CENTRAL UNIVERSITY OF HARYANA

(*Established under the Central Universities Act, 2009*)(NAAC Accredited 'A' Grade)

LOCF and NEP-2020 Based CBCS

Curriculum and Syllabi of
Master of Computer Application (MCA)
(w.e.f. 2022-2023)

Department of Computer Science and Information Technology

School of Basic Sciences

Vision and Mission

i) Vision and Mission of the University

Vision

To develop enlightened citizenship of a knowledge society for peace and prosperity of individuals, nations, and the world, through the promotion of innovation, creative endeavors, and scholarly inquiry.

Mission

To serve as a beacon of change, through multi-disciplinary learning, for the creation of a knowledge community, by building a strong character and nurturing value-based transparent work ethics, promoting creative and critical thinking for holistic development and self-sustenance for the people of India. The University seeks to achieve this objective by cultivating an environment of excellence in teaching, research, and innovation in pure and applied areas of learning.

ii) Vision and Mission of the Department

Vision

To be a Centre of Excellence for nurturing computer professionals with strong application expertise through experiential learning and research for matching the requirements of industry and society instilling in them the spirit of innovation and entrepreneurship by providing knowledge of computer systems in both hardware and software application design so that they contribute not only in the progress of software and its application but even encompass the entire emerging domain of computer technology.

Mission

1. To improve high-quality professional training at the postgraduate with an Emphasis on the basic principle of Computer Science and application.

2. To impart value-based, quality education that provides design and development like software applications in their entirety. Innovative learning-centric facilities for solving computational problems.

3. To promote research-based activities through analysis and interpretation of data and synthesis of the information for utilization in resolving practical problems relating to computer applications.
4. To provide help in promote\preparing students to qualify for exams like UGC-NET, GATE, and other competitive exams.
5. To provide a framework through Project Based Learning to support society and industry in promoting a multidisciplinary activity.
6. To provide a quality learning experience through effective classroom practices, the active learning style of teaching, and opportunities for meaningful interaction between students and faculty.
7. To develop a crystal clear evaluation system and experiential learning mechanism aligned with futuristic technologies and industry.
8. To undertake societal activities for the upliftment of rural/deprived sections of the society.

iii) Mapping of Vision and Mission

Vision and Mission of the University	**Vision and Mission of the Department**
To develop enlightened citizenship of a knowledge society for peace and prosperity of individuals, nations, and the world, through the promotion of innovation, creative endeavors, and scholarly inquiry.	**Yes**
To serve as a beacon of change, through multi-disciplinary learning, for the creation of a knowledge community, by building a strong character and nurturing value-based transparent work ethics, promoting creative and	**Yes**

critical thinking for holistic development and self-sustenance for the people of India.	
The University seeks to achieve this objective by cultivating an environment of excellence in teaching, research, and innovation in pure and applied areas of learning.	**Yes**

1. Background

i) NEP-2020 and LOCF an integrated Approach

Considering the curricular reforms as instrumental for desired learning outcomes, all the academic departments of Central University of Haryana made a rigorous attempt to revise the curriculum of undergraduate and postgraduate programmes in alignment with the National Education Policy-2020 and UGC Quality Mandate for Higher Education Institutions-2021. The process of revising the curriculum could be prompted by the adoption of the "Comprehensive Roadmap for Implementation of NEP-2020" in the 32nd meeting of the Academic Council of the University held on April 23, 2021. The Roadmap identified the key features of the Policy and elucidated the Action Plan with well-defined responsibilities and an indicative timeline for major academic reforms.

The process of revamping the curriculum started with a series of webinars and discussions conducted by the University to orient the teachers about the key features of the Policy, enabling them to revise the curriculum in sync with the Policy. Proper orientation of the faculty about the vision and provisions of NEP-2020 made it easier for them to appreciate and incorporate the vital aspects of the Policy in the revised curriculum focused on 'creating holistic, thoughtful, creative and well-rounded individuals equipped with the key 21st-century skills for the 'development of an enlightened, socially conscious, knowledgeable, and skilled nation'.

With NEP-2020 in background, the revised curricula articulate the spirit of the policy by emphasising upon—integrated approach to learning; innovative pedagogies and assessment strategies; multidisciplinary and cross-disciplinary education; creative and critical thinking; ethical and Constitutional values through value-based courses; 21st century capabilities across the range of disciplines through life skills, entrepreneurial and professional skills; community and constructive public engagement; social, moral and environmental awareness; Organic Living and Global Citizenship Education (GCED); holistic, inquiry-based, discovery-based, discussion-based, and analysis-based learning; exposure to Indian knowledge system, cultural traditions and

classical literature through relevant courses offering 'Knowledge of India'; fine blend of modern pedagogies with indigenous and traditional ways of learning; flexibility in course choices; student-centric participatory learning; imaginative and flexible curricular structures to enable creative combination of disciplines for study; offering multiple entry and exit points initially in undergraduate programmes; alignment of Vocational courses with the International Standard Classification of Occupations maintained by the International Labour Organization; breaking the silos of disciplines; integration of extra-curricular and curricular aspects; exploring internships with local industry, businesses, artists and crafts persons; closer collaborations between industry and higher education institutions for technical , vocational and science programmes; and formative assessment tools to be aligned with the learning outcomes, capabilities, and dispositions as specified for each course. In the case of UG programmes in Engineering and Vocational Studies, it was decided that the departments shall incorporate pertinent NEP recommendations while complying with AICTE, NBA, NSQF, International Standard Classification of Occupations, Sector Skill Council, and other relevant agencies/sources. The University has also developed a consensus on the adoption of Blended Learning with 40% component of online teaching and 60% face-to-face classes for each programme.

The revised curricula of various programmes could be devised with concerted efforts of the faculty, Heads of the Departments, and the Deans of Schools of Study. The draft prepared by each department was discussed in a series of discussion sessions conducted at the Department, School, and University levels. The leadership of the University has been a driving force behind the entire exercise of developing the uniform template and structure for the revised curriculum. The Vice-Chancellor of the University conducted a series of meetings with Heads and Deans to deliberate upon the vital parameters of the revised curriculum to formulate a uniform template featuring Background, Programme Outcomes, Programme Specific Outcomes, Postgraduate Attributes, Structure of Masters Course, Learning Outcome Index, Semester-wise Courses and Credit Distribution, Course-level Learning Outcomes, Teaching-Learning Process, Blended Learning, Assessment and Evaluation, Keywords, References, and Appendices. The experts of various Boards of Studies and School Boards contributed to a large extent in giving the final shape to the revised curriculum of each programme. To ensure the implementation of curricular

reforms envisioned in NEP-2020, the University has decided to implement various provisions in a phased manner. Accordingly, the curriculum may be reviewed annually.

ii) About subject

Computer plays a significant role in every field of life. They help us in several ways, for example, they find applications in medicine, surgery, industrial process, aviation industry, making bills in various big shops & malls, creating presentation slides in application software for making notes & delivering lectures in colleges, universities, analysis of algorithms, programming languages, program design, development of software and computer hardware and a lot more. In short, not only in just one, but the Computer plays an all-rounded role in the field of education of students.

Computer, along with internet facility is the most powerful device that students can use to learn new skills & abilities in education. Innovation in Computer technology has a profound impact on education. It forms a part of the school curriculum as it is an essential part of every individual today. Computer education in schools plays a major noteworthy role in the career development of young students, it becomes an integral part of each student's life. Vast or Immense storage is yet another main great characteristic of a computer. Students and teachers can download and store a lot of educational materials, books, presentations, lecture/ address notes, question papers, and so on. Students can find many different ways to solve a certain problem given to them. Through computers, they can interact with people having the same issues & decisions.

Being actively used in various educational institutes like schools, colleges & big universities, computer centers, computers are used to aid the learning process of students. Professors in colleges & teachers in schools take the help of audio-visual techniques to prepare lesson plans for students. For this, they use Microsoft PowerPoint to prepare electronic presentations about their lectures. These electronic presentations can be shown on multimedia and sound projectors in classrooms. It is an interesting and simple method to learn for students. Multimedia (Sight and sound) presentations are easy to deliver for teachers also as these presentations spare a great deal of time and effort. Computers can be used for online education & research. With the help of the internet, students can find useful information about their projects, and assignments and also can

take useful help from other researchers as they store & organize their research materials on computers. In CBT (Computer Based Training), various projects & educational programs are prepared or set up with the assistance of expert educators and audio-visual media help. These educational programs are generally set up in the shape of lectures on a specific subject/ topic & are given on CDs. Students can learn when they wish at their homes. Using Computer Education students can-

- Enhances creativity & thinking skills
- Proves beneficial for career aspiration
- Design and develop a software application for different industries
- Provides efficient & better use of IT Technology
- Improves research work & helps in communicating with different education providers
- Gives instant information/ **Quick processing of data** on any topic in just a single click
- Manages the software, hardware & networks in any industry
- Involves in the design and development of the hardware components of PCs & laptops
- Develop software for peripheral computing devices such as printers, modems, scanners, etc.
- Write code and algorithms for operating systems like Windows, Linux, etc.
- Develop design, implementation, and management of information systems of computer hardware and software.

iii) About the Programme (Nature, extent, and aims) :

The objective of this report is to propose a curriculum for the 2 year Master of Computer Applications (MCA) course. MCA course is now offered by more than 200 institutions all over India and is an important source of human resources for the software industry. The first MCA curriculum was proposed in 1982 and was later revised by a working group of the Indian Society of Technical Education in 1990. These curricula have been primarily used as guidelines by Universities that have a Board of Studies whose responsibility is to draft curricula. The All-India Council of Technical Education (AICTE), has one of its responsibilities to specify norms and standards for technical institutions. Needless to say, a good curriculum is an essential requirement for ensuring the quality of an academic programme. Thus the All-India Board of Computer Science. Engg./Tech. and Applications constituted a committee that proposed a draft

curriculum for the MCA degree. In this report, we give the modified curriculum. Information Technology is growing rapidly. Increasing applications of computers in almost all areas of human endeavor has led to a vibrant industry with concurrent rapid change in technology. Thus the challenge in designing a curriculum is to identify the areas of reasonably stable core competence and provide a sufficient number of electives and laboratories to accommodate changes. Thus the suggested curriculum has a strong laboratory and project orientation in which the use of new tools will be emphasized. Most courses will have an associated laboratory and it is expected that they will be equipped with the latest software tools. One of the major problems faced by almost all colleges offering MCA, courses is the lack of adequate faculty. This problem has no easy solution as industry jobs are plentiful and very remunerative. This problem can be partially alleviated if good educational material is available to students and Staff covering the curriculum. It will be desirable for colleges to have internet connectivity as the net has plenty of educational material. The objective of the MCA programme is to prepare post graduates for productive careers in the software industry, corporate sector, Govt. organizations, and academia by providing a skill-based environment for teaching and research in the core and emerging areas of the discipline. This Master's Degree Programme has been designed with a semester approach in mind. The first-year courses are aimed at skills development in computers using various technologies, core courses that provide conceptual frame work and the second year offer specialization courses, training, and project works.

iv) Qualification Descriptors (possible career pathways)

On successful completion of the MCA Programme, students of the department are expected to work at different platforms in addition to living productive and meaningful lives. Some of the possible career paths for the postgraduate students may be:

1. Software Developer

Software developer develops, tests, installs and maintains brand new software systems for clients. Software developers are as much engaged in recommending upgrades in existing programs as they are in making all the application system pieces work together.

2. System Analyst

A systems analyst is an information technology professional who specializes in analyzing, designing, and implementing information systems. Systems analysts assess the suitability of information systems in terms of their intended outcomes.

3. Data Scientist

Data scientists are responsible for analyzing all the data that is collected to make predictions, understand consumer and market behavior, and overall improve business and customer service.

4. Network Manager

A Network Manager Manage and maintain the network, as well as network performance monitoring, Identifying, installing, and maintaining upgrades to the network.

5. Web Developer

A popular career choice among MCA graduates is getting into web designing and development. Web designers and developers enable back-end functionality and also ensure that the front end looks appealing.

6. Digital Marketing

After MCA learners can also make a career in digital marketing. This field is emerging day by day.

7. Self-Engagement

After MCA learners can also become an entrepreneur.

8. Govt. organizations

A popular career choice among MCA graduates is getting into Govt. organizations

9. Database Engineer

As a database administrator or engineer, you would be tasked with creating and managing databases, which store and organize data. Besides building new databases, you would also configure existing systems and ensure that everything remains functional

10. Go for Higher Studies

After MCA it is highly recommended that the learner should go for higher studies, depending upon his background and interest. After MCA the learner can opt followed degrees:

- M.Tech years course
- Ph.D. Research course

2. Program Educational Objectives (PEOs)

PEO 1

- To develop the ability to excel in a professional career and/or higher education excellence through the knowledge acquisition of computing, mathematics, and information communication technology.

PEO 2

- To extend the capability to plan, analyze, design, code, test, enforce and hold the software program product.

PEO 3

- To excel in professionalism, moral attitude, conversation skills, team building, and adaptingthe latest ICT tools/techniques.

PEO 4

- To analyze real-world problems, design, and develop computing models/systems for multidisciplinary domains that are feasible, suitable, economical, and socially acceptable.

PEO 5

- To develop the capabilities to pursue higher studies and establish a research practice for the contribution to academia/industry and multidisciplinary research.

PEO 6

- To enhance the capabilities to initiate startups and become entrepreneurs in various domains of computer science and Information technology.

3. Programme Outcomes (POs)

Students enrolled in the Master's Programmes offered by the Departments under the School of Basic Sciences will have the opportunity to learn and master the following components in addition to attaining important essential skills and abilities:

PO no.	Component	Outcomes
PO-1	Computational Knowledge:	Apply knowledge of computing fundamentals, computing specialization, mathematics, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.
PO-2	Problem Analysis:	Identify, formulate, research literature, and solve complex computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.
PO-3	Design /Development of Solutions	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.
PO-4	Conduct Investigations of Complex Computing Problems	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.

PO-5	Modern Tool Usage:	Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to *complex* computing activities, with an understanding of the limitations.

PO-6	Professional Ethics	Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practice.
PO-7	Life-long Learning	Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.
PO-8	Project management and finance	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.
PO-9	Communication Efficacy	Communicate effectively with the computing community, and with society at large, about *complex* computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.
PO-10	Societal and Environmental Concerns	Understand and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practice.
PO-11	Individual and Team Work	Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary environments.
PO-12	Innovation and Entrepreneurship	Identify a timely opportunity and use innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.

4. Programme Specific Outcomes (PSOs)

The postgraduates shall be able to realize the following outcomes by the end of program studies:

Number	Programme Specific Outcomes
PSO-1	The ability to remember and understand the basic concept of associated subjects and Computer Fundamentals, Computer Programming, Design, and Analyze different Network Techniques.
PSO-2	The proficiency to understand, evaluate and analyse the design and algorithm concepts of computer architecture, Operating systems, Computer Networks, Software Engineering, Design and Analysis of Algorithms, Compiler Design, Artificial Intelligence, etc
PSO-3	The ability to design and solve problems in the field of Interdisciplinary subjects by applying the knowledge acquired from Data analysis, Software development & other allied topics.
PSO-4	The skills to develop, adopt, and assess the latest innovative industry best practices, then analyze and comprehend the young mindsets accordingly to their attitude toward higher studies, research, and to possess a successful path as a young entrepreneur.
PSO- 5	Analyze their abilities in systematic planning, developing, testing, and executing complex computing applications, in the field of Social Media and Analytics, Web Application Development, and Data Interpretations.

5. Postgraduate Attributes:

On completion of the post-graduate programme in MCA, students are expected to equip with the skills of creative, critical, and rational thinking associated with computers and their use for human society. The following attributes are expected from the students of MCA :

No.	P.G. Attributes
PGA-1	Describe the notion of mathematical thinking, mathematical proofs, and algorithmic thinking, and be able to apply them in problem-solving that involves Discrete Mathematical Structures, Design and Analysis of Algorithms, image processing, Compiler Design, etc.
PGA-2	Ability to use the updated tools, techniques, and modern Software tools necessary for software Development like Android Application Development, Data Science with R programming, Bioinformatics, Cloud Computing, etc.
PGA-3	Introduce the basic principles, techniques, and applications of Artificial Intelligence. Emphasis will be placed on the teaching of these fundamentals and labs for the 'hands-on' approach to understanding, as well as a challenging avenue for exploration and creativity.
PGA-4	Provide professional knowledge in specialized areas such as Computer Vision, Internet of Things, Natural Language Processing, Speech Recognition, etc.
PGA-5	Communicate effectively by comprehending, documenting, making effective presentations,and exchanging clear instructions through project reports and presentations.
PGA-6	Describe the fundamental concepts, Solve problems, use algorithms in machine learning and popular machine learning algorithms with programming in Python/ MatLab.and describe the concept of Deep Learning.
PGA-7	Design and implement smart, intelligent, and user-friendly interfaces for computer web applications using PHP version 5. Students will learn how to connect to any ODBC-compliant database and perform hands-on practice with a MySQL database to create database-driven HTML forms and reports, etc. Students also learn how to configure PHP and Apache Web Server.
PGA-8	Develop programming skills through C, PHP, object-oriented programming, java programming, Advance Java Programming & Android, etc.

PGA-9	Develop robust, efficient software systems, Analyse the security requirements, examine software problems in multiple aspects including, testing and implementation that would involve software engineering, data structures, networked programming**,** Wireless Sensor Networks, Network Security, etc
PGA-10	Analyze the relationship between organizations, information systems, business processes, Identify different techniques, store, manipulate the huge data from different resources, involving E-commerce and Data Science with R programming.

6. Structure of Master of Computer Science and Application (MCA)

- **General, Course structure & Theme & Semester-wise credit distribution**

A. Definition of Credit:

1 Hour Lecture (L) per week	1 credit
1 Hour Tutorial (T) per week	1 credit
2 Hours Practical (Lab)/week	1 credit

B. Total credits:

The total credit of the MCA 2 Year programme is 104. The minimum qualifying marks for a course or programme shall be 40% (i.e., 'P'grade).

C. Structure of MCA program:

S. No.	Category	Breakup of Credits (Total =104)	%
1	**Professional Core Courses**	**72**	**69.23**
2	**Program Elective Courses** relevant to the branch	**12**	**11.54**
3	**General Elective Courses**: Taken from other departments	**8**	**7.69**
4	**Project work** and Internship in Industry / in house	**2+2+8=12**	**11.54**
5	**Mandatory Courses as bridge course:** [Fundamentals of Computer Science, Internet Fundamentals, Computer0 Programming using C, Computer Programming using C -Lab-I].	**non- Credit**	

	Total	**104**	

7. Learning Outcome Index

(Mapping of Courses with POs and PSOs)

A) Mapping of Courses with POs (First Year)

Semester	**POs ⇨**	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
	Courses ⇩												
I	**CC-1**	M	W		W			W		S	M		
	CC-2	S	M			W		M		M		W	
	CC-3	W	M		M			M		W			
	CC-4	S	M	W	M	M	W	M	W	M	W	M	S
	CCP-1	M	M		M	M		W	W	M	M		M
	CCP-2	S	S	M	W		W	M		M		M	S
	CCP-3	S	M	W	M	M	M	S	S	S	S	S	S
	GEC-1	S	W			S				W	M		
	BC- 1	S				M		M	W	M		M	
	BC- 2	S	S		M	M		M		M	W	M	M
	BCP	S	S		M			M		M	W	M	S
II	**CC-1**	M	W			S		M	W	M	S	M	M
	CC-2	S	S	W	M	S	W	W	M	S	M		S
	CC-3	M	W			W		M	S	S	M	S	M
	CC-4	M	S	M	S	W		W		S		W	W
	CCP-1	M	W		M	M		M		M	W		M
	CCP-2	M	W		M	M	W	M		M		M	S
	CCP-3	S	S	W	M	M		W	M	M	W	W	
	PEC-1	W				S				S	M		
	PEC-2	M				S		M		W			

	PEC-3	M	W			W		W		W	M		
	PEC-4	S		M		M				M	M	W	M

6.1 B) Mapping of Courses with POs (Second Year)

Semester	**POs ⇨**	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**
	Courses ⇩												
III	**CC-1**	M			M	M	M	W		S	S	M	M
	CC-2	M	S		S	M				M		W	
	CC-3	M	M		M	M		M		S			S
	CC-4	M	M			M	W	M	M	S	S		
	GEC-II	W				S					M		
	CCP-1	M	M		W	M	W		M	M	S	W	S
	CCP-2	S	S	M	M	S	M	M		M	M	M	S
	PEC-1	S	W		M	M	M			M	M		M
	PEC-2	M			M		W			M	M		W
	PEC-3	W	S	M	S	M		W	M	M	W	M	M
	PEC-4	S		S		M				W	M	M	S
	PEC-5	M				M		M		S	W	M	
	MP												
	STR												
IV	**CC-1**	M	S		M	W	W		M	M	S	M	S
	CC-2	S	S		S	M		M		M	W		W
	CCP-1	M	S		M	W			M	M	W	M	S
	CCP-2	M	S	S	W	S	M	M		M	M	M	S
	PW	M	M			S		M	S	S	S		
	PEC-1	W	M			S	M			S	S		W
	PEC-2	S	W		M	M		W		M	M	W	

	PEC-3	W	W		S					W	M	M	
	PEC-4	M	W	W	M	S			W	M	W		W
	PEC-5	M	M	M	S	M		M	W	S	M	S	S
	PEC-6	M	M		W	S	W	M		W	M	W	M

B) Mapping of Courses with PSOs (First Year)

Semester	**POs ⇨**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO5**
	Courses ⇩					
I	**CC-1**	S	M	S	S	S
	CC-2	S	S	W	W	M
	CC-3	W	S	W	W	M
	CC-4		W	S	W	W
	CCP-1	M	M	M	S	S
	CCP-2	W	M	W	W	M
	CCP-3		W	M	M	S
	GEC-1	W			W	M
	BC- 1	S	M	M	W	W
	BC-2	S	W	S	M	M
	BCP	S	W	S	M	S
II	**CC-1**	S	M	M	W	S
	CC-2	M	M	W	M	S
	CC-3	S	W	S	M	W
	CC-4	W	S	M	S	S
	CCP-1	S	S	M	M	S
	CCP-2	W	W	S	M	S
	CCP-3		S	M	W	M
	PEC-1	M	M	W	W	M
	PEC-2	M	S	S	S	S

	PEC-3	M	M	W	W	W
	PEC-4	W	S	W	W	W

6.2 B) Mapping of Courses with PSOs (Second Year)

Semester	**POs ⇨**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
	Courses ⇩					
III	**CC-1**	W	S	M		S
	CC-2	M	S	M	M	S
	CC-3	M	S	W		S
	GEC-II	W			W	W
	CCP-1	S	W	S	S	S
	CCP-2	S	M	S	S	S
	PEC-1	M		S	M	S
	PEC-2	W	M	S	S	S
	PEC-3	W	S	S	S	S
	PEC-4	W	M	S	W	S
	PEC-5	W	M	M	W	M
	MP					
	STR					
IV	**CC-1**	W	W	S	S	M
	CC-2	M	M	S	S	M
	CCP-1	S	W	M	M	S
	CCP-2	S	W	S	S	S
	PW	S	S	M	S	S
	PEC-1	W	W	M	M	M
	PEC-2	W	M	W	W	W

	PEC-3	W	W	W		W
	PEC-4	W	S	M	M	M
	PEC-5		M	M	W	W
	PEC-6	W	W	M	M	S

8. Semester-wise Courses and Credit Distribution

Scheme and Syllabi of Master of Computer Applications (MCA) Two years Programme

(with effect from the Academic Session 2022-23)

Total Credit = 104

Semester Wise Distribution of Credits: 26 + 26 + 28 + 24

Eligibility for Admission to MCA two year Programme:

Passed B.C.A/ B.Sc. (Computer Science)/ B.Sc. (IT) / B.E. (CSE)/ B.Tech. (CSE) / B.E. (IT) / B.Tech. (IT) or equivalent Degree.

OR

Passed any graduation degree (e.g.: B.E. / B.Tech. / B.Sc / B.Com. / B.A./ B. Voc./ etc.,) with Mathematics at 10+2 level or at Graduation level Obtained at least 50% marks (45% marks in case of candidates belonging to reserved category) in the qualifying examination. (**The students admitted with this eligibility will have to simultaneously undertake additional Bridge Course(s) as prescribed by the University during the first year *).***

Bridge Course (Non-Credit Course)								
Sr.No.	**Course Code and Course No**	**Course Title**	**L**	**T**	**P**	**Hrs/Week**	**Total Credits**	**NEP-2020 relevancy**
1	SBS CS 01 01 01 E 3104	Fundamentals of Computer Science	**3**	**1**	**0**	4	**0**	MS Office Skills

2	SBS CS 01 01 02 E 3104	Computer Programming using C	**3**	**1**	**0**	4	**0**	Basic Programming Skills development
3	SBS CS 01 01 03 E 0042	Computer Programming using C -Lab-I	**0**	**0**	**4**	4	**0**	Code organization Skills

Note: It is compulsory for each student to pass out Bridge Course(s) during the first year only (two additional theory papers and one practical as prescribed in the scheme of Bridge Course). Papers under Bridge Course will be taught only in the 1st semester of the MCA programme.

