The Curriculum Book

Integrated Bachelor of Science (Hons. / Hons. with Research) - Master of Science

in

Computer Science (Cyber Security)

5 YEAR-PROGRAMME

(Scheme C)

Under Multiple Entry and Exit, Internship and

CBCS-LOCF as per NEP-2020

w.e.f. Session 2025-26

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

GURU JAMBHESHWAR UNIVERSITY OF SCIENCE & TECHNOLOGY

HISAR-125001, HARYANA

(A+ NAAC Accredited State Govt. University)

Table 3: Curriculum and Credit Framework for Undergraduate Programmes (Single Major)

Semester	Discipline-Specific Courses (DSC)	Minor(MIC)/ Vocational (VOC)	Multidisciplinary courses (MDC)	Ability Enhancement courses (AEC)	Skill Enhancement Courses (SEC)/ Internship /Dissertation	Value-Added Courses (VAC)	Total Credits
I	DSC - A1 @ 4 credits DSC – A2 @ 4 credits	MIC1 @ 4 credits	MDC1 @ 3 credits	AEC1 @ 2 credits	SEC1@ 3 credits	VAC1 @ 2 credits	22
II	DSC – A3 @ 4 credits DSC – A4 @ 4 credits	MIC2 @ 4 credits	MDC2 @ 3 credits	AEC2 @ 2 credits	SEC2@ 3 credits	VAC2 @ 2 credits	22
Students exiting the programme after second semester and securing 48 credits including 4 credits of summer internship will be awarded UG Certificate in the relevant Discipline/Subject							
III	DSC – A3 @ 4 credits DSC – A4 @ 4 credits	MIC3 @ 4 credits	MDC3 @ 3 credits	AEC3 @ 2 credits	SEC3@ 3 credits	VAC3 @ 2 credits	22
IV	DSC – A5 @ 4 credits DSC – A6 @ 4 credits DSC – A7 @ 4 credits DSC – A8 @ 4 credits	MIC4(VOC)@ 4 credits	----------	AEC4 @ 2 credits	----------	VAC4 @ 2 credits	24
Students exiting the programme after fourth semester and securing 94 credits including 4 credits of summer internship will be awarded UG Diploma in the relevant Discipline/Subject							
V	DSC – A9 @ 4 credits DSC – A10 @ 4 credits DSC – A11 @ 4 credits DSC – A12 @ 4 credits	MIC5(VOC)@ 4 credits	----------	----------	Internship @ 4 credits#	----------	24
VI	DSC – A13 @ 4 credits DSC – A14 @ 4 credits DSC – A15 @ 4 credits DSC – A16 @ 4 credits	MIC6(VOC)@ 4 credits	----------	----------	SEC3@ 2 credits	----------	22
Students will be awarded 3-year UG Degree in relevant major Discipline/Subject upon securing 136 credits.							
VII	DSC – H1 @ 4 credits DSC – H2 @ 4 credits DSC – H3 @ 4 credits DSC – H4 @ 4 credits DSC – H5 @ 4 credits	MIC7 @ 4 credits	----------	----------	----------	----------	24
VIII (4yr UG Hon.)	DSC – H6 @ 4 credits DSC – H7 @ 4 credits DSC – H8 @ 4 credits DSC – H9 @ 4 credits DSC – H10 @ 4 credits	MIC8 @ 4 credits	----------	----------	----------	----------	24
VIII (4yr UG Hon. with Research)	DSC – H6@ 4 credits DSC – H7@ 4 credits	MIC8 @ 4 credits	----------	----------	Research project/ Dissertation @ 12 credits	---------- TOTAL CREDITS	24 186

#Four credits of internship earned by a student during summer internship after 2nd semester or 4th semester will be counted in 5th semester of a student who pursue 3 year UG Programmes without taking exit option.

SEMESTER I

Type of Course	Course Code	Nomenclature of Paper/Course	Credit(s)	Contact Hours	Internal Marks	External Marks	Total	Duration of Exam (Hrs.)
Discipline Specific Courses	24ADS0101T/ 25BCS0101T	Computer Fundamentals and C Programming	3	3	20	50	70	2.5
	24ADS0101P/ 25BCS0101P	C Programming Lab.	1	2	10	20	30	3
	25BCS0102T	Fundamentals of Computer Networking	3	3	20	50	70	2.5
	25BCS0102P	Computer Networking Lab.	1	2	10	20	30	3
Minor Course/Vocational Course		To be opted from pool	4	4	30	70	100	3
Multidisciplinary Course		To be opted from pool	3	3	25	50	75	2.5
Ability Enhancement Course		To be opted from pool	2	2	15	35	50	2
Skill Enhancement Course		To be opted from pool	2	2	15	35	50	2
		To be opted from pool	1	2	10	15	25	3
Value Added Course		To be opted from pool	2	2	15	35	50	2
		TOTAL	**22**	**25**	**170**	**380**	**550**	

SEMESTER II

Type of Course	Course Code	Nomenclature of Paper/Course	Credit(s)	Contact Hours	Internal Marks	External Marks	Total	Duration of Exam (Hrs.)
Discipline Specific Courses	24ADS0201T/ 25BCS0201T	Data Structures	3	3	20	50	70	2.5
	24ADS0201P/ 25BCS0201P	Data Structures Lab.	1	2	10	20	30	3
	25BCS0202T	Principles of Cryptography	4	4	30	70	100	3
Minor Course/Vocational Course		To be opted from pool	4	4	30	70	100	3
Multidisciplinary Course		To be opted from pool	3	3	25	50	75	2.5
Ability Enhancement Course		To be opted from pool	2	2	15	35	50	2
Skill Enhancement Course		To be opted from pool	2	2	15	35	50	2
		To be opted from pool	1	2	10	15	25	3
Value Added Course		To be opted from pool	2	2	15	35	50	2
		TOTAL	**22**	**24**	**170**	**380**	**550**	

Note: Students who are interested to exit this programme after second semester and securing 48 credits including 4 credits of summer internship will be awarded UG Certificate in the relevant Discipline/Subject.

Computer Fundamentals and C Programming

General Course Information

Course Code: 24ADS0101T/ 25BCS0101T **Credits:** 3 **Hours /Week:** 3 **Course Type**: Discipline Specific course **Category:** Theory **Mode:** Lectures (L) **Examination Duration:** 2.5 Hours	**Course Assessment Methods:** **Max. Marks: 70 (Internal: 20; External: 50)** The department will conduct one minor test worth 10 marks. The Course Coordinator will decide whether to hold a second minor test at their level, and there will be no date sheet for it. Class performance includes attendance (5 marks) and 5 marks for assignments, seminars, presentations, or quizzes. Internal marks will be the total of the minor test score and the class performance marks earned by the student. **Note:** The end semester examination will be of 50 marks. The examiner is required to set seven questions in all. The first question will be compulsory consisting of consisting of five short questions covering the entire syllabus consisting of 2.5 marks each. In addition to that six more questions will be set, two questions from each unit. The students shall be required to attempt four questions in all selecting one question from each unit in addition to compulsory Question No. 01. All question shall carry equal marks i.e. 12.5 marks.

About the Course:

This subject deals with computer fundamentals and the concepts of C programming language.

Course Outcomes:

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

- CO1. Understand and explain fundamental computer concepts, including hardware, software, and memory organization.
- CO2. Develop and execute basic programs in C language, utilizing control structures, loops, and functions to solve problems.
- CO3. Effectively manage and manipulate data using arrays, strings, structures, and pointers in programming.
- CO4. Apply modular and recursive programming techniques for building efficient and structured solutions.

Course Content

Unit I

Introduction to Computers: Introduction, Characteristics and limitations of computers, block diagram of computer, types of computers, uses of computers, computer generations. Input and output devices: Keyboard and mouse, inputting data in other ways, Types of Software: system software, Application software, commercial, open source, domain and freeware software, Memories: primary, secondary and cache memory. Windows basics: desktop, start menu, icons, Programming Languages: Machine language, assembly language, high level language, Flow charts.

Unit II

Introduction to C: Introduction, Structure of C Program, Writing the first C Program, File used in C Program, Compiling and Executing C Programs, Using Comments, Keywords, Identifiers, Basic Data Types in C, Variables, Constants, I/O Statements in C, Operators in C, Programming Examples, Type Conversion and Type Casting. Decision Control and Looping Statements: Introduction to Decision Control Statements, Conditional Branching Statements, Iterative Statements, Nested Loops, Arrays: Introduction, Declaration of Arrays, Accessing elements of the Array, Storing Values in Array, Calculating the length of the Array, Operations on Array, one dimensional array for inter-function communication, Two dimensional Arrays, Operations on Two Dimensional Arrays, Strings.

Unit III

Pointers : Understanding Computer Memory, Introduction to Pointers, declaring Pointer Variables, Pointer Expressions and Pointer Arithmetic, Null Pointers, Structure, Union, and Enumerated Data Types: Introduction, Nested Structures, Arrays of Structures, Structures and Functions, Unions, Enumerated Data Types ,Functions: Introduction, using functions, Function declaration/ prototype, Function definition, function call, return statement, Passing parameters, Scope of variables, Storage Classes, Recursive function.

