Students Performance and Learning Outcomes
(PO, PSO and CO's)

Shri Shivaji Education Society, Amravati's

SCIENCE COLLEGE

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President

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Principal

● 'A+' Grade with 3.51 CGPA
(3rd Cycle) Reassessment
College by NAAC, Bangalore
● A College with Potential for
Excellence identified by UGC, New Delhi
● Member, APQN
(Asia Pacific Quality Network)
● Recognized Centre for Higher
Learning & Research
● Mentor College under
'Paramarsh Scheme' UGC, New Delhi
● An ISO 21001 : 2018 Certified Institution

Dr. Panjabrao alias
Bhausaheb Deshmukh
Founder President

Program Outcomes, Program Specific Outcomes and Course Outcomes

For B.Sc. (CS) & BCA NEP (Effective from 2024-25)

Programme Outcomes (POs) and Course Outcomes (COs) for Computer Science Programmes offered by the institution

Program Outcomes (POs) for B. Sc. Programme

PO1. Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO2. Problem Solving: Solve problems from the disciplines of concern using the knowledge, skills and attitudes acquired from sciences/ mathematics/ social sciences/ humanities.

PO3. Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO4. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in wide variety of settings.

PO5. Ethics: Understand multiple value systems including your own, the moral dimensions of your decisions, and accept responsibility for them.

PO6. Environment and sustainability: Understand the impact of technology and business practices in societal and environmental contexts, and sustainable development.

PO7. Self-directed and life-long learning: Demonstrate the ability to engage in independent and life-long learning in the broadest context socio-technological changes.

PO8. Design/Development of Solutions: Design solutions for complex science problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO9. Computational Thinking: Understand data-based reasoning through translation of data into abstract concepts using computing technology-based tools.

PO10. Effective Citizenship: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO11. Global Perspective: Understand the economic, social and ecological connections that link the world's nations and people.

PO12. Aesthetic Engagement: Demonstrate and master the ability to engage with the arts and draw meaning and value from artistic expression that integrates the intuitive dimensions of participation in the arts with broader social, cultural and theoretical frameworks.

Program Specific Outcomes (PSOs) and Course Outcomes (COs) for B. Sc. (Computer Science) Programme

Programme Specific Outcomes (PSOs):

1. Discipline knowledge: Acquiring knowledge on basics of Computer Science and ability to apply to design principles in the development of solutions for problems of varying complexity.
2. Problem Solving: Improved reasoning with strong mathematical ability to Identify, formulate and analyze problems related to computer science and exhibiting a sound knowledge on data structures and algorithms.
3. Design and Development of Solutions: Ability to design and development of algorithmic solutions to real world problems.
4. Programming a computer: Exhibiting strong skills required to program a computer for various issues and problems of day-to-day scientific applications.
5. Application Systems Knowledge: Possessing a minimum knowledge to practice existing computer application software.
6. Communication: Must have a reasonably good communication knowledge both in oral and writing.
7. Ethics on Profession, Environment and Society: Exhibiting professional ethics to maintain the integrality in a working environment and also have concern on societal impacts due to computer- based solutions for problems.
8. Lifelong Learning: Should become an independent learner. So, learn to learn ability.
9. Motivation to take up Higher Studies: Inspiration to continue educations towards advanced studies on Computer Science.

B.Sc. Sem-I (Computer Science - Major) SC-DSC (Paper I) BCS1T01 PROGRAMMING IN 'C' Credits: 2   Duration: 30 Hours

Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

1. Write simple algorithms for arithmetic and logical problems.
2. Write the C code for a given problem
3. Perform input and output operations using programs in C
4. Write programs that perform operations on arrays, strings, structures, unions, functions and file handling.

B.Sc. Sem-I (Computer Science - Major) SC- DSC (Paper II) BCS1T02
COMPUTER FUNDAMENTALS
Credits: 2   **Duration: 30 Hours**

Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

1. Confidently operate computers to carry out computational tasks
2. Understand working of Hardware and Software and the importance of operating systems
3. Understand number systems, peripheral devices, networking, multimedia and internet concepts

B.Sc. Sem-I (Computer Science) OFFICE AUTOMATION (BVS1P01)
Credits: 2   **Duration: 60 Hours**

Course Outcomes (COs):

After completing this course satisfactorily, a student will be able to:

1. Understand functionality of Operating Systems and its applications.
2. Working with the user interface.
3. Prepare documents, letters and do necessary formatting of the document.
4. Worksheet creation, inserting and editing data in cells.
5. Opening/saving a presentation and printing of slides and handouts.

B.Sc. SEMESTER – I BVE1T01: ENVIRONMENTAL SCIENCE

Course Outcomes (COs):

At the end of the course, students shall be able to:

1. Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
2. Explicate the importance of Environmental Education.
3. Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
4. Describe the various physical and chemical characteristics and properties of Water and Soil
5. Understand the Ecology and its allied branches
6. Comprehend about Population and Community Ecology
7. Study the changes in Population by understanding the concept of Population ecology.

Indian Knowledge System (IKS) SEM1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes (COs):

This course will enable the students to

1. Improve speed and accuracy in numerical calculations
2. Acquire IQ skills and high-end technical knowledge
3. Gain test taking skills & creativity of calculations

B.Sc. Sem -II (Computer Science - Major) SC- DSC (Paper I) BCS2T03 Object Oriented Programming Using 'C++'   Credits: 2   Duration: 30 Hours

Course Outcomes (COs):

After completion of this course, students will be able to:

1. Realize the need and features of OOP and idealize how C++ differs from C.
2. Infer knowledge on various types of overloading.
3. Choose suitable inheritance while proposing solution for the given problem.
4. Handle pointers and effective memory management.
5. Illustrate application of pointers in virtual functions.

B.Sc. Sem -II (Computer Science - Major) SC- DSC (Paper II) BCS2T04 OPERATING SYSTEMS   Credits: 2   Duration: 30 Hours

Course Outcomes (COs):

1. Describe the various OS functionalities, structures and layers.
2. Usage of system calls related to OS management and interpreting different stages of various process states.
3. Design CPU scheduling algorithms to meet and validate the scheduling criteria.
4. Apply and explore the communication between inter process and synchronization techniques.
5. Implement memory placement strategies, replacement algorithms related to main memory and virtual memory techniques.
6. Differentiate the file systems; file allocation, access techniques along with virtualization concepts and designing of OS with protection and security enabled capabilities.

B.Sc. Sem-II (Computer Science) BVS2P03 COMPUTER ANIMATION
Credits: 2   Duration: 60 Hours

Course Outcomes (COs):

After completion of this course, students will be able to:

1. Get knowledge about various terms like, images, text, fonts, file formats. Understanding these things is very necessary.
2. Produce traditional style animation as well as puppet animation and the knowledge of the principles of animation to be built upon in subsequent courses leading up to the Portfolio course.
3. Apply skills learned in this class in other areas including motion graphics, stop motion and basic traditional animation.

Indian Knowledge System (IKS) SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes (COs):

This course will enable the students to understand that

1. It is possible to create a map of the intellectual growth of a culture using astronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phase transitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the past dramatic transitions.

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POs & PSOs for BCA Programme
(Computer Application-Major)
Four Year (Eight Semester Degree Course)

Program Outcomes (POs):

1. The primary objective of this program is to provide a foundation of computing principles for effectively using information systems and enterprise software.
2. It helps students analyze the requirements for system programming and exposes students for information systems
3. This programme provides students with options to specialize in various software system.
4. To produce outstanding Computer Scientists who can apply the theoretical knowledge into practice in the real world and develop standalone live projects themselves
5. To provide opportunity for the study of modern methods of information processing and its applications.
6. To develop among students the programming techniques and the problem solving skills through programming
7. To prepare students who wish to go on to further studies in computer science and related subjects.
8. To acquaint students to Work effectively with a range of current, standard, Office Productivity software applications.