Semester -1st (26 – Credits)

Sr. No.	Course Code and Course No	Course Title	L	T	P	Hrs/Week	Total Credits	NEP-2020 Relevancy
Core Courses (compulsory)								
1	SBS CS 01 01 01 C 3104	Data Structures	**3**	**1**	**0**	4	**4**	Complex Data Structure skills
2	SBS CS 01 01 02 C 3104	Computer Networks	**3**	**1**	**0**	4	**4**	Network Data Comm. Skills
3	SBS CS 01 01 03 C 3104	Discrete Mathematical Structures	**3**	**1**	**0**	4	**4**	Mathematical Reasoning Skills
4	SBS CS 01 01 04 C 3104	Operating System and Shell Programming	**3**	**1**	**0**	4	**4**	Solution wise C/C++ programming Skills
5	General Elective Course-I (To be taken from another department)						**4**	
6	SBS CS 01 01 05 C 0042	Data Structures using C Lab-I	**0**	**0**	**4**	4	**2**	Programming Skills Development

7	SBS CS 01 01 06 C 0042	Operating System and Shell Programming Lab -II	**0**	**0**	**4**	4	**2**	OS Skills Development
8	SBS CS 01 01 07 C 0042	Web Development using PHP Lab-III	**0**	**0**	**4**	4	**2**	Web development skills

Semester – 2nd (26 Credits)

Sr. No.	Course Code and Course No	Course Title	L	T	P	Hrs/Week	Total Credits	NEP-2020 Relevancy
Core Courses (compulsory)								
1	SBS CS 01 02 08 C 3104	Database Management System	**3**	**1**	**0**	**4**	**4**	Database Manipulation Skills
2	SBS CS 01 02 09 C 3104	Object Oriented Programming	**3**	**1**	**0**	**4**	**4**	Object based programming skills
3	SBS CS 01 02 10 C 3104	Software Engineering	**3**	**1**	**0**	**4**	**4**	Conceptual knowledge of Software
4	SBS CS 01 02 11 C 3104	Design and Analysis of Algorithms	**3**	**1**	**0**	**4**	**4**	Algorithmic Skills
5		Departmental Elective Course-I					**4**	
6	SBS CS 01 02 12 C 0042	Database Management System Lab-I	**0**	**0**	**4**	**4**	**2**	Database Management Skills
7	SBS CS 01 02 13 C 0042	Object Oriented Programming using C++ Lab-II	**0**	**0**	**4**	**4**	**2**	Object based programming skills
8	SBS CS 01 02 14 C 0042	Design and Analysis of Algorithms Lab-III	**0**	**0**	**4**	**4**	**2**	Algorithmic Skills

List for Departmental Elective Courses-I

1	SBS CS 01 02 04 E 3104	Mobile Communication	**3**	**1**	**0**	4	**4**	Operation of mobile communications
2	SBS CS 01 02 05 E 3104	Management Information System and E-Commerce	**3**	**1**	**0**	4	**4**	Managing Markets over online platform
3	SBS CS 01 02 06 E 3104	Quantum Computing	**3**	**1**	**0**	4	**4**	Quantum entanglement Skills
4	SBS CS 01 02 07 E 3104	Computer Graphics	**3**	**1**	**0**	4	**4**	Computer Graphics Skills

Students have to undergo the training during summer vacations and prepare its report which will be evaluated in the 3rd Semester.

Semester – 3rd (28 Credits)

Sr. No.	Course Codeand Course No	Course Title	L	T	P	Hrs/Week	Total Credits	NEP-2020 Relevancy
Core Courses (compulsory)								
1	SBS CS 01 03 15 C 3104	Artificial Intelligence and Expert System	**3**	**1**	**0**	4	**4**	AI explorations & creative skills
2	SBS CS 01 03 16 C 3104	Theory of Computation	**3**	**1**	**0**	4	**4**	Computational Solving Skills
3	SBS CS 01 03 17 C 3104	Internet and Java Programming	**3**	**1**	**0**	4	**4**	Platform Independent Programming skills
4	Departmental Elective Course-II						**4**	
5	General Elective Course-II (To be taken from another department)						**4**	
6	SBS CS 01 03 18 C 0042	Internet and Java Programming Lab-I	**0**	**0**	**4**	**4**	**2**	Hands-on over Platform Independent Programming skills
7	SBS CS 01 03 19 C 0042	Artificial Intelligence with Python Lab-II	**0**	**0**	**4**	**4**	**2**	Python Programming skills
8	SBS CS 01 03 20 C 0042	Minor Project (Training)	**0**	**0**	4	**4**	**2**	Advanced Skills Enhancement
9	SBS CS 01 03 21 C 0042	Summer Training Report	**0**	**0**	**4**	4	**2**	Industrial skills development
List for Departmental Elective Courses-II (any one from the list*)								
1	SBS CS 01 03 08 E 3104	Network Programming	**3**	**1**	**0**	4	**4**	Networking Skills
2	SBS CS 01 03 09 E 3104	Machine and Deep Learning	**3**	**1**	**0**	4	**4**	Machine Learning Skills
3	SBS CS 01 03	Software	**3**	**1**	**0**	4	**4**	Software management Skills

	10 E 3104	Project Management						
4	SBS CS 01 03 11 E 3104	Digital Image Processing	**3**	**1**	**0**	4	**4**	Image recognition Skills
5	SBS CS 01 03 12 E 3104	Data Warehousing and Data Mining	**3**	**1**	**0**	4	**4**	Data Processing Skills

Semester – 4th (24 credits)

Sr. No.	Course Codeand Course No	Course Title	L	T	P	Hrs/Week	Total Credits	NEP-2020 relevancy
Core Courses (compulsory)								
1	SBS CS 01 04 22 C 3104	Data Science with R Programming	3	1	0	4	4	Huge Data Manipulating Skills
2	SBS CS 01 04 23 C 3104	Compiler Design	3	1	0	4	4	Compiler OptimizationSkills
3	Departmental Elective Course-III						44	
4	SBS CS 01 04 24 C 0042	Data Science with R Programming Lab-I	0	0	4	4	2	Data Manipulation Programming Skills
5	SBS CS 01 04 25 C 0042	Android Application Development Programming Lab-II	0	0	4	4	2	App Development Skills
6	SBS CS 01 04 26 C 00168	Project Work (In House)	0	0	16	16	8	Research Oriented
List for Departmental Elective Courses-III								
1	SBS CS 01 04 13 E 3104	Distributed and Cloud Computing	3	1	0	4	4	Cloud Computation Oriented
2	SBS CS 01 04 14 E 3104	Bioinformatics	3	1	0	4	4	Basics skills for bioinformatics
3	SBS CS 01 04 15 E 3104	Natural Language Processing and Speech Recognition	3	1	0	4	4	Speech Recognition Skills
4	SBS CS 01 04 16 E 3104	Computer Vision	3	1	0	4	4	Design skills for Computer visionsoftware
5	SBS CS 01 04 17 E 3104	Embedded Programming	3	1	0	4	4	Micro-controller program

								learning
6	SBS CS 01 04 18 E 3104	Wireless Sensor Networks and Internet of Things	**3**	**1**	**0**	4	**4**	Wireless device communication Skill

Generic Elective Courses (for students of other Departments**)**							
SBS CS 01 01 01 E 3104	Fundamentals of Computer Science	**3**	**1**	**0**	4	**4**	**Inter/multidisciplinary**
SBS CS 01 01 19 E 3104	Internet Fundamentals	**3**	**1**	**0**	4	**4**	**Inter/multidisciplinary**
SBS CS 01 02 05 E 3104	Management Information System and E-Commerce	**3**	**1**	**0**	4	**4**	**Managing Markets over online platform**

9. Course-Level Learning Outcomes

<table>
<tr><td rowspan="2">Scheme Version:

2022-2023</td><td rowspan="2">Name of the Subject:

Fundamental of computer science (Bridge course)</td><td>L</td><td>T</td><td>P</td><td>C</td><td rowspan="2">Semester:

I(1st Year)</td><td>Contact hours per week: 4</td></tr>
<tr><td>3</td><td>1</td><td>-</td><td>0</td><td>Total Hours:46</td></tr>
<tr><td rowspan="2">Subject Code: SBS CS 01 01 01 E 3104</td><td rowspan="2">Applicable to Programs:

M.C.A.</td><td rowspan="2">Evaluation (Total Marks):
100</td><td>CIE</td><td>30 Marks</td><td colspan="3">Examination Duration: 3 hours</td></tr>
<tr><td>TEE</td><td>70 Marks</td><td colspan="3">Pre-requisite of course: Basic Fundamentals of Computer Science.</td></tr>
<tr><td>Course Description</td><td colspan="7">To introduce knowledge on basics of fundamental of computer science and various aspects of computational theory, programming, algorithm design, and optimization, network and database management, mobile technologies, electronics and mathematics.</td></tr>
<tr><td>Course Objectives</td><td colspan="7">This course aims to give students an in-depth understanding of why computers are essential components in business, education and society. This course will provide hands-on use of Microsoft Office applications Word, Excel, Access and PowerPoint.</td></tr>
<tr><td>Course Outcomes:</td><td colspan="7">Upon successful completion of the course students will be able to:

COB010101.1 Learn about the fundamental concepts of computer.</td></tr>
</table>

	COB010101.2 To understand the role of Internet and IPV4 and IPV6. **COB010101.3** Apply the binary logics to solve the problems. **COB010101.4** Analyse Boolean logics and truth table. **COB010101.5** Evaluate tasks like compose, format and edit a word document and other office software	
	COURSE SYLLABUS	
Unit No.	**Content of Each Unit**	**Hours of Each Unit**
1.	**Overview of Computer System: [Course Outcome (s): COB010101.1]** Evolution of Computer Systems, Generations of Computers, Parts of Computer System, Categories of Computers, Computer System Characteristics, Computer Hardware. Working of input & output devices: keyboard, mouse, trackball, pen, touch screens, scanner, digital camera, monitor, and printer. Working of storage devices: magnetic tape, magnetic disk, CD, DVD. Software- System & Application.	**11**
2.	**The Internet: [Course Outcome (s): COB010101.2]** Introduction to networks and internet, history, Working of Internet, Internet Congestion, Modes of Connecting to Internet, Internet Service Providers (ISPs), Internet addressing, comparison of IPv4 and IPv6.	**10**
3.	**Information Representation: [Course Outcome (s): COB010101.3 & COB010101.4]** Number systems, BCD codes, character codes, error detecting and correcting codes, fixed-point and floating-point representation of information. Binary arithmetic operations, Booths multiplication. **Binary Logic:** Boolean algebra, Boolean functions, Truth Tables, Canonical and Standard forms, Simplification of Boolean functions, Digital logic gates.	**12**

4.	**Office Automation Tools Word Processing: [Course Outcome (s): COB010101.5]** Editing features, formatting features, saving, printing, table handling, page settings, spell-checking, macros, mail-merge, and equation editors. **Excel/Access Power Point Slides:** Templates, views, formatting slide, slides with graphs, animation, using special features, presenting slide shows.	**13**

REFERENCE BOOKS

1. Norton, P., *Introduction to Computers*, Mc-Graw-Hill, 2017.

2. Raja, Raman V., *Fundamental of Computers*, Prentice Hall of India, 2014.

3. Sanders, D. H., *Computer Today*, Mc-Graw Hill, 1988.

4. Sinha, P.K. and Sinha, P., *Computer fundamentals*, BPB Publications, 2010.

5. Vermaat, M.E., *Discovering Computers & Microsoft Office 2013: A Fundamental Combined Approach*, Cengage Learning, 2013.

COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
COB010101.1	1	-	1	1	1	-	1	-	1	2	2	1
COB010101.2	2	-	-	-	1	-	1	3	1	-	1	1
COB010101.3	1	3	3	2	-	-	-	-	3	-	-	-
COB010101.4	1	2	-	-	-	-	-	-	3	-	-	-
COB010101.5	2	-	2	1	1	3	1	-	1	-	1	1

MAPPING OF COs WITH PSOs

Cos	PSO 1	PSO2	PSO3	PSO 4	PSO5
COB010101.1	3	2	-	1	1
COB010101.2	2	1	-	-	2
COB010101.3	3	3	1	1	-
COB010101.4	1	-	2	1	1
COB010101.5	2	1	2	2	1

10. Teaching –Learning Process

Teaching aids		Open-ended problem/ Numerical	Project-type activity	Lab Work	Open-ended lab work	Delivery mode		Beyond the curriculum
Video, Ppt. etc	Online lecture					Theory/ Description	Numerical / Designed problem	
Yes	Yes	Yes				90%	10%	10%

Instructions for the paper-setter:

Please go through these instructions thoroughly and follow the same pattern while setting the paper as the students have been prepared according to this format.

Maximum Marks = 70 Times: 3 Hours

Weightage per unit = 14 marks (excluding over attempt weight age)

1. Question Paper will consist of five questions.

2. Section A of question paper is compulsory, containing seven parts each of 2 marks covering the whole syllabus (short answer type- total 14 marks).
3. Four Questions will be from Units I, II, III and IV respectively each having weightage of 14 marks.

<table>
<tr><td rowspan="2">Scheme Version:

2022-2023</td><td rowspan="2">Name of the Subject:

Programming using C

(Bridge Course)</td><td>L</td><td>T</td><td>P</td><td>C</td><td rowspan="2">Semester:

I(1st Year)</td><td>Contact hours per week: 4</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>0</td><td>Total Hours:46</td></tr>
<tr><td rowspan="2">Subject Code:

SBS CS 01 01 02 E 3104</td><td rowspan="2">Applicable to Programs:

M.C.A.</td><td rowspan="2">Evaluation (Total Marks):
100</td><td>CIE</td><td>30 Marks</td><td colspan="3">Examination Duration: 3 hours</td></tr>
<tr><td>TEE</td><td>70 Marks</td><td colspan="3">Pre-requisite of course: Basic Operating System and Shell Programming.</td></tr>
<tr><td>Course Description</td><td colspan="7">To introduce knowledge on basics of fundamental of computer science and various aspects of computational theory, programming, algorithm design, and optimization, network and database management, mobile technologies, electronics and mathematics</td></tr>
<tr><td>Course Objectives</td><td colspan="7">The course is designed to provide knowledge of C language. Students will be able to develop logics which will help them to create programs, applications in C. Also by learning the basic programming constructs they can easily switch over to any other language in future. Student will learn the fundamental programming concepts and methodologies.</td></tr>
</table>

Course Outcomes:	Upon successful completion of the course students will be able to: **COB010103.1** Learn the basic concepts of programs connecting decision structures, loops and functions. **COB010103.2** Understand the difference between call by value and call by address. **COB010103.3** Apply the dynamic behaviour of memory by the use of pointers. **COB010103.4** Analyse the arrays and difference between structure and union. **COB010103.5** Evaluate the result based on array, structure and union.	
	COURSE SYLLABUS	
Unit No.	**Content of Each Unit**	**Hours of Each Unit**
1.	**Elements of C: [Course Outcome (s): COB010103.1]** character set identifier and keywords, data type, declaration and definition. Operators: arithmetic, relational, logical, bit wise, unary, assignment and conditional operators their hierarchy arid associativity.	**10**
2.	**Control statements: [Course Outcome (s): COB010103.2]** sequencing, selection, if and switch statement; repetition / loop statements: for, while, and do while loops; break, continue and goto statements.	**12**
3.	**Function: [Course Outcome (s): COB010103.2]** definition, declaration, and calling, call by value, call by reference prototype, passing parameters, actual and formal parameters, recursion.	**10**

4.	**Data Structures**: **[Course Outcome (s): COB010103.4 & COB010103.5]** arrays, structure, structure members, access to structure members union, string, data files. Pointer: declaration, operation of pointers, array to pointers, pointers to arrays.	**14**

REFERENCE BOOKS

1. Gottfried, B.S., *Programming with C*., McGraw Hill Education, 2018.

2. Hanly, J. R., Koffman, E.B. , *Problem Solving and Program Design in C*, 8th edition., Pearson Publications, 2015.

3. Kanetkar, Y., *Let Us C*, 16th Edition, BPB Publication, 2017.

4. Kelley, A., Pohl, I., *A Book on C: Programming in C*, Addison Wesley, 2000.

5. Kernighan, B.W. and Ritchie D., *The C Programming Language*, Pearson Publications, 2015.

COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
COB010103.1	2	3	2	3	2	-	-	1	2	1	-	-
COB010103.2	1	-	-	-	3	1	-	2	1	1	-	-
COB010103.3	1	2	3	2	-	2	1	3	2	-	2	-
COB010103.4	1	2	2	2	-	2	3	1	-	1	-	1
COB010103.5	1	2	2	1	-	1	3	-	-	1	-	1

MAPPING OF COs WITH PSOs

COs	PSO 1	PSO2	PSO3	PSO 4	PSO5
COB010103.1	3	3	2	3	-
COB010103.2	2	2	1	1	1
COB010103.3	1	3	2	1	-

COB010103.4	2	2	-	1	1
COB010103.5	2	3	1	2	-

Teaching –Learning Process

Teaching aids		**Open-ended problem/ Numerical**	**Project-type activity**	**Lab Work**	**Open-ended lab work**	**Delivery mode**		**Beyond the curriculum**
Video, Ppt. etc	Online lecture					Theory/ Description	Numerical/ Designed problem	
Yes	Yes	Yes	Yes	Yes	Yes	50%	50%	10%

Instructions for the paper-setter:

Please go through these instructions thoroughly and follow the same pattern while setting the paper as the students have been prepared according to this format.

Maximum Marks = 70 Times: 3 Hours

Weightage per unit = 14 marks (excluding over attempt weight age)

1. Question Paper will consist of five questions.
2. Section A of question paper is compulsory, containing seven parts each of 2 marks covering the whole syllabus (short answer type- total 14 marks).
3. Four Questions will be from Units I, II, III and IV respectively each having weightage of 14 marks.

<table>
<tr><td rowspan="2">Scheme Version:

2022-2023</td><td rowspan="2">Name of the Subject:

Data Structure</td><td>L</td><td>T</td><td>P</td><td>C</td><td rowspan="2">Semester:

I(1st Year)</td><td>Contact hours per week: 4</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td><td>Total Hours: 47</td></tr>
<tr><td rowspan="2">Subject Code:

SBS CS 01 01 01 C 3104</td><td rowspan="2">Applicable to Programs:

M.C.A.</td><td rowspan="2">Evaluation (Total Marks):
100</td><td>CIE</td><td>30 Marks</td><td colspan="3">Examination Duration: 3 hours</td></tr>
<tr><td>TEE</td><td>70 Marks</td><td colspan="3">Pre-requisite of course: Basic Data Structure.</td></tr>
<tr><td>Course Description</td><td colspan="7">To introduce knowledge on basics of fundamental of computer science and various aspects of computational theory, programming, algorithm design, and optimization, network and database management, mobile technologies, electronics and mathematics</td></tr>
</table>

Course Objectives	Using computer science theory, students will construct and analyze various data structures and abstract data types including lists, stacks, queues, trees, and graphs. Students will implement various sorting, searching, and hashing algorithms. Students will build a substantial, complex data structure.	
Course Outcomes:	Upon successful completion of the course students will be able to: **CO010101.1** To learn the basic concepts about the Data Structures and Algorithm. **CO010101.2** To understand the design correct programs to solve problems **CO010101.3** Choose efficient data structures and apply them to solve problems. **CO010101.4** Analyse the efficiency of programs using sorting and hash table. **CO010101.5** Evaluate the correctness of a program using loop invariants, preconditions and post conditions in programs.	
	COURSE SYLLABUS	
Unit No.	**Content of Each Unit**	**Hours of Each Unit**
1.	**Introduction: [Course Outcome (s): CO010101.1]** Basic Terminology, Elementary Data Organization, Structure Operations, Algorithm, Complexity and Time-Space trade-off. **Arrays:** Array Definition, Representation and Analysis, Single and Multidimensional Arrays, Address Calculation, Application of Arrays.	10
2.	**Stacks: [Course Outcome (s): CO010101.2]** Array Representation and Implementation of the stack, Operations on Stacks: Push & Pop, Array Representation of Stack, Linked Representation of Stack, Operations Associated with Stacks, Application of stack: Conversion of Infix to Prefix and Postfix Expressions, Evaluation of	15

	postfix expression using stack. **Queues:** Array and linked representation and implementation of queues, Operations on Queue: Create, Add, Delete, Full and Empty, Circular queues, D-queues and Priority Queues. **Linked list:** Representation and Implementation of Singly Linked Lists, Traversing and Searching of Linked List, Overflow and Underflow, Insertion and deletion to/from Linked Lists, Insertion and deletion Algorithms, Doubly Linked List, Linked List in Array.	
3.	**Trees: [Course Outcome (s): CO010101.3]** Basic terminology, Binary Trees, Binary tree representation, Array and Linked Representation of Binary trees, Types of Binary Tree, Traversing Binary trees, Binary Search Tree (BST), Insertion and Deletion in BST, AVL Trees, Huffman algorithm. **Graphs:** Terminology & Representations, Graphs & Multi-graphs, Directed Graphs, Sequential Representations of Graphs, Adjacency Matrices, Traversal, Connected Component and Spanning Trees, Minimum Cost Spanning Trees.	10
4.	**Searching and Hashing: [Course Outcome (s): CO010101.4 & CO010101.5]** Sequential search, binary search, comparison and analysis, Hash Table, Hash Functions, Collision Resolution Strategies, Hash Table Implementation. **Sorting:** Insertion Sort, Bubble Sorting, Selection Sort,	12

	Quick Sort, Merge Sort, Heap Sort, Linear time sorting, Practical consideration for Internal Sorting and External Sorting.	

REFERENCE BOOKS

1. Cormen, T.H., Leiserson, C.E., Rivest, R.L. and Stein, C., *Introduction to Algorithms*, MIT Press, 2010.

2. Goodrich, M.T., Tamassia, R. and Mount, D.M., *Data Structures and Algorithms in C++*, John Wiley & Sons, 2016.

3. Langsam, Y., Augenstein, M. and Tenenbaum, A.M., *Data Structures using C and C++*, Prentice Hall, 2015.

4. Lipschutz, S., *Schaum's Outline of Theory and Problems of Data Structures*, McGraw-Hill, 2014

COURSE ARTICULATION MATRIX

COs	**PO 1**	**PO 2**	**PO 3**	**PO4**	**PO 5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
COB010101.1	1	1	2	-	3	2	-	2	-	-	-	-
COB010101.2	2	1	2	1	-	1	-	3	1	-	3	-
COB010101.3	-	-	1	2	-	2	-	1	2	-	-	-

COB010101.4	-	2	-	-	1	-	2	2	-	1	2	2
COB010101.5	-	2	-	-	2	-	1	1	-	2	2	1

MAPPING OF COs WITH PSOs

Cos	PSO 1	PSO2	PSO3	PSO 4	PSO5
COB010101.1	2	3	2	3	1
COB010101.2	2	2	1	1	2
COB010101.3	1	3	2	-	1
COB010101.4	2	2	-	2	-
COB010101.5	2	3	-	1	2

Teaching –Learning Process

Teaching aids		**Open-ended problem/ Numerical**	**Project -type activity**	**Lab Work**	**Open - ended lab work**	**Delivery mode**		**Beyond the curriculum**
Video, Ppt. etc	Online lecture					Theory/ Description	Numerical / Designed problem	
Yes	Yes	Yes		Yes	Yes	50%	50%	10%

Instructions for the paper-setter:

Please go through these instructions thoroughly and follow the same pattern while setting the paper as the students have been prepared according to this format.

Maximum Marks = 70 Times: 3 Hours

Weightage per unit = 14 marks (excluding over attempt weight age)

1. Question Paper will consist of five questions.
2. Section A of question paper is compulsory, containing seven parts each of 2 marks covering the whole syllabus (short answer type- total 14 marks).
3. Four Questions will be from Units I, II, III and IV respectively each having weightage of 14 marks.

