KANNUR UNIVERSITY

(Abstract)

M.Sc Computer Science and M.Sc Computer Science with Specialization in Artificial Intelligence Programmes- Scheme, Syllabus, Pattern of Question Papers and Model Question Papers (First and Second Semesters only) under Choice Based Credit and Semester System (in Outcome Based Education System-OBE) in Affiliated Colleges- Implemented with effect from 2023 Admission- Orders issued.

ACADEMIC C SECTION

ACAD C/ACAD C5/17911/2023 Dated: 25.08.2023

Read:-1. U.O No. Acad C2/429/2017 Dated 08.09.2020.

2. U. O No. Acad C1/21246/2019 Dated 07.12.2020.

3. U.O. No. Acad/C1/21246/2019 Dated 16.02.2023.

4. U.O. No. Acad/C1/21246/2019 Dated 20.04.2023.

5. Minutes of the meeting of the CSMC & Conveners of Adhoc committee held on 15.06.2023

6. Orders of the Vice Chancellor in the file No. Acad C1/21246/2019 Dated 05.08.2023.

7. U.O. No. Acad/C1/21246/2019 Dated 09.08.2023.

8. The Minutes of the meeting of the Ad hoc Committee for Computer Science (PG) held on 09.08.2023.

9. Syllabus of first and second semesters M.Sc Computer Science and M.Sc Computer Science with Specialization in Artificial Intelligence Programmes submitted by the Convenor, Ad hoc Committee for Computer Science vide e-mail dated 23.08.2023

ORDER

1. A Curriculum Syllabus Monitoring Committee comprising the members of Syndicate was constituted for the Syllabus revision of U G & PG Programmes in Affiliated Colleges, vide paper read (1) above and as per the recommendation of this Committee in its meeting held on 20.11.2020, constitute a sub Committee to prepare the Regulation for PG programmes in Affiliated Colleges vide paper read (2) above.

2. As the reconstitution of Board of Studies of the University is under the consideration of the Hon'ble Chancellor, and considering the exigency of the matter, Ad hoc Committees were constituted vide paper read (3) above and it has been modified vide paper read (4) above, to revise the Curriculum and Syllabus of PG Programmes in Affiliated Colleges w.e.f 2023-24 academic year,.

3. The combined meeting of the Curriculum Syllabus Monitoring Committee & Conveners of Ad hoc committee held on 15.06.2023 at syndicate room discussed in detail the draft Regulation, prepared by the Curriculum Syllabus Monitoring Committee, for the PG programmes under Choice Based Credit and Semester System to be implemented in Affiliated Colleges w.e.f 2023 admission and proposed the different phases of Syllabus revision process such as subject wise workshop, vide the paper read (5) above.

4. The revised Regulations for Post Graduate Programmes under Choice Based Credit and Semester System (In OBE- Out Come Based Education System) was approved by the Vice-

chancellor on 05.08.2023 and implemented w.e.f 2023 Admission vide Paper read (7) above.

5. Subsequently, as per the paper read (8) above, the Ad hoc Committee for Computer Science (PG) finalized the Scheme, Syllabus, Pattern of Question Papers and Model Question Papers (1st & IInd Semesters) of M.Sc Computer Science and M.Sc Computer Science with Specialization in Artificial Intelligence Programmes to be implemented with effect from 2023 Admission

6. As per the paper read (9) above, the Convener, Ad hoc Committee for Computer Science (PG) programme submitted the finalized copy of Scheme, Syllabus, Pattern of Question Papers and Model Question Papers (1st & IInd Semesters) of M.Sc Computer Science and M.Sc Computer Science with Specialization in Artificial Intelligence Programmes for implementation with effect from 2023 Admission.