Text and Reference Books:

1. E Balagurusamy, *Computing Fundamentals & C Programming*, TataMcGrawHill, SecondReprint, 2008.
2. P. K. Sinha and P. Sinha, *Foundations of Computing*, BPB publication, 6th edition, 2004.
3. Brian Kernighan and Dennis Ritchie, *The C Programming Language*, PHI, 1988.
4. Byron C Gottfried, *Theory and problem of programming with C*, TMH, 1996.
5. E Balaguruswamy, *Programming in ANSI C*, Tata McGraw-Hill, 2011.

C Programming Lab.

General Course Information

Course Code: 24ADS0101P/ 25BCS0101P **Credit:** 1 **Hours/Week:** 2 **Course Type:** Discipline Specific Course **Category:** Practical **Mode:** Lab Practice and Assignments **Examination Duration:** 3 Hours	**Course Assessment Methods:** **Total Marks: 30 (Internal: 10; External: 20)** The internal and external assessment is based on the level of participation in lab sessions and the timely submission of lab experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA VOCE, the quality of lab file and ethical practices followed. The external examination is conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.

About the Course:

This course will make the student understand and implement the C programming language for problem-solving techniques.

Course Outcomes:

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

- CO1. Write and execute C programs to implement basic programming concepts, including data types, operators, and expressions.
- CO2. Apply control structures and loops to solve problems that require decision-making and iterative processing.
- CO3. Work with arrays, strings, and pointers to perform data manipulation and storage efficiently.
- CO4. Develop modular programs using functions, passing parameters effectively, and implementing recursive solutions where applicable.

Practical Lab based on subject 24ADS0101T/ 25BCS0101T

Note:

The actual experiments/assignments will be designed by the course coordinator. One assignment should be designed to be done in groups of two or three students. The assignments must meet the levels of the given course outcomes. The list of assignments and schedule of submission will be prepared by the course coordinator at the beginning of the semester.

Fundamentals of Computer Networking

General Course Information

Course Code: 25BCS0102T **Credits:** 3 **Hours/ Week:** 3 **Course Type**: Discipline Specific course **Category:** Theory **Mode:** Lectures (L) **Examination Duration:** 2.5 Hours	**Course Assessment Methods:** **Max. Marks: 70 (Internal: 20; External: 50)** The department will conduct one minor test worth 10 marks. The Course Coordinator will decide whether to hold a second minor test at their level, and there will be no date sheet for it. Class performance includes attendance (5 marks) and 5 marks for assignments, seminars, presentations, or quizzes. Internal marks will be the total of the minor test score and the class performance marks earned by the student. **Note:** The end semester examination will be of 50 marks. The examiner is required to set seven questions in all. The first question will be compulsory consisting of consisting of five short questions covering the entire syllabus consisting of 2.5 marks each. In addition to that six more questions will be set, two questions from each unit. The students shall be required to attempt four questions in all selecting one question from each unit in addition to compulsory Question No. 01. All question shall carry equal marks i.e. 12.5 marks.

About the Course:

This course introduces the fundamental concepts of data communication and computer networking.

Program Outcomes:

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

- CO1. Understand the fundamentals of data communication, network structures, and the OSI and TCP/IP models.
- CO2. Identify and describe various types of transmission media and switching techniques.
- CO3. Explain the functions and roles of networking devices and multiplexing techniques in data communication.
- CO4. Analyze the structure and function of Internet protocols and addressing systems.

Course Content

Unit I

Introduction: Introduction to data communications and networking, use of Computer Networks, classification of networks, OSI model, function of the layers, TCP/IP Protocol suite, Network Topologies: Bus, star, ring, mesh, tree, hybrid topologies with their features, advantages and disadvantages of each type. Transmission Modes: simplex, half duplex and full duplex.

Unit II

Transmission Media: Guided Media (Wired) (Twisted pair, Coaxial Cable, Fiber Optics. Unguided Media (Radio Waves, Infrared, Micro-wave, Satellite), Data Communication and Switching Techniques: Framing, flow control, error control, circuit switching, message switching, packet switching, routing.

Unit III

Switching Devices: Repeaters, hubs, switches, bridges, routers, gateways. Multiplexing: (FDM, WDM, TDM) Unit 6 Internet: Internet Service Providers (ISP), internet addressing system: IP address with their classification and notation, transport layer protocols: TCP and UDP, application layer protocols: (DNS, URL, WWW, FTP, SMTP, HTTP, TELNET).

Text and Reference Books:

1. Douglas E. Comer, *Computer Networks and Internet*, 6th edition, Pearson Publication, 2015.
2. Behrouz A Forouzan, *Data Communications and Networking*, 5th edition, McGraw Hill, Indian Reprint 2017
3. Andrew S. Tannenbaum, David J. Wetherall, *Computer Networks*, Pearson Publication, 5th edition

Computer Networking Lab.

General Course Information

Course Code: 25BCS0102P **Credit:** 1 **Hours/Week:** 2 **Course Type:** Discipline Specific Course **Category:** Practical **Mode:** Lab Practice and Assignments **Examination Duration:** 3 Hours	**Course Assessment Methods:** **Total Marks: 30 (Internal: 10; External: 20)** The internal and external assessment is based on the level of participation in lab sessions and the timely submission of lab experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA VOCE, the quality of lab file and ethical practices followed. The external examination is conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.

About the Course:

This lab is designed to provide students with practical knowledge and hands-on experience in computer networking using Cisco Packet Tracer, a powerful network simulation tool. The lab covers the configuration and simulation of various networking devices and protocols, enabling students to apply theoretical concepts in a virtual environment and prepare for real-world networking scenarios.

Program Outcomes:

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

CO1. Design and simulate basic and advanced network topologies using Cisco Packet Tracer.
CO2. Configure and troubleshoot networking devices such as routers, switches, and end devices.
CO3. Implement and test network protocols including IP addressing, DHCP, DNS, and routing protocols.
CO4. Demonstrate effective network management through VLANs, subnetting, and wireless networks.

Practical Lab based on subject 25BCS0102T

Note:

The actual experiments/assignments will be designed by the course coordinator. One assignment should be designed to be done in groups of two or three students. The assignments must meet the levels of the given course outcomes. The list of assignments and schedule of submission will be prepared by the course coordinator at the beginning of the semester.

Data Structures

General Course Information

Course Code: 24ADS0201T/ 25BCS0201T **Credits:** 3 **Hours/Week:** 3 **Course Type**: Discipline Specific course **Category:** Theory **Mode:** Lectures (L) **Examination Duration:** 2.5 Hours	**Course Assessment Methods:** **Max. Marks: 70 (Internal: 20; External: 50)** The department will conduct one minor test worth 10 marks. The Course Coordinator will decide whether to hold a second minor test at their level, and there will be no date sheet for it. Class performance includes attendance (5 marks) and 5 marks for assignments, seminars, presentations, or quizzes. Internal marks will be the total of the minor test score and the class performance marks earned by the student. **Note:** The end semester examination will be of 50 marks. The examiner is required to set seven questions in all. The first question will be compulsory consisting of consisting of five short questions covering the entire syllabus consisting of 2.5 marks each. In addition to that six more questions will be set, two questions from each unit. The students shall be required to attempt four questions in all selecting one question from each unit in addition to compulsory Question No. 01. All question shall carry equal marks i.e. 12.5 marks.

About the Course:

Data Structure is a core and an essential course for every graduate in Computer Science. This course introduces data structures like arrays, linked lists, trees and graphs etc. and various operations to be implemented on these data structures for solving real world problems. It includes various sorting and searching algorithms as well.

Course Outcomes:

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

CO1. Understand and explain different data structures and abstract data types, including their properties, types, and applications in problem-solving.

CO2. Implement and perform operations on linear data structures like arrays, linked lists, stacks, and queues for efficient data management.

CO3. Apply tree and graph data structures to organize and manipulate data, including traversals and searching techniques.

CO4. Analyze algorithms for searching and sorting in terms of time and space complexity, understanding asymptotic notations.

Course Content

Unit I

Introduction to data structures and their types, Abstract data types, Linear lists: Arrays and linked lists: memory representations, implementing operations like traversing, searching, inserting and deleting etc. Applications of arrays and linked lists, Stack and Queue: Static and linked implementations, Operations and Applications

Unit II

Circular queues, Tress, Binary trees and related terminology, Tree traversals (Recursive), Threaded Binary Trees, BinarySearch Trees implementation and operations, Priority queues. Height Balanced or AVL trees and B trees. Graph definitions and related terminology.

Unit III

Single source shortest path, Hashing, Hash tables, hash function and collision resolution. Sequential and binary search, Sorting algorithms: Bubble sort, Selection sort, Insertion sort, Time and space complexity of algorithms: Asymptotic analysis, Big O, Omega, Theta notations.

Text and Reference Books:

1. G.S. Baluja, *Data Structures Through C (a Practical Approach)*, Dhanpat Rai & Co.,2016.
2. Seymour Lipschutz, *Data Structures with C (Schaum's Outline Series)*, McGraw Hill Education,2017.
3. Ujjwal Mishra, *Data Structure Design*, Arihant Books,2023.
4. Aho, A. V., Ullman, J. D., and Hopcroft, J. E., *Data Structures and Algorithms*, Addison-Wesley, 1983.
5. Langsam Yedidyah, Augenstein J Moshe, Tenenbaum M Aaron, *Data Structures using C* and *C++*, PHI, 2009.
6. Cormen, T. H., Leiserson, C. E., Rivest, R. L. and Stein, C., *Introduction to Algorithms*, MITPress, 2009.
7. Robert L. Kruse, *Data Structure and Program Design in C*, Pearson Education India, 2007.