<table>
<tr><td rowspan="2">Scheme Version:

2022-2023</td><td rowspan="2">Name of the Subject:

Computer Network</td><td>L</td><td>T</td><td>P</td><td>C</td><td rowspan="2">Semester:

I(1st Year)</td><td>Contact hours per week: 4</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td><td>Total Hours: 46</td></tr>
<tr><td rowspan="2">Subject Code:

SBS CS 01 01 02 C 3104</td><td rowspan="2">Applicable to Programs:

M.C.A.</td><td rowspan="2">Evaluation (Total Marks):
100</td><td>CIE</td><td>30 Marks</td><td colspan="3">Examination Duration: 3 hours</td></tr>
<tr><td>TEE</td><td>70 Marks</td><td colspan="3">Pre-requisite of course: Basic Computer Network.</td></tr>
<tr><td>Course Description</td><td colspan="7">To introduce knowledge on basics of fundamental of computer science and various aspects of computational theory, programming, algorithm design, and optimization, network and database management, mobile technologies, electronics</td></tr>
</table>

	and mathematics	
Course Objectives	The main emphasis of this course is on the organization and management of local area networks (LANs). The course objectives include learning about computer network organization and obtaining a theoretical understanding of data communication and computer networks.	
Course Outcomes:	Upon successful completion of the course students will be able to: **CO010102.1** To learn about the basic concepts about Computer Network Modules **CO010102.2** To understand network topologies, switching and transmission medium. **CO010102.3** Apply the requirements for a given organizational structure and select the most appropriate networking architecture and technologies. **CO010102.4** Analyse, specify and design the topological and routing strategies for an IP based networking infrastructure. **CO010102.5** Evaluation of working knowledge of datagram and internet socket programming.	
	COURSE SYLLABUS	
Unit No.	**Content of Each Unit**	**Hours of Each Unit**
1.	**Introduction To Computer Networks: [Course Outcome (s): CO010102.1]** Definition of a Computer Network, The OSI Reference Model, The TCP/IP Reference Model, Protocols and Hardware involved in the OSI model, Comparison of the OSI & the TCP/IP. **Application Layer:** Domain name space, DNS in	**10**

	internet, electronic mail, FTP, WWW, HTTP, SNMP, multimedia, network security.	
2.	**Physical Layer: [Course Outcome (s): CO010102.2]** Introduction: Network topologies; Linear Bus Topology, Ring Topology, Star Topology, Hierarchical or Tree Topology, Topology Comparison, Considerations when choosing a Topology: Switching; Circuit switching, Message switching, Packet switching. **Transmission Medium:** Introduction: Transmission medium; Guided & Unguided Transmission medium, Twisted pair, Coaxial cable, Optical fiber, Comparison of fiber optics and copper wire: Wireless transmission; Electromagnetic spectrum, Radio transmission, Microwave transmission.	**13**
3.	**Data Link Layer: [Course Outcome (s): CO010102.4]** Introduction; Goal of DLL: Design issues of DLL; Services provided to the Network layer, Framing, Error control, Flow control, ARQ strategies: Stop-and-Wait, RTT estimation, sliding window, Go-Back-N retransmission, Error Detection and correction: Parity bits, Single bit error correction or (n, m), Error Detection or Cyclic Redundant Code (CRC): Data Link layer protocols; Transmission control protocols, HDLC.	**10**
4.	**Network Layer: Introduction: [Course Outcome (s): CO010102.3 & CO010102.5]** Design issues of Network layer; Nature of the service provided, Internetworking: Principles of Routing; Types of routing algorithms, Properties of routing algorithms, Optimality principle:	**13**

	Routing algorithms; Shortest path algorithm, Flooding, Distance vector routing, Hierarchical routing, Link state routing, Congestion: Factors of congestion, Comparison of flow control and congestion control, General principles of congestion control, Closed loop solution: IP protocol (IPV4). **Transport Layer:** Introduction: Services of Transport layer; Service primitives: Connection establishment: Connection Release: Transport Protocols; TCP protocol, UDP protocol	

REFERENCE BOOKS

1.Comer, D.E., and Droms, R.E., *Computer Networks and Internets,* Prentice-Hall Inc., 2018.

2. Forouzan, A.B., *Data Communications & Networking,* Tata McGraw-Hill Education, 2017.

3. Kundu, S., *Fundamentals of Computer Networks*, PHI Learning Pvt. Ltd., 2008.

4. Kurose, J.F., *Computer Networking: A Top-Down Approach Featuring the Internet,* Pearson Education India. 2016.

5. Stallings, W.S., *Data and Computer Communications,* Pearson Education India, 2013.

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO010102.1	1	-	1	1	2	-	-	1	1	-	-	-
CO010102.2	2	1	-	-	-	1	-	2	2	1	2	-

CO010102.3	-	-	2	1	-	1	1	3	1	-	2	-
CO010102.4	1	1	-	-	-	2	1	1	1	1	3	2
CO010102.5	1	-	-	-	-	1	1	2	1	-	-	2

MAPPING OF COs WITH PSOs

Cos	PSO 1	PSO2	PSO3	PSO 4	PSO5
CO010102.1	3	3	-	1	1
CO010102.2	2	2	-	1	1
CO010102.3	1	2	-	2	2
CO010102.4	1	1	2	2	-
CO010102.5	2	2	-	1	-

Teaching –Learning Process

Teaching aids		**Open-ended problem/ Numerical**	**Project-type activity**	**Lab Work**	**Open-ended lab work**	**Delivery mode**		**Beyond the curriculum**
Video, Ppt. etc	Online lecture					Theory/ Description	Numerical/ Designed problem	
Yes	Yes	Yes				60%	40%	10%

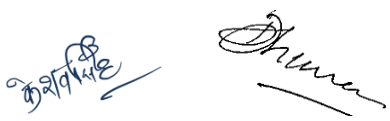
Instructions for the paper-setter:

Please go through these instructions thoroughly and follow the same pattern while setting the paper as the students have been prepared according to this format.

Maximum Marks = 70 Times: 3 Hours

Weightage per unit = 14 marks (excluding over attempt weight age)

1. Question Paper will consist of five questions.
2. Section A of question paper is compulsory, containing seven parts each of 2 marks covering the whole syllabus (short answer type- total 14 marks).
3. Four Questions will be from Units I, II, III and IV respectively each having weightage of 14 marks.



<table>
<tr><td rowspan="2">Scheme Version:

2022-2023</td><td rowspan="2">Name of the Subject:

Discrete Mathematical Structures</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Semester:</td><td>Contact hours per week: 4</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td><td>I(1st Year)</td><td>Total Hours: 48</td></tr>
<tr><td rowspan="2">Subject Code:

SBS CS 01 01 03 C 3104</td><td rowspan="2">Applicable to Programs:

M.C.A.</td><td rowspan="2">Evaluation (Total Marks):
100</td><td>CIE</td><td>30 Marks</td><td colspan="3">Examination Duration: 3 hours</td></tr>
<tr><td>TEE</td><td>70 Marks</td><td colspan="3">Pre-requisite of course: Basic

Discrete Mathematical Structure.</td></tr>
<tr><td>Course Description</td><td colspan="7">To introduce knowledge on basics of fundamental of computer science and various aspects of computational theory, programming, algorithm design, and optimization, network and database management, mobile technologies, electronics and mathematics</td></tr>
<tr><td>Course Objectives</td><td colspan="7">Using computer science theory, students will construct and analyze various data structures and abstract data types including lists, stacks, queues, trees, and graphs. Students will implement various sorting, searching, and hashing algorithms. Students will build a substantial, complex data structure.</td></tr>
<tr><td>Course Outcomes:</td><td colspan="7">Upon successful completion of the course students will be able to:

CO010104.1 Describe the basic concept of mathematical thinking, mathematical proofs, and algorithmic thinking.
CO010104.2 To understand the basics of discrete probability and number theory in problem solving.</td></tr>
</table>

	CO010104.3 Apply the algebraic techniques to analyse basic discrete structures and algorithms. **CO010104.4** Analyse the properties of graphs and related discreate structures. **CO010104.5** Evaluation the outcomes of graphs and trees and their properties.	
	COURSE SYLLABUS	
Unit No.	**Content of Each Unit**	**Hours of Each Unit**
1.	**Set Theory: [Course Outcome (s): CO010104.1]** Definition of Sets, Venn Diagrams, complements, Cartesian products, power sets, counting principle, cardinality and countability (Countable and Uncountable sets), proofs of some general identities on sets, pigeonhole principle. **Relation:** Definition, Types of relation, the composition of relations, domain and range of a relation, pictorial representation of a relation, properties of relation, partial ordering relation, Lattices, Hasse diagram.	**12**
2.	**Algebraic Structure: [Course Outcome (s): CO010104.2]** Binary composition and its properties definition of algebraic structure. **Groups:** Semi-group, Monoid Groups, Abelian group, properties of groups, Permutation Groups, Sub Group, Cyclic Group, Rings and Fields (definition and standard results).	**14**

3.	**Propositional Logic: [Course Outcome (s): CO010104.2]** Proposition logic, basic logic, logical connectives, truth tables, tautologies, contradiction, normal forms (conjunctive and disjunctive), modus Ponens and modus Tollens, validity, predicate logic, universal and existential quantification, Boolean expressions, Karnaugh map.	**12**
4.	**Graphs: [Course Outcome (s): CO010104.4 & CO010104.5]** Graph terminology, types of graphs, connected graphs, components of the graph, Euler graph, Hamiltonian path and circuits, Graph coloring, Chromatic number. **Tree:** Definition, Types of trees (rooted, binary), properties of trees, binary search tree, tree traversing (preorder, inorder, postorder).	**10**

REFERENCE BOOKS

1. Kolman, B., Busby, R.C., and Ross, S.C., *Discrete Mathematical Structures*, Prentice-Hall, 2008.

2. Lipschutz, S., and Lipson, M.L., *Discrete Mathematics*, McGraw-Hill, 2017.

3. Liu, C.L., and Mohapatra, D.P., *Elements of Discrete Mathematics: A Computer Oriented Approach,* Tata McGraw-Hill, 2017.

4. Rosen, K.H., and Krithivasan, K., *Discrete Mathematics and Its Applications: With Combinatorics and Graph Theory*, Tata McGraw-Hill Education, 2017.

5. Sarkar, S.K., *A Textbook of Discrete Mathematics*, S. Chand Publishing, 2016.

COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO010104.1	2	2	1	-	1	2	-	1	2	-	-	-
CO010104.2	-	1	-	-	3	2	-	2	1	1	3	-
CO010104.3	3	-	1	2	-	1	1	-	3	-	2	3
CO010104.4	1	2	-	-	-	1	1	2	1	3	2	-
CO010104.5	-	-	1	-	-	1	1	2	3	-	2	2

MAPPING OF COs WITH PSOs

COs	PSO 1	PSO2	PSO3	PSO 4	PSO5
CO010104.1	2	2	2	-	1
CO010104.2	2	-	1	1	-
CO010104.3	-	-	1	-	-

CO010104.4	-	-	1	1	1
CO010104.5	2	-	2	-	-

Teaching –Learning Process

Teaching aids		**Open-ended problem/ Numerical**	**Project-type activity**	**Lab Work**	**Open-ended lab work**	**Delivery mode**		**Beyond the curriculum**
Video, Ppt. etc	Online lecture					Theory/ Description	Numerical/ Designed problem	
Yes	Yes	Yes				60%	40%	10%

Instructions for the paper-setter:

Please go through these instructions thoroughly and follow the same pattern while setting the paper as the students have been prepared according to this format.

Maximum Marks = 70 Times: 3 Hours

Weightage per unit = 14 marks (excluding over attempt weight age)

1. Question Paper will consist of five questions.
2. Section A of question paper is compulsory, containing seven parts each of 2 marks covering the whole syllabus (short answer type- total 14 marks).
3. Four Questions will be from Units I, II, III and IV respectively each having weightage of 14 marks.

<table>
<tr><td rowspan="2">Scheme Version:

2022-2023</td><td rowspan="2">Name of the Subject:

Operating System and Shell Programming</td><td>L</td><td>T</td><td>P</td><td>C</td><td rowspan="2">Semester:

I(1st Year)</td><td>Contact hours per week: 4</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td><td>Total Hours:46</td></tr>
<tr><td rowspan="2">Subject Code:

SBS CS 01 01 04 C 3104</td><td rowspan="2">Applicable to Programs:

M.C.A.</td><td rowspan="2">Evaluation (Total Marks):
100</td><td>CIE</td><td>30 Marks</td><td colspan="3">Examination Duration: 3 hours</td></tr>
<tr><td>TEE</td><td>70 Marks</td><td colspan="3">Pre-requisite of course: Basic Operating System and Shell Programming.</td></tr>
<tr><td>Course Description</td><td colspan="7">To introduce knowledge on basics of fundamental of computer science and various aspects of computational theory, programming, algorithm design, and optimization, network and database management, mobile technologies, electronics and mathematics</td></tr>
<tr><td>Course Objectives</td><td colspan="7">A successful student will be able to understand the basic components of a computer operating system, and the interactions among the various components. The course will cover an introduction on the policies for scheduling, deadlocks,</td></tr>
</table>

	memory management, synchronization, system calls, and file systems. The students will implement solutions via C/C++ programs.	
Course Outcomes:	Upon successful completion of the course students will be able to: **CO010105.1** Demonstrates the basic concepts of key Linux library functions and system calls. **CO010105.2** Understand the inner workings of Linux operating systems. **CO010105.3** To apply shell scripts to perform repetitive tasks using while and for loops. **CO010105.4** Design analysis and implementation of shell functions. **CO010105.5** Result evaluation using deadlock and shell programming.	
	COURSE SYLLABUS	
Unit No.	**Content of Each Unit**	**Hours of Each Unit**
1.	**Operating System Introduction: [Course Outcome (s): CO010105.1] function**, characteristics, structures– simple batch, multiprogram med, timeshared, personal computer, parallel, distributed systems, real-time systems, system components, operating system services, system calls, virtual machines. **Process and CPU Scheduling:** Process concepts and scheduling, operation on processes, cooperating processes, threads and inter-process communication scheduling criteria, scheduling algorithm, multiple-processor scheduling, real time scheduling.	**11**
2.	**Management and Virtual memory: [Course Outcome (s): CO010105.2]** logical versus physical address space, swapping, contiguous allocation, paging, segmentation,	**10**

	segmentation with paging. Demand paging, performance of denuding paging, page replacement, page replacement algorithm, allocation of frames, thrashing.	
3.	**File System Interface and Implementation: [Course Outcome (s): CO010105.3]** access methods, directory, structure, protection, file system structure, allocation methods, free space management, directory management, directory implementation, efficiency and performance. **I/O Management:** I/O software and its types, disk scheduling. **Process Management and Synchronization:** Critical section problem, synchronization, critical regions, monitors.	**15**
4.	**Deadlocks: [Course Outcome (s): CO010105.4 & CO010105.5] system** model, dead locks characterization, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection and recovery from deadlock. **Shell Programming:** vi editor, shell variables, I/O in shell, control structures, loops, subprograms, creating shell scripts. Basic system administration in Linux/Unix.	**10**
REFERENCE BOOKS		

1. Das, S., *Your UNIX: The Ultimate Guide*, McGraw-Hill Inc., 2012.

2. Goerzen, J., *Linux Programming Bible*, IDG, 2000.

3. Kanetkar, Y.P., *UNIX Shell Programming*, BPB Publications, 2003.

4. Prata, S., and Waite Group, *Advanced UNIX: A Programmer's Guide*, HW Sams, 1985.

5. Venkateshmurthy, M.G., *Introduction to Unix and Shell Programming*, Pearson Education India, 2009.

COURSE ARTICULATION MATRIX

Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO 5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO01010 5.1	2	1	1	1	1	3	-	-	3	1	-	-
CO01010 5.2	1	1	-	-	3	2	-	2	-	1	-	-
CO01010 5.3	1	3	1	2	-	1	1	3	2	-	3	-
CO01010 5.4	1	-	3	-	-	2	1	1	1	1	-	2
CO01010 5.5	1	1	-	2	-	-	1	2	-	1	2	2

MAPPING OF COs WITH PSOs

Cos	PSO 1	PSO2	PSO3	PSO 4	PSO5
CO010105.1	3	2	2	1	2
CO010105.2	2	1	1	1	1
CO010105.3	1	1	1	-	-
CO010105.4	-	-	-	2	1
CO010105.5	-	-	2	1	2

Teaching –Learning Process

Teaching aids		**Open-ended problem/ Numerical**	**Project -type activity**	**Lab Work**	**Open - ended lab work**	**Delivery mode**		**Beyond the curriculum**
Video, Ppt. etc	Online lecture					Theory/ Description	Numerical / Designed problem	
Yes	Yes	Yes	Yes	Yes	Yes	60%	40%	10%

Instructions for the paper-setter:

Please go through these instructions thoroughly and follow the same pattern while setting the paper as the students have been prepared according to this format.

Maximum Marks = 70 Times: 3 Hours

Weightage per unit = 14 marks (excluding over attempt weight age)

1. Question Paper will consist of five questions.
2. Section A of question paper is compulsory, containing seven parts each of 2 marks covering the whole syllabus (short answer type- total 14 marks).
3. Four Questions will be from Units I, II, III and IV respectively each having weightage of 14 marks.

Semester II

Course – 1 [Database Management system]

Scheme Version:	**Name of the Subject:**	**L**	**T**	**P**	**C**	**Semester:**	**Contact hours per week:** 4
2022-2023	Database Management system	**3**	**1**	**0**	**4**	**II**(1st Year)	**Total Hours: 48**

<table>
<tr><td rowspan="2">Subject Code:

SBS CS 01 02 08 C 3104</td><td rowspan="2">Applicable to Programs:

M.C.A.</td><td rowspan="2">Evaluation (Total Marks):
100</td><td>CIE</td><td>30 Marks</td><td>Examination Duration: 3 hours</td></tr>
<tr><td>TEE</td><td>70 Marks</td><td>Pre-requisite of course:

DBMS Basics</td></tr>
<tr><td>Course Description</td><td colspan="5">To introduce knowledge on basics of fundamental of computer science and various aspects of computational theory, programming, algorithm design, and optimization, network and database management, mobile technologies, electronics and mathematics</td></tr>
<tr><td>Course Objectives</td><td colspan="5">This course is intended to provide an introduction to the management of database systems. The course emphasizes the understanding of the fundamentals of relational systems including data models, database architectures, and database manipulations. The course uses a problem-based approach to learning.</td></tr>
<tr><td>Course Outcomes:</td><td colspan="5">Upon successful completion of the course students will be able to:

CO010209.1 Elaborate on different issues involved in the design and implementation of basic database system. Study the physical and logical database designs, database modelling, relational, hierarchical, and network models.
CO010209.2 Understanding and Practice on data manipulation language to query, update and manage a database.
CO010209.3 Determine essential DBMS concepts such as database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing and apply them to solve problems.
CO010209.4 Develop a simple database system and analyse competence with the fundamental tasks involved with modelling, designing, and implementing a DBMS.</td></tr>
</table>

	CO010209.5 Evaluate the analysed concept, including modelling and design.	
	COURSE SYLLABUS	
Unit No.	**Content of Each Unit**	**Hours of Each Unit**
1	**Basic Concepts: [Course Outcome (s): CO010209.1]** File Systems vs. DBMS, Characteristics of the Database Approach, Abstraction and Data Integration, Database users, Advantages and Disadvantages of a DBMS. **Database Systems Concepts and Architecture:** Data Models, Schema and Instances, DBMS architecture and Data Independence, Database languages and Interfaces, DBMS functions and component modules..	10
2	**Entity-Relationship Model: [Course Outcome (s): CO010209.2]** Entity Types, Entity Sets, Attributes & keys, Relationships, Relationships Types, Roles and Structural Constraints, Design issues, E-R Diagrams, Design of an E-R Database Schema, Reduction of an E-R Schema to Tables. **Relational Data Model:** Relational model concepts, Integrity constraints over Relations, Relational Algebra – Basic Operations. **SQL:** DDL, DML, and DCL, views & Queries in	14

	SQL, Specifying Constraints & Indexes in SQL.	
3	**Relational Database Design: [Course Outcome (s): CO010209.3]** Functional Dependencies, Decomposition, Normal forms based on primary keys (1 NF, 2 NF, 3 NF, & BCNF) **Transaction Processing Concepts:** Introduction to Transaction Processing, Transaction & System Concepts, Properties of Transaction, Schedules and Recoverability, Serializability of Schedules. **Concurrency Control Techniques:** Locking Techniques, Timestamp ordering, Multi- version Techniques, Optimistic Techniques, Granularity of Data items.	14
4	**Databases for Advanced Applications**: **[Course Outcome (s): CO010209.4 & CO010209.5]** Active database concepts, Temporal database concepts, Spatial databases, Deductive databases; Emerging Database Technologies: Mobile databases, Multimedia Databases, Geographic information systems (GIS); XML and Internet Databases: Structured, Semi-structured and Unstructured Data, Introduction to web databases and XML, Structure of XML data.	10

REFERENCE BOOKS

1. Bayross, I., *SQL, PL/SQL: The Programming Language of Oracle,* BPB Publications. 2010.
2. Connolly, T.M. and Begg, C.E., *Database Systems: A Practical Approach to Design, Implementation, and Management*, Pearson Education, 2019.
3. Date, C.J., *An Introduction to Database Systems*, Pearson Education India, 2012.
4. Elmasri, R., *Fundamentals of Database Systems*, Pearson Education India, 2015.
5. Silberschatz, A., Korth, H.F. and Sudarshan, S., *Database System Concepts*, McGraw-Hill, 2013.

COURSE ARTICULATION MATRIX

COs	**PO1**	**PO2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**
CO010209.1	1	2	-	-	1	-	3	1	3	3	-	-
CO010209.2	-	3	-	-	-	-	3	-	2	3	-	-
CO010209.3	1	2	-	-	1	-	2	1	3	3	3	2
CO010209.4	-	1	-	-	1	-	2	-	2	3	2	2
CO010209.5	-	1	-	-	1	-	3	-	2	3	2	1

MAPPING OF COs WITH PSOs

Cos	PSO 1	PSO2	PSO3	PSO 4	PSO 5
CO010209.1	1	1	3	-	-
CO010209.2	-	2	3	-	1

CO010209.3	2	2	3	2	1
CO010209.4	2	-	3	3	2
CO010209.5	-	2	3	2	1

Teaching –Learning Process

Teaching aids		**Open-ended problem/ Numerical**	**Project-type activity**	**Lab Work**	**Open-ended lab work**	**Delivery mode**		**Beyond the curriculum**
Video, Ppt. etc	Online lecture					Theory/ Description	Numerical / Designed problem	
Yes	Yes	Yes	Yes	Yes	Yes	70%	30%	10%

Instructions for the paper-setter:

Please go through these instructions thoroughly and follow the same pattern while setting the paper as the students have been prepared according to this format.

Maximum Marks = 70 Times: 3 Hours

Weightage per unit = 14 marks (excluding over attempt weight age)

1. Question Paper will consist of five questions.
2. Section A of question paper is compulsory, containing seven parts each of 2 marks covering the whole syllabus (short answer type- total 14 marks).
3. Four Questions will be from Units I, II, III and IV respectively each having weightage of 14 marks.

Course – II [Object Oriented Programming]

<table>
<tr><td rowspan="2">Scheme Version:

2022-2023</td><td rowspan="2">Name of the Subject:

Object Oriented Programming</td><td>L</td><td>T</td><td>P</td><td>C</td><td rowspan="2">Semester:

II(1st Year)</td><td>Contact hours per week: 4</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td><td>Total Hours: 48</td></tr>
<tr><td rowspan="2">Subject Code:

SBS CS 01 02 09 C 3104</td><td rowspan="2">Applicable to Programs:

M.C.A.</td><td rowspan="2">Evaluation (Total Marks):
100</td><td>CIE</td><td>30 Marks</td><td colspan="3">Examination Duration: 3 hours</td></tr>
<tr><td>TEE</td><td>70 Marks</td><td colspan="3">Pre-requisite of course:

Basic C/C++ Programming.</td></tr>
<tr><td>Course Description</td><td colspan="7">To introduce knowledge on basics of fundamental of computer science and various aspects of computational theory, programming, algorithm design, and optimization, network and database management, mobile technologies, electronics and mathematics</td></tr>
</table>

Course Objectives	The objective of this course is to develop programming skills of students, using object- oriented programming concepts, learn the concept of class and object using C++ and develop classes for simple applications.	
Course Outcomes:	Upon successful completion of the course students will be able to: **CO010211.1** Learn the basic concept of fundamentals of programming such as variables, conditional and iterative execution, methods, etc. **CO010211.2** To understand the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc. **CO010211.3** Summarize important topics and apply principles of software development using OOP. **CO010211.4** Analyse how to write computer programs to solve specific problems. **CO010211.5** Evaluate problems to solve a particular computer program and fix them.	
	COURSE SYLLABUS	
Unit No.	**Content of Each Unit**	**Hours of Each Unit**
1.	**Object-Oriented Concepts: [Course Outcome (s): CO010211.4]** Data abstraction, Data Hiding, Encapsulation, polymorphism, modularity, hierarchy, typing, concurrency, persistence. C++ Basics: Classes and Objects, Data types, loops and decisions, structures and functions, Scope of class and its member, Nested Class, object arrays, Pointers, Constructor: parameterized constructor, multiple constructors, default constructor, copy constructor, implicit constructor, destructor function, dynamic allocation operators: new(), delete().	12

2.	**Inheritance: [Course Outcome (s): CO010211.4]** Base and Derived Classes, Single inheritance, Multilevel inheritance, Hierarchical inheritance, Hybrid Inheritance, Multiple inheritance, Protected Members, Casting Base-Class Pointers to Derived- Class Pointers, Using Member Functions, Overriding Base–Class Members in a Derived Class, Public, Protected and Private Inheritance, Using Constructors and Destructors in derived Classes.	12
3.	**Polymorphism: [Course Outcome (s): CO010211.4]** Compile time and Run time, Abstract class, Virtual class, Virtual base classes, pointers to base and derived classes, virtual functions, early and late binding, Pure virtual function, virtual destructor, virtual derivation. Friend function & Friend class, Inline functions, function overloading, Operator Overloading: Unary, Binary.	11
4.	**Generic Programming: [Course Outcome (s): CO010211.4]** Function Templates, Overloading Template Functions, Class Template, Class Templates and Non-Type Parameters. **Exception Handling:** Try, Throw, Catch, Throwing an Exception, Catching an Exception, Re-throwing an Exception. **File Handling:** Hierarchy of File Stream classes, Opening and Closing files, File modes, testing for errors, File pointers and their manipulations, ASCII & Binary files, Sequential and Random-access files. files, opening & closing a file, read () & write ()	13

	functions, File manipulation using seekg (), tellg() functions.	