7. The Vice Chancellor after considering the matter in detail and in exercise of the powers of the Academic Council conferred under section 11(1) Chapter III of Kannur University Act, 1996 and all other enabling provisions read together with ***accorded sanction to implement the Scheme, Syllabus, Pattern of Question Papers and Model Question Papers (1st & IInd Semesters) of M.Sc Computer Science and M.Sc Computer Science with Specialization in Artificial Intelligence Programmes under Choice Based Credit and Semester System (in OBE-Outcome Based Education System) in Affiliated Colleges under the University with effect from 2023 Admission***, subject to report to the Academic Council.

8. The Scheme, Syllabus, Pattern of Question Papers and Model Question Papers (1st & IInd Semesters) of M.Sc Computer Science and M.Sc Computer Science with Specialization in Artificial Intelligence Programmes under Choice Based Credit and Semester System (in OBE-Outcome Based Education System) in Affiliated Colleges under the University with effect from 2023 Admission is uploaded in the University website.

9. Orders are issued accordingly.

Sd/-
Sajesh Kottambrath
Assistant Registrar1
For REGISTRAR

To:
1. Principals of Affiliated Colleges offering M.Sc Computer Science and M.Sc Computer Science with Specialization in Artificial Intelligence Programmes.
2. Convenor, Curriculum Syllabus Monitoring Committee.
3. Convenor, Adhoc Committee for Computer Science (PG) programme.

Copy To:
1. The Examination Branch (Through PA to CE)
2. PS to VC / PA to PVC / PA to R/PA to FO
3. DR / AR 1 (Acad) /Computer Programmer
4. Web Manager (for uploading on the website).
5. EG 1/EX C1 (Exam), EP V
6. SF/DF/FC

KANNUR UNIVERSITY CIVIL STATION P.O. KANNUR Pin-670 002 THAVAKKARA

Forwarded / By Order

SECTION OFFICER

KANNUR UNIVERSITY
കണ്ണൂർ സർവകലാശാല

Syllabus for
Choice Based Credit and Semester System for Postgraduate Programme in Affiliated Colleges -2023
(OBE (Outcome Based Education) System)

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

Under the

Faculty of Technology

(Academic Year 2023-24 onwards)

Curriculum for Choice Based Credit and Semester System for Postgraduate Programme in Affiliated Colleges -2023

OBE (Outcome Based Education) System

Kannur University introduced Outcome Based Education (OBE) in the curriculum for under graduate students in 2019. Expanding OBE to the Postgraduate curriculum and syllabus from the academic year 2023 onwards demonstrates the university's commitment to further improving the learning experience for its students across different academic levels. This move is to enhance the academic rigour and relevance of the Postgraduate programmes, better preparing the students for their future careers and challenges.

Outcome based education is an educational methodology where each aspect of education is organized around a set of goals (outcomes). Students should achieve their goal by the end of the educational process. Throughout the educational experience, all students should be able to achieve their goals. It focuses on measuring student performance through outcomes. The OBE model aims to maximize student learning outcomes by developing their knowledge & skills.

The key to success in outcome-based education is clarity, for both teachers and students to understand what's expected of them. Outcome-based education aims to create a clear expectation of results that students must achieve. Here, the outcome includes skills, knowledge and attitude. In addition to understanding what's expected, outcome-based education also encourages transparency. The basic principle of outcome-based education is that students must meet a specific standard to graduate. Hence, no curve grading is used in outcome-based education, and instead, teachers are free to experiment with any methodology they feel is best.

Mission statements

- To produce and disseminate new knowledge and to find novel avenues for application of such knowledge.
- To adopt critical pedagogic practices which uphold scientific temper, the uncompromised spirit of enquiry and the right to dissent.
- To uphold democratic, multicultural, secular, environmental and gender sensitive values as the foundational principles of higher education and to cater to the modern notions of equity, social justice and merit in all educational endeavours.
- To affiliate colleges and other institutions of higher learning and to monitor academic, ethical, administrative and infrastructural standards in such institutions.