Program Specific Outcomes (PSOs):

1. Discipline knowledge: Acquiring knowledge on basics of Computer Science and ability to apply to design principles in the development of solutions for problems of varying complexity
2. Problem Solving: Improved reasoning with strong mathematical ability to Identify, formulate and analyze problems related to computer science and exhibiting a sound knowledge on data structures and algorithms.
3. Design and Development of Solutions: Ability to design and development of algorithmic solutions to real world problems.
4. Programming a computer: Exhibiting strong skills required to program a computer for various issues and problems of day-to-day scientific applications.
5. Application Systems Knowledge: Possessing a minimum knowledge to practice existing computer application software.
6. Communication: Must have a reasonably good communication knowledge both in oral and writing.
7. Ethics on Profession, Environment and Society: Exhibiting professional ethics to maintain the integrality in a working environment and also have concern on societal impacts due to computer based solutions for problems.
8. Lifelong Learning: Should become an independent learner. So, learn to learn ability.
9. Motivation to take up Higher Studies: Inspiration to continue educations towards advanced studies on Computer Science.

Course Outcomes (COs) for BCA Programme

BCA Sem-I (Computer Application-Major)
SC-DSC (Paper I) BCA1T01 PROGRAMMING IN 'C'
Credits: 2   Duration: 30 Hours

Course Outcomes:

After completing this course satisfactorily, a student will be able to:
1. Write simple algorithms for arithmetic and logical problems.
2. Write the C code for a given problem
3. Perform input and output operations using programs in C
4. Write programs that perform operations on arrays, strings, structures, unions, functions and file handling.

BCA Sem-I (Computer Application-Major)
SC- DSC (Paper II) BCA1T02 COMPUTER FUNDAMENTALS
Credits: 2   Duration: 30 Hours

Course Outcomes:

After completing this course satisfactorily, a student will be able to:
1. Confidently operate computers to carry out computational tasks
2. Understand working of Hardware and Software and the importance of operating systems
3. Understand number systems, peripheral devices, networking, multimedia and internet concepts.

BCA Sem-I (Computer Application)
OFFICE AUTOMATION (BVS1P01)
Credits: 2   Duration: 60 Hours

Course Outcomes:

After completing this course satisfactorily, a student will be able to:
1. understand functionality of Operating Systems and its applications.
2. Working with the user interface.
3. prepare documents, letters and do necessary formatting of the document.
4. Worksheet creation, inserting and editing data in cells.
5. Opening/saving a presentation and printing of slides and handouts.

BCA SEMESTER – I
BVE1T01: ENVIRONMENTAL SCIENCE

Course Outcomes:

At the end of the course, students shall be able to:
- Explain the basics of Environmental Science and Atmospheric Science along-with the components of Environment
- Explicate the importance of Environmental Education.
- Elucidate the fundamentals of atmospheric science including formation, depletion and effects of ozone layer and acid rain on environment.
- Describe the various physical and chemical characteristics and properties of Water and Soil.
- Understand the Ecology and its allied branches
- Comprehend about Population and Community Ecology
- Study the changes in Population by understanding the concept of Population ecology

BCA SEMESTER – I
Indian Knowledge System (IKS)
SEM-1: VEDIC MATHEMATICS (BIK1T01)

Course Outcomes (COs):

This course will enable the students to
1. Improve speed and accuracy in numerical calculations.
2. Acquire IQ skills and high-end technical knowledge.
3. Gain test taking skills & creativity of calculations.

BCA Sem-II (Computer Application-Major)
SC- DSC (Paper I) BCA2T03
OBJECT ORIENTED PROGRAMMING USING 'C++'
Credits: 2   Duration: 30 Hours)

Course Outcomes (COs):

After completion of this course, students will be able to:
1. Realize the need and features of OOP and idealize how C++ differs from C.
2. Infer knowledge on various types of overloading.
3. Choose suitable inheritance while proposing solution for the given problem.
4. Handle pointers and effective memory management.
5. Illustrate application of pointers in virtual functions.

BCA Sem-II (Computer Application-Major)
SC- DSC (Paper II) BCA2T04 OPERATING SYSTEMS AND LINUX
Credits: 2   Duration: 30 Hours

Course Outcomes (COs):

After completion of this course, students will be able to:
1. Describe the various OS functionalities, structures and layers.
2. Usage of system calls related to OS management and interpreting different stages of various process states.
3. Design CPU scheduling algorithms to meet and validate the scheduling criteria.
4. Apply and explore the communication between inter process and synchronization techniques.
5. Implement memory placement strategies, replacement algorithms related to main memory and virtual memory techniques.
6. Differentiate the file systems; file allocation, access techniques along with virtualization concepts and designing of OS with protection and security enabled capabilities.
7. Working on Linux OS.

BCA Sem-II (Computer Application)
BVS2P03 COMPUTER ANIMATION
Credits: 2   Duration: 60 Hours

Course Outcomes (COs):

After completion of this course, students will be able to:
1. Get knowledge about various terms like, images, text, fonts, file formats. Understanding these things is very necessary.
2. Produce traditional style animation as well as puppet animation and the knowledge of the principles of animation to be built upon in subsequent courses leading up to the Portfolio course.
3. Apply skills learned in this class in other areas including motion graphics, stop motion and basic traditional animation.

BCA Sem-II (Computer Application)
Indian Knowledge System (IKS) SEM2: INDIAN ASTRONOMY (BIK2T02)

Course Outcomes (COs):

This course will enable the students to understand that
1. It is possible to create a map of the intellectual growth of a culture using astronomy as a probe.
2. The growth of Indian astronomy occurs in distinct stages analogous to phase transitions of the evolution of cultures
3. Indian Astronomy therefore provides an excellent window to the past dramatic transitions.

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Program Outcomes (PO), Program Specific Outcomes (PSO) and Course Outcomes (CO)

Before NEP-2020

Program Outcomes: Bachelor of Science (B.Sc.)

- ❖ PO1: Understand the core fundamentals of Basic Sciences
- ❖ PO2: Understand the diverse day to day applications of various fields.
- ❖ PO3: Develop interdisciplinary approach amongst students
- ❖ PO4: Demonstrate, solve and an understanding of major concepts in all disciplines of science.
- ❖ PO5: To inculcate sense of scientific responsibilities and social & environment awareness
- ❖ PO6: Develop skills in handling scientific instruments, planning and performing in laboratory experiments.
- ❖ PO7: Apply ethical principles and commit to professional ethics and responsibilities and norms of the scientific practice.
- ❖ PO8: Apply the acquired knowledge and the applications of basic sciences to community.
- ❖ PO9: Have sustainable development.
- ❖ PO10: Go for higher studies i.e. MSc and then do some research for the welfare of mankind.
- ❖ PO11: To help student to build-up a progressive and successful career in academics and industry
- ❖ PO12: To motivate the students to contribute in the development of Nation
- ❖ PO13: Look for professional job-oriented courses, Indian Army, Indian Navy, Indian Air Force as officers, Indian Civil Services.

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DEPARTMENT OF COMPUTER SCIENCE

Program Outcomes: B.Sc. Computer Science

Department of Computer Science

After successful completion of three year degree program in Computer Science, the students are able to:

Program Outcomes

PO1: To develop problem solving abilities using a computer.

PO2: To build the necessary skill set and analytical abilities for developing Computer based solutions for real life problems.

PO3: To implement quality software development practices.

PO4: To create awareness about process and product standards.

PO5: To train students in professional skills related to Software Industry.

PO6: To prepare necessary knowledge base for research and development in Computer Science

PO7: To help the students to build-up a successful career in Computer Science.

Program Specific Outcomes

PSO1: Demonstrate understanding of the principles and working of the hardware and software aspects of computer systems.

PSO2: Design, implements, test, and evaluate a computer system, Component or algorithm to meet desired needs and to solve a computational problem.

PSO3: To Enhance skills and adapt new computing technologies for attaining professional excellence and carrying research.

PSO4: Apply fundamental principles and methods of Computer Science to a wide range of applications.

PSO5: Impart an understanding of the basics of our discipline.

PSO6: Practice for continued professional development.

Course Outcomes B.Sc. Computer Science
Course Outcome for Semester-I

Paper-I: (Programming in C)

CO1: To illustrate the flowchart and design an algorithm for a given problem. They understand the basic concept of programming structure.

CO2: Students learnt the knowledge of fundamentals of writing C program which include data types, keywords, tokens, variables, and operators. Develop conditional and iterative statements to write C programs

CO3: To solve user defined functions with real time problems.

CO4: Students developed their concepts to write C program that uses Pointers, Arrays, and Strings.

CO5: Understand the knowledge of user defined data types that include

structure and union to solve problems.