REFERENCE BOOKS

1. Cormen, T.H., Leiserson, C.E., Rivest, R.L. and Stein, C., *Introduction to Algorithms*, MIT Press, 2010.

2. Goodrich, M.T., Tamassia, R. and Mount, D.M., *Data Structures and Algorithms in C++*, John Wiley & Sons, 2016.

3. Langsam, Y., Augenstein, M. and Tenenbaum, A.M., *Data Structures using C and C++*, Prentice Hall, 2015.

4. Lipschutz, S., *Schaum's Outline of Theory and Problems of Data Structures*, McGraw-Hill, 2014

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO010211.1	1	-	1	-	-	3	1	3	-	-	-	-
CO010211.2	1	1	-	-	1	3	-	3	1	-	-	-
CO010211.3	2	-	1	-	-	3	1	3	-	1	3	-
CO010211.4	1	1	-	-	1	2	-	3	2	-	2	2
CO010211.5	1	1	-	-	1	3	-	3	-	-	-	1

MAPPING OF COs WITH PSOs

Cos	PSO 1	PSO2	PSO3	PSO 4	PSO 5
CO010211.1	3	-	-	1	3
CO010211.2	3	-	1	3	2
CO010211.3	1	2	2	3	3
CO010211.4	-	2	3	3	1
CO010211.5	-	2	2	3	2

Teaching –Learning Process

Teaching aids		**Open-ended problem/ Numerical**	**Project-type activity**	**Lab Work**	**Open-ended lab work**	**Delivery mode**		**Beyond the curriculum**
Video, Ppt. etc	Online lecture					Theory/ Description	Numerical / Designed problem	
Yes	Yes	Yes	Yes	Yes	Yes	40%	60%	10%

Instructions for the paper-setter:

Please go through these instructions thoroughly and follow the same pattern while setting the paper as the students have been prepared according to this format.

Maximum Marks = 70 Times: 3 Hours

Weightage per unit = 14 marks (excluding over attempt weight age)

1. Question Paper will consist of five questions.
2. Section A of question paper is compulsory, containing seven parts each of 2 marks covering the whole syllabus (short answer type- total 14 marks).
3. Four Questions will be from Units I, II, III and IV respectively each having weightage of 14 marks.

Course – III [Software Engineering]

<table>
<tr><td rowspan="2">Scheme Version:

2022-2023</td><td rowspan="2">Name of the Subject:

Software Engineering</td><td>L</td><td>T</td><td>P</td><td>C</td><td rowspan="2">Semester:

II(1st Year)</td><td>Contact hours per week: 4</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td><td>Total Hours: 46</td></tr>
<tr><td rowspan="2">Subject Code:

SBS CS 01 02 10 C 3104</td><td rowspan="2">Applicable to Programs:

M.C.A.</td><td rowspan="2">Evaluation (Total Marks):
100</td><td>CIE</td><td>30 Marks</td><td colspan="3">Examination Duration: 3 hours</td></tr>
<tr><td>TEE</td><td>70 Marks</td><td colspan="3">Pre-requisite of course:</td></tr>
<tr><td>Course Description</td><td colspan="7">To introduce knowledge on basics of fundamental of computer science and various aspects of computational theory, programming, algorithm design, and optimization, network and database management, mobile technologies, electronics</td></tr>
</table>

	and mathematics	
Course Objectives	The objective of this course is to provide a solid fundamental knowledge of software engineering. This course will help the students to utilize and exhibit strong communication and interpersonal skills, as well as professional and ethical principles when functioning as members and leaders of multi-disciplinary teams.	
Course Outcomes:	Upon successful completion of the course students will be able to: **CO010212.1** To interpret the problem statement for the software design. **CO010212.2** To understand the requirements of the software efficiently. **CO010212.3** Translate the requirements into the design model with modern tools and apply to solve problems. **CO010212.4** Write the test cases and analyse the software modules. **CO010212.5** Evaluation of software module test cases.	
	COURSE SYLLABUS	
Unit No.	**Content of Each Unit**	**Hours of Each Unit**
1	**Software and Software Engineering: [Course Outcome (s): CO010212.1]** software characteristics, software crisis, software engineering paradigms. Planning a Software Project: software cost estimation, project scheduling, personal planning, team structure	11
2	**Software Configuration Management: [Course Outcome (s): CO010212.2]** quality assurance, project monitoring, risk management. Software Requirement Analysis: structured analysis, object-oriented analysis and data modeling, software requirement specification, validation.	11

3	**Design and Implementation of Software: [Course Outcome (s): CO010212.3]** software design fundamentals, design methodology (structured design and object-oriented design), design verification, monitoring and control, coding. **Software Reliability:** metric and specification, fault avoidance and tolerance, exception handling, defensive programming.	12
4	**Testing: [Course Outcome (s): CO010212.4]** testing fundamentals, white box and black box testing, software testing strategies; unit testing, integration testing, validation testing, system testing, debugging Software **Maintenance:** maintenance characteristics, maintainability, maintenance side effects, CASE tools	12

REFERENCE BOOKS

1. Cormen, T.H., Leiserson, C.E., Rivest, R.L. and Stein, C., *Introduction to Algorithms*, MIT Press, 2010.

2. Goodrich, M.T., Tamassia, R. and Mount, D.M., *Data Structures and Algorithms in C++*, John Wiley & Sons, 2016.

3. Langsam, Y., Augenstein, M. and Tenenbaum, A.M., *Data Structures using C and C++*, Prentice Hall, 2015.

4. Lipschutz, S., *Schaum's Outline of Theory and Problems of Data Structures*, McGraw-Hill, 2014

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO010212.1	1	3	1	-	1	-	1	1	3	-	-	-
CO010212.2	1	3	-	1	-	-	-	-	3	1	-	-
CO010212.3	-	2	1	-	-	-	1	-	3	-	3	-
CO010212.4	-	3	-	-	1	-	1	-	3	-	2	-
CO010212.5	-	3	1	-	-	-	1	-	3	1	2	2

MAPPING OF COs WITH PSOs

Cos	PSO 1	PSO2	PSO3	PSO 4	PSO 5
CO010212.1	-	1	3	-	1
CO010212.2	-	3	2	-	-
CO010212.3	-	2	2	2	2
CO010212.4	-	3	1	-	1
CO010212.5	-	2	2	-	1

Teaching –Learning Process

Teaching aids		Open-ended problem/ Numerical	Project-type activity	Lab Work	Open-ended lab work	Delivery mode		Beyond the curriculum
Video, Ppt. etc	Online lecture					Theory/ Description	Numerical / Designed problem	
Yes	Yes	Yes	Yes			90%	10%	10%

Instructions for the paper-setter:

Please go through these instructions thoroughly and follow the same pattern while setting the paper as the students have been prepared according to this format.

Maximum Marks = 70 Times: 3 Hours

Weightage per unit = 14 marks (excluding over attempt weight age)

1. Question Paper will consist of five questions.
2. Section A of question paper is compulsory, containing seven parts each of 2 marks covering the whole syllabus (short answer type- total 14 marks).
3. Four Questions will be from Units I, II, III and IV respectively each having weightage of 14 marks.

Course – IV [Design Analysis of Algorithms]

<table>
<tr><td rowspan="2">Scheme Version:

2022-2023</td><td rowspan="2">Name of the Subject:

Design Analysis of Algorithms</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Semester:</td><td>Contact hours per week: 4</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td><td>II(1st Year)</td><td>Total Hours: 46</td></tr>
<tr><td rowspan="2">Subject Code:

SBS CS 01 02 11 C 3104</td><td rowspan="2">Applicable to Programs:

M.C.A.</td><td rowspan="2">Evaluation (Total Marks):
100</td><td>CIE</td><td>30 Marks</td><td colspan="3">Examination Duration: 3 hours</td></tr>
<tr><td>TEE</td><td>70 Marks</td><td colspan="3">Pre-requisite of course:

Basics of C/C++.</td></tr>
<tr><td>Course Description</td><td colspan="7">To introduce knowledge on basics of fundamental of computer science and various aspects of computational theory, programming, algorithm design, and optimization, network and database management, mobile technologies, electronics and mathematics</td></tr>
<tr><td>Course Objectives</td><td colspan="7">The objective of this course is to reinforce basic design concepts (e.g., pseudo code, specifications, top-down design) and have the knowledge of algorithm design strategies. This course emphasizes mainly on the analysis of an algorithm w.r.t. time and space complexity.</td></tr>
<tr><td>Course Outcomes:</td><td colspan="7">Upon successful completion of the course students will be able to:

CO010213.1 To learn the basic concept of the asymptotic performance of algorithms.
CO010213.2 To understand the write rigorous correctness proofs for algorithms.
CO010213.3 Demonstrate familiarity with major algorithms and data structures and apply them to solve problems.</td></tr>
</table>

	CO010213.4 Analyse the real-life problems and their better solution. **CO010213.5** Evaluation of the analysed problem.	
	COURSE SYLLABUS	
Unit No.	**Content of Each Unit**	**Hours of Each Unit**
1	**Introduction to analysis of algorithms: [Course Outcome (s): CO010213.1]** Analysis of algorithms, asymptotic notation-Big- O, Omega and Theta notations, recurrence relations, solving recurrences, Abstract data types, Linear Data Structures and their sequential storage representation: stacks, queues, priority queues, and their applications.	12
2	**Divide and Conquer: [Course Outcome (s): CO010213.2]** General method, Binary Search, Exponentiation problem, Merge Sort, Quick Sort, Selection Sort, Strassen's Matrix Multiplication algorithms and analysis of algorithms for these problems. **Greedy Method:** General method, Knapsack Problem, Job sequencing with deadlines, Minimum Spanning trees, Single source shortest path and analysis of these algorithms.	12
3	**Dynamic Programming: [Course Outcome (s): CO010213.3]** General method, 0/1 Knapsack problem, Optimal BST, All Pairs shortest path, Traveling Salesman Problem, longest common	12

	subsequence (LCS). **Back Tracking:** General method, 8 queen's problem, graph coloring, Hamiltonian cycles and analysis of these problems.	
4	**NP-Hard and NP-Complete Problems: [Course Outcome (s): CO010213.4]** P, NP, NP-Hard & NP-Complete Classes, Reductions: Vertex cover, Simple Max-Cut, Hamiltonian Circuit, Traveling salesman problem, kernel, 3- dimensional matching, and other NP-Complete Problems, Satisfiability and variations, Cook's theorem, examples of NP-Hard problems.	10

REFERENCE BOOKS

1. Cormen, T.H., Leiserson, C.E., Rivest, R.L. and Stein, C., *Introduction to Algorithms*, MIT Press, 2010.

2. Goodrich, M.T., Tamassia, R. and Mount, D.M., *Data Structures and Algorithms in C++*, John Wiley & Sons, 2016.

3. Langsam, Y., Augenstein, M. and Tenenbaum, A.M., *Data Structures using C and C++*, Prentice Hall, 2015.

4. Lipschutz, S., *Schaum's Outline of Theory and Problems of Data Structures*, McGraw-Hill, 2014

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO010213.1	3	1	-	2	1	3	-	3	-	1	-	-

CO010213.2	3	1	1	-	1	2	-	3	-	-	-	-
CO010213.3	3	-	1	-	-	3	-	3	-	-	3	-
CO010213.4	3	1	-	-	-	3	-	3	-	1	2	2
CO010213.5	3	1	-	-	-	2	-	3	-	-	-	2

MAPPING OF COs WITH PSOs

Cos	PSO 1	PSO2	PSO3	PSO 4	PSO 5
CO010213.1	2	3	-	-	3
CO010213.2	-	3	2	2	3
CO010213.3	-	2	2	3	2
CO010213.4	-	-	3	2	1
CO010213.5	-	2	2	3	2

Teaching –Learning Process

Teaching aids		**Open-ended problem/ Numerical**	**Project-type activity**	**Lab Work**	**Open-ended lab work**	**Delivery mode**		**Beyond the curriculum**
Video, Ppt. etc	Online lecture					Theory/ Description	Numerical / Designed problem	

Yes	Yes	Yes		Yes	Yes	50%	50%	10%

Instructions for the paper-setter:

Please go through these instructions thoroughly and follow the same pattern while setting the paper as the students have been prepared according to this format.

Maximum Marks = 70 Times: 3 Hours

Weightage per unit = 14 marks (excluding over attempt weight age)

1. Question Paper will consist of five qstions.
2. Section A of question paper is compulsory, containing seven parts each of 2 marks covering the whole syllabus (short answer type- total 14 marks).
3. Four Questions will be from Units I, II, III and IV respectively each having weightage of 14 marks.

Course – V [Mobile Communication]

Scheme Version:	**Name of the Subject:**	**L**	**T**	**P**	**C**	**Semester:**	**Contact hours per week:** 3
2022-2023	Mobile Communication	**3**	**1**	**0**	**4**	**II**(1st Year)	**Total Hours: 46**

Subject Code: SBS CS 01 02 04 E 3104	**Applicable to Programs:** M.C.A.	**Evaluation (Total Marks):** 100	**CIE**	**30 Marks**	**Examination Duration: 3 hours**
			TEE	**70 Marks**	**Pre-requisite of course:** Basic Data Structure.
Course Description	To introduce knowledge on basics of fundamental of computer science and various aspects of computational theory, programming, algorithm design, and optimization, network and database management, mobile technologies, electronics and mathematics				
Course Objectives	This course will provide students with both broad and in-depth knowledge, and a critical understanding of mobile computing from different viewpoints: infrastructures, principles and theories, technologies, and applications in different domains. Student will understand the operation of mobile communications systems and their generation divisions.				
Course Outcomes:	Upon successful completion of the course students will be able to: **CO010205.1** Describe the basic fundamentals of wireless communications. **CO010205.2** To understand security, energy efficiency, mobility, scalability, and their unique characteristics in wireless networks. **CO010205.3** Apply basic skills for cellular networks design. **CO010205.4** Analyse knowledge of TCP/IP extensions for mobile and wireless networking. **CO010205.5** Evaluation of mobile and wireless network results.				
	COURSE SYLLABUS				
Unit No.	**Content of Each Unit**				**Hours of Each Unit**
1	**Introduction to Mobile Communications and Computing: [Course Outcome (s): CO010205.1]** Mobile Computing (MC): Introduction to MC, novel applications, limitations, and architecture. Mobile				13

	services, System architecture, Radio interface, Protocols, Localization and calling, Handover, Security, and New data services. **(Wireless) Medium Access Control** Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA.	
2	**Mobile Network Layer: [Course Outcome (s): CO010205.4]** Mobile IP (Goals, assumptions, entities and terminology, IP packet delivery, agent advertisement and discovery, registration, tunneling and encapsulation, optimizations), Dynamic Host Configuration Protocol (DHCP) **Mobile Transport Layer:** Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission /time-out freezing, Selective retransmission, Transaction oriented TCP.	10
3	**Database Issues: [Course Outcome (s): CO010205.2]** Hoarding techniques, caching invalidation mechanisms, client server computing with adaptation, power-aware and context-aware computing, transactional models, query processing, recovery, and quality of service issues. Data Dissemination: Communications asymmetry, classification of new data delivery mechanisms, push based mechanisms, pull-based mechanisms, hybrid mechanisms, selective tuning (indexing) techniques.	12

4	**Mobile Ad hoc Networks (MANETs):[Course Outcome (s): CO010205.3]**Overview, Properties of a MANET, spectrum of MANET applications, routing and various routing algorithms, security in MANETs. **Protocols and Tools:** Wireless Application Protocol-WAP. (Introduction, protocol architecture, and treatment of protocols of all layers), Bluetooth (User scenarios, physical layer, MAC layer, networking, security, link management) and J2ME.	11

REFERENCE BOOKS

1. Cormen, T.H., Leiserson, C.E., Rivest, R.L. and Stein, C., *Introduction to Algorithms,* MIT Press, 2010.

2. Goodrich, M.T., Tamassia, R. and Mount, D.M., *Data Structures and Algorithms in C++*, John Wiley & Sons, 2016.

3. Langsam, Y., Augenstein, M. and Tenenbaum, A.M., *Data Structures using C and C++*, Prentice Hall, 2015.

4. Lipschutz, S., *Schaum's Outline of Theory and Problems of Data Structures*, McGraw-Hill, 2014

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO010205.1	1	2	-	-	1	-	2	-	3	-	-	-
CO010205.2	-	2	-	-	1	1	2	-	3	1	-	-
CO010205.3	-	2	-	-	-	1	-	-	3	-	3	-

CO010205.4	-	2	-	-	1	-	2	-	3	-	2	-
CO010205.5	-	3	-	-	1	-	-	-	2	1	-	-

MAPPING OF COs WITH PSOs

Cos	PSO 1	PSO2	PSO3	PSO 4	PSO 5
CO010205.1	3	-	-	-	1
CO010205.2	-	3	3	1	2
CO010205.3	2	3	3	1	2
CO010205.4	2	-	3	1	-
CO010205.5	-	2	3	-	3

Teaching –Learning Process

Teaching aids		**Open-ended problem/ Numerical**	**Project-type activity**	**Lab Work**	**Open-ended lab work**	**Delivery mode**		**Beyond the curriculum**
Video, Ppt. etc	Online lecture					Theory/ Description	Numerical / Designed problem	
Yes	Yes	Yes	Yes			90%	10%	10%

Instructions for the paper-setter:

Please go through these instructions thoroughly and follow the same pattern while setting the paper as the students have been prepared according to this format.

Maximum Marks = 70 Times: 3 Hours

Weightage per unit = 14 marks (excluding over attempt weight age)

1. Question Paper will consist of five questions.
2. Section A of question paper is compulsory, containing seven parts each of 2 marks covering the whole syllabus (short answer type- total 14 marks).
3. Four Questions will be from Units I, II, III and IV respectively each having weightage of 14 marks.

Course – VI [Management of Information System and E-commerce]

Scheme Version:	**Name of the Subject:**	**L**	**T**	**P**	**C**	**Semester:**	**Contact hours per**

2022-2023	Management of Information System & E-commerece						**week:** 3
		3	**1**	**0**	**4**	**II**(1st Year)	**Total Hours: 46**
Subject Code: SBS CS 01 02 05 E 3104	**Applicable to Programs:** M.C.A.	**Evaluation (Total Marks):** 100	**CIE**	**30 Marks**	**Examination Duration: 3 hours**		
			TEE	**70 Marks**	**Pre-requisite of course:** Basic Data Structure.		
Course Description	To introduce knowledge on basics of fundamental of computer science and various aspects of computational theory, programming, algorithm design, and optimization, network and database management, mobile technologies, electronics and mathematics						
Course Objectives	This course focuses on principles of e-commerce from a business perspective, providing an overview of business and technology topics, business models, virtual value chains and social innovation and marketing strategies. In addition, some of the major issues associated with e- commerce security, privacy, intellectual property rights, authentication, encryption, acceptable use policies, and legal liabilities will be explored. Students will build their own web presence and market it using an online platform.						
Course Outcomes:	Upon successful completion of the course students will be able to: **CO010206.1** Identify the basic concept of relationship between the digital firm, electronic commerce, electronic business and internet technology. **CO010206.2** Understand the relationship between organizations, information systems and business processes, including the processes for customer relationship management and supply chain management. **CO010206.3** Demonstrate an understanding of the foundations and importance of						

	E-commerce and apply them to solve problems. **CO010206.4** Analyse the estimate the effect of changing technology on traditional business models and strategy. **CO010206.5** Evaluation of analyzed problems of business models and strategies.	
	COURSE SYLLABUS	
Unit No.	**Content of Each Unit**	**Hours of Each Unit**
1	**Introduction to the MIS concept [Course Outcome (s): CO010206.1]-** Definition, Role of the MIS, Impact of MIS, MIS and the user, Management as a control system, MIS support to the management, Management effectiveness and MIS, Organization as a system. MIS: organization effectiveness. **Decision Making and DSS-** Decision making concepts, decision-making process, decision- making by analytical modelling, Behavioral concepts in decision making, organizational decision-making, Decision structure, DSS components, Management reporting alternatives.	12
2	**Enterprise Business system [Course Outcome (s): CO010206.2]-** Introduction, cross-functional enterprise applications, real- world case, Functional business system, Introduction, marketing systems, sales force automation, CIM, HRM, Customer relationship management, ERP, Supply chain management. **Client-Server Architecture and E-business Technology-** Client-server architecture,	13

	implementation strategies, Introduction to E-business, the model of E-business, Internet and World Wide Web, Intranet/Extranet, Electronic, Impact of Web on Strategic management, MIS in Web environment.	
3	**Introduction to e-commerce [Course Outcome (s): CO010206.3]** E-commerce Business Models and Concepts, Ecommerce Infrastructure: The Internet and World Wide Web, Web design, JavaScript Internet Information Server (IIS); Personal Web Server (PWS), **E-Commerce techniques and Issues-** Introduction to Active Server Pages (ASP), Building an E-Commerce Web Site, E-Commerce Payment Systems, E-Commerce Marketing Techniques, Building product catalogue, Search Product catalogue, Web Spider and search agent, Ethical, Social and Political Issues in ECommerce.	13
4	**Internet Communication [Course Outcome (s): CO010206.4]-** Transaction Systems, Shopping Carts, XML, E-Commerce Applications: Business-to-Consumer(B2C), Consumer-to-Consumer (C2C), Business- to- Business (B2B), Digital Government, Marketplaces, and Communities, Security and Encryption, Web Security.	08
REFERENCE BOOKS		

1. Cormen, T.H., Leiserson, C.E., Rivest, R.L. and Stein, C., *Introduction to Algorithms,* MIT Press, 2010.

2. Goodrich, M.T., Tamassia, R. and Mount, D.M., *Data Structures and Algorithms in C++*, John Wiley & Sons, 2016.

3. Langsam, Y., Augenstein, M. and Tenenbaum, A.M., *Data Structures using C and C++*, Prentice Hall, 2015.

4. Lipschutz, S., *Schaum's Outline of Theory and Problems of Data Structures*, McGraw-Hill, 2014

COURSE ARTICULATION MATRIX

COs	**PO1**	**PO2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**
CO010206.1	1	-	3	-	1	2	3	1	-	1	-	-
CO010206.2	1	1	2	-	1	2	1	1	-	1	-	-
CO010206.3	-	-	1	1	-	2	3	2	-	-	2	-
CO010206.4	-	2	-	1	1	2	2	1	-	-	3	2
CO010206.5	-	1	-	2	-	2	3	2	-	1	-	2

MAPPING OF COs WITH PSOs

Cos	PSO 1	PSO2	PSO3	PSO 4	PSO 5
CO010206.1	1	1	-	-	1
CO010206.2	-	3	-	2	-
CO010206.3	2	2	3	2	2
CO010206.4	-	2	-	1	1

CO010206.5	2	2	-	2	2

Teaching –Learning Process

Teaching aids		**Open-ended problem/ Numerical**	**Project-type activity**	**Lab Work**	**Open-ended lab work**	**Delivery mode**		**Beyond the curriculum**
Video, Ppt. etc	Online lecture					Theory/ Description	Numerical / Designed problem	
Yes	Yes	Yes				90%	10%	10%

Instructions for the paper-setter:

Please go through these instructions thoroughly and follow the same pattern while setting the paper as the students have been prepared according to this format.

Maximum Marks = 70 Times: 3 Hours

Weightage per unit = 14 marks (excluding over attempt weight age)

1. Question Paper will consist of five questions.
2. Section A of question paper is compulsory, containing seven parts each of 2 marks covering the whole syllabus (short answer type- total 14 marks).
3. Four Questions will be from Units I, II, III and IV respectively each having weightage of 14 marks.

