KANNUR UNIVERSITY
കണ്ണൂർ സർവകലാശാല

III & IV SEMESTER SYLLABUS FOR

MSc Computer Science
&
MSc Computer Science
with Specialization in Artificial Intelligence

Under the

Faculty of Technology

(Academic Year 2023-24 onwards)

Semester -3

Course Code	Course Title	Instructional Hours/Week			Marks			Credits
		L	P	T	CE	ESE	Total	
MSCSC03C14	Advanced Operating System	3		1	20	80	100	3
MSCSC03C15	Artificial Intelligence	3		1	20	80	100	3
MSCSC03C16	Software Engineering	3		1	20	80	100	3
MSCSC03C17	System Programming and Compiler Design	3		1	20	80	100	3
	Open Elective -1	4		1	20	80	100	4
MSCSC03C18	Case Study and Mini Project		09	3	20	80	100	4
	Total	**16**	**09**	**08**	**120**	**480**	**600**	**20**

Semester -4

Course Code	Course Title	Instructional Hours/Week			Marks			Credits
		L	P	T	CE	ESE	Total	
	Elective -1	4		1	20	80	100	4
	Elective -2	4		1	20	80	100	4
MSCSC04C19	Project		17	4	40	160	200	10
	Total	**08**	**17**	**06**	**80**	**320**	**400**	**18**

Note:

Colleges and teachers have the opportunity to propose open elective courses and elective courses for the III and IV semesters. The proposed syllabus and model question papers should be submitted to the university by December 31st each year. If the syllabus is approved by the Board of Studies, colleges can then offer these proposed courses from the subsequent academic year onwards.

Semester-3

Open Elective-1

Course Code	Course Title	Instructional Hours/Week			Marks			Credits
		L	P	T	CE	ESE	Total	
MSCSC03O01	Deep Learning	4		1	20	80	100	4
MSCSC03O02	Digital Image Processing	4		1	20	80	100	4
MSCSC03O03	Information Security	4		1	20	80	100	4

Note: Students enrolled in the MSc Computer Science with specializing in Artificial Intelligence will select the open elective course titled MSCSC03O01: Deep Learning.

Semester-4

Elective-1 and Elective -2 (*Students have the option to select any two courses*)**)**

Course Code	Course Title	Instructional Hours/Week			Marks			Credits
		L	P	T	CE	ESE	Total	
MSCSC04E01	Natural Language Processing	4		1	20	80	100	4
MSCSC04E02	Software Testing	4		1	20	80	100	4
MSCSC04E03	Cyber Security	4		1	20	80	100	4
MSCSC04E04	Soft Computing	4		1	20	80	100	4
MSCSC04E05	Data Mining	4		1	20	80	100	4
MSCSC04E06	Digital Image Forensics	4		1	20	80	100	4

Note: Students enrolled in the MSc Computer Science with specializing in Artificial Intelligence will select the elective courses titled MSCSC04E01: Natural Language Processing and MSCSC04E04: Soft Computing/MSCSC04E05 : Data Mining.

Syllabus and Model Question Papers
for
III Semester Core Courses

MSCSC03C14: Advanced Operating System

Semester	Course Code	Hours per week	Credit	Exam Hours
3	**MSCSC03C14**	3	3	3

Course Outcome

CO1	General understanding of the structure of modern computers
CO2	Understanding CPU Scheduling, Synchronization, Deadlock Handling, and Comparing CPU Scheduling Algorithms.
CO3	Describe the role of paging, segmentation, and virtual memory in operating systems.
CO4	Discuss swapping and page replacement policies of memory management
CO5	General understanding of the structure of modern computers

SYLLABUS

Unit- 1

Operating-System Structures: Operating System Services, System Calls, Operating-System Design and Implementation, Operating-System Structure. **Processes:** Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication: IPC in Shared-Memory Systems, IPC in Message-Passing Systems, Communication in Client-Server Systems – Sockets and remote procedure call

Unit-2

Threads: Single-threaded and Multithreaded Processes, Benefits of Multithreaded Programming, Multithreading Models, Challenges in programming for multicore systems. **CPU Scheduling**: Basic Concepts, Scheduling Criteria, Scheduling Algorithms – FCFS, RR, SJF, Priority Scheduling, Multilevel Queue and Multilevel Feedback Queue Scheduling, Approaches to Multiple Processor Scheduling, **Real-Time CPU Scheduling** - Minimizing Latency and Priority-Based Scheduling.

Unit-3

Process Synchronization: Cooperating Process, Critical-Section Problem, Peterson's Solution, Hardware Support for Synchronization, Mutex Locks, Semaphores, Monitors - Implementing a Monitor Using Semaphores, Liveness- Deadlock and Priority Inversion **Classic Problems of Synchronization** - Bounded-Buffer Problem, Readers –Writers Problem, Dining-Philosophers Problem.

Unit-4

Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance - Resource-Allocation-Graph Algorithm, Banker's Algorithm, Deadlock Detection, Recovery from Deadlock. **Memory Management**: Contiguous Memory Allocation- Memory Protection, Memory Allocation, Fragmentation, Swapping, Paging, Structure of the Page Table. **Virtual Memory:** Demand Paging- Basic Concepts, Copy-on-Write, Page Replacement - Basic Page Replacement, FIFO, Optimal Page Replacement, LRU.

Text books/References:

1. Operating System Concepts, 10th Edition By Abraham Silberschatz, Peter B Galvin, And Greg Gagne.
2. Modern Operating Systems, 5th Edition By Andrew S. Tanenbaum And Herbert Bos
3. Operating Systems: A Design-Oriented Approach, Charles Crowley, International edition, McGraw-Hill Education (ISE Editions). ISBN-13 978 0071144629

Unit Wise Questions Distribution

Units	**Section A**	**Section B**	**Section C**
1	2	1	1
2	2	1	1
3	1	2	1
4	1	1	2
Total Questions	**6**	**5**	**5**

Model Question Paper Pattern

MSCSC03C14: Advanced Operating System

Time: Three Hours **Max. Marks: 80**

Part-A

Answer any 5 questions. 4 marks each

1. What is a process? Illustrate with a neat diagram the different states of a process and control block
2. Explain the issues that come with multi-threaded programming
3. Discuss the implementation of IPC using message-passing systems in detail
4. Explain CPU scheduling criteria
5. What is a critical section? What are the requirements for the solution to the critical section problem?
6. What is the difference between contiguous and non – contiguous storage allocation?

(5 x 4 = 20)

Part-B

Answer any 3 questions. 8 marks each

7. Answer the following:
    a. What do mean by system call? Explain different types of system calls. What is the fork system call used for? (System call definition – 1.5 marks, types - 2.5 marks, fork system call – 1 marks)
    b. What are three general methods used to pass parameters to the operating system? (3 marks)
8. What is the difference between multilevel queue and multilevel feedback queue scheduling? Consider a system implementing multilevel queue scheduling. What strategy can a computer user employ to maximize the amount of CPU time allocated to the user's process?
9. Explain mutual-exclusion implementation with test and set () and using CAS (4 marks each)
10. Explain a classic software-based solution to the critical-section problem using an example.
11. Using Banker's algorithm, answer the following questions:
    a. How many resources of type A, B, C, and D are there?
    b. What are the contents of the need matrix?

c. Find if the system is in a safe state? If it is, find the safe sequence.

Process	**Max**	**Allocation**	**Available**
	A, B, C, D	A, B, C, D	A, B, C, D
P0	6 0 1 2	4 0 0 1	3 2 1 1
P1	2 7 5 0	1 1 0 0	
P2	2 3 5 6	1 2 5 4	
P3	1 6 5 3	0 6 3 3	
P4	1 6 5 6	0 2 1 2	

(3 x 8 = 24)

Part-C

Answer any 3 questions. 12 marks each

12. Answer the following
    a. What do you mean by Multithreading? Why is it important? Explain its models and benefits (Definition – 1 mark, importance – 1 mark, Models – 2 marks, and benefits – 2 marks) – 6 marks
    b. Explain the structure services of an Operating system (3 marks each)
13. Calculate the average waiting time and the average turnaround time by drawing the Gantt chart using FCFS, SRTF, and RR (q=2ms). A lower priority number represents a higher priority. (4 marks each)

Process	Arrival Time	Burst Time	Priority
P1	0	9	3
P2	1	4	2
P3	2	9	1
P4	3	5	4

14. Answer the following:
    a. Define the semaphore operations. What is the purpose of using semaphores or mutex locks for synchronization in synchronization problems? Explain the difference between binary semaphore and mutex. (6 marks)
    b. Explain bounded buffer and dining philosophers problems of synchronization (3 marks each)

15. Answer the following:
    a. What are the main principles of the FIFO and LRU replacement algorithms? (4 marks)
    b. Consider the following page reference using three initially empty frames. Find the page faults using the FIFO and LRU algorithm, where the page reference sequence is 7,0,1,2,0,3,0,4,2,3,0,3,2,1,2,0,1,7,0,1? (4 marks each)
16. How can the system distinguish between the pages in the main memory from those on the disk?