	CO6: Students can write the programs which includes file concept to show input and output of files in C.
Paper-II: **(Fundamentals of IT)**	CO1: Bridge the fundamental concepts of computers with the present level of knowledge of the students.
	CO2: Familiarize operating systems, programming languages, peripheral devices, networking, multimedia and internet
	CO3: Understand binary, hexadecimal and octal number systems and their arithmetic.
	CO4: Understand how logic circuits and Boolean algebra forms as the basics of digital computer
	CO5: Demonstrate the building up of Sequential and combinational logic from basic gate.

Course Outcome for Semester-II

Paper-I: **(Object Oriented Programming Using 'C++')**	CO1: To understand the object-oriented methodology which involves elements and features of object-oriented programming.
	CO2: Students developed the concept of class, object and structure of class which includes definition of class members and also, they learned how to write the programs using class.
	CO3: Students learnt the basic concept of constructor and destructor. Also, they were able to overload the unary and binary operators using the concept of operator overloading.
	CO4: Understand how to reuse code by implementing the OOPs Inheritance concept in C++. Also, they got knowledge of dynamic objects.
	CO5: Students were able to understand how inheritance and virtual functions implement dynamic binding with polymorphism.
	CO6: Students learnt how to use exceptional handling in C++ programs
Paper-II: (System Analysis and Design)	CO1: Identify various types of information systems concepts and terminologies
	CO2: Discuss the initial phase of system Development Life Cycle (SDLC) using analytical tools and quantitative technique used to identify problem
	CO3: Define problem and opportunities that initiate projects
	CO4: Evaluate information systems projects to identify various aspects of feasibility of these projects
	CO5: Apply at least one specific methodology or tool for analyzing business situation by modeling using a formal technique.

Course Outcome for Semester-III

Paper-I: **(Data Structures)**	CO1: To be able to implement the abstract data type list as a linked list using the node and reference pattern.
	CO2: Select appropriate data structures as applied to specified problem definition. Analyze run-time execution of previous learned sorting methods, including selection, merge sort, heap sort and Quick sort and also calculates the complexity of all sorting and searching methods.
	CO3: To understand the abstract data type stack and notation like prefix infix and postfix expression formats. Implement

operations like searching, insertion, and deletion, traversing mechanism etc. on various data structures and design applications based on it.

CO4: Determine and analyze the complexity of given Algorithms.

CO5: Ability to have knowledge of tree and graph concepts.

Paper-II: (Operating Systems)

CO1: Describe and explain the fundamental components of a computer operating system

CO2: Define, restate, discuss, and explain the policies for scheduling, deadlocks, memory management, synchronization, system calls, and file systems.

CO3: Describe and extrapolate the interactions among the various components of computing systems.

CO4: Design and construct the following OS components: System calls, Schedulers, Memory management systems, Virtual Memory and Paging systems.

Course Outcome for Semester-IV

Paper-I:
(Java Programming)

CO1: Explain the Use of java programming language Concept and programming technologies in software development.

CO2: Demonstrate the Concepts of Thread and Applets

CO3: Identify classes, objects, members of the class and relationships among them needed for a specific problem.

CO4: Able to understand basic Concepts of java like variables, operators and tokens etc.

CO5: Design and Develop Applications using AWT controls in Java.

Paper-II:
(Linux Operating System)

CO1: To understand the basic commands and directory structures use in Linux OS and explain the use of all these commands to make the effective use of the environment to solve problems.

CO2: Design and develop applications using Vi Editor in Linux OS.

CO3: Able to identify the differences between processes and shells use in Linux OS.

CO4: Able to Understand the basic set of Communication utilities commands and other commands use in Linux OS.

CO5: To learn Graphical user Interfaces like KDE and GNOME.

Course Outcome for Semester-V

Paper-I: (Visual Basic Programming)

CO1: Explain the basic Concepts of Program building block control statements and the basic concepts of function and procedure.

CO2: Discuss about graphics handling related control and properties and Develop a Graphical User Interface (GUI) based on problem description.

CO3: Discuss about the fundamental functions and properties of Advanced ActiveX Control.

CO4: Design and Develop the programs which are based on events that retrieve input from a file as opposed to input only provided by user.

CO5: Explain the procedure of creating menus and how to use these menus while designing applications in VB. (Menu Editor).

CO6: Describe the concepts of database handling using DAO, ADO

and RDO control with data report concepts.

Paper-II: (Database Management System)

CO1: To learnt the fundamental elements of traditional file processing system, objective of database system.

CO2: Students learnt the basic concept of different data models which includes Hierarchical, Network, and E-R and Relational model.

CO3: Students are able Design E-R model to represent simple database application

CO4: Students developed the concept of how to convert E-R model into relational tables and how to perform relational operation on tables through relational algebra.

CO5: Students developed the concept of functional dependency and improve the database design by the concept of Normalization.

Course Outcome for Semester VI

Paper-I: (Compiler Construction)

CO1: Students learnt the major concept areas of language translation and compiler design

CO2: Students got an awareness of the function and complexity of compilers.

CO3: Students were able to understand the role of Lexical analyzer, its design, and implementation. Students got knowledge of context free grammars, Derivation and parse trees.

CO4: Students are able to identify the similarities and differences among various parsing techniques and grammar transformation techniques

Paper-II: (SQL and PL/SQL)

CO1: Able to Understand the basics of SQL with control structure and sublanguages like DDL, DML and DCL/TCL.

CO2: Able To identify the differences between integrity constraints and value constraints.

CO3: Explain how functions, triggers, cursors and stored procedure work in PL/SQL.

CO4: Compare SQL with PL/SQL and integrate the concept of procedural language with SQL to build advance applications.

CO5: Able to understand the basics of PL/SQL Programming: PL/SQL Data Types, Identifiers, Operators and Expressions, Iterative Statements, Conditional Statements,

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DEPARTMENT OF COMPUTER SCIENCE

DEGREE COURSE: BACHELOR OF COMPUTER APPLICATION (BCA)

Program Specific Outcomes: BCA

Department of Computer Science	After successful completion of three years BCA degree program, the students are able to:
Program Specific Outcomes	PSO1: Analyze and compare alternative solutions to computing problems
	PSO2: Design, correctly implement and document solutions to significant computational problems
	PSO3: Apply algorithmic, mathematical and scientific reasoning to a variety of computational problems.
	PSO4: Implement software systems that meet specified design and performance requirements
	PSO5: Work in the IT sector as system engineer, software tester, junior programmer, web developer, system administrator, software developer etc.

Course Outcomes: BCA

BCA Semester-I

Paper-I	CO1: Familiar with Fundamental concepts of computer
Computer Fundamentals	CO2: Get the knowledge about input and output devices and their working
	CO3: Basic knowledge of Memory storage devices use with computer and computer networks.
	CO4: Understand Network terminology
Paper-II	CO1: Students will be able to develop logics which will help them to create programs, applications in C.
'C' PROGRAMMING	CO2: Understand complete knowledge of C language
	CO3: Improve upon a solution to a problem
	CO4: Design, develop and test programs written in 'C'

Paper-III	CO1:	Learn about Sampling Methods.
STATISTICAL METHODS	CO2:	Know the basic idea of Permutations and Combinations, and Probability Concepts
	CO3:	Apply knowledge of mathematics, science, and engineering.
	CO4:	Evaluate the probabilities and conditional probabilities.
Paper-IV	CO1:	Know the basic idea of Propositional calculus Students completing this course will be able to evaluate Boolean functions and simplify expressions using the properties of Boolean algebra.
DISCRETE MATHEMATICS – I	CO2:	Learn about Disjunctive , connective principal conjunctive normal forms
	CO3:	Students completing this course will be able to use tree and graph algorithms to solve problems.
	CO4:	Students completing this course will be able to evaluate Boolean functions and simplify expressions using the properties of Boolean algebra.
Paper-V	CO1:	Learn different types of operating systems along with concept of file systems and CPU scheduling algorithms used in operating system.
OPERATING SYSTEMS	CO2:	Provide students' knowledge of memory management and deadlock handling algorithms
	CO3:	Implement various algorithms required for management, scheduling, allocation and communication used in Operating System
	CO4:	Understand the difference between process & thread, issues of scheduling of user level processes / threads and their issues & use of locks
Paper-VI	CO1:	Learn about Windows Operating system
Office Automation	CO2:	Know the basics of Word, creating documents , formatting, toolbars, creating templates , mail merge
	CO3:	Understand the use of MS Power point for presentation
	CO4:	Apply knowledge of MS EXCEL, formatting, entering formula, chart creation, functions in EXCEL

Course Outcomes: BCA

BCA Semester-II

Paper-I	CO1:	Describe OOPs concepts
	CO2:	Use the functions and pointers in C++ program.