Course – VII [Quantum Computing]

<table>
<tr><td rowspan="2">Scheme Version:

2022-2023</td><td rowspan="2">Name of the Subject:

Quantum Computing</td><td>L</td><td>T</td><td>P</td><td>C</td><td>Semester:</td><td>Contact hours per week: 3</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td><td>II(1st Year)</td><td>Total Hours: 45</td></tr>
<tr><td rowspan="2">Subject Code:

SBS CS 01 02 06 E 3003</td><td rowspan="2">Applicable to Programs:

M.C.A.</td><td rowspan="2">Evaluation (Total Marks):
100</td><td>CIE</td><td>30 Marks</td><td colspan="3">Examination Duration: 3 hours</td></tr>
<tr><td>TEE</td><td>70 Marks</td><td colspan="3">Pre-requisite of course:</td></tr>
<tr><td>Course Description</td><td colspan="7">To introduce knowledge on basics of fundamental of computer science and various aspects of computational theory, programming, algorithm design, and optimization, network and database management, mobile technologies, electronics</td></tr>
</table>

	and mathematics	
Course Objectives	This course aims to introduce the fundamentals of quantum computation. This course provides an interdisciplinary introduction to the emerging field of quantum computer science, explaining basic quantum mechanics, quantum entanglement, its structure and its physical consequences and introduces quits.	
Course Outcomes:	Upon successful completion of the course students will be able to: **CO010207.1** Learn the basic concept of complex vector spaces. **CO010207.2** To understand the quantum mechanics in quantum computing. **CO010207.3** Apply architecture the quantum algorithms and solve problem. **CO010207.4** Analyse the fundamentals of quantum computation. **CO010207.5** Evaluation of the quantum computation.	
	COURSE SYLLABUS	
Unit No.	**Content of Each Unit**	**Hours of Each Unit**
1	**[Course Outcome (s): CO010207.1]** Complex numbers and its geometrical representations, Complex vector spaces, inner products and Hilbert spaces, Hermitian and unitary matrices, Tensor products of vector spaces	07
2	**[Course Outcome(s):CO010207.2]** Deterministic Systems, Probabilistic descriptions and Quantum systems, Basics of Quantum theory, Schrodinger's time dependent equation, Wave nature of Particles, state vector, operators, postulates of quantum mechanics, Dirac formalism, Stern-Gerlach experiment, electron spin, superposition of states, entanglement	12

3	**[Course Outcome (s): CO010207.3]** Bits and Qubits, Classical gates versus quantum gates, single qubit gates, multiple qubit gates, design of quantum circuits, Deutsch's Algorithm, DeutschJozsa Algorithm, Simon's periodicity algorithm, Grover's search algorithm, Shor's Factoring algorithm	12
4	**[Course Outcome (s): CO010207.4]** Quantum programming languages, Probabilistic and Quantum computations, introduction to quantum cryptography and quantum information theory, Comparison between classical and quantum information theory, Bell states, no cloning theorem, Quantum error correction.	14

REFERENCE BOOKS

1. Cormen, T.H., Leiserson, C.E., Rivest, R.L. and Stein, C., *Introduction to Algorithms,* MIT Press, 2010.

2. Goodrich, M.T., Tamassia, R. and Mount, D.M., *Data Structures and Algorithms in C++*, John Wiley & Sons, 2016.

3. Langsam, Y., Augenstein, M. and Tenenbaum, A.M., *Data Structures using C and C++*, Prentice Hall, 2015.

4. Lipschutz, S., *Schaum's Outline of Theory and Problems of Data Structures*, McGraw-Hill, 2014

COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO010207.1	3	1	1	-	1	2	3	1	2	3	-	-
CO010207.2	2	-	1	-	1	2	1	1	2	2	-	-

CO010207.3	1	1	2	-	1	2	2	-	2	3	3	-
CO010207.4	1	1	-	-	1	2	-	1	2	2	-	-
CO010207.5	1	1	-	-	1	2	-	-	2	3	-	-

MAPPING OF COs WITH PSOs

Cos	PSO 1	PSO2	PSO3	PSO 4	PSO 5
CO010207.1	1	2	-	-	1
CO010207.2	-	3	3	1	2
CO010207.3	-	2	1	1	2
CO010207.4	3	-	-	1	1
CO010207.5	-	2	1	1	2

Teaching –Learning Process

Teaching aids		**Open-ended problem/ Numerical**	**Project-type activity**	**Lab Work**	**Open-ended lab work**	**Delivery mode**		**Beyond the curriculum**
Video, Ppt. etc	Online lecture					Theory/ Description	Numerical / Designed	

							problem	
Yes	Yes	Yes				70%	30%	10%

Instructions for the paper-setter:

Please go through these instructions thoroughly and follow the same pattern while setting the paper as the students have been prepared according to this format.

Maximum Marks = 70 Times: 3 Hours

Weightage per unit = 14 marks (excluding over attempt weight age)

1. Question Paper will consist of five questions.
2. Section A of question paper is compulsory, containing seven parts each of 2 marks covering the whole syllabus (short answer type- total 14 marks).
3. Four Questions will be from Units I, II, III and IV respectively each having weightage of 14 marks.

Course – VIII [Computer graphics]

Scheme Version:	**Name of the Subject:** Computer	**L**	**T**	**P**	**C**	**Semester:**	**Contact hours per week:** 4

<table>
<tr><td>2022-2023</td><td>graphics</td><td>3</td><td>1</td><td>0</td><td>4</td><td>II(1st Year)</td><td>Total Hours: 46</td></tr>
<tr><td rowspan="2">Subject Code:
SBS CS 01 02 07 E 3104</td><td rowspan="2">Applicable to Programs:
M.C.A.</td><td rowspan="2">Evaluation (Total Marks):
100</td><td>CIE</td><td>30 Marks</td><td colspan="3">Examination Duration: 3 hours</td></tr>
<tr><td>TEE</td><td>70 Marks</td><td colspan="3">Pre-requisite of course:
Basics of Graphic.</td></tr>
<tr><td>Course Description</td><td colspan="7">To introduce knowledge on basics of fundamental of computer science and various aspects of computational theory, programming, algorithm design, and optimization, network and database management, mobile technologies, electronics and mathematics</td></tr>
<tr><td>Course Objectives</td><td colspan="7">The main objective of this course is to introduce the concepts of computer graphics to the students. It starts with an overview of interactive computer graphics, two-dimensional system and mapping, then it presents the most important drawing algorithm, two- dimensional transformation; Clipping, filling and an introduction to 3-D graphics.</td></tr>
<tr><td>Course Outcomes:</td><td colspan="7">Upon successful completion of the course students will be able to:
CO010210.1 Describe the basic concepts of computer graphics.
CO010210.2 To implement various scan conversion problems with programming.
CO010210.3 Apply various transformations on the digital drawings.
CO010210.4 Analyse various modelling techniques in multimedia object creation.
CO010210.5 Graphics evaluation and shading in 3D transformation.</td></tr>
<tr><td></td><td colspan="7">COURSE SYLLABUS</td></tr>
</table>

Unit No.	Content of Each Unit	Hours of Each Unit
1.	**Introduction: [Course Outcome (s): CO010210.1]** Survey of computer Graphics and its applications; Interactive and passive graphics; display processors; Graphic Devices: Display systems-refresh CRTs, raster scan and random scan monitors, grey shades, Interlacing, beam penetration shadow mask monitors, lookup tables, plasma panel, LED and LCD monitors, VGA and SVGA resolutions; Hard copy Devices-printers, plotters; Interactive Input Devices.	10
2.	**Drawing Geometry: [Course Outcome (s): CO010210.2]** Coordinate system; resolution; use of the homogeneous coordinate system; scan conversion: symmetrical DDA, simple DDA, Bradenham's line drawing algorithm, Circle drawing using DDA and polar coordinates, Bradenham's circle drawing algorithm, generation of an ellipse. Curve Drawing.	10
3.	**2-D Transformations: [Course Outcome (s): CO010210.3]** Translation; rotation; scaling; mirror reflection; shearing; zooming; panning; input techniques-pointing, positioning, rubber band methods and dragging; tweening, Morphing. Graphic operations: Clipping-line clipping using Sutherland-Cohen and midpoint sub- division algorithm, Liang Barsky Line clippers algorithm, polygon clipping; window and	13

	viewport; windowing transformation; Filling algorithms.	
4.	**3-D Graphics: [Course Outcome (s): CO010210.4]** 3D modelling of objects; 3D display techniques; coordinate system; 3D transformation matrices for translation, scaling and rotation; parallel projection; perspective projection; Hidden-surface removal - Z-buffer, back face, scan-line, depth- sorting, area subdivision; Shading - modelling light intensities, Gouraud shading, Phong shading.	13

REFERENCE BOOKS

1. Cormen, T.H., Leiserson, C.E., Rivest, R.L. and Stein, C., *Introduction to Algorithms,* MIT Press, 2010.

2. Goodrich, M.T., Tamassia, R. and Mount, D.M., *Data Structures and Algorithms in C++*, John Wiley & Sons, 2016.

3. Langsam, Y., Augenstein, M. and Tenenbaum, A.M., *Data Structures using C and C++*, Prentice Hall, 2015.

4. Lipschutz, S., *Schaum's Outline of Theory and Problems of Data Structures,* McGraw-Hill, 2014

COURSE ARTICULATION MATRIX

COs	**PO1**	**PO2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**

CO010210.1	1	-	2	-	-	1	-	-	1	2	-	-
CO010210.2	-	-	2	-	2	-	-	1	-	1	-	-
CO010210.3	1	-	2	-	-	-	1	-	1	2	3	-
CO010210.4	-	-	2	-	1	-	-	-	-	-	3	3
CO010210.5	-	-	2	-	1	-	-	-	1	2	-	-

MAPPING OF COs WITH PSOs

Cos	PSO 1	PSO2	PSO3	PSO 4	PSO 5
CO010210.1	3	-	-	1	1
CO010210.2	2	1	2	2	1
CO010210.3	-	1	2	2	2
CO010210.4	-	2	2	3	2
CO010210.5	-	1	2	2	2

Teaching –Learning Process

Teaching aids		**Open-ended problem/ Numerical**	**Project -type activity**	**Lab Work**	**Open - ended lab work**	**Delivery mode**		**Beyond the curriculum**
Video, Ppt. etc	Online lecture					Theory/ Description	Numerical / Designed problem	

Yes	Yes	Yes				90%	10%	10%

Instructions for the paper-setter:

Please go through these instructions thoroughly and follow the same pattern while setting the paper as the students have been prepared according to this format.

Maximum Marks = 70 Times: 3 Hours

Weightage per unit = 14 marks (excluding over attempt weight age)

1. Question Paper will consist of five questions.
2. Section A of question paper is compulsory, containing seven parts each of 2 marks covering the whole syllabus (short answer type- total 14 marks).
3. Four Questions will be from Units I, II, III and IV respectively each having weightage of 14 marks.

Master of Computer Application [MCA]

3rd Semester

<table>
<tr><td rowspan="2">Scheme Version:

2022-2023</td><td rowspan="2">Name of the Subject:

Artificial Intelligence and Expert System</td><td>L</td><td>T</td><td>P</td><td>C</td><td rowspan="2">Semester:

III

(2nd Year)</td><td>Contact hours per week: 4</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td><td>Total Hours:48</td></tr>
<tr><td rowspan="2">Subject Code:

SBS CS 01 03 15 C 3104</td><td rowspan="2">Applicable to Programs:

M.C.A.</td><td rowspan="2">Evaluation (Total Marks):
100</td><td>CIE</td><td>30 Marks</td><td colspan="3">Examination Duration: 3 hours</td></tr>
<tr><td>TEE</td><td>70 Marks</td><td colspan="3">Pre-requisite of course:</td></tr>
<tr><td>Course Description</td><td colspan="7">To introduce knowledge on basics of fundamental of computer science and various aspects of computational theory, programming, algorithm design, and optimization, network and database management, mobile technologies, electronics and mathematics</td></tr>
</table>

Course Objectives	The primary objective of this course is to introduce the basic principles, techniques, and applications of Artificial Intelligence. Emphasis will be placed on the teaching of these fundamentals and labs for the 'hands-on' approach for understanding, as well as a challenging avenue for exploration and creativity.	
Course Outcomes:	Upon successful completion of the course students will be able to: **CO010319.1** Choose problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem. **CO010319.2** Examine a given problem in the language/framework of different AI methods **CO010319.3** Apply basic AI algorithms (e.g., standard search algorithms or resolution) and solve problems. **CO010319.4** Analyse and carry out an empirical evaluation of different algorithms on a problem formalization.	
	COURSE SYLLABUS	
Unit No.	**Content of Each Unit**	**Hours of Each Unit**
1.	**Basic Concepts: [Course Outcome CO010319.1]** AI and its importance, history of AI, applications areas, AI approach for solving problems. Problem representation: State space representation, problem reduction representation, bounding functions. Propositional logic: syntax and semantics. First order predicate logic (FOPL): syntax and semantics, conversion to clausal form, inference rules, unification, resolution principle, proof procedure, refutation.	**12**

2.	**Search and Control Strategies: [Course Outcome CO010319.2]** Strategies for state space search, data driven and goal driven search; Search algorithms-uninformed search (depth first, breadth first, depth first with iterative deepening) and informed search (Hill climbing, best first, A, A*, AO algorithm, mini-max etc.), computational complexity, Properties of search algorithms Admissibility, Monotonicity, Optimality, Dominance, etc., genetic algorithms.	**14**
3.	**Expert System Architecture: [Course Outcome CO010319.3]** Rule based architecture, non-production system architecture. Components of Expert Systems, Stages of expert system development, Expert systems applications, Building Expert System and Shell. Knowledge acquisition and validation.	**12**
4.	**Managing uncertainty in expert systems: [Course Outcome CO010319.4]** Bayesian probability theory, Stanford certainty factor algebra, No monotonic logic and reasoning with beliefs, Fuzzy logic, Dempster/Shaffer theory.	**10**

REFERENCE BOOKS

1. Luger, G.F. and Stubblefield, W.A., Artificial Intelligence and The Design of Expert Systems, Benjamin-Cummings Publishing Co. Inc., 2008.

2. Nilsson, N.J., Principles of Artificial Intelligence, Morgan Kaufmann, 2014.

3. Patterson, D.W., Introduction to Artificial Intelligence and Expert Systems, Prentice-hall of India, 2007.

4. Rich, E.K. and Nair, S.B., Artificial Intelligence, New Delhi, 2009.

5. Russell, S., and Norvig, P., Artificial Intelligence: A Modern Approach, Prentice Hall, 2015.

COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO010319.1	1	-	3	-	1	-	-	2	1	1	-	-
CO010319.2	-	1	3	2	-	2	-	-	-	-	-	-
CO010319.3	1	2	3	2	1	-	1	-	1	-	-	-
CO010319.4	-	1	3	-	-	1	-	1	-	1	2	-
CO010319.5	1	1	3	2	-	-	1	-	1	-	-	-

MAPPING OF COs WITH PSOs

Cos	PSO 1	PSO2	PSO3	PSO 4	PSO5
CO010319.1	2	2	2	2	-
CO010319.2	1	2	1	1	1
CO010319.3	2	2	1	-	2
CO010319.4	1	2	2	2	1
CO010319.5	1	2	1	1	2

Teaching –Learning Process

Teaching aids		Open-ended problem/ Numerical	Project-type activity	Lab Work	Open-ended lab work	Delivery mode		Beyond the curriculum
Video, Ppt. etc	Online lecture					Theory/ Description	Numerical / Designed problem	
Yes	Yes	Yes	Yes	Yes	Yes	70%	30%	10%

Instructions for the paper-setter:

Please go through these instructions thoroughly and follow the same pattern while setting the paper as the students have been prepared according to this format.

Maximum Marks = 70 Times: 3 Hours

Weightage per unit = 14 marks (excluding over attempt weight age)

1. Question Paper will consist of five questions.
2. Section A of question paper is compulsory, containing seven parts each of 2 marks covering the whole syllabus (short answer type- total 14 marks).
3. Four Questions will be from Units I, II, III and IV respectively each having weightage of 14 marks.

<table>
<tr><td rowspan="2">Scheme Version:

2022-2023</td><td rowspan="2">Name of the Subject:

Theory of Computation</td><td>L</td><td>T</td><td>P</td><td>C</td><td rowspan="2">Semester:

III (2nd Year)</td><td>Contact hours per week: 3</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td><td>Total Hours: 46</td></tr>
<tr><td rowspan="2">Subject Code:

SBS CS 01 03 16 C 3104</td><td rowspan="2">Applicable to Programs:

M.C.A.</td><td rowspan="2">Evaluation (Total Marks):
100</td><td>CIE</td><td>30 Marks</td><td colspan="3">Examination Duration: 3 hours</td></tr>
<tr><td>TEE</td><td>70 Marks</td><td colspan="3">Pre-requisite of course:</td></tr>
<tr><td>Course Description</td><td colspan="7">To introduce knowledge on basics of fundamental of computer science and various aspects of computational theory, programming, algorithm design, and optimization, network and database management, mobile technologies, electronics and mathematics</td></tr>
<tr><td>Course Objectives</td><td colspan="7">This course aims to introduce the fundamentals of quantum computation. This course provides an interdisciplinary introduction to the emerging field of quantum computer science, explaining basic quantum mechanics, quantum entanglement, its structure and its physical consequences and introduces quits.</td></tr>
<tr><td>Course Outcomes:</td><td colspan="7">Upon successful completion of the course students will be able to:
CO010208.1 Relate practical problems to languages, automata, and computability.
CO010208.2 Understand the mathematical and formal techniques for solving problems.
CO010208.3 Distinguish different computing languages and classify their</td></tr>
</table>

	respective types and apply them to solve problem. **CO010208.4** Analyze and design finite automata, pushdown automata, Turing machines, formal languages, and grammars. **CO010208.5** Evaluation of the analysed problems in automata.	
	COURSE SYLLABUS	
Unit No.	**Content of Each Unit**	**Hours of Each Unit**
1	**Recursive Languages [Course Outcome CO010208.1]:** Recursive definition, Alphabets, Language, Regular expression, definitions of Finite state machine, Transition graphs, Deterministic & non-deterministic finite state machines, Regular grammar, Left-linear and right linear, Thomson's construction to convert regular Expression to NDFA & subset algorithm to convert NDFA to DFA. Minimization of DFA, Finite state machine with output (Moore machine and Mealy Machine), conversion of Moore machine to Mealy machine & vice-versa.	**14**
2	**Properties of Regular Languages [Course Outcome CO010208.2]:** Conversion of DFA to regular expression, Pumping lemma, Properties and limitations of finite state machine, Decision properties of regular languages, Application of finite automata. **Context Free Grammar:** Context free grammar, Writing context free grammar for problems, Derivation tree and ambiguity, Application of context free grammars, Chomsky and Greibach Normal form, Conversion of CFG to CNF and GNF. Properties of	**12**

	context free grammar, CYK algorithm	
3	**PDA [Course Outcome CO010208.3 & CO010208.4] :** Push down stack machine, Design of deterministic and non-deterministic push-down stack, Parser design. **Turing Machine :**Turing machine definition and design of Turing Machine, Church- Turing Thesis, Variations of Turing Machines, combining Turing machine, Universal Turing Machine, Post Machine, Chomsky Hierarchy.	**12**
4	**Incommutability [Course Outcome CO010208.4]:** Halting problem, Turing enumerability, Turing acceptability and Turing decidability, Unsolvable problems about Turing machines. Computation Complexity: P, NP and NP Complete Problems.	**8**

REFERENCE BOOKS

1. Cormen, T.H., Leiserson, C.E., Rivest, R.L. and Stein, C., *Introduction to Algorithms*, MIT Press, 2010.

2. Goodrich, M.T., Tamassia, R. and Mount, D.M., *Data Structures and Algorithms in C++*, John Wiley & Sons, 2016.

3. Langsam, Y., Augenstein, M. and Tenenbaum, A.M., *Data Structures using C and C++*, Prentice Hall, 2015.

4. Lipschutz, S., *Schaum's Outline of Theory and Problems of Data Structures*, McGraw-Hill, 2014

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO010207.1	-	1	-	3	-	-	-	-	-	1	-	-
CO010207.2	3	-	3	-	-	1	-	2	-	1	-	-
CO010207.3	1	-	-	3	1	-	-	2	3	-	3	-
CO010207.4	-	-	-	3	-	1	-	1	-	-	2	3
CO010207.5	2	-	3	-	1	-	-	2	2	1	-	2

MAPPING OF COs WITH PSOs

Cos	PSO 1	PSO2	PSO3	PSO 4	PSO 5
CO010207.1	1	2	-	-	1
CO010207.2	-	1	-	-	2
CO010207.3	1	-	-	-	-
CO010207.4	-	1	-	-	2
CO010207.5	-	1	-	2	1

Teaching –Learning Process

Teaching aids	Open-ended problem/ Numerica	Project-type activity	Lab Work	Open-ended lab	Delivery mode	Beyond the curriculum

		l			**work**			
Video, Ppt. etc	Online lecture					Theory/ Description	Numerical / Designed problem	
Yes	Yes	Yes				70%	30%	10%

Instructions for the paper-setter:

Please go through these instructions thoroughly and follow the same pattern while setting the paper as the students have been prepared according to this format.

Maximum Marks = 70 Times: 3 Hours

Weightage per unit = 14 marks (excluding over attempt weight age)

1. Question Paper will consist of five questions.
2. Section A of question paper is compulsory, containing seven parts each of 2 marks covering the whole syllabus (short answer type- total 14 marks).
3. Four Questions will be from Units I, II, III and IV respectively each having weightage of 14 marks.

<table>
<tr><td rowspan="2">Scheme Version:

2022-2023</td><td rowspan="2">Name of the Subject:

Internet and java Programming</td><td>L</td><td>T</td><td>P</td><td>C</td><td rowspan="2">Semester:

III

(2nd Year)</td><td>Contact hours per week: 4</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td><td>Total Hours: 50</td></tr>
<tr><td rowspan="2">Subject Code:

SBS CS 01 03 17 C 3104</td><td rowspan="2">Applicable to Programs:

M.C.A.</td><td rowspan="2">Evaluation (Total Marks):
100</td><td>CIE</td><td>30 Marks</td><td colspan="3">Examination Duration: 3 hours</td></tr>
<tr><td>TEE</td><td>70 Marks</td><td colspan="3">Pre-requisite of course:</td></tr>
<tr><td>Course Description</td><td colspan="7">To introduce knowledge on basics of fundamental of computer science and various aspects of computational theory, programming, algorithm design, and optimization, network and database management, mobile technologies, electronics and mathematics</td></tr>
<tr><td>Course Objectives</td><td colspan="7">The objective of this course is to teach students about programming in the Java language and the use of Java in a variety of technologies and on different platforms.</td></tr>
</table>

Course Outcomes:	Upon successful completion of the course students will be able to: **CO010321.1** Describe the basic fundamental blocks of the Internet and TCP/IP. **CO010321.2** Understand classes, objects, members of a class and relationships among them needed for a specific problem **CO010321.3** Write Java application programs using OOP principles and proper program Structuring and apply them to solve problems. **CO010321.4** Analyse the concepts of polymorphism, inheritance and error handling techniques using exception handling. **CO010321.5** Evaluation of AWT and Swings with the use of exception handling.	
	COURSE SYLLABUS	
Unit No.	**Content of Each Unit**	**Hours of Each Unit**
5.	**Internetworking with TCP / IP:** [**Course outcome CO010321.1]** Review of network technologies, Internet addressing, Address resolution protocols (ARP / RARP), Routing IP datagrams, Reliable stream transport service (TCP) TCP / IP over ATM networks, Internet applications - E-mail, Telnet, FTP, NFS, Internet traffic management.	**10**
6.	[**Course outcome CO010321.2]** The overview of Java's architecture and the architecture of the Java Virtual Machine (JVM). Methods: **Method** Declarations, this reference, Method Overloading, Constructors, The Default Constructor and Constructors overloading. Arrays, Anonymous Arrays, Multidimensional Arrays, The main () Method, Program Arguments. **Classes:** Declaring Members (Fields and Methods),	**16**

	Instance Members, Static Members. **Objects:** Class Instantiation, Reference Values, and References. Primitive Data Types, Variable Declarations, Initial Values for Variables, Class Declarations.	
7.	**Object-Oriented Programming:** [**Course outcome CO010321.3]** Single Implementation Inheritance, Overriding Methods, Hiding Members, The Object Reference super, Chaining Constructors Using this () and super (). **Interfaces:** Defining Interfaces, Abstract Method Declarations, Implementing Interfaces, Extending Interfaces, Interface References, Constants in Interfaces, Polymorphism and Dynamic Method Lookup	**12**
8.	**Exception Handling:** [**Course outcome CO010321.4]** The try Block, the catch Block, the finally Block, the throw Statement, the throws Clause, Checked and Unchecked Exceptions, Defining New Exceptions. **Multithreading:** Overview of Threads, the Main Thread, Thread Creation, Synchronization, Thread Transitions. Basics of Event Handling, Graphics Programming using AWT and Swing	**12**
REFERENCE BOOKS		

1. Comer, D.E., Stevens, D.L. and Evangelista, M., Internetworking with TCP/IP, Vol. III: Client-Server Programming and Applications, Prentice Hall, 2001.

2. Deitel, P. and Deitel, H., Java How to Program, Pearson Education, 2015.

3. Eckel, B., Thinking in Java, Pearson Education, 2006.

4. Freeman, A. and Ince, D., Programming the Internet with Java, Addison-Wesley Longman Publishing Co. Inc., 1998.

5. Horstmann, C.S. and Cornell, G., Core Java Volume I (Fundamentals), Pearson, 2019.

COURSE ARTICULATION MATRIX

COs	**PO 1**	**PO 2**	**PO 3**	**PO4**	**PO 5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO010321.1	-	-	-	2	1	1	1	3	1	1	-	-
CO010321.2	-	1	-	-	1	2	2	3	2	-	-	-
CO010321.3	-	-	-	2	-	2	1	3	1	1	3	-
CO010321.4	-	1	-	-	1	1	1	3	1	-	-	3
CO010321.5	-	-	-	2	2	2	1	3	1	-	-	2

MAPPING OF COs WITH PSOs

COs	PSO 1	PSO2	PSO3	PSO 4	PSO5
CO010321.1	2	2	2	3	1
CO010321.2	2	3	2	3	1
CO010321.3	1	3	1	2	1
CO010321.4	1	2	1	2	2

CO010321.5	1	2	1	2	2

Teaching –Learning Process

Teaching aids		**Open-ended problem/ Numerical**	**Project -type activity**	**Lab Work**	**Open - ended lab work**	**Delivery mode**		**Beyond the curriculum**
Video, Ppt. etc	Online lecture					Theory/ Description	Numerical / Designed problem	
Yes	Yes	Yes	Yes	Yes	Yes	50%	50%	10%

I

nstructions for the paper-setter:

Please go through these instructions thoroughly and follow the same pattern while setting the paper as the students have been prepared according to this format.