Data Structures Lab.

General Course Information

Course Code: 24ADS0201P/ 25BCS0201P **Credit:** 1 **Hours/Week:** 2 **Course Type:** Discipline Specific Course **Category:** Practical **Mode:** Lab Practice and Assignments **Examination Duration:** 3 Hours	**Course Assessment Methods:** **Total Marks: 30 (Internal: 10; External: 20)** The internal and external assessment is based on the level of participation in lab sessions and the timely submission of lab experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA VOCE, the quality of lab file and ethical practices followed. The external examination is conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.

About the Course:

This lab course involves implementation of basic data structures and various operations on these data structures. The objective of the lab course is to train the students to solve the problems related to data structures and choose the appropriate data structure for solving computational problem efficiently.

Course Outcomes:

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

CO1. Implement fundamental data structures such as arrays, linked lists, stacks, and queues using programming techniques.

CO2. Apply data structure operations (like insertion, deletion, traversal, and searching) to solve practical problems.

CO3. Develop tree and graph algorithms for tasks such as searching, sorting, and finding the shortest path.

CO4. Analyze and evaluate the efficiency of different algorithms in terms of time and space complexity through practical experimentation.

Practical Lab based on subject 24ADS0201T/ 25BCS0201T

Note:

The actual experiments/assignments will be designed by the course coordinator. One assignment should be designed to be done in groups of two or three students. The assignments must meet the levels of the given course outcomes. The list of assignments and schedule of submission will be prepared by the course coordinator at the beginning of the semester.

Principles of Cryptography

General Course Information

Course Code: 25BCS0202T **Credits:** 4 **Hours/Week:** 4 **Course Type:** Discipline Specific course **Category:** Theory **Mode:** Lectures (L) **Examination Duration:** 3 Hours	**Course Assessment Methods:** **Max. Marks: 100 (Internal: 30; External: 70)** The department will conduct one minor test worth 15 marks. The Course Coordinator will decide whether to hold a second minor test at their level, and there will be no date sheet for it. Class performance includes attendance (5 marks) and 10 marks for assignments, seminars, presentations, or quizzes. Internal marks will be the total of the minor test score and the class performance marks earned by the student. **Note:** The end semester examination will be of 70 marks. The examiner is required to set nine questions in all. The first question will be compulsory consisting of consisting of seven short questions covering the entire syllabus consisting of 2 marks each. In addition to that eight more questions will be set, two question from each unit. The students shall be required to attempt five questions in all selecting one question from each unit in addition to compulsory Question No. 01. All question shall carry equal marks i.e. 14 marks.

About the Course:

This course introduces the foundational principles and mathematical concepts essential for understanding and implementing secure communication in digital systems.

Course Outcomes:

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

- CO1. Understand the fundamental goals of cryptography and the basic concepts of security services, mechanisms, and cryptographic attacks.
- CO2. Apply mathematical foundations such as modular arithmetic, congruence, and algebraic structures in the design of cryptographic algorithms.
- CO3. Analyze and compare symmetric and asymmetric cryptographic techniques including DES, AES, RC5, and RSA.
- CO4. Explain the concepts of message authentication, cryptographic hash functions, and digital signature schemes for ensuring data integrity and authenticity.

Course Content

Unit I

Introduction: Security Goals, Cryptographic attacks, Services and Mechanism, Techniques for Security Goals Implementation – Mathematics of Cryptography – Modular Arithmetic, Congruence and Matrices.

Unit II

Traditional Symmetric Key Ciphers: Mathematics of Symmetric Key Cryptography – Algebraic Structures - Introduction to Modern Symmetric Key Ciphers- DES, AES, RC5, - Modes of operation of Modern Symmetric Key Ciphers.

Unit III

Mathematics of Asymmetric Key Cryptography: Primes, Primality Testing, Factorization, Chinese Remainder Theorem, Quadratic Congruence - Asymmetric Key Cryptography – RSA, Public Key Infrastructure and Digital Certificates.

Unit IV

Message Integrity and Message Authentication: Random Oracle Model, Message Authentication – Cryptographic Hash Functions – MD5, SHA-512 - Digital Signature – Process, Services, Attacks on Digital Signature, Digital Signature Schemes.

Text and Reference Books:

1. Behrouz A. Forouzan and Debdeep Mukhopadhyay, *Cryptography and Network Security*, third edition, Tata McGraw Hill, 2016
2. W. Stallings, *Cryptography and Network Security Principles and practice*, Seventh Edition, Pearson Education Asia, 2017.
3. Atul Kahate, *Cryptography and Network Security*, Third Edition, McGraw Hill, July 2017
4. Michael Stinson. D. *Cryptography: Theory and Practice*, third edition, Chapman & Hall/CRC, 2010
5. Wembo Mao, *Modern cryptography: theory & practice*, Pearson Education; First Edition, 2004.

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

Details of the courses offered by the department to students from other departments as per NEP-2020 are categorized as shown in the table below.

Type of Course	Semester	Course Code	Nomenclature of Paper/Course	Credit(s)	Contact Hours	Internal Marks	External Marks	Total	Duration of Exam (Hrs.)
Minor / Vocational Courses	1st	24MIC0117T	Multimedia and its Applications	2	2	15	35	50	2
	2nd	24MIC0217T	Logical Organization of Computers	2	2	15	35	50	2
	3rd	24MIC0317T	E-Commerce	4	4	30	70	100	3
	4th	24VOC0417T	Software Development	2 (Th)	2	15	35	50	2
		24VOC0417P	Software Development Lab.	2 (Pr)	4	15	35	50	3
Multidisciplinary Courses	1st	24MDC0103T	Introduction to Artificial Intelligence	3	3	25	50	75	2.5
	2nd	24MDC0203T	Introduction to Data Science	3	3	25	50	75	2.5
	3rd	24MDC0303T	Machine Learning	3	3	25	50	75	2.5
Skill Enhancement Courses	1st	24SEC0103T	R Programming	2 (Th)	2	15	35	50	2
		24SEC0103P	R Programming Lab.	1(Pr)	2	10	15	25	3
	2nd	24SEC0203T	Python Programming	2 (Th)	2	15	35	50	2
		24SEC0203P	Python Programming Lab.	1(Pr)	2	10	15	25	3
	3rd	24SEC0303T	Python Tools for Data Science	2 (Th)	2	15	35	50	2
		24SEC0303P	Python Tools for Data Science Lab.	1(Pr)	2	10	15	25	3
Value Added Courses	1st & 2nd	24VAC0114T	Cyber Security	2	2	15	35	50	2
	3rd & 4th	24VAC0314T	Cyber Laws and Ethics	2	2	15	35	50	2

Chairman

Multimedia and its Applications

General Course Information

Course Code: 24MIC0117T **Credits:** 2 **Hours /Week:** 2 **Course Type**: Minor / Vocational Courses **Category:** Theory **Mode:** Lectures (L) **Examination Duration:** 2 Hours	**Course Assessment Methods:** **Max. Marks: 50 (Internal: 15; External: 35)** The department will conduct one minor test worth 10 marks. The Course Coordinator will decide whether to hold a second minor test at their level, and there will be no date sheet for it. Class performance includes attendance (5 marks). Internal marks will be the total of the minor test score and the class performance marks earned by the student. **Note:** The end semester examination will be of 35 marks. The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to that four more questions will be set with two questions from each unit. The students shall be required to attempt three questions in all selecting one question from each unit consisting of 10 marks each in addition to compulsory Question No. 1 consisting of marks 15.

About the Course:

Multimedia is a minor course to understand the basic concepts of Multimedia and its applications. The objective of this course is to make students learn about the concepts of developing multimedia animations and to understand the technologies behind multimedia applications.

Course Outcomes:
Upon completion of this course, students will be able to:

- CO1. Understand and classify multimedia components, including hardware, software, audio, graphics, and video technologies.
- CO2. Work proficiently with multimedia audio and graphics by recording, editing, and manipulating digital files.
- CO3. Create basic animations and apply digital video editing techniques in multimedia projects.
- CO4. Develop multimedia projects through concept design, planning, and collaboration while exploring future trends in digital communication.

Course Contents

Unit I

Definition & Classification: Multimedia application -Multimedia Hardware - Multimedia software - CDROM - DVD. Multimedia Audio: Digital medium - Digital audio technology, sound cards - recording, editing. MP3: MIDI fundamentals - Working with MIDI - audio file formats - adding sound to Multimedia project. Multimedia Text: Text in Multimedia -Multimedia graphics: Coloring- digital imaging fundamentals - development and editing - file formats - scanning and digital photography

Unit II

Multimedia Animation: Computer animation fundamentals - Kinematics - morphing - animation s/w tools and techniques. Multimedia Video: How video works - broadcast video standards - digital video fundamentals – digital video production and editing techniques - file formats. Multimedia Project: stages of project - Multimedia skills - design concept - authoring - planning and costing –Multimedia Team. Multimedia-looking towards Future: Digital Communication and New Media, Interactive Television, Digital Broadcasting, Digital Radio, Multimedia Conferencing

T**ext and Reference Books:**

1. S. Gokul, *Multimedia Magic*, BPB Publications, 2nd Edition.
2. T. Vaughen, *Multimedia Making it Work*, TMH, 6th Edition.
3. K. Thakrar and P. K. Andleigh, *Multimedia System Design*, Prentice Hall India.
4. M. K. Pakhira, *Computer Graphics, Multimedia and Animation*, Prentice Hall India, 2nd Edition.
5. R. Parekh, *Principles of Multimedia*, Tata McGraw-Hill, 2007.