PROGRAMMI NG IN 'C++	CO3:	Describe and use constructors and destructors.
	CO4:	Explain arrays and strings and create programs using them.
Paper -II	CO1:	Understand the steps in software development.
SYSTEM ANALYSIS AND DESIGN	CO2:	Know the tools for System Analysis and design.
	CO3:	Learn about Data collection
	CO4:	Describe structured tools and techniques of data analysis
Paper- III **NUMERICAL METHODS**	CO1:	Solve Algebraic , Polynomial Equations, iterative, bisection, false position methods
	CO2:	Understand the concepts of Integration and differentiation
	CO3:	Apply various interpolation methods and finite difference concepts
	CO4:	Work numerically on the partial differential equations using different methods through the theory of finite differences
Paper -IV **DISCRETE MATHEMATICS–II**	CO1:	Know the Graph theory concepts like types of graph, representation etc.
	CO2:	Understand the concept of Set theory
	CO3:	Describe Functions, its types, counting concept like Permutations, combinations
	CO4:	Demonstrate different traversal methods for trees and graphs
Paper -V **LINUX OPERATING SYSTEM**	CO1:	Learn about Linux concepts such as Directory structures, file types, data files, Shell , commands
	CO2:	Learn about Vi editor
	CO3;	Learn about Sharing files with other users
	CO4:	Get knowledge of Managing Disk space
Paper -VI **E COMMERCE**	CO1:	Describe the concept of Electronic market, concepts, inter-organizational value chains
	CO2:	Get knowledge of Business strategy in electronic age, its competitive advantages , technology ecommerce evaluation
	CO3:	Get knowledge of Business to business Electronic commerce
	CO4:	Learn about Business to consumer electronic commerce

Course Outcomes: BCA

BCA Semester-III

Paper -I	CO1:	Design, create, build, and debug Visual Basic applications.
VISUAL BASIC PROGRAMMING	CO2:	Explore Visual Basic's Integrated Development Environment(IDE).
	CO3:	Implement syntax rules in Visual Basic programs
	CO4:	Explain variables and data types used in program development
Paper -II	CO1:	Gain a good understanding of the architecture and functioning of database management systems
DATABASE MANAGEMENT SYSTEM	CO2:	Understand the use of structured query language and its syntax, transactions, database recovery and techniques for query optimization
	CO3:	Acquire a good understanding of database systems concepts and to be in a position to use and design databases for different applications
	CO4:	Draw various data models for Data Base and Write queries mathematically.
Paper -III	CO1:	Get the knowledge of Concept of data structure its applications in different areas.
DATA STRUCTURES	CO2:	To access how the choices of data structure & algorithm methods impact the performance of program.
	CO3:	To Solve problems based upon different data structure & also write programs.
	CO4:	Choose an appropriate data structure for a particular problem.
Paper -IV	CO1:	Formulate a real-world problem as a mathematical programming model
OPERATIONS RESEARCH – I	CO2:	Understand the theoretical workings of the simplex method for linear programming and perform iterations of it by hand
	CO3:	Understand the relationship between a linear program and its dual, including strong duality and complementary slackness
	CO4:	Solve specialized linear programming problems like the transportation and assignment problems
Paper -V	CO1:	Design and develop web pages

WEB TECHNOLOGY–I	CO2:	Understand, analyze and apply the role of languages like HTML, DHTML,CSS, XML, JavaScript, in the workings of the web and web applications
	CO3:	Understand, analyze and create web pages using HTML, DHTML and Cascading Styles Sheets.
	CO4:	Understand, analyze and build dynamic web pages using JavaScript and VB Script
Paper -VI	CO1:	Understand Number system and their conversions
DIGITAL ELECTRONICS–I	CO2:	Explain the concepts like Binary arithmetic
	CO3:	Get the knowledge of Logic gates
	CO4:	Understand the concept of Boolean algebra.

Course Outcomes: BCA

BCA Semester-IV

Paper -I	CO1:	Select and implement different software development process models.
SOFTWARE ENGINEERING–I	CO2:	Extract and analyze software requirements specifications for different projects.
	CO3:	Develop some basic level of software architecture/design.
	CO4:	Define the basic concepts and importance of Software project management concepts like cost estimation, scheduling and reviewing the progress
Paper -II	CO1:	Get detail knowledge of SQL queries and its sublanguages.
SQL AND PL/SQL	CO2:	Understand the concept of PL/SQL programming.
	CO3:	Learn about Built-in functions of SQL
	CO4:	Understand about table View, Log & Triggers
Paper -III	CO1:	Learn the concept of Finite automation and regular expression
THEORY OF COMPUTATION	CO2:	Knowledge of concepts like Set, Context free grammar
	CO3:	Understand the Push down automata, context free languages.
	CO4:	To solve various problems of applying normal form techniques, push down automata and Turing Machines
Paper-V	CO1:	Get the practical knowledge of concepts of adding VB Script to HTML

WEB TECHNOLOGY–II	CO2:	Learn Java script
	CO3:	Get knowledge of Web services
	CO4:	To solve various problems of applying normal form techniques, push down automata and Turing Machines
Paper-VI	CO1:	Understand the concept of Combinational circuits
DIGITAL ELECTRONICS–II	CO2:	Understand the concept of Sequential circuits, Flip-Flops, Counters
	CO3:	Understand the concept of Assembly language programming
	CO4:	Get the knowledge of Instruction set

Course Outcomes: BCA

BCA Semester-V

Paper-I **COMPUTER GRAPHICS–I**	CO1:	Provide comprehensive introduction about computer graphics system, design algorithms and two dimensional transformations
	CO2:	Make the students familiar with techniques of clipping, three dimensional graphics and three dimensional transformations
	CO3:	Understand 2D transformation concept like translation, scaling, rotation.
	CO4:	Write programs that demonstrate geometrical transformations
Paper-II **COMPILER CONSTRUCTION**	CO1:	Learn about the concepts of Compilers and translators
	CO2:	Get knowledge of High level programming languages, Lexical and syntactic structure of a language
	CO3:	Learn the concept of code generation, Parsing
	CO4:	Understand Finite state machine and purpose
Paper-III **VB.NET**	CO1:	Students will understand .NET Framework and describe some of the major enhancements to the new version of Visual Basic.
	CO2:	Students will describe the basic structure of a Visual Basic.NET project and use main features of the integrated development environment (IDE)
	CO3:	Students will create applications using Microsoft Windows Forms
	CO4:	Students will create applications that use ADO.NET
Paper-IV **SOFTWARE ENGINEERING – II**	CO1:	Understand the concept of Software architecture
	CO2:	Understand the basic concepts of Software testing, Strategies, approaches of testing

	CO3:	Learn the concept of Risk management in software testing
	CO4:	Use PHP's built in server to server static resources
Paper-V	CO1:	Analyze PHP scripts and determine their behavior
PHP – I	CO2:	Design web pages with ability to retrieve and present data from a MySQL.
	CO3:	Learn how to take a static websites and turn it into a dynamic website run from a database using PHP
	CO4:	Use PHP's built in server to server static resources
Paper-VI **DATA COMMUNICATION AND NETWORK- I**	CO1:	Explain how communication works in computer networks and to understand the basic terminology of computer networks
	CO2:	Explain the role of protocols in networking and to analyze the services and features of the various layers in the protocol stack.
	CO3:	Understand design issues in network security and to understand security threats, security services and mechanisms to counter
	CO4:	Connect internet to the system and knowledge of trouble

Course Outcomes: BCA

BCA Semester-VI

Paper-I **COMPUTER GRAPHICS–II**	CO1:	Provide comprehensive introduction about computer graphics system, design algorithms and three dimensional transformations
	CO2:	Get knowledge of 3D transformations, Geometric Transformations
	CO3:	Learn computer animation design, functions, motion specifications
	CO4:	Develop new kinds of graphics and animations
Paper -II **PROGRMMING IN JAVA**	CO1:	Understand the principles and practice of object oriented analysis and design in the construction of robust, maintainable programs which satisfy their requirements.
	CO2:	Implement, compile, test and run Java programs comprising more than one class, to address a particular software problem
	CO3:	Demonstrate the principles of object oriented programming
	CO4:	Demonstrate simple data structures like arrays in a Java program
Paper-III **ASP.NET**	CO1:	Understand the ASP.Net framework and Page structure
	CO2:	Design web application with variety of controls
	CO3:	Access the data using inbuilt data access tools