- To build stronger community networks based on the values and principles of higher education and to ensure the region's intellectual integration with national vision and international standards.
- To associate with the local self-governing bodies and other statutory as well as non-governmental organizations for continuing education and also for building public awareness on important social, cultural and other policy issues.

Establishing the Programme Outcomes (POs)

Programme Outcomes (POs): Programme outcomes can be defined as the objectives achieved at the end of any specialization or discipline. These attributes are mapped while a student is doing graduation and determined when they get a degree.

PO 1. Advanced Knowledge and Skills: Postgraduate courses aim to provide students with in-depth knowledge and advanced skills related to their chosen field. The best outcome would be to acquire a comprehensive understanding of the subject matter and develop specialized expertise.

PO 2. Research and Analytical Abilities: Postgraduate programmes often emphasize research and analytical thinking. The ability to conduct independent research, analyze complex problems, and propose innovative solutions is highly valued.

PO 3. Critical Thinking and Problem-Solving Skills: Developing critical thinking skills is crucial for postgraduate students. Being able to evaluate information critically, identify patterns, and solve problems creatively are important outcomes of these programs.

PO 4. Effective Communication Skills: Strong communication skills, both written and verbal, are essential in various professional settings. Postgraduate programs should focus on enhancing communication abilities to effectively convey ideas, present research findings, and engage in academic discussions.

PO 5. Ethical and Professional Standards: Graduates should uphold ethical and professional standards relevant to their field. Understanding and adhering to professional ethics and practices are important outcomes of postgraduate education.

PO 6. Career Readiness: Postgraduate programs should equip students with the necessary skills and knowledge to succeed in their chosen careers. This includes practical skills, industry-specific knowledge, and an understanding of the job market and its requirements.

PO 7. Networking and Collaboration: Building a professional network and collaborating with peers and experts in the field are valuable outcomes. These connections can lead to opportunities for research collaborations, internships, and employment prospects.

PO 8. Lifelong Learning: Postgraduate education should instill a passion for lifelong learning. The ability to adapt to new developments in the field, pursue further education, and stay updated with emerging trends is a desirable outcome.

Establishing the Course Outcomes

Course Outcomes (COs) are the objectives that are achieved at the end of any semester/year. For instance, if a student is studying a particular course, then, the outcomes would be concluded on the basis of the marks or grades achieved in theory and practical lessons.

Each programme shall define the COs according to the outcome set at the beginning of the study of the course.

Automated Question Bank System

The evaluation process shall be based on the revised Bloom's Taxonomy. Hence the syllabus shall be defined and designed in view of the scheme of the said taxonomy.

Modules

The syllabus shall be prepared in four Modules to reflect the spirit of revised Blooms Taxonomy and the evaluation system based on the six cognitive levels.

Evaluation process using Revised Bloom's Taxonomy

There are six levels of cognitive learning according to the revised version of Bloom's Taxonomy. Each level is conceptually different. The six levels are remembering, understanding, applying, analysing, evaluating, and creating. These levels can be helpful in developing learning outcomes.

Remember: Definition: retrieve, recall, or recognize relevant knowledge from long-term memory. Appropriate learning outcome verbs for this level include: *cite, define, describe, identify, label, list, match, name, outline, quote, recall, report, reproduce, retrieve, show, state, tabulate, and tell.*

Understand: Definition: demonstrate comprehension through one or more forms of explanation. Appropriate learning outcome verbs for this level include: abstract, arrange, articulate, associate, categorize, clarify, classify, compare, compute, conclude, contrast, defend, diagram, differentiate, discuss, distinguish, estimate, exemplify, explain, extend, extrapolate, generalize, give examples of, illustrate, infer, interpolate, interpret, match, outline, paraphrase, predict, rearrange, reorder, rephrase, represent, restate, summarize, transform, and translate.