Logical Organization of Computers

General Course Information

Course Code: 24MIC0217T **Credits:** 2 **Hours /Week:** 2 **Course Type**: Minor / Vocational Courses **Category:** Theory **Mode:** Lectures (L) **Examination Duration:** 2 Hours	**Course Assessment Methods:** **Max. Marks: 50 (Internal: 15; External: 35)** The department will conduct one minor test worth 10 marks. The Course Coordinator will decide whether to hold a second minor test at their level, and there will be no date sheet for it. Class performance includes attendance (5 marks). Internal marks will be the total of the minor test score and the class performance marks earned by the student. **Note:** The end semester examination will be of 35 marks. The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to that four more questions will be set with two questions from each unit. The students shall be required to attempt three questions in all selecting one question from each unit consisting of 10 marks each in addition to compulsory Question No. 1 consisting of marks 15.

About the Course

"Logical Organization of Computer" is a course exploring the fundamental principles of digital systems. Covering topics such as information representation, binary logic, digital logic gates, and sequential circuits, students delve into the core components and operations of computers. Through understanding number systems, Boolean algebra, and circuit design, learners gain the skills to analyse, design, and optimize digital circuits. The course equips students with essential knowledge for various fields within computer science and engineering, providing a solid foundation for future studies and professional endeavours.

Course Outcomes

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

- CO1. Understand various number systems and their conversions, explain fixed-point and floating-point representations, and utilize error detection and correction codes in digital systems.
- CO2. Apply Boolean algebra and simplification techniques to design and analyze combinational and sequential logic circuits, including the use of Karnaugh maps for minimization.
- CO3. Design and implement various combinational circuits (such as adders, subtractors, encoders, decoders, multiplexers, and comparators) and sequential circuits (like flip-flops, shift registers, and counters) using standard design methodologies.
- CO4. Utilize digital design principles and practices to analyze, design, and implement digital systems, demonstrating the ability to apply theoretical concepts to practical applications.

Course Contents

Unit I

Information Representation: Number systems, Binary arithmetic, Fixed-point and Floating-point representation of numbers, BCD codes, Error detecting and correction codes, Character representation- ASCII, EBCDIC.
Digital Logic: Basic gates- AND, OR, NOT, Universal gates- NAND, NOR, Other gates – XOR, XNOR etc.,
Binary Logic: Boolean algebra, Boolean theorems, Boolean functions and Truth tables, Canonical and standard forms of boolean functions, De-Morgan's theorems, Simplification of boolean functions- Venn diagram, Karnaugh maps.

Unit II

Implementations of digital circuits, Combinational logic- characteristics, Design procedures, Analysis procedures. Combinational circuits: Half-Adder, Full- Adder, Half- Subtractor, Full-Subtractor, Encoders, Decoders, Multiplexers, De-multiplexers, Comparators, Code converters
Sequential Logic: Characteristics, Flip-Flops, Clocked RS, D type, JK, T type and Master- Slave flip-flops. State table, State diagram. Flip-flop excitation tables Shift registers: serial in parallel out and parallel in parallel out, Designing counters – Asynchronous and synchronous binary counters, Modulo-N counters and Up-Down counters

Text and Reference Books:

1. M. M. Mano, *Digital Logic and Computer Design*, Prentice Hall of India Pvt. Ltd.
2. V. Rajaraman and T. Radhakrishnan, *An Introduction to Digital Computer Design*, Prentice Hall of India Pvt. Ltd.
3. S. Goel, *Logical Organisation of Computer*, Natraj Publishing House.
4. C. Hamacher, Z. Vranesic, and S. Zaky, *Computer Organization*, 5th Edition, McGraw-Hill.

E-Commerce

General Course Information

Course Code: 24MIC0317T **Credits:** 4 **Hours /Week:** 4 **Course Type**: Minor / Vocational Courses **Category:** Theory **Mode:** Lectures (L) **Examination Duration:** 3 Hours	**Course Assessment Methods:** **Max. Marks: 100 (Internal: 30; External: 70)** The department will conduct one minor test worth 15 marks. The Course Coordinator will decide whether to hold a second minor test at their level, and there will be no date sheet for it. Class performance includes attendance (5 marks) and 10 marks for assignments, seminars, presentations, or quizzes. Internal marks will be the total of the minor test score and the class performance marks earned by the student. **Note:** The end semester examination will be of 70 marks. The examiner is required to set nine questions in all. The first question will be compulsory consisting of consisting of seven short questions covering the entire syllabus consisting of 2 marks each. In addition to that eight more questions will be set, two question from each unit. The students shall be required to attempt five questions in all selecting one question from each unit in addition to compulsory Question No. 01. All question shall carry equal marks i.e. 14 marks.

About the Course:
This course deals with the introduction, different business models for e-Commerce, concept of mobile computing, different types of on-line business systems, techniques and implementation for electronics payment system, and legal considerations in e-Commerce.

Course Outcomes:
Upon completion of this course, students will be able to:

CO1. Grasp the fundamentals of e-commerce, including electronic markets, data interchange, and web-based architecture.
CO2. Analyze and apply various electronic payment systems, including EDI and secure transaction protocols, highlighting their significance in the digital economy.
CO3. Examine the influence of e-commerce on industries such as manufacturing, logistics, online publishing, and banking, while identifying related management challenges.
CO4. Evaluate the impact of intranets on corporate finance and customer asset management, focusing on financial systems and CRM strategies for improved business operations.

Course Contents

Unit I

E-commerce and its Technological Aspects Overview of developments in Information Technology and Defining E-Commerce: The scope of E-commerce, Electronic Market, Electronic Data Interchange, Internet Commerce, Benefits and limitations of E-Commerce, produce a generic framework for E-Commerce, Architectural framework of Electronic Commerce, Web based E-Commerce Architecture.

Unit II

Electronic Data Interchange: Benefits of EDI, EDI technology, EDI standards, EDI communications, EDI Implementation, EDI Agreements, EDI Security. Electronic Payment Systems, Need of Electronic Payment System: Study and examine the use of Electronic Payment system and the protocols used, Study Electronic Fund Transfer and secure electronic transaction protocol for credit card payment. Digital economy: Identify the methods of payments on the net – Electronic Cash, cheques and credit cards on the Internet.

Unit III

Intranets and Manufacturing: Integrated Logistics, Agile Manufacturing, Emerging Business Requirements, Manufacturing Information Systems, Intranet-based Manufacturing, Logistics Management. E-Commerce and Online Publishing: Why Online Publishing, Online Publishing approaches, Advertising and Online Publishing E-Commerce and Banking: Changing Dynamics in the Banking Industry, Home Banking Implementation Approaches, Management Issues in Online Banking.

Unit IV

Intranets and Corporate Finance: An Introduction, Financial Systems, Financial Intranets, Software Modules in Financial Information Systems, Human Resource Management Systems, Size/Structure of Financial Software Market.

Intranets and Customer Asset Management: Basics of Customer Asset Management, Online Sales Force, Online Customer Service and Support, Technology and Marketing Strategy.

Text and Reference Books:

1. R. Kalakota and A. B. Whinston, *Electronic Commerce: A Manager's Guide*, Pearson Education.
2. M. Greenstein and M. Vasarhelyi, *Electronic Commerce: Security, Risk Management and Control*, Tata McGraw-Hill.
3. P. T. Joseph, *E-Commerce: An Indian Perspective*, Prentice Hall of India.
4. E. Turban et al., *Electronic Commerce: A Managerial Perspective*, Pearson Education.
5. E. M. Awad, *Electronic Commerce*, Prentice-Hall of India Pvt. Ltd.
6. R. Kalakota and A. B. Whinston, *Electronic Commerce: A Manager's Guide*, Addison-Wesley.
7. E. Turban, J. Lee, D. King, and H. M. Chung, *Electronic Commerce: A Managerial Perspective*, Addison-Wesley.

Software Development

General Course Information

Course Code: 24VOC0417T **Credits:** 2 **Hours/Week:** 2 **Course Type:** Vocational Courses **Category:** Theory **Mode:** Lectures (L) **Examination Duration:** 2 Hours	**Course Assessment Methods:** **Max. Marks: 50 (Internal: 15; External: 35)** The department will conduct one minor test worth 10 marks. The Course Coordinator will decide whether to hold a second minor test at their level, and there will be no date sheet for it. Class performance includes attendance (5 marks). Internal marks will be the total of the minor test score and the class performance marks earned by the student. **Note:** The end semester examination will be of 35 marks. The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to that four more questions will be set with two questions from each unit. The students shall be required to attempt three questions in all selecting one question from each unit consisting of 10 marks each in addition to compulsory Question No. 1 consisting of marks 15.

About the Course:

This course will help the students to understand the systematic approach to requirement analysis, design, development, operations and maintenance of software systems. Besides this, it also guides students in developing the optimal software systems based on programming language and various software development tools used with connectivity to database.