	CO4:	Students will be able to create database driven ASP.NET web applications and web services
Paper-IV	CO1:	Understand the fundamental concept in software testing
SOFTWARE TESTING	CO2:	Distinguish characteristics of structural testing methods
	CO3:	Discuss about the functional and system testing methods
	CO4:	Understand different types of testing levels
Paper-V	CO1:	Learn how to use HTML forms
PHP – II	CO2:	Learn how to use PHP's built in server to serve static resources
	CO3:	Learn How to use cookies to store some data in the browser and pass it to next request
	CO4:	learn how to upload files to the website

Paper-VI DATA COMMUNICATION ANDNETWORK–II	CO1:	Understand network communication using layered concept, OSI and Internet model.
	CO2:	Understand various types of transmission media, network devices
	CO3:	Learn about different Protocols operations
	CO4:	Identify and describe development history of routing protocols

Shri Shivaji Education Society Amravati's

Science College, Congress Nagar, Nagpur

DEPARTMENT OF COMPUTER SCIENCE

PG COURSE

MASTER IN COMPUTER APPLICATIONS (MCA)
(2 Years)(CBCS)
Program Specific Outcomes: MCA

https://www.nagpuruniversity.ac.in/links/Syllabus/Faculty_of_Science/Notification_Direction_Syllabus_and_Program_Outcome_of_MCA_28122020.pdf

Department of Computer Science

After successful completion of two years MCA PG degree program, the students are able to:

Targeted Graduate Attributes: Disciplinary Knowledge, Critical Thinking, Problem Solving, Analytical Reasoning, Communication Skills, Teamwork, Moral and Ethical Awareness

Program Specific Outcomes

PSOl: Computational Knowledge: The students will be able to apply knowledge of computing fundamentals, computing specialization, mathematics, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualisation of computing models from defined problems and requirements

PSO2: Problem Analysis: The students will be able to think critically for Identify, formulate, research literature, and solve complex computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines

PSO3: Design /Development of Solutions: The students will be able to design and evaluate solutions for complex computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.

PSO4: Conduct Investigations of Complex Computing Problems: The students will be able to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions, maintenance and its implementation

PSO5: Modern Tool Usage: The students will be able to create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.

PSO6: Professional Ethics: The students will be able to understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practice.

PSO7: Project management and finance: The students will be able to demonstrate knowledge and understanding of the computing and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Course Outcomes: Master in Computer Applications

MCA Semester-I

Course Name: Advanced Java Programming	CO1: Facilitates in understanding the concepts of object oriented programming. Skill Enhancing through concepts like multithreading, abstraction , platform independence
	CO2: Effective to implement platform independence, Applet programming
	CO3: JDBC Architecture and RMI programming
	CO4: Design Programs for JAVA Beans and Servlets
Course Name: Data Communication and Network	CO1: To understand and master the fundamentals of data communications through the knowledge of data transmission concepts, media used for data communication
	CO2: To know the different layer of OSI reference model
	CO3: To know the different network security algorithms
	CO4: To know the intrusion detection techniques and Authentication
Course Name: Open source Web Programming using PHP	CO1: To become familiar with client server architecture and able to develop a web application using various technologies.
	CO2: To understand and develop a web-based application using a framework concept
	CO3: To gain the skills and project-based experience needed for entry into web application and development careers
	CO4: Web page development using PHP

Course Name: Advanced DBMS and Administration	CO1:	Can explore efficient method for handling multiple types of data
	CO2:	Have a detailed view of handling parallel and distributed database
	CO3:	Ability to normalize the database & understand the internal data structure
	CO4:	Deep visualization of realistic data into physical structure
Course Name: Software Engineering	CO1:	To Get detailed knowledge of role of software in daily basis
	CO2:	Student will be identifying different models and find out the best
	CO3:	Test the developed software for high performance and maintainability
	CO4:	Study the software measure parameters for software quality
Course Name:1P1 Practical-1	CO1:	Design and program stand-alone Java Applications
	CO2:	Useful in designing web and desktop applications
	CO3:	Analyse And Setup Protocol Designing Issues For Communication Networks
	CO4:	Web development using PHP
Course Name:1P2 Practical-2	CO1:	Facilitates in creation of Data Structures and effective management of Database
	CO2:	Ability to normalize the database & understand the internal data structure
	CO3:	To implement Software prototyping for better software development
	CO4:	To acquire skills to think about problems and solution using appropriate method

Course Outcomes: Master in Computer Applications

MCA Semester-II

Course Name: C# and ASP .NET	CO1:	To study simple C# program structure
	CO2:	To write C# program for classes, arrays, struct, array of objects
	CO3:	To understand ASP.NET structure
	CO4:	Error handling, Component based programming
Course Name: Cloud Computing	CO1:	To become familiar with Cloud Computing and its ecosystem and learn basics of virtualization and its importance.
	CO2:	To evaluate in-depth analysis of Cloud Computing capabilities and give technical overview of Cloud Programming and Services.

CO3: To understand security issues in cloud computing and exposed to Ubiquitous Cloud and Internet of Things

CO4: To understand emerging trends in cloud computing.

Course Name: Computer Graphics

CO1: Provides user interfaces, data visualization, television commercials, motion pictures

CO2: Hardware devices and algorithms which are necessary for improving the effectiveness, realism, and speed of picture generation

CO3: Three dimensional graphic algorithm are incorporated in various streams to better simulate complex interactions

CO4: 3-d transformations, b-spline surfaces, curves, and hidden surfaces can be explored

Course Name: CE1-1 (Elective)

Computer Architecture and Organization

CO1: To explore the fundamentals of Computer Architecture and Organization

CO2: To understand the design of control unit

CO3: To study the concepts of memory organization and to understand various memory technologies

CO4: To understand the concepts of input output processing to interface various I/O devices

Course Name: CE1-2 (Elective) Operation Research

CO1: Understand LPP

CO2: Understand Transportation problem, assignment problem

CO3: Study of decision theory, CPM/PERT

CO4: Study of queuing Theory

Course Name: CE1-3 (Elective) Cyber Forensics

CO1: Understand the different types of vulnerability scanning

CO2: To know the different network defense tools and web application tools

CO3: To understand the different types of cybercrimes and laws

CO4: To understand the different tools for cybercrime investigation

Course Name: Android Programming

CO1 Able to develop apps based on different types of menus

CO2 Make decision to solve a problem using package, library and threads Handling Errors and Exceptions

CO3 Ability to design and develop database applications

CO4 Able to design and develop mobile applications works with internet applications

Course Name: 2P1 Practical-1	CO1:	To write C# program for classes, arrays, struct, array of objects
	CO2:	To write ASP.NET Programs and Component based programming
	CO3:	Study the common elements in user interfaces, data visualization, television commercials, motion pictures, and many other applications
	CO4:	Explore the algorithms necessary for basic transformation with respect to computer graphics
Course Name: 2P2 Practical-2	CO1:	Would gain the knowledge about inside of computer
	CO2:	Transportation problem, LPP problem, Inventory problem
	CO3:	To develop apps based on different types of menus
	CO4:	Design and develop mobile applications works with internet applications
Course Name: Project	CO1:	Select the topic for software development
	CO2:	Analysis and design of proposed system
	CO3:	Apply the known language for project programs
	CO4:	Combine the small program to make the integrated software

Course Outcomes: Master in Computer Applications

MCA Semester-III

Course Name: Big Data Analytics	CO1:	To know the structuring the big data, technology for handling the big data, Hadoop, Map Reduce.
	CO2:	To understand the big data technology foundation, Storing data in databases and data warehouses.
	CO3:	To get a basic understanding of R and the various ways to create scripts and programs in R and understand some of the key constructs in R for data handling.
	CO4:	To understand and appreciate how to summarize large volumes of data effectively by appropriate use of charts of different types.
Course Name: Data Mining	CO1:	To introduce the students, the basic concepts and techniques of Data mining and Warehousing and data pre-processing.
	CO2:	Understand association mining algorithms for discovery of frequent item patterns in large data sets and their Visualizations
	CO3:	Understand classification analysis algorithms for discovery and generation of rules in large data sets and their Visualizations