Maximum Marks = 70 Times: 3 Hours

Weightage per unit = 14 marks (excluding over attempt weight age)

1. Question Paper will consist of five questions.
2. Section A of question paper is compulsory, containing seven parts each of 2 marks covering the whole syllabus (short answer type- total 14 marks).
3. Four Questions will be from Units I, II, III and IV respectively each having weightage of 14 marks.

Scheme Version:	**Name of the Subject:**	**L**	**T**	**P**	**C**	**Semester:**	**Contact hours per week: 3**
2022-2023	Network Programming	**3**	**1**	**0**	**4**	**III** (2^{nd} Year)	**Total Hours:**

							46
Subject Code: SBS CS 01 03 08 E 3104	**Applicable to Programs:** M.C.A.	**Evaluation (Total Marks):** 100	**CIE**	**30 Marks**	**Examination Duration: 3 hours**		
			TEE	**70 Marks**	**Pre-requisite of course:** Basic Computer Network.		
Course Description	To introduce knowledge on basics of fundamental of computer science and various aspects of computational theory, programming, algorithm design, and optimization, network and database management, mobile technologies, electronics and mathematics						
Course Objectives	The objective of this course is to teach how to write network programs using an application program interface (or API), implement basics of socket programming using TCP Sockets. This course will guide the students to create client and server applications using the "Sockets" API and the implementation of Data link layer protocol and TCP layer.						
Course Outcomes:	Upon successful completion of the course students will be able to: **CO010309.1** To learn the basic concept of key protocols that support the Internet. **CO010309.2** To understand the detailed knowledge of the TCP/UDP Sockets. **CO010309.3** Apply advanced programming techniques such as Broadcasting, Multicasting and apply them to solve problem. **CO010309.4** Analysing the DNS and Functional of IPV6 **CO010309.5** Evaluation of the security requirements of a networked programming environment and identify the issues to be solved.						
	COURSE SYLLABUS						
Unit No.	**Content of Each Unit**					**Hours of Each Unit**	
1.	**Introduction to Network Programming: [Course Outcome CO010309.1]**OSI model, Unix standards,					**10**	

	TCP and UDP & TCP connection establishment and Format, Buffer sizes and limitation, standard internet services, Protocol usage by common internet application. **Sockets:** Address structures, value – result arguments, Byte ordering and manipulation function and related functions Elementary TCP sockets – Socket, connect, bind, listen, accept, fork and exec function, concurrent servers. Close function and related function.	
2.	**TCP client server: [Course Outcome CO010309.3]** Introduction, TCP Echo server functions, Normal startup, terminate and signal handling server process termination, Crashing and Rebooting of server host shutdown of server host. **I/O Multiplexing and socket options:** I/O Models, select function, Batch input, shutdown function, poll function, TCP Echo server, getsockopt and setsockopt functions. Socket states, Generic socket option IPV6 socket option ICMPV6 socket option IPV6 socket option and TCP socket options.	**12**
3.	**Elementary UDP sockets: [Course Outcome CO010309.2 & CO010309.4]** Introduction UDP Echo server function, lost datagram, summary of UDP example, Lack of flow control with UDP, determining outgoing interface with UDP. **Elementary name and Address conversions:** DNS,	**12**

	get host by Name function, Resolver option, Function and IPV6 support, uname function, other networking information.	
4.	**IPC: [Course Outcome CO010309.5]** Introduction, File and record locking, Pipes, FIFOs streams and messages, Name spaces, system IPC, Message queues, Semaphores. **Remote Login:** Terminal line disciplines, Pseudo-Terminals, Terminal modes, Control Terminals, rlogin Overview, RPC Transparency Issues.	**12**

REFERENCE BOOKS

1. Chan, T., Unix System Programming using *C++*, Prentice Hall, 1999 .
2. Glass, G. and Ables, K., *UNIX for Programmers and Users*, Prentice Hall, 2003.
3. Richard, S.W., *Unix Network Programming. In The Sockets Networking API (Vol. 1)*, Pearson Education India, 2015.
4. Rochkind, M.J., *Advanced UNIX Programming*, Pearson Education, 2004.
5. Stevens, W.R., Rudoff, A.M. and Fenner, B., *UNIX Network Programming Volume 1: The Sockets Networking API (Vol. 3)*, Addison-Wesley Professional, 2003.

COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO010309.1	-	2	-	-	1	-	2	2	3	1	-	-

CO010309.2	1	2	1	-	-	1	2	2	3	-	-	-
CO010309.3	1	1	1	-	1	1	2	1	2	1	3	3
CO010309.4	-	1	-	-	1	-	1	2	2	-	-	-
CO010309.5	1	-	-	1	-	1	1	1	2	1	2	3

MAPPING OF COs WITH PSOs

Cos	PSO 1	PSO2	PSO3	PSO 4	PSO5
CO010309.1	2	2	1	2	1
CO010309.2	2	2	1	1	1
CO010309.3	1	1	-	-	-
CO010309.4	1	1	-	-	2
CO010309.5	2	1	1	1	-

Teaching –Learning Process

Teaching aids		**Open-ended problem/ Numerical**	**Project-type activity**	**Lab Work**	**Open-ended lab work**	**Delivery mode**		**Beyond the curriculum**
Video, Ppt. etc	Online lecture					Theory/ Description	Numerical / Designed problem	
Yes	Yes	Yes	Yes			60%	40%	10%

Instructions for the paper-setter:

Please go through these instructions thoroughly and follow the same pattern while setting the paper as the students have been prepared according to this format.

Maximum Marks = 70 Times: 3 Hours

Weightage per unit = 14 marks (excluding over attempt weight age)

1. Question Paper will consist of five questions.
2. Section A of question paper is compulsory, containing seven parts each of 2 marks covering the whole syllabus (short answer type- total 14 marks).
3. Four Questions will be from Units I, II, III and IV respectively each having weightage of 14 marks.

<table>
<tr><td rowspan="2">Scheme Version:

2022-2023</td><td rowspan="2">Name of the Subject:

Machine and Deep Learning</td><td>L</td><td>T</td><td>P</td><td>C</td><td rowspan="2">Semester:

III

(2nd Year)</td><td>Contact hours per week: 3</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td><td>Total Hours: 48</td></tr>
<tr><td rowspan="2">Subject Code:

SBS CS 01 03 09 E 3104</td><td rowspan="2">Applicable to Programs:

M.C.A.</td><td rowspan="2">Evaluation (Total Marks):
100</td><td>CIE</td><td>30 Marks</td><td colspan="3">Examination Duration: 3 hours</td></tr>
<tr><td>TEE</td><td>70 Marks</td><td colspan="3">Pre-requisite of course:</td></tr>
<tr><td>Course Description</td><td colspan="7">To introduce knowledge on basics of fundamental of computer science and various aspects of computational theory, programming, algorithm design, and optimization, network and database management, mobile technologies, electronics and mathematics</td></tr>
<tr><td>Course Objectives</td><td colspan="7">This course will serve as a comprehensive introduction to various topics in machine learning. At the end of the course, the students should be able to design and implement machine learning solutions to classification, regression, and clustering problems; and be able to evaluate and interpret the results of the algorithms.</td></tr>
<tr><td>Course Outcomes:</td><td colspan="7">Upon successful completion of the course students will be able to:

CO010310.1 Discuss the basic concept of supervised and unsupervised learning algorithms.
CO010310.2 To understand the fundamental concepts in machine learning and popular machine learning algorithms.</td></tr>
</table>

	CO010310.3 Solve problems related to the application of machine learning algorithms with programming in Python/MatLab. **CO010310.4** Analyse the concept of Deep Learning. **CO010310.5** Evaluation the result of Deep Learning.	
	COURSE SYLLABUS	
Unit No.	**Content of Each Unit**	**Hours of Each Unit**
1.	**Introduction: [Course Outcome CO010310.1]** History of Machine Learning, Programs vs learning algorithms, Machine Learning definition, types of learning, hypothesis space and inductive bias, evaluation, cross-validation, Instance based learning, Feature reduction, Collaborative filtering-based recommendation, Gradient Descent learning.	**10**
2.	**Supervised Learning: [Course Outcome CO010310.2]** General notions - Bayes optimality, curse of dimensionality, overfitting and model, selection, bias vs. variance tradeoff, generative vs. discriminative for parameter estimation, feature selection, and etc Linear methods - linear, logistic regression and generalized linear models, naive Bayes, linear discriminant analysis, support vector machines Nonlinear methods - kernel methods, nearest neighbor, decision trees, neural networks, and etc Ensemble learning - bagging, boosting, and etc.	**16**

3.	**Unsupervised Learning: [Course Outcome CO010310.3]** Clustering and density estimations - K-means/vector quantization, mixture models, Dimensionality reduction - linear and nonlinear methods, Principal components analysis. **Deductive Learning:** Probability theory and Bayes rule. Naive Bayes learning algorithm. Parameter smoothing. Generative vs. discriminative training. Logistic regression. Bayes nets and Markov nets for representing dependencies.	**12**
4.	**Deep Learning: [Course Outcome CO010310.4]** Artificial Neural Networks, Perceptron, Multilayer networks and Backpropagation algorithm, Introduction to Deep Neural networks, Recurrent Neural Networks (RNNs) and Convolutional Neural Networks (CNNs).	**10**

REFERENCE BOOKS

1. Alpaydin, E., *Introduction to Machine Learning*, MIT Press, 2004.
2. Bishop, C.M., *Pattern Recognition and Machine Learning*, Springer, 2006.
3. Hastie, T., Tibshirani, R. and Friedman, J., *The Elements of Statistical Learning*, Springer, 2008.
4. Mitchell, T.M., *Machine Learning*, McGraw- Hill, 1997.
5. Russell, S. and Norvig, P., *Artificial Intelligence: A Modern Approach*, Prentice Hall, 2002.

COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO010310 .1	1	-	1	-	1	3	-	1	-	1	-	-
CO010310 .2	1	1	1	1	1	3	1	2	1	2	3	-
CO010310 .3	-	2	1	-	1	3	1	-	1	-	3	3
CO010310 .4	1	-	-	1	1	3	-	1	-	1	2	-
CO010310 .5	-	2	1	1	1	3	-	1	-	2	-	2

MAPPING OF COs WITH PSOs

Cos	PSO 1	PSO2	PSO3	PSO 4	PSO5
CO010310.1	2	3	2	3	1
CO010310.2	1	2	1	-	1
CO010310.3	1	2	1	-	1
CO010310.4	1	1	1	2	1
CO010310.5	1	3	2	2	1

Teaching –Learning Process

Teaching aids	Open-ended problem/	Project-type activity	Lab Work	Open-ended lab	Delivery mode	Beyond the curriculum

		Numerical			**work**			
Video, Ppt. etc	Online lecture					Theory/ Description	Numerical/ Designed problem	
Yes	Yes	Yes	Yes			70%	30%	10%

Instructions for the paper-setter:

Please go through these instructions thoroughly and follow the same pattern while setting the paper as the students have been prepared according to this format.

Maximum Marks = 70 Times: 3 Hours

Weightage per unit = 14 marks (excluding over attempt weight age)

1. Question Paper will consist of five questions.
2. Section A of question paper is compulsory, containing seven parts each of 2 marks covering the whole syllabus (short answer type- total 14 marks).
3. Four Questions will be from Units I, II, III and IV respectively each having weightage of 14 marks.

Scheme Version:	**Name of the Subject:**	**L**	**T**	**P**	**C**	**Semester:**	**Contact hours per week: 3**
2022-2023	Software Project Management	**3**	**1**	**0**	**4**	**III**	**Total**

						(2nd Year)	**Hours:** 48
Subject Code: SBS CS 01 03 10 E 3104	**Applicable to Programs:** M.C.A.	**Evaluation (Total Marks):** 100	**CIE**	**30 Marks**	**Examination Duration: 3 hours**		
			TEE	**70 Marks**	**Pre-requisite of course:**		
Course Description	To introduce knowledge on basics of fundamental of computer science and various aspects of computational theory, programming, algorithm design, and optimization, network and database management, mobile technologies, electronics and mathematics						
Course Objectives	This course is aimed at introducing the important concepts of project management related to managing software development. Students will also get familiar with the different activities involved in Software Project Management. Further, they will also come to know how to successfully plan and implement a software project management activity, and to complete a specific project in time with the available budget.						
Course Outcomes:	Upon successful completion of the course students will be able to: **CO010311.1** To learn the basic concept of Software Project Management. **CO010311.2** Understand the different techniques for software cost estimation **CO010311.3** Apply activity planning and risk management and solve problem **CO010311.4** Analyse of management and control projects. **CO010311.5** Evaluation of project management.						
	COURSE SYLLABUS						
Unit No.	**Content of Each Unit**					**Hours of Each Unit**	
5.	**Project Evaluation and Project Planning: [Course**					**12**	

	Outcome CO010311.1] Importance of Software Project Management, Activities Methodologies, Categorization of Software Projects, Setting objectives, Management Principles, Management Control, Project portfolio Management, Cost-benefit evaluation technology, Risk evaluation, Strategic program Management, Stepwise Project Planning.	
6.	**Project Life Cycle and Effort Estimation: [Course Outcome CO010311.2]** Software process and Process Models, Choice of Process models, Mental delivery, Rapid Application development, Agile methods, Extreme Programming, SCRUM, managing interactive processes, Basics of Software estimation, Effort and Cost estimation techniques, COSMIC Full function points, COCOMO II- A Parametric Productivity Model, Staffing Pattern.	**14**
7.	**Activity Planning and Risk Management: [Course Outcome CO010311.3]** Objectives of Activity planning, Project schedules, Activities, Sequencing and scheduling, Network Planning models, Forward Pass & Backward Pass techniques, Critical path (CRM) method, Risk identification, Assessment, Monitoring, PERT technique, Monte Carlo simulation, Resource Allocation, Creation of critical patterns, Cost schedules	**12**

8.	**Project Management and Control: [Course Outcome CO010311.4]** Framework for Management and control, Collection of data Project termination, visualizing progress, Cost monitoring, Earned Value Analysis, project tracking, change control, Software Configuration Management, Managing contracts, Contract Management.	**10**

REFERENCE BOOKS

1. Futrell, R.T., Shafer, L.I. and Shafer, D.F., *Quality Software Project Management*, Prentice Hall, 2001.
2. Meredith, J.R., Shafer, S.M. and Mantel S.J., *Project Management: A Strategic Managerial Approach*, John Wiley & Sons, 2017.
3. Royce, W., *Software Project Management*, Pearson Education India, 1998.
4. Stellman, A. and Greene, J., *Applied Software Project Management*, O'Reilly Media, Inc., 2005.
5. Wysocki, R.K., *Effective Software Project Management*, John Wiley & Sons, 2010.

COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO010311. 1	-	3	1	-	3	-	-	1	-	1	-	-
CO010311. 2	1	2	1	1	3	-	1	1	1	1	-	-
CO010311.	1	2	1	-	3	-	1	-	1	1	2	-

3												
CO010311.4	-	3	1	-	2	-	-	1	2	1	3	3
CO010311.5	-	2	1	-	3	-	1	1	2	2	2	1

MAPPING OF COs WITH PSOs

Cos	PSO 1	PSO2	PSO3	PSO 4	PSO5
CO010311.1	1	3	2	3	2
CO010311.2	2	2	1	1	1
CO010311.3	1	2	1	-	2
CO010311.4	-	2	1	1	2
CO010311.5	1	2	1	1	1

Teaching –Learning Process

Teaching aids		**Open-ended problem/ Numerical**	**Project-type activity**	**Lab Work**	**Open-ended lab work**	**Delivery mode**		**Beyond the curriculum**
Video, Ppt. etc	Online lecture					Theory/ Description	Numerical / Designed problem	

Yes	Yes	Yes				90%	10%	10%

Instructions for the paper-setter:

Please go through these instructions thoroughly and follow the same pattern while setting the paper as the students have been prepared according to this format.

Maximum Marks = 70 Times: 3 Hours

Weightage per unit = 14 marks (excluding over attempt weight age)

1. Question Paper will consist of five questions.
2. Section A of question paper is compulsory, containing seven parts each of 2 marks covering the whole syllabus (short answer type- total 14 marks).
3. Four Questions will be from Units I, II, III and IV respectively each having weightage of 14 marks.

Scheme Version: 2022-2023	**Name of the Subject:** Digital Image Processing	**L**	**T**	**P**	**C**	**Semester:** **III** (2^{nd} Year)	**Contact hours per week: 3**
		3	**1**	**0**	**4**		**Total Hours:**46
Subject	**Applicable to**	**Evaluation**	**CIE**	**30**	**Examination Duration: 3**		

Code: SBS CS 01 03 11 E 3104	**Programs:** M.C.A.	**(Total Marks):** 100		**Marks**	**hours**
			TEE	**70 Marks**	**Pre-requisite of course:**
Course Description	To introduce knowledge on basics of fundamental of computer science and various aspects of computational theory, programming, algorithm design, and optimization, network and database management, mobile technologies, electronics and mathematics				
Course Objectives	In this course, students will understand the image fundamentals and mathematical transforms necessary for image processing. Study about the image enhancement techniques, image restoration procedures and image compression procedures. Students will learn about the image segmentation and representation techniques & pattern recognition and interpretation.				
Course Outcomes:	On completion of the module the student will be able to: **CO010312.1** Explain and analyse the steps of image formation, sampling, quantization and representation digitally. **CO010312.2** Outline and understand how images are processed by discrete, linear, time-invariant systems. **CO010312.3** Apply how images are perceived by humans and how colour is represented and solve problems. **CO010312.4** Analysing how image information can be modeled analytically and compare transform- domain representation of images (Fourier, DCT, Haar, WHT). **CO010312.5** Evaluation of descriptors				
	COURSE SYLLABUS				
Unit No.	**Content of Each Unit**				**Hours of Each Unit**
5.	**Digital Image Fundamentals: [Course Outcome**				**10**

	CO010312.1] Digital Image Processing, Origins of Digital Image Processing Application of Digital Image Processing, Steps in Digital Image Processing, Components of an Image Processing System, Image formation, Image transforms – Fourier transforms.	
6.	**Image Enhancement Techniques: [Course Outcome CO010312.2 & CO010312.3]]** Histogram modification techniques - Image smoothening Image Sharpening - Image Restoration - Degradation Model – Noise models - Spatial filtering – Frequency domain filtering.	**14**
7.	**Image Compression & Segmentation: [Course Outcome CO010312.3]** Compression Models - Elements of information theory Error free Compression -Image segmentation –Detection of discontinuities, Region based segmentation - Morphology.	**12**
8.	**Representation and Description: [Course Outcome CO010312.4]** Representation schemes- Boundary descriptors- Regional descriptors - Relational Descriptors.	**10**

REFERENCE BOOKS

1. Christopher, R.M., *An Introduction to MATLAB for Behavioral Researchers.*, SAGE Publications, Inc., 2013
2. Forsyth, D., and Ponce, J., *Computer Vision: A Modern Approach.*, Pearson Education India., 2015.
3. Gonzalez, C., Rafael., E., and Woods, R., *Digital Image Processing*., Pearson Publication., 2007.

4. Gonzalez, R., Woods, R., and Eddins, S., *Digital Image Processing Using MATLAB*., McGraw Hill Education., 2017.
5. Jayaraman, S., Veerakumar, T., and Esakkirajan, S., *Digital Image Processing*., McGraw Hill Education., 2017.

COURSE ARTICULATION MATRIX

Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO 5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO010312.1	3	1	-	1	1	-	-	1	2	-	-	-
CO010312.2	3	2	1	-	1	1	1	1	1	2	-	-
CO010312.3	3	1	1	2	1	-	2	-	1	1	-	3
CO010312.4	2	1	-	1	-	1	1	-	-	1	2	2
CO010312.5	2	1	1	2	1	-	2	-	-	1	2	-

MAPPING OF COs WITH PSOs

Cos	PSO 1	PSO2	PSO3	PSO 4	PSO5
CO010312.1	1	3	2	3	1
CO010312.2	-	1	-	-	-
CO010312.3	1	1	1	-	2

CO010312.4	-	1	-	-	-
CO010312.5	1	1	2	3	1

Teaching –Learning Process

Teaching aids		**Open-ended problem/ Numerical**	**Project-type activity**	**Lab Work**	**Open-ended lab work**	**Delivery mode**		**Beyond the curriculum**
Video, Ppt. etc	Online lecture					Theory/ Description	Numerical / Designed problem	
Yes	Yes	Yes	Yes			70%	30%	10%

Instructions for the paper-setter:

Please go through these instructions thoroughly and follow the same pattern while setting the paper as the students have been prepared according to this format.

Maximum Marks = 70 Times: 3 Hours

Weightage per unit = 14 marks (excluding over attempt weight age)

1. Question Paper will consist of five questions.
2. Section A of question paper is compulsory, containing seven parts each of 2 marks covering the whole syllabus (short answer type- total 14 marks).
3. Four Questions will be from Units I, II, III and IV respectively each having weightage of 14 marks.

Scheme Version:	**Name of the Subject:** Data Warehousing	**L**	**T**	**P**	**C**	**Semester:**	**Contact hours per week: 3**

2022-2023	and Data Mining	**3**	**1**	**0**	**4**	**III** (2^{nd} Year)	**Total Hours:**48
Subject Code: SBS CS 01 03 12 E 3104	**Applicable to Programs:** M.C.A.	**Evaluation (Total Marks):** 100	**CIE**	**30 Marks**	**Examination Duration: 3 hours**		
			TEE	**70 Marks**	**Pre-requisite of course:**		
Course Description	To introduce knowledge on basics of fundamental of computer science and various aspects of computational theory, programming, algorithm design, and optimization, network and database management, mobile technologies, electronics and mathematics						
Course Objectives	The main objective of this course is to impart the knowledge on how to implement classical models and algorithms in data warehousing and data mining and to characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering. Data quality and methods and techniques for pre-processing of data.						
Course Outcomes:	Upon successful completion of the course students will be able to: **CO010313.1** Comprehend the various architectures and its application with data mining **CO010313.2** To understand the design and develop data mining algorithms to analyze raw real-world data **CO010313.3** Monitor and apply to predict online digital activities and solve problem using them. **CO010313.4** Analyse and Evaluate various mining techniques on complex data objects						
	COURSE SYLLABUS						

Unit No.	Content of Each Unit	Hours of Each Unit
1	**[Course Outcome CO010313.1]** Basic Concepts, Data Warehousing Components, Building a Data Warehouse, Database Architectures for Parallel Processing, Parallel DBMS Vendors, Multidimensional Data Model, Data Warehouse Schemas for Decision Support, Concept Hierarchies, Characteristics of OLAP Systems, Typical OLAP Operations, OLAP and OLTP.	**10**
2	**[Course Outcome CO010313.2]** Introduction to Data Mining Systems, Knowledge Discovery Process, Data Mining Techniques, Issues, Applications, Data Objects and attribute types, Statistical description of data, Data Preprocessing, Cleaning, Integration, Reduction, Transformation and Discretization, Data Visualization, Data similarity and dissimilarity measures.	**16**
3	**[Course Outcome CO010313.3]** Mining Frequent Patterns, Associations and Correlations, Mining Methods, Pattern Evaluation Method, Pattern Mining in Multilevel, Multi-Dimensional Space, Constraint Based Frequent Pattern Mining, Classification using Frequent Patterns	**10**
4	**[Course Outcome CO010313.4]** Decision Tree Induction, Bayesian Classification, Rule Based Classification, Classification by Back Propagation, Support Vector Machines, Lazy Learners, Model Evaluation and Selection, Techniques to improve Classification Accuracy, Clustering Techniques, Cluster analysis, Partitioning Methods, Hierarchical	**12**

	Methods, Density Based Methods.	

REFERENCE BOOKS

1. Berson, A. and Smith, S.J., *Data Warehousing, Data Mining & OLAP*, Tata McGraw Hill, 2017.
2. Han, J., Pei, J. and Kamber, M., *Data Mining Concepts and Techniques*, Elsevier, 2011.
3. Pujari, A.K., *Data Mining Techniques*, Universities Press, 2010.
4. Soman, K.P., Diwakar, S. and Ajay, V., *Insight into Data Mining Theory and Practice*,PHI, 2009.
5. Witten, I.H. and Frank, E., *Data Mining: Practical Machine Learning Tools and Techniques*, Elsevier, 2016

COURSE ARTICULATION MATRIX

Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO 5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO010313.1	-	3	-	1	-	1	3	1	-	2	-	-
CO010313.2	1	2	1	-	1	-	2	-	1	2	-	-
CO010313.3	-	3	1	1	2	2	2	2	1	2	3	-
CO010313.4	-	2	-	-	1	-	2	-	-	2	2	3

CO010313.5	-	2	1	-	2	1	2	-	1	2	-	-

MAPPING OF COs WITH PSOs

COs	PSO 1	PSO2	PSO3	PSO 4	PSO5
CO010313.1	2	-	-	-	-
CO010313.2	1	3	2	3	1
CO010313.3	-	3	1	3	1
CO010313.4	-	-	2	1	1
CO010313.5	-	2	2	3	1

Teaching –Learning Process

Teaching aids		**Open-ended problem/ Numerical**	**Project-type activity**	**Lab Work**	**Open-ended lab work**	**Delivery mode**		**Beyond the curriculum**
Video, Ppt. etc	Online lectur					Theory/ Description	Numerical / Designed	

	e						problem	
Yes	Yes	Yes	Yes			90%	10%	10%

Instructions for the paper-setter:

Please go through these instructions thoroughly and follow the same pattern while setting the paper as the students have been prepared according to this format.