Course Outcomes:

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

- CO1. Understand the foundations of software development, including the history, significance, and various software development methodologies such as Waterfall, Spiral, RAD, Agile, and Scrum.
- CO2. Demonstrate proficiency in using programming languages and tools, particularly Python, along with IDEs and version control systems like Git.
- CO3. Apply software design principles, including design patterns, architectural styles (e.g., MVC, Microservices), and UML diagrams, to develop robust software solutions.
- CO4. Utilize software development tools for database design and querying, front-end and back-end web development, testing practices, and project management techniques, including planning, scheduling, and risk management.

Course Content

Unit I

Foundations of Software Development: Overview, history, and significance of software development, Software Development Life Cycle (SDLC), Software Development Methodologies: Waterfall, Spiral, RAD, Agile, and Scrum, Programming Languages and Tools: Introduction to key programming language python including IDEs and version control (e.g., Git).Software Design and Architecture: design patterns, architectural styles (MVC, Microservices), and UML diagrams.

Unit II

Software Development Tools: Databases: Overview of SQL database, design principles, and querying techniques, Web Development: Introduction to front-end HTML, and back-end technologies, Testing: Concepts of unit, integration, and system testing, Project management: Project planning, scheduling, risk management, and resource allocation. Security: Principles of secure coding, common vulnerabilities, and security testing practices.

Text and Reference Books:

1. K. K. Aggarwal and Y. Singh, *Software Engineering*, 3rd Edition, New Age International Publishers Ltd., Reprint 2014.
2. R. S. Pressman, *Software Engineering: A Practitioners Approach*, 7th Edition, McGraw-Hill Education, 2014.
3. R. Elmasri and S. B. Navathe, *Fundamentals of Database Systems*, 3rd Edition, Addison Wesley, 2002.
4. A. Silberschatz, H. F. Korth, and S. Sudarshan, *Database System Concepts*, McGraw-Hill, 2011.
5. Y. D. Liang, *Introduction to Programming Using Python*, Pearson, 2013.
6. R. Thareja, *Python Programming Using Problem Solving Approach*, Oxford Publications, 2017.
7. T. A. Powell, *HTML: The Complete Reference*, Tata McGraw-Hill, 2003.

Software Development Lab.

General Course Information

Course Code: 24VOC0417P **Credit:** 2 **Hours/Week:** 4 **Course Type:** Vocational Courses **Category:** Practical **Mode:** Lab Practice and Assignments	**Course Assessment Methods:** **Total Marks: 50 (Internal: 15; External: 35)** The internal and external assessment is based on the level of participation in lab sessions and the timely submission of lab experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA VOCE, the quality of lab file and ethical practices followed. The external examination is conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.

About the Course:

This course will provide a comprehensive understanding of basic programming, software development, and database management, preparing students for further studies or projects in software development. The objective of the lab course is to inculcate proficiency in students to design and develop market-based software applications.

Course Outcomes:

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

- CO1. Implement Agile and Scrum methodologies in practical projects, enhancing teamwork and collaboration skills.
- CO2. Develop proficiency in Python programming, including debugging and optimizing code, and using Git for version control.
- CO3. Design software solutions using appropriate design patterns and architectural styles for maintainability and scalability.
- CO4. Perform unit, integration, and system testing on software applications, documenting the process for quality assurance.

Practical Lab based on subject 24VOC0417T

Note:

The actual experiments/assignments will be designed by the course coordinator. One assignment should be designed to be done in groups of two or three students. The assignments must meet the levels of the given course outcomes. The list of assignments and schedule of submission will be prepared by the course coordinator at the beginning of the semester.

Introduction to Artificial Intelligence

General Course Information

Course Code: 24MDC0103T **Credits:** 3 **Hours /Week:** 3 **Course Type**: Multidisciplinary Course **Category:** Theory **Mode:** Lectures (L) **Examination Duration:** 2.5 Hours	**Course Assessment Methods:** **Max. Marks: 75 (Internal: 25; External: 50)** The department will conduct one minor test worth 15 marks. The Course Coordinator will decide whether to hold a second minor test at their level, and there will be no date sheet for it. Class performance includes attendance (5 marks) and 5 marks for assignments, seminars, presentations, or quizzes. Internal marks will be the total of the minor test score and the class performance marks earned by the student. **Note:** The end semester examination will be of 50 marks. The examiner is required to set seven questions in all. The first question will be compulsory consisting of consisting of five short questions covering the entire syllabus consisting of 2.5 marks each. In addition to that six more questions will be set, two questions from each unit. The students shall be required to attempt four questions in all selecting one question from each unit in addition to compulsory Question No. 01. All question shall carry equal marks i.e. 12.5 marks.

About the Course:

This subject deals with the basic concepts of Artificial Intelligence.

Course Outcomes:

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

- CO1. Understand foundational AI concepts, including techniques and methodologies for problem-solving as state space searches.
- CO2. Demonstrate proficiency in search techniques, including depth-first, breadth-first, heuristic methods, and game-playing algorithms, analyzing their efficiency and applications.
- CO3. Apply logical reasoning to represent facts and infer conclusions using normal forms, clause forms, unification, and resolution techniques.
- CO4. Analyze and utilize knowledge representation methods such as semantic networks, frames, and scripts to organize and manipulate knowledge in AI applications.

Course Content

Unit I

Overview of Artificial Intelligence: Introduction to AI, Importance of AI, AI and its related field, AI techniques, Problems, Problem Space and search: Defining the problem as a state space search, Production system and its characteristics, Issue in the design of search problem.

Unit II

Search Techniques: Depth first search, Breadth First Search, Heuristic Search Technique: Hill

climbing, best first search technique, A* algorithm, Searching of AND/ OR graph using AO* algorithm, Game Playing: AI and game playing, min-max algorithm, and Modified minimax with alpha-beta pruning.

Unit III

Logic: Propositional Logic, Predicate Logic, Representing facts in logic, Normal forms in logic, clause form, Unification, Resolution in predicate logic. Knowledge representation: Significance of Knowledge representation, Semantic Networks, Frames, Scripts, Conceptual dependency.

Text and Reference Books:

1. E. Rich, K. Knight, and S. B. Nair, *Artificial Intelligence*, McGraw Hill Education, 2009.
2. R. Chopra, *Artificial Intelligence (A Practical Approach)*, S Chand Publishing, 2012.
3. S. Russel and P. Norvig, *Artificial Intelligence: A Modern Approach*, Pearson Education, 2015.
4. D. W. Patterson, *Introduction to Artificial Intelligence and Expert System*, Pearson Education, 1st edition, 2007.
5. D. Khemani, *A First Course in Artificial Intelligence*, McGraw Hill Education, 3rd edition, 1st edition, 2013.
6. G. F. Luger, *Artificial Intelligence: Structures and Strategies for Complex Problem Solving*, Pearson Education, 5th edition, 2009.

Introduction to Data Science

General Course Information

Course Code: 24MDC0203T **Credits:** 3 **Hours /Week:** 3 **Course Type**: Multidisciplinary Course **Category:** Theory **Mode:** Lectures (L) **Examination Duration:** 2.5 Hours	**Course Assessment Methods:** **Max. Marks: 75 (Internal: 25; External: 50)** The department will conduct one minor test worth 15 marks. The Course Coordinator will decide whether to hold a second minor test at their level, and there will be no date sheet for it. Class performance includes attendance (5 marks) and 5 marks for assignments, seminars, presentations, or quizzes. Internal marks will be the total of the minor test score and the class performance marks earned by the student. **Note:** The end semester examination will be of 50 marks. The examiner is required to set seven questions in all. The first question will be compulsory consisting of consisting of five short questions covering the entire syllabus consisting of 2.5 marks each. In addition to that six more questions will be set, two questions from each unit. The students shall be required to attempt four questions in all selecting one question from each unit in addition to compulsory Question No. 01. All question shall carry equal marks i.e. 12.5 marks.

About the Course:

This subject deals with the basic concepts of Data Science.

Course Outcomes:

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

CO1. Understand data science fundamentals, including data cleaning and preparation challenges.
CO2. Transform and preprocess data for effective analysis, distinguishing between structured and unstructured data.
CO3. Create and interpret various visualizations to communicate insights, utilizing advanced techniques like 3D graphics.
CO4. Analyze data science applications across sectors such as business, healthcare, and telecommunications, identifying relevant data-driven solutions.

Course Content

Unit I

Data Science-a Discipline, Landscape-Data to Data science, Data Growth-issues and challenges, data science process. foundations of data science. Messy data, Anomalies and artifacts in datasets. Cleaning data, Data Acquisition and Processing: introduction, Structured Vs. Unstructured data, data preprocessing techniques including data cleaning, selection, integration, transformation and reduction, data mining, interpretation.

Unit II

Representation of Data: Special types-acoustic, image, sensor and network data. General techniques for handling large data

Data Wrangling Combining and Merging Data Sets – Reshaping and Pivoting – Data Transformation – String manipulations – Regular Expressions , Data Aggregation and Group Operations Group By Mechanics – Data Aggregation – GroupWise Operations – Transformations – Pivot Tables – Cross Tabulations – Date and Time data types

Unit III

Data Modeling: Basics of Generative modeling and Predictive modeling. Charts histograms, scatter plots, time series plots etc. Graphs, 3D Visualization and Presentation, Applications of Data Science: Business, Insurance, Energy, Health care, Biotechnology, Manufacturing, Utilities, Telecommunication, Travel, Governance, Gaming, Pharmaceuticals, Geospatial analytics and modeling.