	CO4:	Understand basic and advanced clustering analysis algorithms and Visualizations in Data Mining.
Course Name: Python Programming	CO1:	Understand the data types and structures in python
	CO2:	Ability to understand object oriented programing concepts and write programs in python. Handling Errors and Exceptions
	CO3:	Ability to design and develop database applications
	CO4:	Web development using Python
Course Name: CE2-1 (Elective) Artificial Intelligence	CO1:	Understand the various underlying concepts in Artificial Intelligence. Acquire the knowledge of search techniques used in Artificial Intelligence
	CO2:	Acquire the concepts of knowledge representation
	CO3:	Analyze and design a real-world problem for implementation and understand the dynamic behavior of a system.
	CO4:	To understand NLP and Distributed reasoning system

Course Name: CE2-2 (Elective) Mobile Computing	CO1:	Helps to understand the fundamental requirements for initiating an online business
	CO2:	Helps in process of initiating and funding a start-up, e-Business or large projects
	CO3:	Necessary to describe the issue and methods of transforming an organization into an e-business
	CO4:	Provides deeper knowledge of mobile handheld devices, wireless mediums, palm OS, MANNET
Course Name: CE2-3 (Elective) Machine Learning	CO1:	To understand the different machine learning methods
	CO2:	To understand the Multilayer Perceptron, Back Propogation algorithm, Support Vector Machine
	CO3:	To understand the machine learning with trees, different classifier
	CO4:	To understand the concept of dimensionality reduction, Graphical Methods
Course Name: Soft Computing	CO1:	To know the soft computing methodology, heuristic search techniques
	CO2:	To understand the Neural Network structure, different types of leaning methods
	CO3:	To understand the different methods of unsupervised learning
	CO4:	To understand the concept of Fuzzification and defuzzification
Course Name: 3P1 Practical-1	CO1:	Programs in R for data analysis and visualization
	CO2:	Programming on classification, association and clustering algorithm
	CO3:	Programming in python to design and develop database applications
	CO4:	Programming in python for Web development
Course Name: 3P2 Practical-2	CO1:	Programming for AI search techniques
	CO2:	Programs on Mobile Computing
	CO3:	Programs on Neural Network
	CO4:	Programs on Fuzzification and defuzzification
Course Outcomes: Master in Computer Applications		
MCA Semester-IV		
Course Name: Project Work	CO1:	To use the working knowledge in industry.
	CO2:	To develop software in industry for various clients
	CO3:	To gain awareness about ethical aspects and development work.
	CO4:	Ability to plan and use adequate methods for software development

Head
Department of Computer Science

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Science College, Congress Nagar, Nagpur

PG COURSES

MASTER OF SCIENCE (M.Sc.) (CBCS)

❖ M.Sc. Computer Science

Program Outcomes: Master of Science (Computer Science) (CBCS)

https://www.nagpuruniversity.ac.in/pdf/Naac_Reports/programs_outcomes/MSc_Computer_Science_compressed_150620.pdf

M.Sc. Semester-I

Targeted Graduate Attributes: Disciplinary Knowledge, Critical Thinking, Problem Solving, Analytical Reasoning, Communication Skills, Teamwork, Moral and Ethical Awareness

	Program Outcomes
PSO1	The students will be able to develop aptitude to manifest a wide and extensive knowledge in the field of computer science.
PSO2	Ability to think critically for solving various problems and recent trends in computer softwares.
PSO3	The students will be capable of working effectively in diverse conditions as a team.
PSO4	The students will be able to develop skills in software design and its implementation.
PSO5	The students will be able to apply knowledge of computer science in academic and corporate sectors.
PSO6	The students will be able to develop self sustainability as well as competitiveness and employability.
PSO7	The students will be able to plan and write a research paper or proposal and assignment in computer science.

Course Outcomes: Master of Science (Computer Science) (CBCS)

Program Matrix

Name of Program: M.Sc. (Computer Science)

(Low Correlation = L/1 ; Moderate Correlation = M/2 ; High Correlation = H/3)

Course Outcomes (COs)		Program Outcomes (POs)						
		Domain Specific (PSO)				Domain Independent (PO)		
Course Name: M.Sc.(Computer Science) - Semester I		1	2	3	4	5	6	7
DISCRETE MATHEMATICAL STRUCTURE								
CO1	To able to specify and manipulate basic mathematical object	M	M	L	M	M	M	H
CO2	Very important to develop logic for the problem solving in the field of computer science.	H	H	M	H	M	M	H
CO3	Understand the basics of probability and number theory which is very important in problem solving.	M	H	M	H	M	M	H
CO4	Use effectively algebraic techniques to analyse basic discrete structures and algorithms	M	M	L	H	H	M	H
PROGRAMMING IN JAVA								
CO1	Facilitates in understanding the concepts of object oriented programming	M	H	M	M	M	M	H
CO2	Effective to implement platform independence	H	H	H	H	H	H	H
CO3	Design Programs for RMI and JAVA Beans and Swings	H	M	M	M	H	H	H
CO4	Skill Enhancing through concepts like multithreading, abstraction , platform independence	H	H	H	H	H	H	H
DIGITAL ELECTRONICS AND MICROPROCESSOR								
CO1	Learning to design various applications based on digital electronics	M	M	H	M	H	M	H
CO2	Developing assembly language programming skills	M	H	H	H	H	H	H
CO3	Learning to design various applications based on digital electronics	M	H	H	H	H	H	H

CO4	Developing assembly language programming skills	M	M	M	H	H	H	H
	ADVANCED DBMS & ADMINISTRATION							
CO1	Can explore efficient method for handling multiple types of data	M	M	H	H	H	H	M
CO2	Have a detailed view of handling parallel and distributed database	M	M	M	H	H	H	H
CO3	Ability to normalize the database & understand the internal data structure	M	H	H	M	H	H	H
CO4	Deep visualization of realistic data into physical structure	M	H	H	H	H	H	H
	PRACTICAL I							
CO1	Solve problems in theoretical computer science as it relies heavily on graphs and logic	M	H	H	H	M	M	H
C02	The students can imbibe the idea of proving programs correct through the use of discrete mathematic structure	M	H	M	M.	M	M	H
C03	Useful in designing web and desktop applications	H	H	H	H	M	M	H
CO4	Design and program stand-alone Java Applications	H	H	M	H	M	M	H
	PRACTICAL II							
CO1	Learning to design various applications based on digital electronics	M	H	H	M	H	H	H
CO2	Developing assembly language programming skills	H	H	H	H	H	H	H
CO3	Facilitates in creation of Data Structures and effective management of Database	H	H	H	H	H	H	H
CO4	Ability to normalize the database & understand the internal data structure	H	H	H	H	H	M	H
	Course Name: M.Sc.(Computer Science) - Semester II							
	WINDOWS PROGRAMMING USING VC++							
CO1	Provides many tools for coding and debugging visual codes	M	H	H	M	M	M	H
CO2	Facilitates as a lightweight tool to edit your C++ files	H	M	H	M	M	M	H
CO3	Provides add-on features such as smart pointers, New Container, Polymorphism, Exception Handling etc	H	H	M	M	M	M	H
CO4	Encapsulates multiple applications and hence can make use of the package with installing it once	H	H	H	M	M	M	H
	THEORY OF COMPUTATION AND COMPILER CONSTRUCTION							