(3x12 = 36)

MSCSC03C15: Artificial Intelligence

Semester	Course Code	Hours per week	Credit	Exam Hours
3	**MSCSC03C15**	3	3	3

Course Outcome

CO1	Understand fundamental concepts of intelligent systems.
CO2	Formulate problems as a state space and apply various search algorithms to identify optimal solutions.
CO3	Understand effective knowledge representation ways.
CO4	Ability to design and develop expert systems

SYLLABUS

Unit-1

Introduction to AI, Definitions, Evolution of AI, Applications of AI, Turing Test, Intelligent Agents, Agents and Environments, Nature of Environments, Structure of Agents. Production systems, Control strategies, Problem characteristics, Production system characteristics, AI Problems, Water Jug problems, 8 Puzzle problem, Crypt arithmetic Problems, block world Problem

Unit-2

Solving Problem by Searching, State Space Search, Blind Search Techniques, Uninformed search, Breadth First Search, Depth First Search, Iterative Deepening Search, Informed Search, Introduction to Heuristics, Admissible heuristics, Best First Search, Hill Climbing, A*, Ant Colony Optimization

Unit-3

Game Playing: Adversarial search, Optimal decisions in games, The Minmax algorithm, Alpha-Beta pruning, Constraint Satisfaction Problems, Knowledge representation, reasoning, and decision-making: Propositional logic, Predicate logic, Application: Logic based Financial Advisor Knowledge Representation Structures : Frames, Semantic Networks, Conceptual Dependencies, Scripts, Ontology (Basic idea only)

Unit-4

Planning, Overview, components of a planning system, Goal stack planning, Problem Decomposition, Means Ends Analysis, AO*, Expert systems, Architecture of expert systems, Rule Based Expert Systems, Machine learning: General model of learning process, How does machine learn, Types of learning: Supervised, Un supervised, reinforcement learning

Text books/ References:

1. George F Luger, Artificial Intelligence – Structures and Strategies for Complex problem solving, 5thEdn, pearson.
2. Russell, S and Norvig, P, 2015, Artificial Intelligence – A Modern Approach, 3rd Edition, Prentice Hall.
3. Elaine Rich, Kevin Knight, Shivashankar B Nair., "Artificial Intelligence", 3rd Edition, McGraw Hill Education, 2011
4. Peter Jackson, "Introduction to Expert Systems", 3rd Edition, Pearson Education, 2007.
5. Dan W. Patterson, "Introduction to AI and ES", Pearson Education, 2007.
6. http://nptel.ac.in/courses/106105077/

Unit Wise Question Distribution

Units	**Section A**	**Section B**	**Section C**
1	1	1	1
2	2	1	2
3	1	2	1
4	2	1	1
Total Questions	**6**	**5**	**5**

Model Question Paper

MSCSC03C15: Artificial Intelligence

Time : Three Hours **Maximum Marks : 80**

PART A:

(Answer any 5 Questions. Each question carries 4 marks)

1 Define turing test

2 Illustrate the problem of under estimation and over estimation in A*

3 With an example define heuristics. Why uninformed search can't be used in all AI problems?

4 Design a script for taking Msc AI course in KBMGCT

5 Why is knowledge representation necessary in AI systems?

6 Explain AO*.

PART B:

(Answer any 3 Questions. Each question carries 8 marks)

7 List and explain AI applications

8 Explain Hill climbing . List limitations.

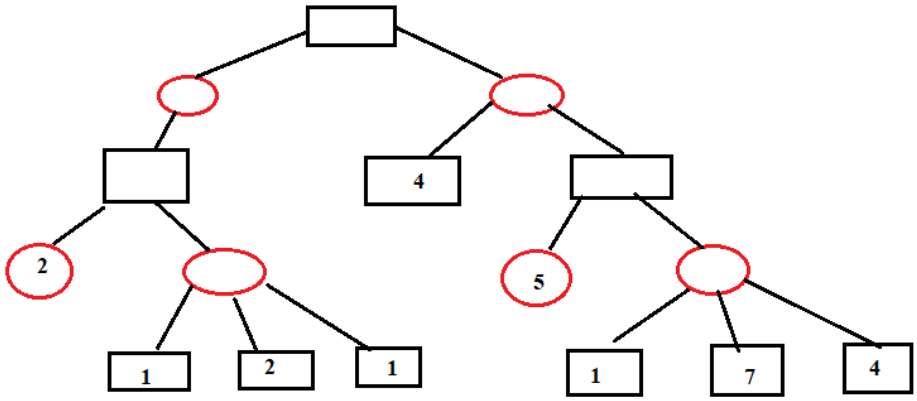
9 a) List the advantages of conceptual dependency over semantic network. (2)

b) Translate each of the following sentences into conceptual dependencies

i. Mizhi bought a mask
ii. Ram cut a lemon with a knife
iii. Say returned from USA
iv. Nithin's health is better
v. Swetha gave medicine to Pooja
vi. I saw police men on road.

10 a) Min Max algorithm improves its performance by Alpha Beta Pruning. Explain this statement? (2)

b) In the below game tree use the minimax procedure along with alpha-beta pruning to select the next move. Mark the nodes that don't need to be evaluated. At each step clearly mention how that decision is made?



11 With an example explain Means Ends Analysis .

PART C:

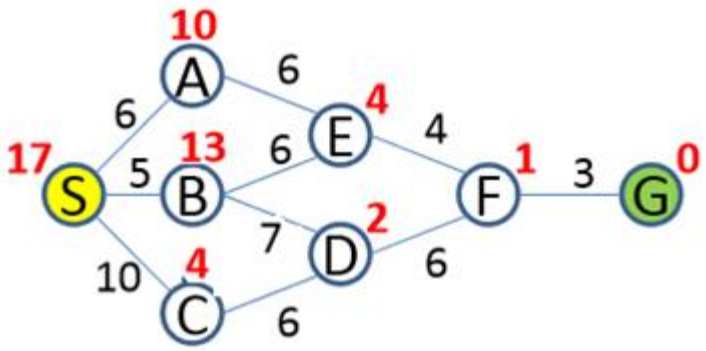
(Answer any 3 Questions. Each question carries 12 marks)

12 a) Define the production system and write its components. (3)

b) You are given a 4-litre jug and a 3-litre jug. Neither has a measuring mark on it. You have to measure exactly 2 litres of water in the 4 litre jug. Define the production rules for solving the problem and also write a control strategy to solve this problem.

13 a) Differentiate between A* algorithm and Best First Search algorithms. (4)

b) Apply Best First algorithm to find a path between S and G. (8)



14 a) With an example explain state space representation

b) Explain Ant Colony Optimization

15 a) What are the Components of a Constraint Satisfaction Problem? Illustrate with an example.

b) Represent the given scenario in Semantic Network and frame.

Baleno is a car. There are 4 wheels in the car. Baleno is in blue colour.

Sedan and hatchback are different classes of car. Baleno is a hatchback. Baleno is manufactured by Suzuki.

16 a) What is an expert system? With an example explain its architecture

b) Illustrate goal stack planning.