Apply: Definition: Use information or a skill in a new situation Appropriate learning outcome verb for this level include: apply, calculate, carry out, classify, complete, compute, demonstrate, dramatize, employ, examine, execute, experiment, generalize, illustrate, implement, infer, interpret, manipulate, modify, operate, organize, outline, predict, solve, transfer, translate, and use.

Analyze: Definition: break material into its constituent parts and determine how the parts relate to one another and/or to an overall structure or purpose Appropriate learning outcome verbs

for this level include: analyse, arrange, break down, categorize, classify, compare, connect, contrast, deconstruct, detect, diagram, differentiate, discriminate, distinguish, divide, explain, identify, integrate, inventory, order, organize, relate, separate, and structure.

Evaluate: Definition: make judgments based on criteria and standards Appropriate learning outcome verbs for this level include: appraise, apprise, argue, assess, compare, conclude, consider, contrast, convince, criticize, critique, decide, determine, discriminate, evaluate, grade, judge, justify, measure, rank, rate, recommend, review, score, select, standardize, support, test, and validate.

Create: Definition: put elements together to form a new coherent or functional whole; reorganize elements into a new pattern or structure. Appropriate learning outcome verbs for this level include: arrange, assemble, build, collect, combine, compile, compose, constitute, construct, create, design, develop, devise, formulate, generate, hypothesize, integrate, invent, make, manage, modify, organize, perform, plan, prepare, produce, propose, rearrange, reconstruct, reorganize, revise, rewrite, specify, synthesize, and write.

Programme Specific Outcomes (PSO)

PSO 1: Graduates of this programme will get opportunities as Software Engineer, Research Scientist, Data Analyst in the emerging areas of Computer Science like Artificial Intelligence, Cyber Security, Data Science, etc.

PSO 2: The programme will help students to develop an interest towards research in Computer Science.

PSO 3: To inspire and support the students to prepare and qualify competitive examinations such as UGC-NET/JRF, GATE etc.

PSO 4: Graduates of this programme with get opportunities in teaching at different level of education.

ADHOC COMMITTEE FOR CURRICULUM AND SYLLABUS REVISION

SLNo	Name and Designation
1	**Dr Thomas Monoth** (Convenor) Professor Department of Computer Science Mary Matha Arts & Science College Mananthavady, Wayanad.
2	**Dr. Sabu M K** (External Expert) Professor Department of Computer Applications Cochin University of Science & Technology, Kochi – 682 022
3	**Dr. Sreekanth N S** Associate Professor & Head Department of IT Kannur University
4	**Dr Jithesh K** Associate Professor Department of Computer Science Mahatma Gandhi College, Iritty, Kannur
5	**Ms.Jisha T E** Associate Professor Department of Computer Science Mary Matha Arts & Science College, Mananthavady, Wayanad.
6	**Ms.Hridya Shobhanam** Assistant Professor Department of Computer Science Government College, Thalassery, Kannur
7	**Dr. Daphna Chacko** Assistant Professor Department of Computer Science Government College, Thalassery, Kannur
8	**Ms. Rechitha C R** Assistant Professor, Department of Computer Science, Government College, Thalassery, Kannur

REGULATIONS

The existing regulations of Curriculum for Choice Based Credit and Semester System for Postgraduate Programme in Affiliated Colleges -2023 (OBE – Outcome Based Education – system) are applicable for these programmes with the following exceptions.

1. Admission

The eligibility, admission policy and procedure are as decided from time to time by the Kannur University.

2. Structure of the MSc Computer Science Programme

The programme of instruction will consist of:

i. Core courses (compulsory)

ii. Elective/Open Elective courses

iii. Practical/Seminar/Case Study and

iv. Project/Internship and dissertation

3. Evaluation

The evaluation scheme for each Theory and Practical courses (except MSCSC02C11-Semnar) shall contain two parts:

(a) Continuous Assessment (CA) and

(b) End Semester Evaluation (ESE).

20% marks shall be given to CA and the remaining 80 % to ESE. For MSCSC02C12-Seminar the evaluation is 100% by CA.