CO1	Analyze the behaviour of machines and how they solve a problem	M	H	H	H	M	H	H
CO2	Problems solving in many fields beside computer science such as physics, economy, biology etc	M	H	H	H	M	H	H
CO3	Would know program execution using lexical and syntactical analysis	M	H	H	H	H	H	H
CO4	Can correlate the working of compiler in program execution	M	H	H	H	H	H	H
	COMPUTER ARCHITECTURE AND ORGANIZATION							
CO1	To explore the fundamentals of Computer Architecture and Organization	H	H	M	H	H	H	H
CO2	To understand the design of control unit	M	H	M	H	H	M	H
CO3	To study the concepts of memory organization and to understand various memory technologies	H	M	M	H	H	M	H
CO4	To understand the concepts of input output processing to interface various I/O devices	H	M	M	H	H	H	H
	COMPUTER GRAPHICS							
CO1	Provides user interfaces, data visualization, television commercials, motion pictures	H	M	H	H	H	H	H
CO2	Hardware devices and algorithms which are necessary for improving the effectiveness, realism, and speed of picture generation	H	M	H	H	H	H	H
CO3	Three dimensional graphic algorithm are incorporated in various streams to better simulate complex interactions	H	H	H	H	M	H	H
CO4	3-d transformations, b-spline surfaces, curves, and hidden surfaces can be explored	H	H	H	H	H	M	H
	Practical I							
CO1	Helps to understand the nature of efficient computation	H	H	H	H	M	H	H
CO2	Facilitates in efficient problem solving	H	H	H	H	M	H	H
CO3	To understand the nature of efficient computation	H	M	M	H	H	M	H
CO4	Apply and redistribute runtime packages mostly installed for standard libraries that many applications use	M	M	M	H	H	H	M
	Practical II							
CO1	Would gain the knowledge about inside of computer	H	M	M	M	M	H	H
CO2	Develop the design concepts of latest processors	M	M	M	M	M	M	M

CO3	Study the common elements in user interfaces, data visualization, television commercials, motion pictures, and many other applications	H	H	H	H	H	H	H
CO4	Explore the algorithms necessary for basic transformation with respect to computer graphics	H	M	M	M	M	H	H
	COURSE NAME: M.SC.(COMPUTER SCIENCE) - SEMESTER III							
	DATA COMMUNICATION AND NETWORK							
CO1	To understand and master the fundamentals of data communications through the knowledge of data transmission concepts, media used for data communication	H	M	M	M	H	H	H
CO2	To compress the data, different compression algorithms used to optimize data transfer even if the network is congested	H	M	M	H	H	H	H
CO3	Various network routing algorithms, data link layer protocols are necessary to be understood while working on networking concepts	H	H	H	H	H	H	H
CO4	Exploring frequency and time division multiplexing techniques to share network bandwidth among multiple users are very necessary to be learnt	M	M	H	H	H	H	H
	SOFTWARE ENGINEERING							
CO1	To Get detailed knowledge of role of software in daily basis	H	H	H	H	H	H	H
CO2	Student will be identifying different models and find out the best	H	H	H	H	H	H	H
CO3	Test the developed software for high performance and maintainability	M	H	H	H	H	H	H
CO4	Study the software measure parameters for software quality	M	H	H	H	H	H	H
	CE1-1(ELECTIVE 1) NEURAL NETWORK							
CO1	Provides an understanding of underlying geometry of foundation Neural Network models	H	H	H	H	H	H	H
CO2	Helps in Neural Network algorithm along with an approach to neuro-science findings	H	H	H	H	H	H	H
CO3	Necessary for the research community around the world to realize the biological fidelity	H	H	H	H	H	H	H
CO4	Develop powerful computational models that has applications to vast number of disciplines	H	M	L	H	H	H	H
	CE1-2(ELECTIVE -2)MOBILE COMPUTING							
CO1	Helps to understand the fundamental requirements for initiating an online business	M	M	M	M	M	H	H

CO2	Helps in process of initiating and funding a start-up, e-Business or large e-projects	H	H	H	M	H	H	H
CO3	Necessary to describe the issue and methods of transforming an organization into an e-business	H	H	H	H	H	H	H
CO4	Provides deeper knowledge of mobile handheld devices, wireless mediums, palm OS, MANNET	H	M	M	H	H	H	H
	CE1-3 MULTIMEDIA TECHNOLOGIES							
CO1	Define multimedia to potential clients	M	M	M	M	M	H	H
CO2	Identify the basic components of a multimedia project	M	H	H	H	H	H	H
CO3	Identify the basic hardware and software requirements for multimedia development and playback	H	H	M	H	H	H	H
CO4	Identify and describe the function of the general skill sets in the multimedia industry	M	M	M	M	M	M	H
	CE1-4 ASP.NET							
CO1	Helps to create web form with server control	H	M	M	M	M	M	H
CO2	Separate page code from content by using code-behind pages, page controls, and Components	M	H	H	H	H	H	H
CO3	Display dynamic data from a data source by using Microsoft ADO.NET	M	M	M	M	M	H	H
CO4	Debug ASP.NET Pages by using trace	M	M	H	H	H	H	H
	CE1-5 DIGITAL AND CYBER FORENSICS							
CO1	Cite and adhere to the highest professional and ethical standards of conduct, including impartiality and the protection of personal privacy	M	M	H	M	H	H	H
CO2	Identify and document potential security breaches of computer data that suggest violations of legal, ethical, moral, policy	M	M	H	M	H	H	H
CO3	Work collaboratively with law enforcement to advance digital investigations or protect the security of digital resources	M	M	H	M	H	H	H
CO4	Access and critically evaluate relevant technical and legal information and emerging industry trends	H	M	H	M	H	H	H
	PRACTICAL V							
CO1	Analyse And Setup Protocol Designing Issues For Communication Networks	H	M	M	H	H	H	H

CO2	Estimate The congestion Control Mechanism to improve Quality Of Service of Networks	M	M	H	H	H	H	H
CO3	To implement Software prototyping for better software development	H	M	M	H	H	H	H
CO4	To acquire skills to think about problems and solution using appropriate method	H	H	H	H	H	H	H
	Practical VI							
CO1	To design neuro-biologically oriented models	H	M	M	H	H	H	H
CO2	To implement deep learning for solving real world problems	M	M	H	H	H	H	H
CO3	To train through hands-on on m-computing for ease of use	H	M	M	H	H	H	H
CO4	To secure digital documents through data hiding, water marks etc	H	H	H	H	H	H	H
	Course Name: M.Sc.(Computer Science) - Semester IV							
	DATA MINING							
CO1	Necessary to deal with explosive growth of the stored and transient data	H	M	H	M	H	H	H
CO2	Introduces new techniques and automated tools useful in transforming data into knowledge	H	M	H	H	H	H	H
CO3	Provides basic Techniques for OLAP & Data generalization	H	M	H	H	H	H	H
CO4	Helps to identify different cluster analysis techniques and advanced data mining techniques	H	M	H	H	H	H	H
	ARTIFICIAL INTELLIGENCE & EXPERT SYSTEM							
CO1	Explore AI problem solving techniques	H	M	H	M	H	H	H
CO2	Explore techniques knowledge representation in Machine	H	M	H	H	H	H	H
CO3	Helps in a deeper knowledge towards natural language processing, robotics	H	M	H	H	H	H	H
CO4	Necessary in decision making, problem solving, perception and understanding human communication	H	M	H	H	H	H	H
	CE2-1 DESIGN & ANALYSIS OF ALGORITHM							
CO1	Ability to analyze performance of algorithms	M	H	H	M	H	H	H
CO2	Choose appropriate algorithm for problem solving	M	H	H	M	H	H	H
CO3	Analyze worst-case running times of algorithms using asymptotic analysis	M	H	H	M	H	H	H
CO4	Analyze greedy algorithm and its applications, divide and conquer strategy	M	H	H	M	H	H	H
	CE2-2 EMBEDDED SYSTEM							
CO1	Helps to addresses the issue of the response time constrain of various tasks	M	H	H	H	H	H	H