MSCSC03C16: Software Engineering

Semester	Course Code	Hours per week	Credit	Exam Hours
3	**MSCSC03C16**	3	3	3

Course Outcome

CO1	Familiarize and understand the basics of software engineering
CO2	Learn requirement analysis and data modelling
CO3	Understand the design concepts and modular design
CO4	Understand the application of design methods for real time systems
CO5	Analyze the analysis, design and testing concepts, evaluate and create software products

SYLLABUS

Unit - 1

Introduction to Software Engineering: The evolving role of software, changing nature of software, software myths. Software Engineering Process paradigms - Project management - Process and Project Metrics – Software estimation - planning - Risk analysis - Software project scheduling. **A Generic view of process:** Software engineering- a layered technology, a process framework, process assessment, personal and team process models. **Process models:** The waterfall model, incremental process models, evolutionary process models, the unified process, Agile Model, Full Stack Development Method.

Unit-2

Software Requirements: Functional and non-functional requirements, user requirements, system requirements, the software requirements document (SRD). **Requirements engineering process:** Feasibility studies, requirements elicitation and analysis, requirements validation, requirements management. **System models:** Context models, behavioral models, data models, object models, structured methods. **Risk management:**

Reactive Vs proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM, RMMM plan.

Unit-3

Design Engineering: Requirements Analysis and Design: Prototyping - Specification - Analysis modeling -Software design - Abstraction - Modularity - Software Architecture - Effective modular design - Cohesion and Coupling - Architecture design and Procedural design - Data flow oriented design. User interface design -Design process and design quality, design concepts, the design model.

Programming languages and coding - Language classes - Code documentation – Code efficiency -Software Configuration Management (SCM) – Reverse Engineering and Re-engineering.

Unit-4

Testing Strategies: Software testing fundamentals. White box testing: basis path testing and control structure testing – black box testing – testing for specialized environments. Software Testing Strategies: A strategic approach to software testing – unit testing – Integration testing – Validation testing-– System Testing- Performance Testing- Art of Debugging. **Metrics for Process and Products:** Software measurement, metrics for software quality. Software quality. **Quality Management:** Quality concepts, software quality assurance (SQA), software reviews, formal technical reviews, software reliability- Software maintenance.

Text Books/ Reference Books:

1. Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition, Mc Graw Hill International Edition.
2. Software Engineering- Sommerville, 7th edition, Pearson Education.
3. The unified modelling language user guide Grady Booch, James Rambaugh, Ivar Jacobson, Pearson Education.
4. Software Engineering, an Engineering approach- James F. Peters, Witold Pedrycz, John Wiley.
5. Software Engineering principles and practice- Waman S Jawadekar, The Mc Graw-Hill Companies.
6. Fundamentals of object-oriented design using UML Meiler Page-Jones: Pearson Education.

Unit Wise Question Distribution

Units	**Section A**	**Section B**	**Section C**
1	2	1	2
2	1	1	1
3	1	1	1
4	2	2	1
Total Questions	**6**	**5**	**5**

Model Question Paper

MSCSC03C16- Software Engineering

Time: 3 Hrs **Max. Marks: 80**

Part A

(Answer any 5 questions. Each question carries 4 marks)

1. Define Software Engineering.
2. What is Software Requirement Analysis?
3. What is SRS?
4. Differentiate between a Program and a Software.
5. What is unit testing?
6. Explain the metrics for software Quality.

Part B

(Answer any 3 questions. Each question carries 8 marks)

7. List and explain various phases of unified process.
8. What do you mean by quality control?

9. What are the four framework activities involved in user interface design?
10. Explain in detail about black box testing.
11. Define the term software risk. What are its characteristics? Explain different categories of software risks.

(3x8=24)

Part C

(Answer any 3 questions. Each question carries 12 marks)

12. What are the major phases in software development? Explain the Spiral model of a software development.
13. Compare Coupling and Cohesion. What is functional independence? Explain the different types of coupling and its effect on software modules.
14. What is system model? Explain in detail about object oriented model with examples.

15. Define the term software risk. What are its characteristics? Explain different categories of software risks.
16. Explain the importance of boundary value analysis and equivalence class testing in designing the test case.

(3x12=36)

MSCSC03C17: System Programming and Compiler Design

Semester	Course Code	Hours per week	Credit	Exam Hours
3	**MSCSC03C17**	3	3	3

Course Outcome

CO1	Familiarize language processing system
CO2	Understand compiler phases and components
CO3	Understand the parser and its types
CO4	Learn about the language translation systems
CO5	Familiarize various code generation and optimization techniques

SYLLABUS

Unit-1

Assemblers: Elements of assembly language programming, Pass structure of assemblers. Macros and macro processors: Macro definition, call and expansion, Nested macro calls, Advanced macro facilities. Design of macro preprocessor. Linkers: linking and relocation concepts, Design of linkers, Self-relocating programs, Linking for over-lays, Loaders.

Unit-2

Introduction to compilers: Different phases. Lexical analysis: role of the lexical analyzer, input buffering, specification of tokens, Recognition of tokens, Syntax analysis: Role of the parser, Context free grammar, writing a grammar, Top-down parsing, Recursive descent parsing, Predictive parsing. Bottom-Up parsing, Operator precedence parsing, LR parsers (SLR, Canonical LR and LALR).

Unit-3

Syntax-directed translation: Syntax-directed definitions, Evaluation Orders for SDD's. Type checking, Type systems, Specification of a type checker. Run time environment: source language issues, storage organization Storage organization schemes, Activation records. Storage allocation strategies, Access to non-local names. Parameter passing mechanisms.

Unit-4

Intermediate code generation, intermediate languages, declaration, and assignment statements. Code generation: Issues, target machine, run time storage management, Runtime storage allocation, basic blocks, and flow graphs. Code optimization: Principal sources of optimization.

Text Books/References:

1. D.M. Dhamdhere, "Systems Programming", TMH, 2011
2. Alfred V. Aho, Ravi Sethi, J.D. Ullman, "Compilers - Principles, techniques and tools", Pearson Education.

Unit Wise Question Distribution

Units	**Section A**	**Section B**	**Section C**
1	2	1	1
2	1	1	2
3	2	1	1
4	1	2	1
Total Questions	**6**	**5**	**5**

Model Question Paper
MSCSC03C17 - System Programming and Compiler Design

Time: 3 Hrs **Max Marks: 80**

Part A

(Answer any 5 questions. Each question carries 4 marks)

1. What are absolute loaders?
2. Write a note on Assembly Language.
3. Explain relocation algorithm.
4. Explain S-attributed definition with an example.
5. Write a note on type systems.
6. What is the role of code optimizer in a compiler?

(5x4=20)

Part B

(Answer any 3 questions. Each question carries 8 marks)

7. Write a note on advanced macro facilities.
8. How do you eliminate left recursion in a grammar? Give an example.
9. What is activation record? Explain structure and purpose of each field in the activation record.
10. What is Basic Block? Explain with example.
11. What is a three-address code? Mention its types.

(3x8=24)

Part C

(Answer any 3 questions. Each question carries 12 marks)

12. Explain the data structures considered for design of macro preprocessor.
13. i) With a neat diagram explain LR parser.
    ii) Explain error recovery in predictive parsing.
14. Explain the different storage allocation strategies in detail.
15. Explain the issues in the design of a code generator.
16. Construct SLR table for
    $S \rightarrow BB$
    $B \rightarrow bB / d$
    And also find if the following input is valid? bbddb

(3x12=36)

MSCSC03C18: Case Study and Mini Project

Semester	Course Code	Hours per week	Credit	Exam Hours
3	**MSCSC03C18**	9	4	3

Course Outcome

CO1	Students gain practical experience in applying theoretical knowledge to real-world problems in cutting-edge fields such as AI, ML, cyber security, cyber forensics, etc.
CO2	Enhanced ability to conduct literature reviews, analyze data, and interpret results based on current research trends and methodologies.
CO3	Development of critical thinking and problem-solving abilities through tackling challenges encountered during the project.
CO4	Improved technical skills in software tools, programming languages, and techniques relevant to the chosen field of specialization
CO5	Potential contribution to the academic community through findings that may lead to publications or presentations in conferences or journals,

GUIDE LINES

Students are encouraged to engage in research-oriented mini projects to gain hands-on experience in cutting-edge fields such as AI, ML, cyber security, and cyber forensics etc. These projects should draw upon top-tier research published in respected journals like those from Springer, IEEE, Elsevier, or indexed in Scopus (Q1/Q2 category). Each student will be allocated at least one internal guide, and potentially additional internal or external guides, to offer essential support throughout the mini project's execution. At the end of the semester, each student must submit a comprehensive project report detailing their findings.