Text and Reference Books:

1. S. Ozdemir, *Principles of Data Science*, Packt Publishing, 2016.
2. J. Grus, *Data Science from Scratch*, O'Reilly, 2016.
3. F. Provost and T. Fawcett, *Data Science for Business*, O'Reilly, 2013.
4. R. D. Peng and E. Matsui, *The Art of Data Science*, Lean Publishing, 2015.
5. P. Bruce, A. Bruce, and P. Gedeck, *Practical Statistics for Data Scientists, 2e: 50+ Essential Concepts Using R and Python*, O′Reilly.

Machine Learning

General Course Information

Course Code: 24MDC0303T **Credits:** 3 **Hours /Week:** 3 **Course Type**: Multidisciplinary Course **Category:** Theory **Mode:** Lectures (L) **Examination Duration:** 2.5 Hours	**Course Assessment Methods:** **Max. Marks: 75 (Internal: 25; External: 50)** The department will conduct one minor test worth 15 marks. The Course Coordinator will decide whether to hold a second minor test at their level, and there will be no date sheet for it. Class performance includes attendance (5 marks) and 5 marks for assignments, seminars, presentations, or quizzes. Internal marks will be the total of the minor test score and the class performance marks earned by the student. **Note:** The end semester examination will be of 50 marks. The examiner is required to set seven questions in all. The first question will be compulsory consisting of consisting of five short questions covering the entire syllabus consisting of 2.5 marks each. In addition to that six more questions will be set, two questions from each unit. The students shall be required to attempt four questions in all selecting one question from each unit in addition to compulsory Question No. 01. All question shall carry equal marks i.e. 12.5 marks.

About the Course:

This subject deals with the basic concepts of Machine Learning.

Course Outcomes:

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

- CO1. Understand well-posed learning problems and articulate essential components of designing learning systems, understanding well-posed learning problems, challenges, and inductive biases in machine learning tasks.
- CO2. Implement supervised learning algorithms such as linear regression, logistic regression, decision tree learning (ID3), and k-nearest neighbors, while evaluating model accuracy and coefficients.
- CO3. Analyze and implement unsupervised learning techniques, including clustering methods (k-means, k-medoids, DBSCAN) and artificial neural networks (perceptron, backpropagation), to extract patterns from unlabelled data.
- CO4. Apply Bayesian learning principles, including Bayes theorem and the Naïve Bayes classifier, for concept learning and maximum likelihood estimation in hypothesis formulation.

Course Content

Unit I

Introduction: Well posed learning problems, designing a learning system, Issues in machine learning, the concept learning task, Concept learning as search, Finding a maximally specific hypothesis, Version spaces and candidate elimination algorithm, Remarks on version spaces and candidate-eliminations, Inductive bias..

Unit II

Supervised Learning: Introduction to linear regression, estimating the coefficients, Accessing the accuracy of the coefficient estimates, Accessing the accuracy of the regression model, Multiple linear regression, Logistic regression, basic decision tree learning (ID3) algorithm, Hypothesis space search in decision tree learning algorithm, Inductive bias in decision tree learning, Issues in decision tree learning, k-nearest neighbor learning.

Unit III

Unsupervised Learning: About clustering, type of data in clustering analysis, k-means and k-medoids, DBSCAN density-based clustering method, Performance analysis of clustering algorithms, Artificial Neural networks: Neural Network representations, Appropriate problems for neural network learning, back propagation algorithm.

Bayesian Learning: Bayes theorem, Bayes theorem and concept learning, Maximum likelihood and least-squared error hypotheses, Naïve Bayes Classifier.

Text and Reference Books:

1. T. M. Mitchell, *Machine Learning*, McGraw-Hill, 1997.
2. C. Bishop, *Pattern Recognition and Machine Learning*, Springer Verlag, 2006.
3. T. Hastie, R. Tibshirani, and J. Friedman, *The Elements of Statistical Learning: Data Mining, Inference and Prediction*, 2nd Edition, Springer, 2009.
4. J. Han and M. Kamber, *Data Mining Concepts and Techniques*, 3rd Edition, Elsevier, 2012.
5. S. Rajeshkaran and G. A. Vijayalakshmi Pai, *Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications*, PHI, 2003.

R Programming

General Course Information

Course Code: 24SEC0103T **Credits:** 2 **Hours/Week:** 2 **Course Type:** Skill Enhancement Course **Category:** Theory **Mode:** Lectures (L) **Examination Duration:** 2 Hours	**Course Assessment Methods:** **Max. Marks: 50 (Internal: 15; External: 35)** The department will conduct one minor test worth 10 marks. The Course Coordinator will decide whether to hold a second minor test at their level, and there will be no date sheet for it. Class performance includes attendance (5 marks). Internal marks will be the total of the minor test score and the class performance marks earned by the student. **Note:** The end semester examination will be of 35 marks. The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to that four more questions will be set with two questions from each unit. The students shall be required to attempt three questions in all selecting one question from each unit consisting of 10 marks each in addition to compulsory Question No. 1 consisting of marks 15.

About the Course:

This course is to learn the fundamentals of R and covers how to use different functions in R for data analysis.

Course Outcomes:
Upon completion of this course, students will be able to:

CO1. Understand the significance of R as a programming language, and its advantages over others, and navigate R Studio effectively and manage packages, input, and output operations in R.
CO2. Manipulate R data types (vectors, lists, matrices, etc.) through operations like accessing, modifying, and merging data.
CO3. Implement decision-making constructs and looping mechanisms, including user-defined functions, to control program flow in R.
CO4. Load and analyze datasets in R, summarize data, perform statistical calculations, and manipulate text data for effective data analysis.

Course Content
Unit I

Introduction to R: What is R?, Why R? , Advantages of R over Other Programming Languages, R Studio: R command Prompt, R script file, Handling Packages in R: Installing a R Package, Input and Output: Entering Data from keyboard, Printing fewer digits or more digits, Special Values functions: NA, Inf and –inf, R Data Types: Vectors, Lists, Matrices, Arrays, Factors, Data Frame,R Variables: Variable assignment, Data types of Variable, Finding Variable ls(), Deleting Variables. R Operators: Arithmetic Operators, Relational Operators, Logical Operator, Assignment Operators, Miscellaneous Operators. R

Decision Making: if statement, if – else statement, if – else if statement, switch statement.R Loops: repeat loop, while loop, for loop - Loop control statement: break statement, next statement.R Function: function definition, Built in functions: mean (), paste(), sum(), min(), max(), seq(), user-defined function, calling a function, calling a function without an argument, calling a function with argument values. R-Strings: Manipulating Text in Data: substr(), strsplit(), paste(), grep(), toupper(), tolower().

Unit II

R Vectors: Sequence vector, rep function, vector access, vector names, vector math, vector element sorting.R List: Creating a List, List Tags and Values, Add/Delete Element to or from a List, Size of List, Merging Lists, Converting List to Vector.R Matrices: Accessing Elements of a Matrix, Matrix Computations: Addition, subtraction, Multiplication and Division- R Arrays: Naming Columns and Rows, Accessing Array Elements, Manipulating Array Elements, Calculation Across Array Elements
R Factors: creating factors, generating factor levels gl().Data Frames : Create Data Frame, Data Frame Access, Understanding Data in Data Frames: dim(), nrow(), ncol(), str(), Summary(), names(), head(), tail(), edit() functions , Extract Data from Data Frame, Expand Data Frame: Add Column, Add Row - Joining columns and rows in a Data frame rbind() and cbind() – Merging Data frames merge() – Melting and Casting data melt(), cast(). Loading and handling Data in R: Getting and Setting the Working Directory – getwd(), setwd(), dir().R-CSV Files - Input as a CSV file, Reading a CSV File, Analyzing the CSV File: summary(), min(), max(), range(), mean(), median(), apply() - Writing into a CSV File , R - Excel File – Reading the Excel file.

Text and Reference Books:

1. S. D. Ratnoo and H. S. Ratnoo, *Essentials of R for Data Analytics*, Wiley, January 2021.
2. S. Rakshit, *R Programming for Beginners*, McGraw Hill Education (India), 2017.
3. S. Acharya, *Data Analytics using R*, McGraw Hill Education (India), 2018.
4. A. de Vries and J. Meys, *R for Dummies*, 2nd Edition, John Wiley and Sons, Inc, 2015.

R Programming Lab.

General Course Information

Course Code: 24SEC0103P **Credit:** 1 **Hours/Week:** 2 **Course Type:** Skill Enhancement Course **Category:** Practical **Mode:** Lab Practice and Assignments	**Course Assessment Methods:** **Total Marks: 25 (Internal: 10; External: 15)** The internal and external assessment is based on the level of participation in lab sessions and the timely submission of lab experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA VOCE, the quality of lab file and ethical practices followed. The external examination is conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.

About the Course:

This course provides practical study related to the fundamentals of R and covers how to use different functions in R for data analysis.

Course Outcomes:

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

- CO1. Apply practical knowledge of R programming by writing and executing scripts that demonstrate data manipulation, statistical analysis, and visualization techniques.
- CO2. Effectively use R to clean and preprocess datasets, including handling missing values, transforming variables, and reshaping data structures for analysis.
- CO3. Create various data visualizations using R libraries like ggplot2 to communicate findings through graphical representations, including bar charts, histograms, scatter plots, and boxplots.
- CO4. Design and implement a mini-project that encompasses the entire data science process in R, from data acquisition and cleaning to analysis and visualization.