3.1 Continuous Assessment (CA)

3.1.1. Theory

The components of theory evaluation are as follows:

SLNo	Components	% of Marks
1	Test papers	50
2	Assignment	25
3	Case Study/Seminar / Viva	25

Test Papers: There shall be a minimum of two test papers to be conducted for each course. If more than two test papers are conducted, then two best scores shall be taken for the award of Internal marks. The dates of test papers shall be announced well in advance and the marks should be displayed in the notice board.

Assignments: Two or more assignments (including practical assignments) shall be given for each course. The mode of assessment of the assignments shall be decided by the faculty concerned with due approval from the department council and shall be declared at the beginning of the semester. (It is suggested that to the extent possible, give individual assignments and also conduct short viva based on the assignment submitted).

Case study / Seminar / Viva: The faculty with due approval from the department council shall choose one or more from this category, depending on the nature of course and the mode of assessment is to be declared at the commencement of the semester. For seminar, topics outside but related to the course shall be chosen.

3.1.2. Practical

The Components of CA for practical courses (I and II semester) are as follows:

SLNo	Components	% of Marks
1	Lab Test (Minimum two)	50
2	Completion of the list of Lab assignments prescribed by the faculty	30
3	Periodical assessment of Lab assignments through execution of programs and viva	20

3.1.3. Seminar

The Components of CA for seminar course:

SL No	Components	Marks
1	Seminar report duly certified by guide and HoD	10
2	Relevant of the topic and contents of the report#	10
3	Presentation (15-20 Minutes)	15
4	Viva based on presentation and report	15
	Total Marks	**50**

 # Cutting-edge topics within the field of Computer Science. The seminar assessment conducted by a minimum of three examiners.

3.2. End Semester Evaluation (ESE)

3.2.1. Theory

End Semester Evaluation carries 80 marks. The model question paper and Unit/Module wise question distributions (Core/Elective/Open Elective courses) are attached along with the syllabus.

3.2.2. Practical

The End Semester Evaluation in the practical courses shall be conducted by two examiners (one internal and one external) appointed by the University. If more than 10 student appearing practical examination, two external examiners appointed by the university. The practical examinations conduct at the end of each semester.

3.2.2.1 ESE Scheme of Evaluation

1) MSCSC01C06: LAB-1: C, C++ and Data Structures

SL No	Components	Marks
1	Record of work done duly certified by faculty and HoD	10
2	Correct Program writing (C, C++ and DS)	10+10 = 20
3	Correct output (C, C++ and DS)	10+10 = 20
4	Modifications (C, C++ and DS)	10+10 = 20
5	Viva based on lab list	05+05 = 10
	Total Marks	**80**

2) MSCSC02C13/MSCAI02C13: LAB -2 : Python Programming/Machine Learning and DBMS

SL No	Components	Marks
1	Record of work done duly certified by faculty and HoD	10
2	Correct Program writing (Python/ML and DBMS)	10+10 = 20
3	Correct Output (Python/ML and DBMS)	10+10 = 20
4	Modifications (Python/ML and DBMS)	10+10 = 20
5	Viva based on lab list	05+05 = 10
	Total Marks	**80**

Programme Structure

Semester -1

Course Code	Course Title	Instructional Hours/Week			Marks			Credits
		L	P	T	CE	ESE	Total	
MSCSC01C01	Discrete Structures and Optimization #	3		1	20	80	100	3
MSCSC01C02	Computer System Architecture#	3		1	20	80	100	3
MSCSC01C03	Data Structures and Algorithms	3		1	20	80	100	3
MSCSC01C04	Programming Languages	4		1	20	80	100	4
MSCSC01C05	Research Methodology and Publication Ethics	3	1	1	20	80	100	3
MSCSC01C06	LAB-1: C, C++ and Data Structures		8	1	20	80	100	4
	Total	**16**	**09**	**06**	**120**	**480**	**600**	**20**

 # Instead of these two courses, students of MSc Computer Science with Specialization in Artificial Intelligence shall choose the courses listed below. All other courses are same.