The assessment of the mini project includes Continuous Assignment (CA) and End Semester Evaluation (ESE), which are based on the following components:

1. **Continues Assignment (CA)**

Sl No	Components	Marks
1	Lab implementation	04
2	Presentations (Minimum two)	08
3	Novelty and Contribution	04
4	Viva voce based on presentation, implementation and report	04
	Total marks	20

2. **End Semester Evaluation (ESE)**

Sl No	Components	Marks
1	Lab implementation	20
2	Presentation	20
3	Novelty and Contribution	20
4	Viva voce based on presentation, implementation and report	20
	Total marks	**80**

Sample Format for project report:

1. Front Page
2. Certificate
3. Declaration
4. Acknowledgments
5. Contents
6. Abstract
7. List of Abbreviations
8. List of Figures
9. List of Tables
10. Chapter -1: Introduction
11. Chapter-2: Review of Recent Advances
12. Chatpter-3: Proposed Work
13. Chapter-4: Experimental Results and Analysis
14. Chapter-5: Future Work and Conclusions
15. References

MSCSC04C19: Project

Semester	Course Code	Hours per week	Credit	Exam Hours
4	**MSCSC04C19**	17	10	3

Course Outcome

CO1	Application of advanced theoretical knowledge and practical skills acquired throughout the program to solve real-world problems.
CO2	Development of research skills, including the ability to conduct literature reviews, analyze data, and propose innovative solutions in computer science
CO3	Mastery of technical tools, methodologies, and programming languages relevant to the chosen project area
CO4	Enhancement of critical thinking abilities and problem-solving skills through the investigation and resolution of complex issues
CO5	Collaboration with academic advisors, peers, and potentially industry partners to leverage diverse perspectives and expertise.
CO6	Potential contribution to the field of computer science through novel findings, methodologies, or applications.

GUIDE LINES

1. **Project Proposal**: Students must submit a detailed project proposal outlining the problem statement, objectives, methodology, and expected outcomes. The proposal should demonstrate relevance to current trends or challenges in computer science.
2. **Selection of Guide**: Each student is assigned a project guide, who may be an internal faculty member or an external expert with relevant expertise in the project area.
3. **Literature Review**: Conduct a thorough literature review to establish the theoretical foundation for the project and identify gaps or opportunities for innovation.
4. **Project Execution Plan**: Develop a clear plan for executing the project, including milestones, timelines, and resources required.
5. **Implementation**: Implement the project according to the proposed methodology, utilizing appropriate tools, technologies, and techniques.
6. **Documentation**: Maintain detailed documentation throughout the project, including progress reports, meeting minutes, and code documentation as applicable.
7. **Regular Meetings**: Schedule regular meetings with the project guide(s) to discuss progress, receive feedback, and address any challenges encountered.

8. **Evaluation**: The project is evaluated based on Continuous Assessment (CA) and End Semester Evaluation (ESE), which may include the project report, demonstration or presentation, and viva voce examination.
9. **Project Report**: Prepare a comprehensive project report detailing the objectives, methodology, implementation details, results, analysis, conclusions, and future recommendations.
10. **Presentation**: Present the project findings and outcomes in a structured manner to peers, faculty, and potentially external evaluators.
11. **Ethical Considerations**: Adhere to ethical guidelines in research and project implementation, including proper attribution of sources, data privacy, and intellectual property rights.
12. **Final Submission**: Submit the final project report and any required artifacts by the specified deadline.
13. Students are encouraged to publish their project work in journals listed in UGC-CARE or present it at international conferences with proceedings published by reputable publishers.

The assessment of the mini project includes Continuous Assignment (CA) and End Semester Evaluation (ESE), which are based on the following components:

(i) Continues Assignment (CA)

Sl No	Components	Marks
1	Presentations (Minimum two)	15
2	Novelty and Contribution	10
3	Viva voce based on presentation	10
4	Project report	05
	Total marks	40

(ii) End Semester Evaluation (ESE)

Sl No	Components	Marks
1	Presentation	50
2	Novelty and Contribution	40
3	Viva voce based on presentation	50
4	Project report	20
	Total marks	**160**

Syllabus and Model Question Papers
for
III Semester Open Elective Courses

MSCSC03O01: Deep Learning

Semester	Course Code	Hours per week	Credit	Exam Hours
3	**MSCSC03O01**	4	4	3

Course Outcome

CO1	Understand the architecture of deep learning networks
CO2	Analyze different deep learning algorithms
CO3	Compare different Neural Network Architecture
CO4	Apply deep learning to real world problems

SYLLABUS

Unit-1

Basics-Biological Neuron, Idea of computational units, McCulloch–Pitts unit and Threshold logic, Linear Perceptron, Multilayer Perceptron, Perceptron Learning Algorithm, Linear separability. Convergence theorem for Perceptron Learning Algorithm. Deep Neural Networks: Difficulty of training deep neural networks. Newer optimization methods for neural networks (Adagrad, adadelta, rmsprop, adam, NAG), Saddle point problem in neural network.

Unit-2

Deep Feed forward Networks- Gradient Descent, hidden units, Back propagation, Regularization for deep learning, Optimization for training deep models-Empirical Risk Minimization

Unit-3

Convolutional Neural Network:- LeNet, AlexNet. Recurrent Neural Networks: Back propagation through time, Bidirectional RNNs, Long Short Term Memory, Gated Recurrent Units, Bidirectional LSTMs

Unit-4

Auto encoder- Generative models: Restrictive Boltzmann Machines (RBMs), Introduction to MCMC and Gibbs Sampling, gradient computations in RBMs. Recent trends: Variational Auto encoders, Generative Adversarial Networks, LLMs, Deep Learning Applications: Computer Vision, NLP, Speech Processing

Text Books/References:

1. Deep Learning, Ian Goodfellow and Yoshua Bengio and Aaron Courville, MIT Press, 2016.
2. Nikhil Ketkar, Deep Learning with Python- A Hands on Introduction, Apress, 2017.
3. Neural Networks: A Systematic Introduction, Raúl Rojas, 1996
4. Pattern Recognition and Machine Learning, Christopher Bishop, 2007
5. Sandro Skansi, "Introduction to Deep Learning from Logical calculus to Artificial Intelligence", Springer, 2018.

Unit Wise Question Distribution

Units	Section-A	Section-B	Section-C
1	2	1	1
2	1	1	1
3	1	2	1
4	2	1	2
Total Questions	**6**	**5**	**5**

Model Question Paper
MSCSC03O01: Deep Learning

Time: 3 Hours **Maximum Marks: 80**

PART A

(Answer ANY 5 questions. Each question carries 4 marks)

1. What is McCulloh Pitt's neuron? Briefly describe XOR learning problem.
2. Explain the saddle point problem in neural networks.
3. What is deep feedforward network? Explain the gradient descent problem.
4. What is Long Short Term Memory? What are its disadvantages?
5. What do you mean by Computer Vision? Briefly describe any related algorithm/ architecture.
6. Give a brief description about Natural Language Processing.

PART B

(Answer ANY 3 questions. Each question carries 8 marks)

7. What is linear separability? Differentiate between linear perceptron and multi-layer perceptron.
8. With the help of a diagram explain back propagation neural networks
9. Explain in detail Recurrent Neural Networks and Bidirectional RNN
10. Briefly describe GRU? How is it different from Bidirectional LSTMs
11. Describe Restricted Boltzmann Machines. Write a note about gradient computation in RBMs

PART B

(Answer ANY 3 questions. Each question carries 12 marks)

12. Bring out the difficulty in training a neural network effectively**.** What is the role of optimization in neural networks? Explain new optimization techniques being used.
13. What is regularization in deep neural networks? Explain in detail about Empirical Risk Minimization.
14. Explain the architecture of Convolutional Neural Networks with the help of a diagram. Briefly describe an application of CNN.
15. What do you mean by generative models? Describe about variational auto encoders and generative adversarial networks.
16. Explain in detail MCMC and Gibbs Sampling

MSCSC03O02: Digital Image Processing

Semester	Course Code	Hours per week	Credit	Exam Hours
3	**MSCSC03O02**	4	4	3

Course Outcomes

CO1	Discuss the fundamental concepts of digital image processing, image formation and representation of images.
CO2	Understand image enhancement methods in the spatial domain.
CO3	Study image transforms and image smoothing & sharpening using various kinds of filters in frequency domain.
CO4	Explore various methods in image restoration and compression
CO5	Discuss morphological basics and image segmentation methods.

