematics by Sri Bharati Krishna

Course Code 23BUCS2P03	Course Title FP: Green Technologies	Credits 02	No. of lectures 45

CO1	Describe awareness among stakeholders and promote green agenda and green initiatives	L1
CO2	Identify IT Infrastructure Management and Green Data Centre Metrics	L1
CO3	Illustrate various green IT services and its roles	L4
CO4	Use Green IT Strategies and metrics for ICT development	L3

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	2	3	1	3
CO2	2	2	3	3	1	2
CO3	2	2	3	2	1	2
CO4	2	2	3	3	1	2

Unit I	**Overview and Issues:** Problems: Toxins, Power Consumption, Equipment Disposal, Company's Carbon Footprint. **Minimizing Power Usage:** Power Problems, Monitoring Power Usage, Servers, Low-Cost Options, Reducing Power Use, Data De-Duplication, Virtualization **Cooling:** Cooling Costs, Power Cost, Causes of Cost, Calculating Cooling Needs, Reducing Cooling Costs, Economizers, On-Demand Cooling **Changing the Way of Work:** Old Behaviors, starting at the Top, Process Reengineering with Green in Mind, Analyzing the Global Impact **Going Paperless:** Paper Problems, The Environment, Costs: Paper and Office, Practicality, Storage, Destruction, Going Paperless **Recycling:** Problems, Materials, Means of Disposal, Recycling, Refurbishing, Make the Decision, Life Cycle, from beginning to end, Life, Cost **Hardware Considerations:** Energy Star, Computers, Monitors, Printers, Scanners, All-in-Ones, Thin Clients, Servers, Blade Servers	15

Suggested Field Projects:

1. Green IT Audit of your residence (Study toxins, power usage and suggest improvements)
2. Green IT Audit of a College Computer Lab (Study toxins, power usage and suggest improvements)
3. Carbon Footprint Analysis of College Computer Lab (Suggest reduction strategies)
4. Do survey of households, College E-waste and suggest methods for e-waste handling.
5. Consider some IT / Electronic device and Identify hazardous substances in it.
6. Study the current month electricity bill of your home and identify the reason behind the number of units used. Suggest and implement the methods to minimize the bill.
7. Study the Power consumption of Desktop, Laptop and other IT Gazettes.
8. Study how virtualization reduces power usage.
9. Analyze duplicate data in our college. Do required study for Storage Optimization.
10. Compare traditional servers and blade servers (theoretical + field)
11. Study AC usage and cooling costs. Suggest cost reduction methods.
12. Study Natural Cooling & Economizer Techniques Study.
13. Measure paper consumption and propose digital alternatives.
14. Study the use of cloud tools to design paperless workflow.
15. Compare paper and digital storage costs
16. Study the life cycle of Computer System from manufacturer to disposal and analyze the environmental cost.
17. Study feasibility of reusing old hardware for education
18. Analyze Energy Star ratings of electronic gazettes.

References:

1. Green IT by Toby Velte, Anthony Velte, McGraw Hill,
2. Green Computing and Green IT Best Practice by Jason Harris, Emereo Publication

Evaluation and Examination Scheme

Evaluation Scheme 30:20
Internals Based on Unit 1 / Unit 2 / Unit 3/ Unit 4

Assignments/ Tutorials/Class Test	Seminar or any other activities	Active Participation & Leadership qualities	Total
10	05	05	20

Suggested Format for Mandatory Question paper

Duration: 1.30Hours **Total Marks: 30**

N. B.: 1. All the questions are compulsory
2. Figures to the right indicate full marks.
3. Answer to the same question must be written together.
4.Use of non-programmable calculator is allowed.

Q.1		**Attempt any Two**	**8**
	(A)		
	(B)		
	(C)		
	(D)		
Q.2	**(A)**	**Attempt any One**	**4**
		i)	
		ii)	
	(B)	**Attempt any One**	**3**
		i)	
		ii)	
Q.3		**Attempt any Two**	**8**
	(A)		
	(B)		
	(C)		
	(D)		
Q.4	**(A)**	**Attempt any One**	**4**
		i)	
		ii)	
	(B)	**Attempt any One**	**3**
		i)	
		ii)	

Semester End Practical Examination:
Practical examination of each paper for 50 marks will be held for 2 or 3 hours.

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VPM's B. N. Bandodkar College of Science (Autonomous), Thane

Curriculum Structure for the Undergraduate Degree Programme F.Y.B.Sc. Computer Science

	Course Code	SEMESTER–I	Course imparts Employability (EM), Entrepreneurship (EN), Skill Development (SD)			Course integrates with Professional Ethics (PE), Gender Equity (GE), Human Value (HV), Environmental Sustainability (ES)			
		Course Title	EM	EN	SD	PE	GE	HV	ES
Major	23BUCS1T01	Computer Organization	√	√	√				
	23BUCS1T02	Systems Programming and Digital Logic	√	√	√				
	23BUCS1P01	Practicals based upon 23BUCS1T01 and 23BUCS1T02	√	√	√				
Minor	23BUCS1T03	Discrete Mathematics		√	√				
	23BUCS1T04	Object Oriented Programming	√	√	√				
	23BUCS1P02	Practicals based upon 23BUCS1T03 and 23BUCS1T04	√	√	√				
GE	23BUCS1T05	Descriptive Statistics and Introduction to Probability	√	√	√				
ID	23BUID1T02	Introduction to Soft Skills	√	√	√				
VSC	23BU1VSC07	Introduction to Programming	√	√	√				
AEC	23BUEN1T01	Basic English Learning Course	√	√	√				
IKS	23BUIK1T03	Science and Technology	√	√	√				

	Course Code	SEMESTER–II	Course imparts Employability (EM), Entrepreneurship (EN), Skill Development (SD)			Course integrates with Professional Ethics (PE), Gender Equity (GE), Human Value (HV), Environmental Sustainability (ES)			
		Course Title	EM	EN	SD	PE	GE	HV	ES
Major	23BUCS2T01	Operating System	√	√	√				
	23BUCS2T02	Introduction to Python Programming	√	√	√				
	23BUCS2P01	Practicals based upon 23BUCS2T01 and 23BUCS2T02	√	√	√				
Minor	23BUCS2T03	Data Structures	√	√	√				
	23BUCS2T04	Database Systems	√	√	√				
	23BUCS2P02	Practicals based upon 23BUCS2T03 and 23BUCS2T04	√	√	√				
GE	23BUCS2T05	Statistical Method & Testing of Hypothesis	√	√	√				
VEC	23BUID2T03	Professional Ethics	√	√	√	√		√	
AEC	23BUEN2T03	Introduction to Technical Writing	√	√	√				
IKS	23BUIK2T03	Quick Mathematics	√	√	√				
FP	23BUCS2P03	Green Technologies	√	√	√				√

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