CO2	Necessary for designing high performance response time constrained sophisticated systems	H	H	H	H	H	H	H
CO3	Helps to develop the systems that make optimum use of the available system resources: processor, memory	H	H	H	H	H	H	H
CO4	Employ the key concepts of embedded systems like sensors and actuators	M	H	H	H	H	H	H
	CE2-3 PATTERN RECOGNITION							
CO1	Apply performance evaluation methods for pattern recognition, and critique comparisons of techniques made in the research literature	H	M	H	M	H	H	H
CO2	Apply pattern recognition techniques to real-world problems such as document analysis and recognition	H	M	H	H	H	H	H
CO3	Implement simple pattern classifiers, classifier combinations, and structural pattern recognizers	H	M	M	M	H	H	H
CO4	Summarize, analyze, and relate research in the pattern recognition area verbally and in writing	M	L	M	M	M	M	H
	CE2-4 PARALLEL COMPUTING							
CO1	Introduces to various models of parallelism such as shared and distributed memory	H	H	H	M	M	H	H
CO2	Develop parallel computing solutions with respect to different mapping techniques	M	M	H	M	H	H	H
CO3	Helps in developing and implementing various routing mechanism necessary for parallel computing	M	M	H	M	H	H	H
CO4	Contribute as driving force in development of faster computers	H	M	H	M	H	H	H
	CE2-5 MOBILE & CYBER FORENSICS							
CO1	Introduces to Computer Forensics Fundamentals	H	H	H	H	H	H	H
CO2	Helps to analyze and explore different forensic technologies	H	M	H	H	M	H	H
CO3	Helps to identify methods of digital evidence preservation	H	M	H	H	M	H	H
CO4	Helps in exploring data recovery in mobile forensics	H	M	H	H	M	H	H
	PRACTICAL VII							
CO1	To implement standard data mining techniques and methods such as association rules, clustering techniques	H	H	H	H	H	H	H
CO2	To apply data mining techniques on datasets for realistic sizes using	H	H	H	H	H	M	h

	modern data analysis frameworks							
CO3	Implement microcontroller interfacing	H	H	M	M	M	H	H
CO4	To implement real time operating system using embedded	H	M	M	M	M	H	H
	PROJECT							
CO1	To display the working knowledge and skills to the industry	H	H	H	H	H	H	H
CO2	Deeper knowledge of methods in major field of study	H	H	H	H	H	H	H
CO3	To gain a consciousness of ethical aspects of research and development work	H	H	H	H	H	H	H
CO4	Capability to plan and use adequate methods to conduct qualified tasks in given frameworks and evaluate the work	H	H	H	H	H	H	H

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PG COURSES

MASTER OF SCIENCE (M.Sc.) (NEP) (Effective from 2023-24)

❖ M.Sc. Computer Science

Program Outcomes, Course Objectives & Outcomes: M.Sc. Computer Science (NEP) (Effective from 2023-24)	
https://nagpuruniversity.ac.in/writereaddata/fckimagefile/MSC_Computer_Science_Syllabus_NEP_2020.pdf	
Department of Computer Science	After successful completion of two year degree PG program in Computer Science, the students are able to:

PROGRAMME SPECIFIC OUTCOMES (PSOs)

1. The ability to apply theoretical foundations of Computer Science and problem-solving skills through programming techniques for complex real time problems using appropriate data structures and algorithms.

2. The ability to design/develop hardware and software interfaces along with database management to meet the needs of industry.

3. The ability to demonstrate personal, organizational and entrepreneurship skills through critical thinking, engage themselves in life-long learning by following innovations in business, science & technology

4. Ethics on Profession, Environment and Society: Exhibiting professional ethics to maintain the integrality in a working environment and also have concern on societal impacts due to computer-based solutions for problems.

M. Sc. (Computer Science)
Semester I

MCS1T01
Paper I : ARTIFICIAL INTELLIGENCE

Hours/Week : 4
Credits : 4

Course Objectives:
1. To impart artificial intelligence principles, techniques and its history.
2. To assess the applicability, strengths, and weaknesses of the basic knowledge representation, problem solving, and learning methods in solving engineering problems.
3. To develop intelligent systems by assembling solutions to concrete computational problems

Course Outcomes:
1. Evaluate Artificial Intelligence (AI) methods and describe their foundations.
2. Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation and learning.
3. Demonstrate knowledge of reasoning and knowledge representation for solving real world problems.
4. Analyze and illustrate how search algorithms and planning play vital role in problem solving.

M. Sc. (Computer Science)
Semester I

MCS1T02
Paper II : COMPILER CONSTRUCTION

Hours/Week : 4
Credits : 4

Course Objectives :
1. To gain knowledge on Language Processor.
2. Distinguish different computing models and classify their respective types
3. Show a competent understanding of the basic concepts of Syntax Analysis.

Course Outcomes :
1. Demonstrate the knowledge of Lexical Analysis
2. Derive an appropriate model of code generation.

M. Sc. (Computer Science)
Semester I

Elective 1 : MCS1T03
Paper III : COMPUTER ARCHITECTURE AND ORGANIZATION

Hours/Week : 4
Credits : 4

Course Objectives:
1. To provide knowledge on overview of IAS computer function and addressing modes.
2. Hardware and software implementation of arithmetic unit to solve addition, subtraction, multiplication and division.
3. To provide knowledge of memory technologies, interfacing techniques and sub system devices.

Course Outcomes:
1. Provide fundamentals on machine instructions and addressing modes.
2. Comprehend the various algorithms for computer arithmetic.
3. Analyse the performance of various memory modules in memory hierarchy.
4. Compare and contrast the features of I/O devices and parallel processors.
5. Outline the evaluation of memory organization.
6. Analyse the performance of Arithmetic logic unit, memory and CPU.

M. Sc. (Computer Science)
Semester I

Elective 1 : MCS1T03
Paper III : DISCRETE MATHEMATICAL STRUCTURE

Hours/Week : 4
Credits : 4

Course Objectives:
1 To cover certain sets, functions, relations and groups concepts for analyzing problems that arise in engineering and physical sciences.
2 To imparting to analyze the problems connected with combinatorics and Boolean algebra.
3 To solve calculus and integral calculus problems.

Course Outcomes:
1. Observe the various types of sets, functions and relations.
2. Understand the concepts of group theory.
3. Understand the concepts of combinatorics.
4. Understand the concepts of graph theory and its applications.
5. Learning logic and Boolean algebra. Using these concepts to solve the problems

M. Sc. (Computer Science)
Semester I

MCS1T04

Paper IV : RESEARCH METHODOLOGY

Hours/Week : 4
Credits : 4

Course Objectives:
1. To study and understand the research issues & challenges, research goals, scientific methods
2. To study processing and analysis of data, Quantitative and Qualitative data analysis.
3. Reviewing Literature and research papers, writing research papers, Thesis reports.

Course Outcomes:
1. The basic concept of research and its methodologies, Identify appropriate research topics, select and define appropriate research problem and parameters.
2. Prepare a project (to undertake a project)
3. Organize and conduct research in a more appropriate manner, writing research report and thesis.

M. Sc. (Computer Science)
Semester II

MCS2T05
Paper I : CLOUD COMPUTING

Hours/Week : 4
Credits : 4

Course Objectives:
1. To Understand fundamentals of cloud computing
2. To acquire good working knowledge of the essentials of Cloud Micro Services
3. To implement business specific cloud applications

Course Outcomes:
1. Analyze the trade-offs between deploying applications in the cloud and over the local infrastructure.
2. Compare the advantages and disadvantages of various cloud computing platforms.
3. Program data intensive parallel applications in the cloud.
4. Analyze the performance, scalability, and availability of the underlying cloud technologies and software.
5. Identify security and privacy issues in cloud computing.

M. Sc. (Computer Science)
Semester II

MCS2T06
Paper II : MACHINE LEARNING

Hours/Week : 4
Credits : 4

Course Objectives:
1. Ability to comprehend the concept of supervised and unsupervised learning techniques
2. Differentiate regression, classification and clustering techniques and to implement their algorithms.
3. To analyze the performance of various machine learning techniques and to select appropriate features for training machine learning algorithms.

Course Outcomes:
1. Understand the concepts of various machine learning strategies.
2. Handle computational data and learn ANN learning models.
3. Solve real world applications by selecting suitable learning model.
4. Boost the performance of the model by combining results from different approaches.

M. Sc. (Computer Science)
Semester II

Elective 2 : MCS2T07
Paper III : R PROGRAMMING

Hours/Week : 4
Credits : 4

Course Objectives:
1. This course introduces R, which is a popular statistical programming language.
2. The course covers data reading and its manipulation using R, which is widely used for data analysis. It also covers different control structures and design of user-defined functions. Loading, installing and building packages .

Course Outcomes :
1. Develop an R script and execute it
2. Install, load and deploy the required packages, and build new packages for sharing and reusability
3. Extract data from different sources using API and use it for data analysis
4. Visualize and summarize the data
5. Design application with database connectivity for data analysis

M. Sc. (Computer Science)
Semester II

Elective 2 : MCS2T07
Paper III : NEURAL NETWORK

Hours/Week : 4
Credits : 4

Course Objectives:
1. To introduce the foundations of Artificial Neural Networks
2. To learn various types of Artificial Neural Networks

Course Outcomes:
1. Ability to understand the concepts of Neural Networks.
2. Ability to select the Learning Networks in modeling real world systems

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