SYLLABUS

Unit-1

Digital Image Processing: Basic concepts, Difference between image processing and computer vision, Components of an image processing system. Image processing applications. Mathematical preliminaries: Basic Vector and Matrix operations, Toeplitz, Circulant, Unitary & Orthogonal matrices. Elements of Visual Perception: Structure of the human eye and image formation, Brightness adaptation and discrimination. Types of Images: Binary, Gray scale and Color Images. Image Sampling and Quantization: Digital image as a 2D array, Spatial and Intensity resolution, 2D-sampling theorem. RGB and HSI color models.

Unit-2

Concept of Image enhancement, Basic grey level transformation functions: Image negative, Log transformation, Power-law transformation, Piecewise linear transformations. Histogram of an Image, Histogram equalization with illustration. Fundamentals of Spatial Filtering: Mechanics of Spatial filtering, 2D correlation and convolution. Smoothing spatial filters: Linear and Nonlinear types. Sharpening spatial filters: Laplacian operator, Unsharp masking and High-boost filtering, Gradient based operators for image sharpening.

Unit-3

Image Transform-representation of an image in frequency domain, Unitary transformation of an Image-transform pair equations in matrix form, Properties of unitary transforms. 1D-DFT,

2D-DFT of an image- Properties of 2D-DFT. DCT and its properties, Filtering an Image in the Frequency Domain– Steps of frequency domain filtering. Basic concept and illustration of frequency domain image smoothing and sharpening. Image Restoration: Concept of Image restoration, A Model of the Image Degradation/Restoration Process, Image Noise Models, Point Spread Function, Restoration using Inverse filtering, Wiener filtering.

Unit-4

Image compression: Need for compression, redundancy, classification of image compression schemes, A general image compression system, Huffman coding, Transform based compression, JPEG standard, Digital image watermarking-basic concept. Morphological image processing basics: erosion and dilation, opening and closing, Hit or Miss transformation. Image segmentation: Fundamentals, Point detection, Line detection, Basic steps of edge detection, Hough transform, Edge detectors - Marr-Hildreth edge detector & Canny edge detector. Thresholding: Basics of intensity thresholding, Global thresholding and Otsu's method. Region-based segmentation: Region growing, Region Splitting and Merging.

Text Books/References:

1. Rafael C., Gonzalez & Woods R.E., "Digital Image Processing", Pearson Education.
2. Jain A.K, "Fundamentals of Digital Image Processing", Prentice Hall, Eaglewood Cliffs, NJ.
3. Schalkoff R. J., "Digital Image Processing and Computer Vision", John Wiley
4. Pratt W.K., "Digital Image Processing", John Wiley
5. Al Bovick , "Handbook of Image and Video Processing" , Academic Press, 2000

Unit Wise Question Distribution

Units	Section-A	Section-B	Section-C
1	2	1	1
2	1	1	1
3	1	2	1
4	2	1	2
Total Questions	**6**	**5**	**5**

Model Question paper

MSCSC03O02: Digital Image Processing

Time : Three Hours **Max. Marks : 80**

Section-A

Answer any 5 questions. 4 marks each

1. Describe the elements of visual perception
2. Explain histogram equalization in detail.
3. Differentiate linear spatial filter and non-linear spatial filter
4. List the components of a compression system
5. Define Toeplitz & Circulant matrices
6. Explain the merits and demerits of edge thresholding in segmentation

(5 x 4 = 20)

Section-B

Answer any 3 questions. 8 marks each

7. Differentiate sampling and quantization in image processing.
8. Compare Unsharp masking and High-boost filtering in Spatial filtering.
9. Explain image restoration process in detail.
10. Compare erosion and dilation in Morphological image analysis
11. Explain Discrete Cosine Transform and its properties.

(8 x 3 = 24)

Section-C

Answer any 3 questions. 12 marks each

12. Explain canny edge detector in detail
13. Explain basic grey level transformation in spatial domain
14. Explain the working of Homomorphic filtering with an example.
15. Differentiate lossy and lossless image compression methods
16. Explain fundamental steps in Digital Image Processing

(12 x 3 = 36)

MSCSC03O03 – Information Security

Semester	Course Code	Hours per week	Credit	Exam Hours
3	**MSCSC03O03**	4	4	3

Course Outcomes

CO1	Understand fundamental principles of information security
CO2	Distinguish between Symmetric and Asymmetric Cryptosystems
CO3	Familiarity with Digital Watermarking, Digital Steganography and Secret Sharing
CO4	Achieve knowledge in Visual Cryptography Schemes
CO5	Conduct research on information security techniques

SYLLABUS

UNIT-1

Computer Security Concepts, Security Attacks, Security Services, Model for Network Security, Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Stream Ciphers and Block Ciphers, Data Encryption Standard, Multiple Encryption and Triple DES, Block Cipher Modes of Operations-ECB, CBC, CFB, OFB, CTR.

UNIT-2

Public-Key Cryptosystems, Applications for Public-Key Cryptosystems, Requirements and Cryptanalysis for Public-Key Cryptography, RSA algorithm, Cryptographic hash function, Applications of Cryptographic Hash Functions, Secure Hash Algorithm, Digital Signatures.

UINIT-3

Digital Watermarking, Classification in Digital Watermarking, Spatial Domain Watermarking-Substitution Watermarking, Additive Watermarking, Applications of Digital Watermarking. Digital Steganography, Types of Steganography, Applications of Steganography, Differences between Watermarking and Steganography. Secret Sharing- principle of secret splitting, phases of secret sharing, Threshold Schemes, Shamir’s Scheme.

UNIT 4

Visual Cryptography- Introduction, Construction of Visual Cryptography Schemes, basis matrices, Construction of 2-out-of-2 Visual Cryptography Schemes, Construction of 2-out-of-2 Visual Cryptography Schemes with Square Pixel Expansion, Construction of Visual Cryptography Schemes with Consistent Image Size. Visual Cryptography Schemes- 2-out-of-n, n-out-of-n, k-out-of-n, Colour Visual Cryptography Schemes, Applications of Visual Cryptography.

Text Books/References:

1. Cryptography and Network Security: Principles and Practice, William Stallings, 7th Edition, Pearson India. ISBN:978-93-325-8522-5.
2. Digital Watermarking and Steganography Fundamentals and Techniques, Frank Y. Shih, CRC Press, Taylor & Francis Group. ISBN : 13: 978-1-4200-4758-5.
3. Visual Cryptography for Image Processing and Security Theory, Methods, and Applications, Feng Liu and Wei Qi Yan, Springer, ISBN 978-3-319-09644-5.
4. Fundamentals of computer security, Josef Pieprzyk, Thomas hardjino and Jennifer Sebberry, Springer International Edition 2008

Unit Wise Question Distribution

Units	Section-A	Section-B	Section-C
1	2	1	1
2	1	1	2
3	1	2	1
4	2	1	1
Total Questions	**6**	**5**	**5**

Model Question Paper

MSCSC03O03 – Information Security

Time : Three Hours **Max. Marks : 80**

Section-A

Answer any 5 questions. 4 marks each

1. Define Stream Ciphers and Block Ciphers
2. Explain Symmetric Cipher Model.
3. Explain Public-Key Cryptosystems.
4. Differences between Watermarking and Steganography
5. Define Visual Cryptography Schemes with Consistent Image Size.
6. Write different Applications of Visual Cryptography.