Maximum Marks = 70

Time: 3 Hours

Weightage per unit = 14 marks (excluding over attempt weight age)

1. Question Paper will consist of five questions.
2. Section A of question paper is compulsory, containing seven parts each of 2 marks covering the whole syllabus (short answer type- total 14 marks).
3. Four Questions will be from Units I, II, III and IV respectively each having weightage of 14 marks.

Semester IV

Scheme Version:	**Name of the Subject:**	**L**	**T**	**P**	**C**	**Semester:**	**Contact hours per week:** 4
2022-2023	Data Science with R Programming	**3**	**1**	**0**	**4**	**IV** (2^{nd} Year)	**Total Hours:**

							50
Subject Code: SBS CS 01 04 22 C 3104	**Applicable to Programs:** M.C.A.	**Evaluation (Total Marks):** 100	**CIE**	**30 Marks**	**Examination Duration: 3 hours**		
			TEE	**70 Marks**	**Pre-requisite of course:**		
Course Description	To introduce knowledge on basics of fundamental of computer science and various aspects of computational theory, programming, algorithm design, and optimization, network and database management, mobile technologies, electronics and mathematics						
Course Objectives	In this course, students will have knowledge on accessing, storing and manipulating the huge data from different resources. Students will understand the working environment of Pig and Hive for processing the structured and unstructured data. & Differentiate the RDBMS and Hive architectures, and implement queries to process the data.						
Course Outcomes:	Upon completion of the module the student will be able to: **CO010426.1** Learn the main R data structures – vector and data frame and import external data into R for data processing and statistical analysis. **CO010426.2** To understand review, manipulate and summarize data-sets in R. **CO010426.3** Apply data-sets to create testable hypotheses and identify appropriate statistical tests. **CO010426.4** Analyse R programming from a statistical perspective. **CO010426.5** Evaluating the techniques of R programming.						
	COURSE SYLLABUS						
Unit No.	**Content of Each Unit**					**Hours of Each Unit**	

1	**Introduction of Data Science: [Course Outcome CO010426.1]** Introduction to data science, Data collection, integration, management, modeling, analysis, visualization, prediction and informed decision making, Big data definition, structured and unstructured data. Exploratory data analysis Components of Hadoop Eco System- Data Access and storage, Data Intelligence, Data Integration, Data Serialization, Monitoring, Indexing	**14**
2	**R Programming: [Course Outcome CO010426.2]** Basic commands, graphics, indexing data, loading data, Data types in R: Numeric/character/logical; real/integer/complex, creation of new variables, vectors, matrices, data frames, and lists, accessing elements of a vector or matrix.	**12**
3	**Operations with R: [Course Outcome CO010426.3]** import and export of files, for loop, repeat loop, while loop, if command, if else command. Graphics in R: the plot command, histogram, bar-plot, box- plot, points, lines, segments, arrows, inserting mathematical symbols in a plot, pie diagram matrix operations such as addition, subtraction, multiplication, rank, eigenvalues, matrix inverse, generalized inverse, solution of linear equations.	**14**

4	**Statistics Techniques and R: [Course Outcome CO010426.4]** measures of central tendency and dispersion. Covariance, correlation, regression, some discrete and continuous probability z and t tests, F test for equality of variances, Chi-square tests.	**10**

REFERENCE BOOKS

1. Braun, W.J. and Murdoch, D.J., *A First Course in Statistical Programming with R.*, Cambridge University Press., 2008.
2. Hadley, W., *Advanced R.*, Chapman and Hall/CRC Press, 2019.
3. Jones, O., Maillardet, R. and Robinson, A., *Introduction to Scientific Programming and Simulation Using R.*, Chapman and Hall/CRC., 2014.
4. Rhys, H.I., *Machine Learning with R, The Tidyverse, and MLR.*, Manning Publications., 2020.
5. Zumel, N., Mount, J. and Porzak, J., *Practical Data Science with R.*, Manning Publications., 2019.

COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO010426.1	-	2	1	-	1	1	2	1	1	2	-	-
CO010426.2	1	2	-	-	1	-	3	2	1	2	-	-
CO010426.3	-	3	1	-	1	2	2	1	1	3	3	-

CO010426.4	1	3	-	-	1	-	3	2	1	2	2	2
CO010426.5	-	2	1	-	1	2	2	1	1	2	-	2

MAPPING OF COs WITH PSOs

Cos	PSO 1	PSO2	PSO3	PSO 4	PSO 5
CO010426.1	3	2	-	1	1
CO010426.2	2	1	2	3	-
CO010426.3	1	1	2	3	2
CO010426.4	2	-	2	1	1
CO010426.5	3	2	2	1	2

Teaching –Learning Process

Teaching aids		**Open-ended problem/ Numerical**	**Project-type activity**	**Lab Work**	**Open-ended lab work**	**Delivery mode**		**Beyond the curriculum**
Video, Ppt. etc	Online lecture					Theory/ Description	Numerical / Designed problem	
Yes	Yes	Yes	Yes	Yes	Yes	50%	50%	10%

Instructions for the paper-setter:

Please go through these instructions thoroughly and follow the same pattern while setting the paper as the students have been prepared according to this format.

Maximum Marks = 70 Times: 3 Hours

Weightage per unit = 14 marks (excluding over attempt weight age)

1. Question Paper will consist of five questions.
2. Section A of question paper is compulsory, containing seven parts each of 2 marks covering the whole syllabus (short answer type- total 14 marks).
3. Four Questions will be from Units I, II, III and IV respectively each having weightage of 14 marks.

Scheme	Name of the	L	T	P	C	Semester:	Contact

<table>
<tr><td rowspan="2">Version:

2022-2023</td><td rowspan="2">Subject:

Compiler Design</td><td></td><td></td><td></td><td></td><td rowspan="2">IV

(2nd Year)</td><td>hours per week: 4</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td><td>Total Hours:48</td></tr>
<tr><td rowspan="2">Subject Code: SBS CS 01 04 23 C 3104</td><td rowspan="2">Applicable to Programs:

M.C.A.</td><td rowspan="2">Evaluation (Total Marks):
100</td><td>CIE</td><td>30 Marks</td><td colspan="3">Examination Duration: 3 hours</td></tr>
<tr><td>TEE</td><td>70 Marks</td><td colspan="3">Pre-requisite of course:</td></tr>
<tr><td>Course Description</td><td colspan="7">To introduce knowledge on basics of fundamental of computer science and various aspects of computational theory, programming, algorithm design, and optimization, network and database management, mobile technologies, electronics and mathematics.</td></tr>
<tr><td>Course Objectives</td><td colspan="7">The aim of this course is to provide students with the knowledge and abilities to design and implement compilers. It describes the steps of compilation starting with the scanner, and then, followed by the parser design and implementation. The course also provides information on semantic analysis and, local and global compiler optimization algorithms.</td></tr>
<tr><td>Course Outcomes:</td><td colspan="7">Upon successful completion of the course students will be able to:

CO010318.1 To learn the knowledge of lexical tool to develop a scanner & parser
CO010318.2 To understand the lexical, syntactic and semantic analysis into meaningful phases for a compiler to undertake language translation.
CO010318.3 Design and develop software system for backend of the compiler and apply them to solve problems.
CO010318.4 Comprehend and analyse to new tools and technologies in compiler</td></tr>
</table>

	design. **CO010318.5** Evaluation of basic Blocks, Loops in flow graph, Introduction to Global data flow analysis.	
	COURSE SYLLABUS	
Unit No.	**Content of Each Unit**	**Hours of Each Unit**
5.	**Compiler structure [Course Outcome:CO010318.1]** Analysis-Synthesis model of compilation, Various phases of a compiler, Tool based approach to Compiler Construction **Lexical analysis** Interface with input, Parser and Symbol table, Token, Lexeme and Patterns. Difficulties in Lexical Analysis. Error reporting. Implementation. Regular definition, Transition diagrams, LEX.	**10**
6.	**Syntax analysis [Course Outcome:CO010318.2 & CO010318.3]** CFGs, Ambiguity, Associativity, Precedence, Top-Down Parsing, Recursive Descent Parsing, Transformation on the grammars, Predictive Parsing, Bottom-Up Parsing, Operator Precedence grammars, LR parsers (SLR, LALR, LR), YACC. **Syntax directed definitions** Inherited and Synthesized Attributes, Dependency Graph, Bottom Up and Top-Down Evaluation of Attributes, L- and S-Attributed Definitions.	**16**

7.	**Type checking [Course Outcome:CO010318.4]** Type System, Type Expressions, Structural and Name Equivalence of types, Type Conversion, Overloaded Functions and Operators **Run time system** Storage Organization, Activation Tree, Activation Record, Parameter Passing, Symbol Table, Dynamic Storage Allocation.	**10**
8.	**Intermediate code generation [Course Outcome: CO010318.5]:** Intermediate Representations, Translation of Declarations, Assignments, Control Flow, Boolean Expressions and Procedure Calls. **Code generation and instruction selection** Issues, Basic Blocks and Flow Graphs, Register Allocation, Code Generation, DAG representation of programs, Code Generation from DAGS, Peep-Hole Optimization, Code Generators, Specifications of machine.	**12**

REFERENCE BOOKS

1. Aho, A.V., Sethi, R. and Ullman, J.D., *Compilers: Principles, Techniques and Tools*, Pearson, 2008.
2. Appel, A.W., *Modern Compiler Implementation in C*, Cambridge University Press, 2004.
3. Dham here, D.M., *Compiler Construction – Principles & Practice*, Macmillan India, 2008.
4. Fischer, C.N. and LeBlanc Jr, R.J., *Crafting a Compiler*, Pearson, 2011.
5. Holub, A.I., *Compiler Design in C*, PHI, 1992.

COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO3	PO4	PO	PO6	PO7	PO8	PO9	PO10	PO11	PO12

					5							
CO010318.1	2	-	-	-	-	1	-	1	1	-	-	-
CO010318.2	3	-	2	1	-	-	1	-	1	1	-	3
CO010318.3	3	1	1	2	-	1	1	1	3	-	3	2
CO010318.4	2	3	-	2	-	1	1	1	1	1	-	2
CO010318.5	1	-	-	1	-	-	1	-	1	-	-	-

MAPPING OF COs WITH PSOs

Cos	PSO 1	PSO2	PSO3	PSO 4	PSO5
CO010318.1	2	2	1	1	-
CO010318.2	2	2	1	-	1
CO010318.3	2	2	-	-	1
CO010318.4	1	2	2	1	1
CO010318.5	1	1	-	-	1

Teaching –Learning Process

Teaching aids	**Open-ended problem/ Numerica**	**Project-type activity**	**Lab Work**	**Open-ended lab**	**Delivery mode**	**Beyond the curriculum**

		l			**work**			
Video, Ppt. etc	Online lecture					Theory/ Description	Numerical / Designed problem	
Yes	Yes	Yes				70%	30%	10%

Instructions for the paper-setter:

Please go through these instructions thoroughly and follow the same pattern while setting the paper as the students have been prepared according to this format.

Maximum Marks = 70 Times: 3 Hours

Weightage per unit = 14 marks (excluding over attempt weight age)

1. Question Paper will consist of five questions.
2. Section A of question paper is compulsory, containing seven parts each of 2 marks covering the whole syllabus (short answer type- total 14 marks).
3. Four Questions will be from Units I, II, III and IV respectively each having weightage of 14 marks.

Scheme Version:	**Name of the Subject:**	**L**	**T**	**P**	**C**	**Semester:**	**Contact hours per week: 4**
2022-2023	Distributed and Cloud Computing	**3**	**1**	**0**	**4**	**IV**	**Total Hours:**

						(2nd Year)	**48**
Subject Code: SBS CS 01 04 13 E 3104	**Applicable to Programs:** M.C.A.	**Evaluation (Total Marks):** 100	**CIE**	**30 Marks**	**Examination Duration: 3 hours**		
			TEE	**70 Marks**	**Pre-requisite of course:**		
Course Description	To introduce knowledge on basics of fundamental of computer science and various aspects of computational theory, programming, algorithm design, and optimization, network and database management, mobile technologies, electronics and mathematics						
Course Objectives	Cloud computing is a key distributed systems paradigm that has grown popular in the last few years. Cloud technologies are pervasive, touching our daily lives any time we access the world wide web, use a mobile app, or make a retail purchase. The objective of this course is to teach the fundamental concepts of how and why Cloud systems works, as well as Cloud technologies that manifest these concepts such as Amazon AWS, Microsoft Azure and OpenStack etc.. Students will learn distributed systems concepts like virtualization, data parallelism.						
Course Outcomes:	Upon successful completion of the course students will be able to: **CO010414.1** Describe the basic concept of system models for distributed. **CO010414.2** Understanding the different cloud computing. **CO010414.3** Apply the cloud-enabling technologies, cloud mechanisms, and cloud architectures. **CO010414.4** Analyse the different virtualization techniques **CO010414.5** Evaluation of the cloud and data security.						
	COURSE SYLLABUS						
Unit No.	**Content of Each Unit**					**Hours of Each Unit**	

1	**Introduction to Distributed System: [Course Outcome CO010414.1]** Models and Enabling Technologies, Computer Clusters for Scalable Parallel Computing, Virtual Machines and Virtualization of Clusters and Data centers.	**10**
2	**Introduction to Cloud Computing: [Course Outcome CO010414.2 & CO010414.3]** Cloud Computing in a Nutshell System Model for Distributed and Cloud Computing, Roots of Cloud Computing, Grid and Cloud, Layers and Types of Clouds, Desired Features of a Cloud, Basic Principles, of Cloud Computing, Challenges and Risks, Service Models	**12**
3	**Virtual Machines and Virtualization of Cluster and Data Centres: [Course Outcome CO010414.4]** Levels of Virtualization, Virtualization structures/Tools and Mechanism, Virtualization of CPU, Memory and I/O Devices, Virtual Clusters and Resources Management, Virtualization Data- Centre Automation **Service Oriented Architecture for Distributed Computing:** Services & SOA, Message Oriented Middleware, Workflow in SOA.	**14**
4	**Cloud Security, Data Security in the Cloud: [Course Outcome CO010414.5]** An Introduction to the Idea of Data Security, The Current State of Data Security in the Cloud CryptDb: Onion Encryption layers- DET, RND, OPE, JOIN, SEARCH, HOM, and Homomorphism Encryption, FPE	**12**
REFERENCE BOOKS		

1. Coulouris, G.F., Dollimore, J. and Kindberg, T., *Distributed Systems: Concepts and Design*, Pearson education, 2005.
2. Erl, T., Puttini, R. and Mahmood, Z., *Cloud Computing: Concepts, Technology, & Architecture*, Pearson Education, 2013.
3. Hwang, K., Dongarra, J. and Fox, G.C., *Distributed and Cloud Computing: From Parallel Processing to The Internet of Things*, Morgan Kaufmann, 2013.
4. Tanenbaum, A.S. and Van Steen, M., *Distributed systems: principles and paradigms*, Prentice-Hall, 2007.
5. Velte, T., Velte, A. and Elsenpeter, R., *Cloud Computing, A Practical Approach*, McGraw-Hill, Inc., 2009.

COURSE ARTICULATION MATRIX

COs	**PO1**	**PO2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**
CO010414.1	1	1	-	1	1	1	1	2	2	1	-	-
CO010414.2	2	-	1	2	1	1	-	2	2	1	-	-
CO010414.3	2	1	2	-	1	2	1	2	2	-	-	3
CO010414.4	1	-	-	2	1	2	-	1	2	1	-	3
CO010414.5	1	-	1	-	1	-	1	-	2	1	-	2

MAPPING OF COs WITH PSOs

Cos	PSO 1	PSO2	PSO3	PSO 4	PSO 5
CO010414.1	2	2	2	3	2
CO010414.2	2	1	1	2	1
CO010414.3	2	1	1	2	1
CO010414.4	-	1	-	-	1

CO010414.5	1	2	1	1	1

Teaching –Learning Process

Teaching aids		**Open-ended problem/ Numerical**	**Project -type activity**	**Lab Work**	**Open - ended lab work**	**Delivery mode**		**Beyond the curriculum**
Video, Ppt. etc	Online lecture					Theory/ Description	Numerical / Designed problem	
Yes	Yes	Yes	Yes			90%	10%	10%

Instructions for the paper-setter:

Please go through these instructions thoroughly and follow the same pattern while setting the paper as the students have been prepared according to this format.

Maximum Marks = 70 Times: 3 Hours

Weightage per unit = 14 marks (excluding over attempt weight age)

1. Question Paper will consist of five questions.
2. Section A of question paper is compulsory, containing seven parts each of 2 marks covering the whole syllabus (short answer type- total 14 marks).

3. Four Questions will be from Units I, II, III and IV respectively each having weightage of 14 marks.

Course – IV [**Bioinformatics**]

Scheme Version: 2022-2023	**Name of the Subject:** Bioinformatics	**L**	**T**	**P**	**C**	**Semester:** **IV** (2^{nd} Year)	**Contact hours per week: 4**
		3	**1**	**0**	**4**		**Total Hours: 50**
Subject Code: SBS CS 01 04 14 E 3104	**Applicable to Programs:** M.C.A.	**Evaluation (Total Marks):** 100	**CIE**	**30 Marks**	**Examination Duration: 3 hours**		
			TEE	**70 Marks**	**Pre-requisite of course:**		
Course Description	To introduce knowledge on basics of fundamental of computer science and various aspects of computational theory, programming, algorithm design, and optimization, network and database management, mobile technologies, electronics and mathematics						
Course Objectives	The unprecedented increase in the amount of available biological data ranging from protein sequences to biomedical images have rendered the use of computers and computational techniques for analysing and managing the						

	biological data inevitable. This course aims to provide students with the basics of bioinformatics algorithms that have been applied over various types of biological data.	
Course Outcomes:	Upon successful completion of the course students will be able to: **CO010415.1** Describe about the basic concept of different types of Biological databases. **CO010415.2** To understand the information Retrieval from Biological Databases. **CO010415.3** Describe about pairwise sequence alignment, algorithms and tools for pairwise alignment and apply them to solve problem **CO010415.4** Analyse about protein folding and its significance **CO010415.5** Apply algorithms and evaluation to the real-world problems.	
	COURSE SYLLABUS	
Unit No.	**Content of Each Unit**	**Hours of Each Unit**
1	**Introduction to Bioinformatics: [Course Outcome CO010415.1 & CO010415.2]** What is a Database, Types of Databases, Biological Databases, Pitfalls of Biological Databases, Information Retrieval from Biological Databases.	**10**
2	**Sequences: [Course Outcome CO010415.3]** Problem statement, Edit distance and substitution matrices, HMMs and pairwise HMMs, Global and local alignments, Spliced alignment, Space-efficient sequence alignment, Multiple alignment, Database searching tools, Sequence by hybridization, Profile HMMs.	**14**

3	**Structures: [Course Outcome CO010415.4]** Protein structure alignment, Protein Structure Prediction: Methods for predicting the secondary and tertiary structure of proteins. Techniques: neural networks, SVMs, genetic algorithms and stochastic global optimization.	**12**
4	**Transcriptomics: [Course Outcome CO010415.5]** Methods for analyzing gene expression and microarray data. Techniques: clustering, SVMs. Agent-based Genome Analysis: Automation of genome analysis using intelligent software agents. Drug Discovery Informatics: Approaches to drug discovery using bioinformatics techniques.	**14**

REFERENCE BOOKS

1. Compeau, P. and Pevzner, P.A., *Bioinformatics Algorithms: An Active Learning Approach*, Active Learning Publishers, 2018.
2. Jones, N.C., Pevzner, P.A. and Pevzner, P., *An Introduction to Bioinformatics Algorithms*, MIT press, 2004.
3. Krawetz, S.A. and Womble, D.D., *Introduction to Bioinformatics: A Theoretical and Practical Approach*, Springer Science & Business Media, 2003.
4. Lesk, A., *Introduction to bioinformatics*, Oxford University Press, 2019.
5. Mandoiu, I. and Zelikovsky, A., *Bioinformatics Algorithms: Techniques and Applications*, John Wiley & Sons, 2008

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12

CO010415.1	1	1	1	1	2	1	-	2	2	2	-	-
CO010415.2	-	2	1	2	-	-	1	1	-	2	-	-
CO010415.3	2	2	1	1	1	-	-	1	-	1	2	-
CO010415.4	1	1	1	1	2	-	-	-	1	2	2	-
CO010415.5	1	1	1	1	-	-	-	1	-	1	2	2

MAPPING OF COs WITH PSOs

Cos	PSO 1	PSO2	PSO3	PSO 4	PSO 5
CO010415.1	1	2	1	2	-
CO010415.2	1	2	1	2	1
CO010415.3	-	1	1	-	1
CO010415.4	-	1	1	-	-
CO010415.5	1	1	1	1	1

Teaching –Learning Process

Teaching aids		**Open-ended problem/ Numerical**	**Project-type activity**	**Lab Work**	**Open-ended lab work**	**Delivery mode**		**Beyond the curriculum**
Video, Ppt. etc	Online lecture					Theory/ Description	Numerical / Designed problem	
Yes	Yes	Yes	Yes			60%	40%	10%

Instructions for the paper-setter:

Please go through these instructions thoroughly and follow the same pattern while setting the paper as the students have been prepared according to this format.

Maximum Marks = 70 Times: 3 Hours

Weightage per unit = 14 marks (excluding over attempt weight age)

1. Question Paper will consist of five questions.
2. Section A of question paper is compulsory, containing seven parts each of 2 marks covering the whole syllabus (short answer type- total 14 marks).
3. Four Questions will be from Units I, II, III and IV respectively each having weightage of 14 marks.

Course – V [Natural Language Processing and Speech Recognition**]**

<table>
<tr><td rowspan="2">Scheme Version:

2022-2023</td><td rowspan="2">Name of the Subject:

Natural Language Processing and Speech Recognition</td><td>L</td><td>T</td><td>P</td><td>C</td><td rowspan="2">Semester:

IV

(2nd Year)</td><td>Contact hours per week: 4</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td><td>Total Hours: 48</td></tr>
<tr><td rowspan="2">Subject Code:

SBS CS 01 04 15 E 3104</td><td rowspan="2">Applicable to Programs:

M.C.A.</td><td rowspan="2">Evaluation (Total Marks):
100</td><td>CIE</td><td>30 Marks</td><td colspan="3">Examination Duration: 3 hours</td></tr>
<tr><td>TEE</td><td>70 Marks</td><td colspan="3">Pre-requisite of course:</td></tr>
<tr><td>Course Description</td><td colspan="7">To introduce knowledge on basics of fundamental of computer science and various aspects of computational theory, programming, algorithm design, and optimization, network and database management, mobile technologies, electronics and mathematics</td></tr>
<tr><td>Course Objectives</td><td colspan="7">The objective of this course is to give students a clear understanding of linguistics methods, various tools and aspects of NLP like syntax and semantic analysis, parsing, machine translation, information retrieval and statistical discourse processing.</td></tr>
</table>

Course Outcomes:	Upon successful completion of the course students will be able to: **CO010416.1** Describe the challenges involved in developing NLP solutions. **CO010416.2** Understand the various recent statistical methods in natural language processing. **CO010416.3** Apply the linguistics and their application to part-of-speech tagging and solve the problem using them. **CO010416.4** Analyse background to various tools and aspects of NLP like syntax and semantic analysis, parsing, machine translation, information retrieval and statistical discourse processing **CO010416.5** Evaluation the Various Mechanics of Speech	
	COURSE SYLLABUS	
Unit No.	**Content of Each Unit**	**Hours of Each Unit**
1	**Introduction: [Course Outcome CO010416.1]** NLP tasks in syntax, semantics, and pragmatics. Applications such as information extraction, question answering, and machine translation. The problem of ambiguity. The role of machine learning. Brief history of the field.	**10**
2	**N-gram Language Models: [Course Outcome CO010416.2 & CO010416.3]** The role of language models. Simple N-gram models. Estimating parameters and smoothing. Evaluating language models. **Part of Speech Tagging and Sequence Labeling:** Lexical syntax. Hidden Markov Models (Forward and Viterbi algorithms and EM training)	**12**
3	**Syntactic parsing: [Course Outcome CO010416.4]** Grammar formalisms and treebanks. Efficient parsing for context-free grammars (CFGs). Statistical parsing and probabilistic CFGs (PCFGs). Lexicalized PCFGs.	**12**

	Neural shift-reduce dependency parsing **Semantic Analysis:** Lexical semantics and word-sense disambiguation. Compositional semantics. Semantic Role Labeling and Semantic Parsing.	
4	**Mechanics of Speech: [Course Outcome CO010416.5] Speech** Production Mechanism, Nature of Speech Signal, Discrete Time Modeling of Speech Production, Representation of Speech Signals, Classification of Speech Sounds, Phones, Phonemes, Phonetics, IPA and Phonetic Alphabets, Articulatory Features, Auditory Perceptions, Anatomical Pathways from Ear to the Perception of Sound Peripheral Auditory System.	**14**

REFERENCE BOOKS

1. Jurafsky, D. and Martin, J.H., *Speech and Language Processing*, Pearson, 2020.
2. Lane, H., Howard, C. and Hapke, H., *Natural Language Processing in Action*, Manning Publications, 2019.
3. Manning, C. and Schutze, H., *Foundations of Statistical Natural Language Processing*, MIT Press, 1999.
4. Rabiner, L.R. and Juang, B.H., *Fundamentals of Speech Recognition*, Pearson, 2009
5. Thanaki, J., *Python Natural Language Processing*, Packt, 2017.