Practical Lab based on subject 24SEC0103T

Note:

The actual experiments/assignments will be designed by the course coordinator. One assignment should be designed to be done in groups of two or three students. The assignments must meet the levels of the given course outcomes. The list of assignments and schedule of submission will be prepared by the course coordinator at the beginning of the semester.

Python Programming

General Course Information

Course Code: 24SEC0203T **Credits:** 2 **Hours/Week:** 2 **Course Type:** Skill Enhancement Course **Category:** Theory **Mode:** Lectures (L) **Examination Duration:** 2 Hours	**Course Assessment Methods:** **Max. Marks: 50 (Internal: 15; External: 35)** The department will conduct one minor test worth 10 marks. The Course Coordinator will decide whether to hold a second minor test at their level, and there will be no date sheet for it. Class performance includes attendance (5 marks). Internal marks will be the total of the minor test score and the class performance marks earned by the student. **Note:** The end semester examination will be of 35 marks. The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to that four more questions will be set with two questions from each unit. The students shall be required to attempt three questions in all selecting one question from each unit consisting of 10 marks each in addition to compulsory Question No. 1 consisting of marks 15.

About the Course:

Python is a popular open-source programming language used for both standalone programs and scripting applications in a wide variety of domains. It is free, portable, and powerful and is both relatively easy and remarkably fun to use. In today's era Python has found great applicability in machine learning, data analytics and many other data science applications. This is introductory course and covers most of the basic concepts required for basic python programming.

Course Outcomes:

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

- CO1. Understand the Python programming fundamentals, including data types, control structures, and functions, enabling the development of effective scripts and algorithms.
- CO2. Efficiently use and manipulate Python's built-in data structures, such as lists, tuples, and dictionaries, to solve programming problems and organize data effectively.
- CO3. Apply object-oriented programming principles in Python, including the creation of classes and objects, to design modular and reusable code.
- CO4. Manipulate strings and handle file operations in Python, showcasing the ability to process and manage text data and files effectively.

Course Content

Unit I

Introduction to Python, History of Python, Features of Python, Python Identifiers, Python Character Set, Keywords and Indentation, Comments, Command Line Arguments, Assignment Operator,

Operators and Expressions, print() Function, input() Function, eval() Function, Python Data Types: int, float, complex, Variables, Mutable vs Immutable variables, Decision Statements: Boolean Type, Boolean Operators, if statement, else statement, Nested Conditionals Statements, Multi-way Decision Statements (elif statement), Loop Control Statements: While loop, range() Function, For Loop, Nested Loops, Infinite Loop, Break Statement, Continue Statement, Pass Statement, Introduction to Strings, String Operations: Indexing and Slicing.

Unit II

Lists: Operations on List: Slicing, Inbuilt Functions for Lists, List Processing: Searching and Sorting, Tuples, Dictionaries: Need of Dictionary, Operations on Directories: Creation, Addition, Retrieving Values, Deletion; Tuples, operations on Tuples, Inbuilt Functions for Tuples, Python Functions, Inbuilt functions, Main function, User Defined functions, Defining and Calling Function, Parameter Passing, Actual and Formal Parameters, Default Parameters, Global and Local Variables, Recursion, Passing Functions as Data, Lamda Function, Modules, Importing Own Module. Python Object Oriented: Overview of OOP, Classes and objects, Accessing attributes, Built- In Class Attributes, Methods, Class and Instance Variables, Destroying Objects, Polymorphism,Class Inheritance.

Text and Reference Books:

1. Ashok Namdev Kamthane, *Programming and Problem Solving with Python*, Mc Graw Hill Education Publication, 2018.
2. Lutz, M., *Learning Python: Powerful Object-Oriented Programming*, O'Reilly Media, Inc.,2013.
3. John Guttag, *Introduction to Computation and Programming using Python*, Springer, Revisedand Expanded version (Referred by MIT), 2013.
4. Michael T Goodrich and Robertto. Thamassia, Micheal S Goldwasser, *Data Structures and Algorithms in Python*, Wiley, 2016.
5. Y. Daniel Liang, *Introduction to Programming Using Python*, Pearson, 2013.
6. Reema Thareja, *Python Programming Using Problem Solving Approach*, Oxford Publications,2017.
7. R. Nageswara Rao, *Core Python Programming*, dreamtech Press, 2019.
8. Allen B. Downey *Think Python*, O'Reilly Media,2012.
9. Kenneth A. Lambert, *The Fundamentals of Python: First Programs*, Cengage Learning, 2011.

Python Programming Lab.

General Course Information

Course Code: 24SEC0203P **Credit:** 1 **Hours/Week:** 2 **Course Type:** Skill Enhancement Course **Category:** Practical **Mode:** Lab Practice and Assignments	**Course Assessment Methods:** **Total Marks: 25 (Internal: 10; External: 15)** The internal and external assessment is based on the level of participation in lab sessions and the timely submission of lab experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA VOCE, the quality of lab file and ethical practices followed. The external examination is conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.

About the Course:

Python is a scripting programming language known for both its simplicity and wide breadth of applications. For this reason, it is considered one of the best languages for beginners. Used for everything from web development to scientific computing Python is referred to as a general-purpose language by the greater programming community. The major objective of Python language is to make the students solve real word problem efficiently using python.

Course Outcomes:

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

- CO1. Implement Python Programming Concepts, including data types, control structures, and functions to solve programming problems.
- CO2. Design, code, and debug Python programs that utilize lists, tuples, dictionaries, and object-oriented programming principles to create structured and reusable code.
- CO3. Effectively use Python libraries and modules to enhance functionality and efficiency in coding, including importing and leveraging third-party libraries for specific tasks.
- CO4. Apply Python programming skills to perform data analysis and visualization using relevant libraries, enabling the interpretation and presentation of data effectively.

Practical Lab based on subject 24SEC0203T

Note:

The actual experiments/assignments will be designed by the course coordinator. One assignment should be designed to be done in groups of two or three students. The assignments must meet the levels of the given course outcomes. The list of assignments and schedule of submission will be prepared by the course coordinator at the beginning of the semester.

Python Tools for Data Science

General Course Information

Course Code: 24SEC0303T **Credits:** 2 **Hours/Week:** 2 **Course Type:** Skill Enhancement Course **Category:** Theory **Mode:** Lectures (L) **Examination Duration:** 2 Hours	**Course Assessment Methods:** **Max. Marks: 50 (Internal: 15; External: 35)** The department will conduct one minor test worth 10 marks. The Course Coordinator will decide whether to hold a second minor test at their level, and there will be no date sheet for it. Class performance includes attendance (5 marks). Internal marks will be the total of the minor test score and the class performance marks earned by the student. **Note:** The end semester examination will be of 35 marks. The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to that four more questions will be set with two questions from each unit. The students shall be required to attempt three questions in all selecting one question from each unit consisting of 10 marks each in addition to compulsory Question No. 1 consisting of marks 15.

About the Course:

This course is about to familiarize the students with the python tools like NumPy, Pandas and other to solve the problems in data science effectively.

Course Outcomes:

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

- CO1. Utilize NumPy to create and manipulate multi-dimensional arrays, performing indexing, slicing, and mathematical operations for data analysis.
- CO2. Apply Pandas data structures (Series and DataFrames) to manage structured data, conduct data cleaning, and handle missing values for effective preprocessing.
- CO3. Design informative visualizations using Matplotlib to communicate data insights through various plots and charts.
- CO4. Implement techniques to read from and write to multiple data formats (CSV, Excel, HTML, JSON, etc.) and databases for seamless data integration across applications.

Course Content

Unit I

NumPy: History , Ndarray, Create an Array , Types of Data , dtype Option , Intrinsic Creation of an Array , Basic Operations, Arithmetic Operators , Matrix Product , Increment and Decrement Operators , Universal Functions (ufunc) , Aggregate Functions ,Indexing, Slicing, and Iterating , Indexing ,Slicing , Iterating an Array , Conditions and Boolean Arrays , Shape Manipulation , Array Manipulation , Joining Arrays, Splitting Arrays , General Concepts- Copies or Views of Objects ,Vectorization ,Broadcasting ,Structured Arrays , Reading and Writing Array Data on Files , Loading and Saving Data in Binary Files , Reading Files with Tabular Data

Introduction to pandas Data Structures , Series , DataFrame , Index Objects , Other Functionalities on Indexes , Reindexing , Dropping , Arithmetic and Data Alignment , Operations Between Data Structures , Flexible Arithmetic Methods , Operations Between DataFrame and Series , Function Application and Mapping , Functions by Element , Functions by Row or Column ,Statistics Functions ,

Sorting and Ranking , Correlation and Covariance , “Not a Number” Data , Assigning a NaN Value , Filtering Out NaN Values , Filling in NaN Occurrences , Hierarchical Indexing and Leveling , Reordering and Sorting Levels , Summary Statistic by Level .