(5 x 4 = 20)

Section-B

Answer any 3 questions. 8 marks each

7. Distinguish between Substitution Techniques and Transposition Techniques with example
8. Explain RSA algorithm with example.
9. Differentiate Substitution Watermarking and Additive Watermarking
10. Explain different types of digital Steganography
11. Colour Visual Cryptography Schemes

(8 x 3 = 24)

Section-C

Answer any 3 questions. 12 marks each

12. Explain different Block Cipher Modes of Operations
13. Define hash functions. Explain different hash algorithms
14. Explain Digital Signatures with example.
15. Explain Secret Sharing methods with example
16. Explain 2-out-of-n, n-out-of-n, and k-out-of-n Visual Cryptography Schemes

(12 x 3 = 36)

Syllabus and Model Question Papers
for
IV Semester Elective Courses

MSCSC04E01: Natural Language Processing

Semester	Course Code	Hours per week	Credit	Exam Hours
4	**MSCSC04E01**	4	4	3

Course Outcome

CO1	Understand the basic concepts of Natural language processing.
CO2	Understand approaches to syntax and semantics in NLP.
CO3	Understand effective knowledge representation ways
CO4	Design systems that uses NLP techniques

SYLLABUS

Unit-1

Introduction to Natural Language Processing, Corpus, NLP Libraries, NLP challenges, NLP phases, Natural Language Understanding, Natural Language Generation, Applications

Unit-2

Basic Text Processing: Word Level Analysis: Regular Expressions, FiniteState Automata, Lexicon, Tokenization, Word Normalisation, Stemming, Lemmatization, Synsets and Hypernyms, Morphological Parsing- Finite state transducer, POS Tagging, Stopwords

Unit-3

Language modelling, N-grams, Probabilistic Language Models, Markov Assumption, TF-IDF Classification, Spelling Error Detection and correction. Syntactic Analysis: Context-free Grammar, Constituency structure, Dependency structure, Probabilistic Parsing, CKY Parsing

Unit-4

Strategies for Semantic Interpretation, Semantic Analysis, Word sense disambiguation, Relationship Extraction, Named Entity Recognition, Hyponymy, Homonymy, Synonymy, Antonymy, Polysemy, Meronomy Knowledge Representations: Case Grammar, Knowledge graph , Ontology. Case study: Computational skills to create NLP processing pipelines using existing NLP libraries. Take an application of NLP and understand NLP pipeline

Text books/ Reference :

1. Dan Jurafsky and James Martin. Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition. Prentice Hall, Second Edition, 2009. Some draft chapters of the third edition are available online: https://web.stanford.edu/~jurafsky/slp3/
2. James Allen, "Natural Language Processing with Python", First Edition, O'Reilly Media, 2009.
3. Chris Manning and Hinrich Schütze. Foundations of Statistical Natural Language Processing. MIT Press, Cambridge, MA: May 1999.
4. Daniel and James H. Martin "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", Second Edition, Prentice Hall of India, 2008.
5. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
6. Steven Bird, Ewan Klein, Edward Loper, Natural Language Processing with Python – Analyzing Text with the Natural Language Toolkit (O'Reilly 2009, website 2018) http://www.nltk.org/book/

Unit Wise Question Distribution

Units	Section A	Section B	Section C
1	2	1	1
2	2	1	2
3	1	2	1
4	1	1	1
Total Questions	6	5	5

Model Question Paper

MSCSC04E01 : Natural Language Processing

Time : Three Hours **Maximum Marks : 80**

PART A:

(Answer any 5 Questions. Each question carries 4 marks)

1 Write about challenges in NLP.

2 How is a typical NLP system organised?

3 Describe open class words and closed class words with examples

4 What is the expected output when the given sentence is stemmed, Among the elective courses students opted for NLP and the course is completed.

5 How are TF and IDF related?

6 With examples differentiate homonymy and polysemy.

PART B:

(Answer any 3 Questions. Each question carries 8 marks)

7 What is Natural Language Processing? Discuss with some applications.

8 Differentiate between different morphemes, with examples.

9 Perform parsing using simple top down parsing for the sentence “Mozhi completed the course” using the grammar given below:

S→NP VP
NP →Pronoun | Proper Name
NP-→Det NOMINAL
NOMINAL →Noun
VP→Verb |Verb NP

10 Describe the usage of PCFG in NLP.

11 a. With an example explain Named Entity Recognition.

b Describe thematic roles used in the semantic analysis with examples.

PART C:
(Answer any 3 Questions. Each question carries 12 marks)

12 Explain Natural Language Understanding & Natural Language Generation. Quote examples.

13 Design a finite state transducer with E-insertion orthographic rule that parses from surface level "girls" to lexical level "girl+N+PL" using FST.

14 Define the following process

15 Explain statistical language modelling. Using a bigram model, find the probability of the sentence Students are from Kannur using the training set given.

I am from Kollam
I am a teacher
students are good and are from various cities
students from Kannur do Msc AI

16 a Analyse the significance of Word Sense Disambiguation in NLP. Explain any one WSD method.
b. How does ontology help in NLP

MSCSC04E02: Software Testing

Semester	Course Code	Hours per week	Credit	Exam Hours
4	**MSCSC04E02**	4	4	3

Course Outcomes

CO1	Learn software testing techniques
CO2	Understand the levels of software testing
CO3	Understand the software testing automation tools
CO4	Analysis about different software testing tools
CO5	Learn software testing techniques

SYLLABUS

Unit -1

Foundations of Software Testing, Software testing concepts and principles, Testing processes and methodologies, Test case design techniques, Test documentation and reporting, Risk-based testing approach, Quality assurance and control.

Unit-2

Black-box testing techniques (Equivalence partitioning, Boundary value analysis, Decision table testing), White-box testing techniques (Statement coverage, Branch coverage, Path coverage), Model-based testing methods, Static and dynamic analysis techniques, Exploratory testing approach, Mutation testing

Unit -3

Unit testing strategies and frameworks, Integration testing methods (Top-down, Bottom-up, Big Bang), System testing techniques (Functional, Non-functional, Performance, Usability), Acceptance testing (Alpha, Beta, User acceptance testing), Regression testing strategies, Compatibility testing

Unit- 4

Test automation frameworks (Keyword-driven, Data-driven, Behavior-driven), Automated testing tools (Selenium, HP UFT, JUnit, TestNG), Continuous Integration and Continuous Testing (CI/CD), Performance testing tools (JMeter, LoadRunner), API testing tools (Postman, SoapUI), Mobile testing tools (Appium, Xamarin Test Cloud)

Text Books/References

1. Software Testing: Principles and Practices by Naresh Chauhan
2. Foundations of Software Testing ISTQB Certification by Dorothy Graham, Rex Black, and Erik van Veenendaal
3. Software Testing Techniques by Boris Beizer
4. The Art of Software Testing by Glenford J. Myers, Corey Sandler, and Tom Badgett

UNIT WISE QUESTION DISTRIBUTION			
Unit	**Part A**	**Part B**	**Part C**
1	2	1	2
2	1	1	1
3	1	1	1
4	2	2	1
Total Question	**6**	**5**	**5**

Model Question Paper

MSCSC04E02- Software Testing

Time: 3 Hrs **Max Marks: 80**

Part A

Answer any 5 questions. Each question carries 4 marks (5x4=20)

1. What is software testing, and why is it important?
2. Explain the difference between verification and validation in software testing.
3. Describe the main objectives of software testing.
4. What is performance testing, and why is it important?
5. Describe boundary value analysis and its importance in testing.
6. What is test automation, and how does it differ from manual testing?

Part B

Answer any 3 questions. Each question carries 8 marks (3x 8=24)

7. Compare and contrast black-box testing and white-box testing.
8. Explain Alpha testing techniques and give examples.
9. Explain the concept of security testing and its objectives.
10. What are the key considerations when selecting a test automation tool?
11. Explain API testing tools

Part C

Answer any 3 questions. Each question carries 12 marks (3x12=36)

12. Describe the various levels of software testing. For each level, explain its objectives & key activities
13. Explain the different types of non-functional testing
14. Explain various software testing automation tools
15. Explain software quality assurance and control
16. Compare any 5 types of software testing.

MSCSC04E03: Cyber Security

Semester	Course Code	Hours per week	Credit	Exam Hours
4	**MSCSC04E03**	4	4	3

Course Outcomes

CO1	Understand the cyber security threat landscape
CO2	Analyse and evaluate the cyber security risks
CO3	Analyse and evaluate existing legal framework and laws on cyber security
CO4	To expose students to responsible use of online social media networks
CO5	Take measures for self-cyber-protection as well as societal cyber-protection

SYLLABUS

UNIT-1

Overview of Cyber security - Cyber security increasing threat landscape, Cyber security terminologies- Cyberspace, attack, attack vector, attack surface, threat, risk, vulnerability, exploit, exploitation, hacker., Non-state actors, Cyber terrorism, Protection of end user machine, Critical IT and National Critical Infrastructure, Cyberwarfare.