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO010416.1	1	-	1	3	1	2	1	2	-	2	-	-
CO010416.2	1	1	1	3	1	2	-	2	1	1	-	-

CO010416.3	2	-	1	3	1	1	1	2	1	2	2	-
CO010416.4	1	-	1	2	1	-	-	2	-	1	3	-
CO010416.5	2	1	-	3	1	1	-	-	1	1	-	2

MAPPING OF COs WITH PSOs

Cos	PSO 1	PSO2	PSO3	PSO 4	PSO 5
CO010416.1	1	2	2	1	1
CO010416.2	-	1	1	-	1
CO010416.3	-	1	1	-	2
CO010416.4	1	2	-	1	2
CO010416.5	1	2	1	2	1

Teaching –Learning Process

Teaching aids		**Open-ended problem/ Numerical**	**Project-type activity**	**Lab Work**	**Open-ended lab work**	**Delivery mode**		**Beyond the curriculum**
Video, Ppt. etc	Online lecture					Theory/ Description	Numerical / Designed problem	
Yes	Yes	Yes	Yes			90%	10%	10%

Instructions for the paper-setter:

Please go through these instructions thoroughly and follow the same pattern while setting the paper as the students have been prepared according to this format.

Maximum Marks = 70 Times: 3 Hours

Weightage per unit = 14 marks (excluding over attempt weight age)

1. Question Paper will consist of five questions.
2. Section A of question paper is compulsory, containing seven parts each of 2 marks covering the whole syllabus (short answer type- total 14 marks).
3. Four Questions will be from Units I, II, III and IV respectively each having weightage of 14 marks.

Course – VI [Computer Vision**]**

<table>
<tr><td rowspan="2">Scheme Version:

2022-2023</td><td rowspan="2">Name of the Subject:

Computer Vision</td><td>L</td><td>T</td><td>P</td><td>C</td><td rowspan="2">Semester:

IV

(2nd Year)</td><td>Contact hours per week: 4</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td><td>Total Hours: 50</td></tr>
<tr><td rowspan="2">Subject Code:

SBS CS 01 04 16 E 3104</td><td rowspan="2">Applicable to Programs:

M.C.A.</td><td rowspan="2">Evaluation (Total Marks):
100</td><td>CIE</td><td>30 Marks</td><td colspan="3">Examination Duration: 3 hours</td></tr>
<tr><td>TEE</td><td>70</td><td colspan="3">Pre-requisite of course:</td></tr>
</table>

				Marks	
Course Description	To introduce knowledge on basics of fundamental of computer science and various aspects of computational theory, programming, algorithm design, and optimization, network and database management, mobile technologies, electronics and mathematics				
Course Objectives	The objectives of this course are to develop the understanding of the basic principles and techniques of image processing and image understanding, and to develop your skills in the design and implementation of computer vision software. This course will explore some of the basic principles and techniques from these areas which are currently being used in real- world computer vision systems and the research and development of new systems.				
Course Outcomes:	Upon successful completion of the course students will be able to: **CO010417.1** Describe image representation and basics of computer vision. **CO010417.2** Understand fundamental image processing for vision application. **CO010417.3** Apply fundamental image recognition and decisions and solve problem using them. **CO010417.4** Analyse the pattern recognition methods. **CO010417.5** Evaluate various applications using computer vision.				
	COURSE SYLLABUS				
Unit No.	**Content of Each Unit**				**Hours of Each Unit**
1	**[Course Outcome CO010417.1]** Digital image representation, image acquisition, storage and processing. fundamental steps in image processing, Introduction to Image Processing, Computer Vision and Computer Graphics, Monocular imaging system, basics of Image Formation, Radiance, Irradiance, BRDF, color				**14**

	etc. Binocular imaging systems, Multiple views geometry, Structure determination, shape from shading and Photometric Stereo.	
2	**[Course Outcome CO010417.1 & CO010417.4]** Introduction, definition, Active vision system, Machine vision components, hardware's and algorithms, segmentation, data reduction, feature extraction, edge detection, image recognition and decisions, identification, Triangulation geometry, resolution passive and active stereo imaging, optical scanners, interfacing machine vision system, vision system calibration.	**14**
3	**[Course Outcome CO010417.3]** Structure of the human eye, image formation, brightness adaptation and discrimination, a simple image model, uniform and non-uniform sampling and quantization, distance measures, Fourier and wavelet descriptors, Multiresolution analysis, Hough transforms and other simple object recognition methods, PCA, HMM and GMM.	**12**
4	**[Course Outcome CO010417.5]** Face detection and Face recognition, Eigen faces, Active appearance and 3D shape models of faces. Surveillance – foreground-background separation, particle filters, Chamfer matching, tracking, and occlusion, combining views from multiple cameras, human gait analysis.	**10**

REFERENCE BOOKS

1. Davies, E. R., *Computer & Machine Vision*, 4th Edition, Academic Press, 2012.
2. Forsyth, D.A. and Ponce, J., *Computer Vision: A Modern Approach*. Prentice Hall

Professional Technical Reference, 2002.

3. Mark, N.A.S., *Feature Extraction & Image Processing for Computer Vision*, 3rd Edition, Academic Press, 2012.
4. Prince, S.J., *Computer Vision: Models, Learning, and Inference*, Cambridge University Press, 2012.
5. Szeliski, R., *Computer Vision: Algorithms and Applications (CVAA)*. Springer Science and Business Media, 2010.

COURSE ARTICULATION MATRIX

Cos	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO010417.1	3	-	2	2	1	-	-	1	1	1	-	-
CO010417.2	3	2	2	-	1	1	-	-	1	-	-	-
CO010417.3	3	1	1	2	1	-	-	2	-	1	2	-
CO010417.4	3	2	1	-	1	-	-	-	1	-	2	3
CO010417.5	3	2	1	-	1	-	-	1	1	-	-	2

MAPPING OF COs WITH PSOs

Cos	PSO 1	PSO2	PSO3	PSO 4	PSO 5
CO010417.1	2	2	2	1	-
CO010417.2	-	1	1	1	1
CO010417.3	1	2	2	2	-
CO010417.4	-	2	1	-	2
CO010417.5	1	1	1	3	-

Teaching –Learning Process

Teaching aids		Open-ended problem/ Numerical	Project-type activity	Lab Work	Open-ended lab work	Delivery mode		Beyond the curriculum
Video, Ppt. etc	Online lecture					Theory/ Description	Numerical / Designed problem	
Yes	Yes	Yes	Yes			70%	30%	10%

Instructions for the paper-setter:

Please go through these instructions thoroughly and follow the same pattern while setting the paper as the students have been prepared according to this format.

Maximum Marks = 70 Times: 3 Hours

Weightage per unit = 14 marks (excluding over attempt weight age)

1. Question Paper will consist of five questions.
2. Section A of question paper is compulsory, containing seven parts each of 2 marks covering the whole syllabus (short answer type- total 14 marks).
3. Four Questions will be from Units I, II, III and IV respectively each having weightage of 14 marks.

Course – VII [Embedded Programming]

Scheme Version: 2022-2023	**Name of the Subject:** Embedded Programming	**L**	**T**	**P**	**C**	**Semester:**	**Contact hours per week: 4**
		3	**1**	**0**	**4**	**IV** (2nd Year)	**Total Hours: 48**
Subject Code: SBS CS 01 04 17 E 3104	**Applicable to Programs:** M.C.A.	**Evaluation (Total Marks):** 100	**CIE**	**30 Marks**	**Examination Duration: 3 hours**		
			TEE	**70 Marks**	**Pre-requisite of course:**		
Course Description	To introduce knowledge on basics of fundamental of computer science and various aspects of computational theory, programming, algorithm design, and optimization, network and database management, mobile technologies, electronics and mathematics						
Course Objectives	In this course, Student will understand the architecture of embedded processors, microcontrollers, and peripheral devices and appreciate the nuances of programming micro- controllers in assembly for embedded systems. The challenges in developing operating systems for embedded systems. Students will learn about programming these systems in high-level languages such as C.						

Course Outcomes:	Upon completion of the module the student will be able to: **CO010418.1** Learn the basic concept of Embedded System **CO010418.2** Understand the differences between the general computing system and the embedded system, also recognize the classification of embedded systems. **CO010418.3** Apply the architecture of the ATOM processor and its programming aspects (assembly Level) **CO010418.4** Analyse the interrupts, hyper threading and software optimization. **CO010418.5** Evaluation of Design real time embedded systems using the concepts of RTOS.	
	COURSE SYLLABUS	
Unit No.	**Content of Each Unit**	**Hours of Each Unit**
1	**Introduction of Embedded Systems: [Course Outcome CO010418.1 & CO010418.2]** Concept of Embedded System Design: Design challenge, Processor technology, IC technology, Embedded Design technology.	**10**
2	**Single and General-Purpose Processor: [Course Outcome CO010418.3]** introduction, basic architecture, operation, super-scalar and VLSIIW architecture, application specific instruction set processors (ASIPS), microcontrollers, digital signal processors, selecting a microprocessor.	**12**
3	**Memory and Input / Output Management: [Course Outcome CO010418.4]** Interfacing Analog and digital blocks: Analog-to-Digital Converters (ADCs), Digital to-Analog, Converters (DACs)., Communication basics	**14**

	and basic protocol concepts, Microprocessor interfacing: I/O addressing, Port and Bus based, I/O, Memory mapped I/O, Standard I/O interrupts, Direct memory access, communication principles parallel, serial and wireless.	
4	**Processes and Operating Systems: [Course Outcome CO010418.5]** Real time operating systems, Kernel architecture: Hardware, Device Embedded operating systems, Task scheduling in embedded systems: task scheduler, first in first out, shortest job first, round robin, priority-based scheduling. Types of embedded operating systems.	**12**

REFERENCE BOOKS

1. Barrett, S.F. and Pack, D.J., *Embedded Systems: Design and Applications.*, Pearson Education India, 2008.
2. Barry, P. and Crowley, P., *Modern Embedded Computing: Designing Connected, Pervasive, Media-Rich Systems*, Morgan Kaufmann Publication, 2012.
3. Kamal, R., *Embedded Systems: Architecture, Programming and Design.*, 2nd Edition., McGraw Hill Education, 2008.
4. Shibu, K.V., *Introduction to Embedded Systems.*, McGraw Hill Education, 2017.
5. Vahid, F. and Givargis, T., *Embedded System Design: A Unified Hardware / Software Introduction.*, Wiley Publication, 2006.

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12

CO010418.1	-	1	-	3	-	-	2	2	-	1	-	-
CO010418.2	1	-	-	3	1	1	2	3	1	-	-	-
CO010418.3	1	1	-	2	1	-	3	1	-	1	3	3
CO010418.4	-	-	-	2	1	2	1	2	2	-	2	-
CO010418.5	1	-	-	2	1	-	1	1	1	-	-	2

MAPPING OF COs WITH PSOs

Cos	PSO 1	PSO2	PSO3	PSO 4	PSO 5
CO010418.1	1	2	1	2	1
CO010418.2	1	2	1	2	1
CO010418.3	1	2	1	1	2
CO010418.4	3	2	2	1	2
CO010418.5	1	1	1	1	1

Teaching –Learning Process

Teaching aids	**Open-ended problem/ Numerical**	**Project-type activity**	**Lab Work**	**Open-ended lab work**	**Delivery mode**	**Beyond the curriculum**

Video, Ppt. etc	Online lecture					Theory/ Description	Numerical / Designed problem	
Yes	Yes	Yes	Yes			60%	40%	10%

Instructions for the paper-setter:

Please go through these instructions thoroughly and follow the same pattern while setting the paper as the students have been prepared according to this format.

Maximum Marks = 70 Times: 3 Hours

Weightage per unit = 14 marks (excluding over attempt weight age)

1. Question Paper will consist of five questions.
2. Section A of question paper is compulsory, containing seven parts each of 2 marks covering the whole syllabus (short answer type- total 14 marks).
3. Four Questions will be from Units I, II, III and IV respectively each having weightage of 14 marks.

Scheme Version:	**Name of the Subject:**	**L**	**T**	**P**	**C**	**Semester:**	**Contact hours per week:** 4
2022-2023	Wireless Sensor Network and Internet of Things	**3**	**1**	**0**	**4**	**IV**	**Total Hours:**

						(2nd Year)	**46**
Subject Code: SBS CS 01 04 18 E 3104	**Applicable to Programs:** M.C.A.	**Evaluation (Total Marks):** 100	**CIE**	**30 Marks**	**Examination Duration: 3 hours**		
			TEE	**70 Marks**	**Pre-requisite of course:**		
Course Description	To introduce knowledge on basics of fundamental of computer science and various aspects of computational theory, programming, algorithm design, and optimization, network and database management, mobile technologies, electronics and mathematics						
Course Objectives	The objective of this course is to impart comprehensive knowledge of the wireless networks needed for design and implementation of a typical IoT system. The course also aims at developing necessary skills required for efficient network infrastructure of an IoT. This course focuses on the latest microcontrollers with application development, product design and prototyping. This also focuses on interoperability in IoT along with various IoT Platforms for application development.						
Course Outcomes:	Upon completion of the module the student will be able to: **CO010427.1** Learn the Fundamental of Wireless Sensor Network **CO010427.2** Understand various concepts of ubiquitous sensing **CO010427.3** Apply Wireless Sensor Networks Principles in IoT **CO010427.4** Analyse the role of Big Data, Cloud Computing and Data Analytics in a typical IoT system. **CO010427.5** Evaluation of the design a simple IoT system made up of sensors, wireless network connection, data analytics and display/actuators, and write the necessary control software.						

	COURSE SYLLABUS	
Unit No.	**Content of Each Unit**	**Hours of Each Unit**
5.	**Introduction to Wireless Sensor Network: [Course Outcome CO010427.1]** Wireless Sensor, Coverage & Placement, Topology Management in Wireless Sensor Network, Mobile WSNs, Medium Access Control in Wireless Networks, Routing in WSNs, Enabling Technologies for WSNs	**10**
6.	**Architecture of Wireless Sensor Network: [Course Outcome CO010427.2]** Sensor Network Scenarios, Optimization Goals, Figures of Merit, Design Principles for WSNs, Service Interfaces of WSNs Gateway Concepts Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments	**12**
7.	**Internet of Things (IOT): [Course Outcome CO010427.3]** Sensing, Actuation, Basics of Networking, Communication Protocols Sensor Networks, Machine to Machine Communications. Understanding of the IoT ecosystem, various layers in building an IoT application and interdependencies.	**10**
8.	**Applications of IOT & Arduino: [Course Outcome CO010427.4 & CO010427.5]** IoT Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino, IoT platforms like PTC Thing Worx and IoT frameworks like MS Azure, usage of these platforms to build applications like Smart Cities and Smart	**14**

	Homes, Connected Vehicles, Smart Grid, Case Study: Agriculture, Healthcare	

REFERENCE BOOKS

1. Hersent, O., Boswarthick, D. and Elloumi, O., *Internet Of Things: Key Applications and Protocols.*, Wiley Publication., 2015.
2. Holler, J., Tsiatsis, V., Mulligan, C., Avesand, S., Karnouskos, S. and Boyle, D., *From Machine to Machine to the Internet of Things: Introduction to a New Age of Intelligence*., Academic Press., 2014.
3. Raj, P. and Raman, A.C., *The Internet of Things: Enabling Technologies, Platforms, and Use Cases.*, Auerbach Publications., 2017.
4. Yasuura, H., Kyung, C.M., Liu, Y. and Lin, Y.L., *Smart Sensors at the IoT Frontier.*, Springer Publication., 2018.
5. Zheng, J. and Jamalipour, A., *Wireless Sensor Networks: A Networking Perspective.*, Wiley Publication., 2014.

COURSE ARTICULATION MATRIX

COs	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO010427.1	1	-	2	3	1	1	1	-	2	-	-	-
CO010427.2	-	1	1	2	2	-	-	1	2	1	-	-
CO010427.3	1	-	2	3	-	-	1	-	1	2	3	-
CO010427.4	-	2	2	2	1	-	-	-	2	-	2	3
CO010427.5	1	1	1	1	-	1	-	-	1	-	2	2

MAPPING OF COs WITH PSOs

Cos	PSO 1	PSO2	PSO3	PSO 4	PSO 5
CO010427.1	2	2	2	2	1
CO010427.2	2	2	1	1	2
CO010427.3	1	2	1	2	1
CO010427.4	1	2	1	2	1
CO010427.5	-	2	1	-	1

Teaching –Learning Process

Teaching aids	Open-ended problem/ Numerical	Project-type activity	Lab Work	Open-ended lab work	Delivery mode	Beyond the curriculum

Video, Ppt. etc	Online lecture					Theory/ Description	Numerical / Designed problem	
Yes	Yes	Yes				90%	10%	10%

Instructions for the paper-setter:

Please go through these instructions thoroughly and follow the same pattern while setting the paper as the students have been prepared according to this format.

Maximum Marks = 70 Times: 3 Hours

Weightage per unit = 14 marks (excluding over attempt weight age)

1. Question Paper will consist of five questions.
2. Section A of question paper is compulsory, containing seven parts each of 2 marks covering the whole syllabus (short answer type- total 14 marks).
3. Four Questions will be from Units I, II, III and IV respectively each having weightage of 14 marks.

Scheme Version: 2022-2023	**Name of the Subject:** Internet Fundamentals	**L**	**T**	**P**	**C**	**Semester: Ist Sem**	**Contact hours per week:** 4
		3	**1**	**0**	**4**		**Total Hours:**45
Subject Code:	**Applicable to**	**Evaluation**	**CIE**	**30**	**Examination Duration: 3**		

SBS CS 01 01 19 E 3104	**Programs:** GEC	**(Total Marks):** 100		**Marks**	**hours**
			TEE	**70 Marks**	**Pre-requisite of course:** Basic Internet fundamentals
Course Description	To introduce knowledge on basics of fundamental of computer science and various aspects of computational theory, programming, algorithm design, and optimization, network and database management, mobile technologies, electronics and mathematics				
Course Objectives	This course aims to introduce the building blocks of the internet and to provide the necessary skills to utilize the internet efficiently.				
Course Outcomes:	Upon successful completion of the course students will be able to: **COB010102.1** Describe how the Internet works. **COB010102.2** Understand the connections that need to be made in order to access the internet. **COB010102.3** Demonstrate internet tools technologies including current web-based applications, e-mail, and social networking tools and apply them to solve problems. **COB010102.4** Analyse the privacy & security protocols involved in the internet communication. **COB010102.5** Evaluation of the internet security and document security.				
	COURSE SYLLABUS				
Unit No.	**Content of Each Unit**				**Hours of Each Unit**
1.	**Electronic Mail**: **[Course Outcome (s): COB010102.3]** Introduction, advantages and disadvantages, Use rids, Pass words, e-mail addresses, message components, message composition, mailer features, E-mail inner workings, E-mail management, Mime types, Newsgroups, mailing lists, chat rooms.				**10**
2.	**The Internet**: **[Course Outcome (s): COB010102.1]** Introduction to networks and internet, history, Working of Internet, Internet Congestion, Modes of Connecting to Internet, Internet Service Providers (ISPs), Internet addressing, comparison of IPv4 and IPv6.				**10**

3.	**Languages and Servers**: **[Course Outcome (s): COB010102.2]** Basic and advanced HTML, XML basics. Introduction to Web Servers: PWS, IIS, Apache; Microsoft Personal Web Server. Accessing & using these servers.	**12**
4.	**Privacy and Security Topics**: **[Course Outcome (s): COB010102.4 & COB010102.5]** Introduction, Encryption schemes, Secure Web document, Digital Signatures, Firewalls.	**13**

REFERENCE BOOKS

1. Castro, E., *HTML for the World Wide Web with XHTML and CSS: Visual QuickStart Guide*, Peachpit Press 2006.
2. Comer, D.E. and Droms, R.E., *Computer Networks and Internets*, Prentice-Hall, Inc., 2003.
3. Deitel, H.M., Deitel, P.J. and Nieto, T.R., *Internet & World Wide Web How to Program*, Pearson Education, 2011.
4. Gralla, P., *How the Internet Works*, QUE Publication, 2006.
5. Greenlaw, R. and Hepp, E., *Inline/Online: Fundamentals of the Internet and The World Wide Web*, McGraw-Hill Higher Education, 2001.

COURSE ARTICULATION MATRIX

Cos	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
COB010102.1	1	-	1	-	1	2	-	1	2	1	-	-
COB010102.2	1	1	-	-	3	-	-	-	1	-	-	-
COB010102.3	1	3	1	2	-	1	1	-	3	2	3	-
COB010102.	1	-	-	-	-	2	-	1	1	-	-	2

4												
COB010102.5	1	-	-	-	1	1	1	2	-	-	3	2

MAPPING OF COs WITH PSOs

COs	PSO 1	PSO2	PSO3	PSO 4	PSO5
COB010102.1	2	1	-	-	2
COB010102.2	3	2	1	1	1
COB010102.3	1	-	-	1	-
COB010102.4	1	-	2	-	3
COB010102.5	1	-	2	2	-

Teaching –Learning Process

Teaching aids		**Open-ended problem/ Numerical**	**Project-type activity**	**Lab Work**	**Open-ended lab work**	**Delivery mode**		**Beyond the curriculum**
Video, Ppt. etc	Online lecture					Theory/ Description	Numerical/ Designed problem	

Yes	Yes	Yes				90%	10%	10%

Instructions for the paper-setter:

Please go through these instructions thoroughly and follow the same pattern while setting the paper as the students have been prepared according to this format.

Maximum Marks = 70
Time: 3 Hours

Weightage per unit = 14 marks (excluding over attempt weight age)

1. Question Paper will consist of five questions.
2. Section A of question paper is compulsory, containing seven parts each of 2 marks covering the whole syllabus (short answer type- total 14 marks).

Four Questions will be from Units I, II, III and IV respectively each having weightage of 14 marks.

9. Teaching-Learning Process

- Lectures
- Discussions
- Simulations
- Role Playing
- Participative Learning
- Interactive Sessions
- Seminars
- Research-based Learning/Dissertation or Project Work
- Technology-embedded Learning

11. Implementation of Blended Learning

Blended Learning is a pedagogical approach that combines face to-face classroom methods with computer-mediated activities in the process of teaching and learning. It implies nice blend of face-to-face and online activities to make the learning processes more interesting and engaging. It focuses on integration of traditional classroom activities and innovative ICT-enabled strategies. It emphasises student-centric learning environment where the teacher is the facilitator for productive and measurable learning outcomes. It optimises and compliments the face to face

learning, giving ample freedom and flexibility to the students and teachers to access and explore the wide range of open-access sources such as video lectures, podcasts, recordings and articles through digital platforms. It gives freedom and autonomy to the teachers in selection of appropriate digital platforms, resources and time-slots to complement and supplement face to face learning. The Blended Learning doesn't undermine the role of the teacher, rather it gives him/her an opportunity to explore the unexplored in accordance with the requirements of the curriculum.

Key features of Blended Learning

- **Student-Centric Pedagogical Approach** focusing on flexibility in timing, quality content, needs and interests of students and freedom to study through the mode of his/her choice;
- Freedom to Select variety of mediums and techniques;
- Increased student engagement in learning;
- Enhanced teacher and student interaction;
- Improved student learning outcomes;
- More flexible teaching and learning environment;
- More responsive for self and continuous learning;
- Better opportunities for experiential learning;
- Increased learning skills;
- Greater access to information, improved satisfaction and learning outcomes.

Note: Resolution no (c) as per minutes circulated by VC office**:** It was resolved that Blended Learning with 40% component of online teaching and 60% face to face classes for each programme, be adopted

12. Assessment and Evaluation

- Continuous Comprehensive Evaluation at regular after achievement of each Course-level learning outcome
- Formative Assessment on the basis of activities of a learner throughout the programme instead of one-time assessment
- Oral Examinations to test presentation and communication skills

- Open Book Examination for better understanding and application of the knowledge acquired
- Group Examinations on Problem solving exercises
- Seminar Presentations
- Review of Literature
- Collaborative Assignments

13. Keywords

- LOCF
- NEP-2020
- Blended Learning
- Face to face (F to F) Learning
- Programme Outcomes
- Programme Specific Outcomes
- Course-level Learning Outcomes
- Postgraduate Attributes
- Learning Outcome Index
- Formative Assessment and Evaluation
- Comprehensive and Continuous Evaluation

14. References

- National Education Policy-2020. https://www.education.gov.in/sites/upload_files/mhrd/files/NEP_Final_English_0.pdf

- The draft subject specific LOCF templates available on UGC website. https://www.ugc.ac.in/ugc_notices.aspx?id=MjY5OQ==
- Draft Blended Mode of Teaching and Learning: Concept Note available on UGC website. https://www.ugc.ac.in/pdfnews/6100340_Concept-Note-Blended-Mode-of-Teaching-and-Learning.pdf

15. Appendices

- **Syllabi & Scheme**