Unit II

pandas: Reading and Writing Data, I/O API Tools ,CSV and Textual Files , Reading Data in CSV or Text Files, Using RegExp to Parse TXT Files , Reading TXT Files Into Parts ,Writing Data in CSV , Reading and Writing HTML Files , Writing Data in HTML , Reading Data from an HTML File , Reading Data from XML, Reading and Writing Data on Microsoft Excel Files , JSON Data , Format HDF5 , Pickle—Python Object Serialization , Serialize a Python Object with cPickle , Pickling with pandas , Interacting with Databases , Loading and Writing Data with SQLite3 ,Loading and Writing Data with PostgreSQL , Reading and Writing Data with a NoSQL Database: MongoDB

pandas in Depth: Data Manipulation, Data Preparation, Merging, Concatenating, Combining, Pivoting, Removing , Data Transformation , Removing Duplicates , Mapping , Discretization and Binning , Detecting and Filtering Outliers , Permutation , Random Sampling , Data Aggregation , GroupBy , Hierarchical Grouping , Group Iteration , Chain of Transformations , Functions on Groups , Advanced Data Aggregation

Data Visualization with matplotlib : matplotlib Library , matplotlib Architecture , Backend Layer , Artist Layer , Scripting Layer (pyplot) , pylab and pyplot , pyplot -A Simple Interactive Chart , Plotting Window , Set the Properties of the Plot , matplotlib and NumPy , Using the kwargs , Working with Multiple Figures and Axes , Handling Date Values , Chart Typology ,Line Charts ,Line Charts with pandas , Histograms , Bar Charts , Horizontal Bar Charts , Multiserial Bar Charts , Multiseries Bar Charts with pandas Dataframe , Multiseries Stacked Bar Charts , Stacked Bar Charts with a pandas Dataframe , Other Bar Chart Representations , Pie Charts , Pie Charts with a pandas Dataframe , Advanced Charts , Contour Plots , Polar Charts , 3D Surfaces , Scatter Plots in 3D , Bar Charts in 3D , Multi-Panel Plots , Grids of Subplots

Text and Reference Books:

1. Fabio Nelli, S. B., *Python Data Analytics: With Pandas, NumPy, and Matplotlib*, Apress; 2nd ed. edition (28 September 2018).
2. Oswald Campesato , S., *Python Tools for Data Scientists*, Mercury Learning and Information, 2022.

Python Tools for Data Science Lab.

General Course Information

Course Code: 24SEC0303P **Credit:** 1 **Hours/Week:** 2 **Course Type:** Skill Enhancement Course **Category:** Practical **Mode:** Lab Practice and Assignments	**Course Assessment Methods:** **Total Marks: 25 (Internal: 10; External: 15)** The internal and external assessment is based on the level of participation in lab sessions and the timely submission of lab experiments/assignments, the quality of solutions designed for the assignments, the performance in VIVA VOCE, the quality of lab file and ethical practices followed. The external examination is conducted by external examiner appointed by the Controller of Examination in association with the internal examiner appointed by the Chairperson of the Department.

About the Course:

This course is to make the student to implement the Python Tools for Data Science like NumPy, Pandas and more for problem solving techniques.

Course Outcomes:

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

- CO1. Perform data manipulation using NumPy and Pandas, including array and DataFrame creation, data transformation, and aggregation.
- CO2. Analyze real-world datasets with Python, applying statistical methods to extract insights and identify trends.
- CO3. Create and customize visualizations using Matplotlib, including line plots, bar charts, histograms, and scatter plots.
- CO4. Read and write data in various formats (CSV, Excel, JSON, etc.) and utilize databases for effective data integration in Python.

Practical Lab based on subject 24SEC0303T

Note:

The actual experiments/assignments will be designed by the course coordinator. One assignment should be designed to be done in groups of two or three students. The assignments must meet the levels of the given course outcomes. The list of assignments and schedule of submission will be prepared by the course coordinator at the beginning of the semester.

Cyber Security

General Course Information

Course Code: 24VAC0114T **Credits:** 2 **Hours /Week:** 2 **Course Type**: Value Added Course **Category:** Theory **Mode:** Lectures (L) **Examination Duration:** 2 Hours	**Course Assessment Methods:** **Max. Marks: 50 (Internal: 15; External: 35)** The department will conduct one minor test worth 10 marks. The Course Coordinator will decide whether to hold a second minor test at their level, and there will be no date sheet for it. Class performance includes attendance (5 marks). Internal marks will be the total of the minor test score and the class performance marks earned by the student. **Note:** The end semester examination will be of 35 marks. The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to that four more questions will be set with two questions from each unit. The students shall be required to attempt three questions in all selecting one question from each unit consisting of 10 marks each in addition to compulsory Question No. 1 consisting of marks 15.

About the Course:

This subject deals with the computer fundamentals and the concepts Cyber Security.

Course Outcomes:

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

- CO1. Understand the architecture of cyberspace and key concepts of cyber security, including cyber-crime classification and legal frameworks.
- CO2. Identify and mitigate challenges related to cyber security threats such as malware, ransomware, and social engineering.
- CO3. Assess security risks in social media and digital payment systems, implementing best practices for safe usage.
- CO4. Apply security measures for endpoint devices, including password policies and data backup, in line with cyber security best practices.

Course Content

Unit I

Defining Cyberspace and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Internet infrastructure for data transfer and governance, Internet society, Concept of cyber security, Issues and challenges of cyber security, Classification of cyber crimes, Common cyber crimes- cyber crime targeting computers and mobiles, cyber crime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Reporting of cyber crimes, Remedial and mitigation measures, Legal perspective of cyber crime, IT Act 2000 and its amendments, Cyber crime and offences, Organisations dealing with Cyber crime and Cyber security in India.

Unit II

Introduction to Social networks and media, Social media platforms, Social media monitoring, Hashtag, Viral content, Social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Best practices for the use of Social media.

Introduction to digital payments, Components of digital payment and stake holders, Modes of digital payments- Banking Cards, Unified Payment Interface (UPI), e-Wallets, Aadhar enabled payments, Digital payments related common frauds and preventive measures. RBI guidelines on digital payments and customer protection in unauthorised banking transactions. End Point device and Mobile phone security, Password policy, Security patch management, Data backup, Downloading and management of third party software, Device security policy, Cyber Security best practices, Significance of host firewall and Ant-virus, Wi-Fi security, Configuration of basic security policy and permissions.

Text and Reference Books:

1. R. C. Mishra, *Cyber Crime Impact in the New Millennium*, Author Press, 2010.
2. S. Belapure and N. Godbole, *Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives*, Wiley India Pvt. Ltd., 1st Edition, 2011.
3. H. A. Oliver, *Security in the Digital Age: Social Media Security Threats and Vulnerabilities*, Create Space Independent Publishing Platform, Pearson, 13th November, 2001.
4. E. M. Awad, *Electronic Commerce*, Prentice Hall of India Pvt. Ltd.
5. K. Kumar, *Cyber Laws: Intellectual Property & E-Commerce Security*, Dominant Publishers.
6. E. Cole, R. Krutz, and J. W. Conley, *Network Security Bible*, 2nd Edition, Wiley India Pvt. Ltd.
7. E. Maiwald, *Fundamentals of Network Security*, McGraw-Hill.

Cyber Laws and Ethics

General Course Information

Course Code: 24VAC0314T **Credits:** 2 **Hours /Week:** 2 **Course Type**: Value Added Course **Category:** Theory **Mode:** Lectures (L) **Examination Duration:** 2 Hours	**Course Assessment Methods:** **Max. Marks: 50 (Internal: 15; External: 35)** The department will conduct one minor test worth 10 marks. The Course Coordinator will decide whether to hold a second minor test at their level, and there will be no date sheet for it. Class performance includes attendance (5 marks). Internal marks will be the total of the minor test score and the class performance marks earned by the student. **Note:** The end semester examination will be of 35 marks. The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to that four more questions will be set with two questions from each unit. The students shall be required to attempt three questions in all selecting one question from each unit consisting of 10 marks each in addition to compulsory Question No. 1 consisting of marks 15.

About the Course:
Tis course is about to underlines the ethical concerns and cyber security issues surrounding information security policies, procedures, systems, and teams.

Course Outcomes :
Upon completion of this course, students will be able to:

- CO1. Understand the various forms of cybercrime, including forgery, hacking, and software piracy, and explain the methods criminals use to execute attacks.
- CO2. Analyze security challenges posed by mobile and wireless devices, including the specific threats and cryptographic measures needed to protect them.
- CO3. Identify tools and techniques used in cybercrime, such as proxy servers, phishing, and SQL injection, and discuss their implications for cybersecurity.
- CO4. Evaluate the legal frameworks governing cybercrime in India, including the IT Act, and understand the ethical considerations surrounding cybersecurity practices and case studies.

Course Content

Unit I

Introduction of Cybercrime: What is cybercrime?, Forgery, Hacking, Software Piracy, Computer Network intrusion Category of Cybercrime: how criminals plan attacks, passive attack, Active attacks, cybers talking. Cybercrime Mobile & Wireless devices: Security challenges posted by mobile devices, cryptographic security for mobile devices, Attacks on mobile/cellphones, Theft, Virus, Hacking. Bluetooth; Different viruses on laptop.

Unit II

Tools and Methods used in Cyber crime: Proxy servers, panword checking, Random checking, Trojan

Horses and Backdoors; DOS & DDOS attacks; SQL injection: buffer over flow. Phishing & Identity Theft: Phishing methods, ID Theft; Online identity method. Cybercrime & Cyber security: Legal aspects, Indian laws, IT act, Public key certificate Ethics: Legal Developments, Cyber security in Society, Security in cyber laws case studies, General law and Cyber Law-a Swift Analysis.

Text and Reference Books:

1. N. Godbole and S. Belapure, *Cyber Security*, Wiley India.
M. F. Grady and F. Parisi, *The Law and Economics*