UNIT-2

Cyber crimes - Cyber crimes targeting Computer systems and Mobiles- data diddling attacks, spyware, logic bombs, DoS, DDoS, APTs, virus, Trojans, ransomware, data breach., Online scams and frauds- email scams, Phishing, Vishing, Smishing, Online job fraud, Online sextortion, Debit/ credit card fraud, Online payment fraud, Cyberbullying, website defacement, Cyber-squatting, Pharming, Cyber espionage, Cryptojacking, Darknet- illegal trades, drug trafficking, human trafficking., Social Media Scams & Frauds- impersonation, identity theft, job scams, misinformation, fake newscyber crime against persons - cyber grooming, child pornography, cyber stalking., Social Engineering attacks, Cyber Police stations, Crime reporting procedure.

UNIT-3

Cyber Law -Cybercrime and legal landscape around the world, IT Act,2000 and its amendments. Limitations of IT Act, 2000. Cybercrime and punishments, Cyber Laws and

Legal and ethical aspects related to new technologies- AI/ML, IoT, Blockchain, Darknet and social media, Cyber Laws of other countries, Data Privacy and Data Security -Defining data, meta-data, big data, non-personal data. Data protection, Data privacy and data security, Personal Data Protection Bill and its compliance.

UNIT-4

Data protection principles, Big data security issues and challenges, Data protection regulations of other countries- General Data Protection Regulations (GDPR), 2016 Personal Information Protection and Electronic Documents Act (PIPEDA), Social media- data privacy and security issues. Cyber security Management, Compliance and Governance - Cyber security Plan- cyber security policy, cyber crises management plan., Business continuity, Risk assessment, Types of security controls and their goals, Cyber security audit and compliance, National cyber security policy and strategy.

Text Books/References:

1. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd.
2. Information Warfare and Security by Dorothy F. Denning, Addison Wesley.
3. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform.
4. Data Privacy Principles and Practice by Natraj Venkataramanan and Ashwin Shriram, CRC Press.
5. Information Security Governance, Guidance for Information Security Managers by W. Krag Brothy, 1st Edition, Wiley Publication.
6. Auditing IT Infrastructures for Compliance By Martin Weiss, Michael G. Solomon, 2nd Edition, Jones Bartlett Learning.

Unit Wise Question Distribution

Units	Section-A	Section-B	Section-C
1	1	1	1
2	2	1	1
3	1	2	1
4	2	1	2
Total Questions	**6**	**5**	**5**

Model Question Paper

MSCS04E03 – Cyber Security

Time : Three Hours **Max. marks : 80**

Section-A

Answer any 5 questions. 4 marks each

1. Define the following terms:
   a) Cyberspace
   b) Attack vector
   c) Vulnerability
   d) Exploit
2. Explain the difference between a virus and a Trojan horse. Provide an example of each.
3. Define DDoS (Distributed Denial of Service) attack. How can organizations mitigate the impact of such attacks?
4. Define Cybercrime. Discuss the key provisions of the Information Technology Act, 2000 (IT Act) in combating cybercrimes in India.
5. Explain the core principles of data protection as outlined in the General Data Protection Regulation (GDPR). How do these principles ensure privacy and security of personal data?
6. What role do encryption and anonymization play in mitigating risks associated with Big Data analytics? Provide examples to illustrate your points.

(5 x 4 = 20)

Section-B

Answer any 3 questions. 8 marks each

7. Define cyber terrorism. What are the key characteristics and motivations of cyber terrorists?
8. Discuss the impact of ransomware attacks on businesses and individuals. Include strategies that organizations can adopt to prevent and recover from such attacks.
9. Define the terms: data, meta-data, big data, and non-personal data. How do these concepts relate to data protection laws?
10. Explore the ethical considerations involved in the use of Darknet and social media platforms. How can these platforms balance freedom of speech with the need for regulation?

11. Describe the importance of cyber security policies in an organization. What should be included in a robust cyber security policy framework?

(8 x 3 = 24)

Section-C
Answer any 3 questions. 12 marks each

12. Explain the importance of protecting end-user machines in cybersecurity. List and describe at least three common techniques used to protect end-user devices from cyber threats.
13. Evaluate the role of cyber police stations in combating cybercrime. How does the reporting procedure for cybercrimes differ from traditional crime reporting?
14. Explain the differences between data privacy and data security. Why is it essential for organizations to address both aspects comprehensively?
15. Compare and contrast the cyber security strategies of two countries known for their robust cyber security frameworks. What lessons can other countries learn from these strategies?
16. How does a cyber crises management plan differ from a business continuity plan? Provide a comparative analysis.

(12 x 3 = 36)

MSCSC04E04: Soft Computing

Semester	Course Code	Hours per week	Credit	Exam Hours
4	**MSCSC04E04**	4	4	3

Course Outcomes

CO1	Apply fuzzy logic to different applications of your relevant field.
CO2	Analyze various neural network architectures.
CO3	Understand the genetic algorithm concepts and their applications.
CO4	Solving multi-objective optimization problems using Evolutionary algorithms.

SYLLABUS

Unit-1

"Soft" versus "Hard" computing, Applications of Soft computing techniques. Introduction to Fuzzy logic, fuzzy vs crisp set. Fuzzification, Membership Functions, Operations on Fuzzy sets Fuzzy relations, rules, Propositions, implications and inferences. Defuzzyfication Techniques Fuzzy Inference Systems - Mamdani Type, Sugeno Type.

Unit-2

Activation function. Different ANNs architectures. Back propagation Network – Architecture, Training algorithm. Case Studies on applications of ANN

Unit-3

Solving optimization problems, Concept of Genetic Algorithm. GA Operators: Encoding, selection, fitness evaluation. GA Operators : Crossover, Mutation. Case Studies on applications of GA

Unit-4

Hybrid expert systems, Neuro-fuzzy hybrid systems, neuro hybrid systems, Genetic-Fuzzy rule based system. Concept of multi-objective optimization problems (MOOPs). Multi-Objective Evolutionary Algorithm (MOEA). Non-Pareto approaches to solve MOOPs. Pareto-based approaches to solve MOOPs

Text books/ Reference:

1. Principles of Soft computing, S.N.Sivanandam & S.N.Deepa John Wiley & Sons, 2007
2. Neural Networks and Learning Machines Simon Haykin (PHI)
3. An Introduction to Genetic Algorithm Melanic Mitchell (MIT Press)
4. Evolutionary Algorithm for Solving Multi-objective, Optimization Problems (2nd Edition), Collelo, Lament, Veldhnizer (Springer)
5. David E. Goldberg, Genetic Algorithms In Search, Optimization And Machine Learning, Pearson Education, 2002
6. Introduction To Soft Computing - Course (nptel.ac.in)

.

Unit Wise Question Distribution

Units	Section-A	Section-B	Section-C
1	2	1	2
2	1	1	1
3	1	1	1
4	2	2	1
Total Questions	**6**	**5**	**5**

Model Question Paper

MSCSC04E04: Soft Computing

Time: 3 Hours **Maximum Marks: 80**

PART A

(Answer ANY 5 questions. Each question carries 4 marks)

1. Differentiate between hard computing and soft computing.
2. What is the significance of fuzzy logic? Differentiate fuzzy and crisp set.
3. What is activation function? Bring out its significance.
4. What is genetic algorithm? Explain its characteristics?
5. What are neuro fuzzy systems? Bring out its advantages and disadvantages
6. Write a note on optimization problems. What is the significance of multi objective optimization?

PART B

(Answer ANY 3 questions. Each question carries 8 marks)

7. Explain various defuzzification methods.
8. Describe the back-propagation architecture used in ANN
9. Describe various operators used in genetic algorithms
10. What are hybrid expert system? Explain neuro hybrid system
11. Explain genetic fuzzy-rule based system.

PART B

(Answer ANY 3 questions. Each question carries 12 marks)

12. With the help of examples describe the various operation on fuzzy sets.
13. Explain fuzzy inference systems in detail.
14. What are Artificial Neural Networks. Explain the various architectures.
15. Explain the different cross over and mutation techniques used in Genetic algorithms
16. What is MOEA? Explain the different pareto methods to solve MOOP.

MSCSC04E05: Data Mining

Semester	Course Code	Hours per week	Credit	Exam Hours
4	**MSCSC04E05**	4	4	3

Course Outcomes

CO1	Students will be able to interpret the contribution of data mining in Knowledge discovery process and identify different data attribute types
CO2	Students will be able to apply the link analysis and frequent item- set algorithms to identify the entities on the real-world data.
CO3	Students will be able to apply the various classification and clustering algorithms for supervised and unsupervised learning problems.
CO4	Students will be able to apply various data visualization techniques for in-depth data analysis.
CO5	Students will be able to apply the advanced data mining techniques and use the popular data mining tools

SYLLABUS

Unit-1

Introduction: Data Mining, Motivation, Application, Data Mining—On What Kind of Data? Data Mining Functionalities, Data Mining Task Primitives, Major Issues in Data Mining. Data pre-processing: Attribute types, Similarity & Dissimilarity measures.

Unit-2

Data Preprocessing: Data Cleaning, Data Integration, Data Reduction, Data Transformation & Discretization. Mining Frequent Patterns: Basic Algorithms, Association Rule Mining, Apriori Algorithm, FP tree growth Algorithm, Advanced Pattern Mining Techniques.

Unit-3

Classification Techniques: Decision Tree, Bayes Classification, Bayesian Belief Networks, Support Vector Machines, Classification Evaluation Techniques, Classification Accuracy improvement Techniques.

Unit-4

Clustering Techniques: Partitioning algorithms, Hierarchical algorithms, Density-Based algorithms, Grid-Based algorithms, Evaluation of Clustering. Outlier Detection Techniques.

Applications and Trends in Data Mining: Applications, Advanced Techniques, Web Mining, Web Content Mining, Structure Mining.

Text books/ Reference:

1. J. Han and M. Kamber, Data Mining: Concepts and Techniques. 3rd Edition
2. M. H. Dunham. Data Mining: Introductory and Advanced Topics. Pearson Education.
3. Parteek Bhatia, Data Mining and Data Warehousing: Principles and Practical Techniques
4. I. H. Witten and E. Frank. Data Mining: Practical Machine Learning Tools and Techniques.
5. D. Hand, H. Mannila and P. Smyth. Principles of Data Mining. Prentice, Hall.

Unit Wise Question Distribution

Units	Section-A	Section-B	Section-C
1	2	1	1
2	1	1	1
3	1	2	1
4	2	1	2
Total Questions	**6**	**5**	**5**

Model Question Paper

MSCSC04E05: Data Mining

Time: 3 hours **Max. Marks: 80**

SECTION- A

Answer **any five** questions. **Each** question carries **four** marks. **(5x4=20 marks)**

1. What is transactional data?
2. Differentiate Characterization and Discrimination.
3. What is KDD process? How it differs from data mining?
4. What is data cube?
5. Differentiate Bitmap index and join index.
6. What is tree pruning?

SECTION- B

Answer **any three** questions. Each question carries **eight** marks **(3x8=24 marks)**

7. What are the different data visualization techniques?
8. What are the different types of data that can be mined?
9. Find frequent item set for the following transaction using FP growth algorithm, where support count is 2.

Transaction ID	Items
T1	{E, K, M, N, O, Y}
T2	{D, E, K, N, **O**, Y}
T3	{A, E, K, M}
T4	{C, K, M, U, Y}
T5	{C, E, I, K, O, O}

10. Explain rule-based classification methods.
11. Elaborate the concept of mining multilevel association rules from relational databases and data warehouses with case study.

SECTION C

Answer **any three** questions. Each question carries **twelve** marks **(3x12=36)**

12. Demonstrate how Bayesian classification helps in predicting class membership probabilities.
13. Find frequent item set for the following transaction using Apriori Algorithm

TID	items
T1	I1, I2 , I5
T2	I2,I4
T3	I2,I3
T4	I1,I2,I4
T5	I1,I3
T6	I2,I3
T7	I1,I3
T8	I1,I2,I3,I5
T9	I1,I2,I3

minimum support count is 2
minimum confidence is 60%

14. How to improve classification accuracy? Explain any technique to improve classification accuracy.
15. What is holdout method? How it varies from random subsampling?
16. What are the different OLAP operations?

MSCSC04E06: Digital Image Forensics

Semester	Course Code	Hours per week	Credit	Exam Hours
4	**MSCSC04E06**	4	4	3

Course Outcomes

CO1	Understand digital image fundamentals
CO2	Familiarize with different digital image file formats
CO3	Learn multimedia forensic techniques
CO4	Explore digital image forensic methods

SYLLABUS

UNIT-1

Digital image Processing: Fundamentals- Digital Image Representation-coordinate conversions, images as matrices, Image Types- intensity images, binary images, RGB images; Colour Image Processing-, Colour Image Representation- RGB model, CMY model, HSI model.

UNIT-2

Digital Image Formats: Statistical Techniques- Huffman Coding, Arithmetic Coding. Lossless Image Compression - Run length Coding, Dictionary Compression - LZ77, LZW, Predictive Coding, Graphic Interchange Format, Portable Network Graphics, Tag Interchange File Format. Lossy Compression- Transform Coding, JPEG, Wavelet-Based Compression, JPEG2000, JP2 File Format.

UNIT-3

Searching and Extracting Digital Image Evidence- File Systems and Fragmentation, Carving Non-fragmented Files, Carving Bifragmented Files, Graph Theoretic Carving, Smart Carver. Multimedia forensic techniques- Active and Passive Forensics, Multimedia Source Class Identification, Forensics Learning Techniques, Anti-Forensics and Countermeasures.

UNIT-4

Threats to the Integrity of Digital Media Content, Digital Content Protection, Digital Forensics- Image Source Identification, Image Forgery Detection. Camera Source Identification- Digital Camera Components, Source Camera Identification Framework. Classification of Block-

Based Copy-Move Forgery Detection Techniques, Three-Way Parameterization Platform, Region Duplication Detection Technique Using Statistical Image Features, DyWT-Based Image Region Duplication Detection, Application to Digital Image Forensics

Text Books/References:

1. Digital Image Processing, Rafael C. Gonzalez, Richard E. Woods, Pearson Education.
2. Digital Image Forensics- There is More to a Picture than Meets the Eye; 1st Edition, Husrev Taha Sencar and Nasir Memon, Springer, 2013.
3. Digital Image Forensics Theory and Implementation, Aniket Roy, Rahul Dixit , Ruchira Naskar, Rajat Subhra Chakraborty, Springer, 2020.

Unit Wise Question Distribution

Units	Section-A	Section-B	Section-C
1	2	1	1
2	2	1	1
3	1	2	1
4	1	1	2
Total Questions	**6**	**5**	**5**

Model Question Paper
MSCSC04E06: Digital Image Forensics

Time: 3 Hours **Maximum Marks: 80**

PART A
(Answer ANY 5 questions. Each question carries 4 marks)

1. Explain the concept of digital image representation.
2. Discuss the significance of coordinate systems in digital image processing.
3. Explain the principle behind Huffman coding and how it applies to image compression.
4. Describe the basic idea behind LZ77 compression and its application in image compression
5. Explain the concept of file fragmentation in digital forensics.
6. Define digital content integrity. Discuss three common threats to the integrity of digital media content.

PART B
(Answer ANY 3 questions. Each question carries 8 marks)

7. Differentiate between intensity images, binary images, and RGB images.
8. How does lossless compression differ from lossy compression in the context of digital images? Provide examples of each.
9. Compare and contrast the methods for carving non-fragmented files versus bifragmented files in digital image forensics.
10. What is smart carving in the context of multimedia forensic techniques? How does it differ from traditional file carving methods?
11. Describe the role of digital forensics in image source identification.

PART B
(Answer ANY 3 questions. Each question carries 12 marks)

12. Discuss the RGB, CMY and HSI color model in detail. What are its advantages over RGB and CMY models in terms of image processing applications?
13. Arithmetic Coding vs. Huffman Coding: Discuss the differences between these two techniques.
14. Define active and passive forensics in multimedia analysis. Give examples of each approach and discuss their significance in digital image evidence extraction
15. Explain the concept of block-based copy-move forgery detection techniques.
16. Describe the statistical image features used in region duplication detection techniques. Provide examples of how these features contribute to accurate detection

****