Course Code	Course Title	Instructional Hours/Week			Marks			Credits
		L	P	T	CE	ESE	Total	
MSCAI01C01	Mathematical Foundations for Machine Learning	3		1	20	80	100	3
MSCAI01C02	Machine Learning	3		1	20	80	100	3

Semester -2

Course Code	Course Title	Instructional Hours/Week			Marks			Credits
		L	P	T	CE	ESE	Total	
MSCSC02C07	Data Communication and Computer Networks	3		1	20	80	100	3
MSCSC02C08	Database Management Systems	3		1	20	80	100	3
MSCSC02C09	Theory of Computation	3		1	20	80	100	3
MSCSC02C10	Computer Graphics	3		1	20	80	100	3
MSCSC02C11	Python Programming	4		1	20	80	100	4
MSCSC02C12	Seminar			2	50		50	2
MSCSC02C13	LAB-2 : Python Programming and DBMS#		9	2	20	80	100	4
	Total	**16**	**09**	**09**	**170**	**480**	**650**	**22**

 # Instead of practical course, students of MSc Computer Science with Specialization in Artificial Intelligence shall choose the course listed below. All other courses are same.

Course Code	Course Title	Instructional Hours/Week			Marks			Credits
		L	P	T	CE	ESE	Total	
MSCAI02C13	LAB-2: Machine Learning and DBMS		9	2	20	80	100	4

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**

Syllabus

and

Model Question Papers

MSCSC01C01- Discrete Structures and Optimization

Semester	Course Code	Hours per week	Credit	Exam Hours
1	MSCSC01C01	3	3	3

Course Outcomes

CO1	Understand the fundamental concepts of discrete mathematics.
CO2	Develop the ability to analyse and solve problems using discrete mathematics and optimization techniques.
CO3	Analyse and solve problems in group theory.
CO4	Students will learn optimization techniques, including linear programming and mathematical modelling, to solve practical problems efficiently

SYLLABUS

Unit-1

Mathematical Logic: Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Normal Forms, Rules of Inference.

Set Theory: Sets, Set Operations. Functions- One-to-One and Onto Functions, Inverse functions and Compositions of Functions. Representation and Properties of Relations, Equivalence Relations, Partial Ordering.

Unit-2

Counting: Basics of counting, The Pigeonhole Principle, Permutations and Combinations, Inclusion -Exclusion principle. Discrete Probability- Probability Theory, Bayes' Theorem.

Group Theory: Definition and Elementary Properties, Cyclic Groups, Sub Groups, Semi Groups and Monoid, Isomorphism, Homomorphism and Automorphism. Rings, Integral Domains and Fields.

Unit-3

Graph Theory: Basic Terminology, Multi Graph and Weighted Graph, Bipartite Graph, Isomorphic Graphs, Sub Graph. Paths and Circuits, Shortest Paths in Weighted Graph-Dijstra's Algorithm, Eulerian Paths and Circuits, Hamiltonian Paths and Circuits. Trees and Rooted Trees, Spanning Trees and Cut- Sets.

Unit-4

Optimization: Linear programming- Mathematical Model, Graphical Solution-2 variables, Simplex Method, Big M Method, Duality in LPP and its Formulation. Applications of LPP-Transportation problem, Assignment problem. PERT-CPM- Diagram Representation, Critical Path Calculations.

Reference Books:

1. Kenneth H. Rosen ,Discrete Mathematics and Its Applications. McGraw-Hill Education. Seventh Edition.
2. C Liu and D. Mohapatra, Elements of Discrete Mathematics- A Computer Oriented Approach, TMH.
3. Alan Doerr and Kenneth Levassur, Applied Discrete Structure, Galgotia Publications Pvt. Ltd.
4. Hamdy A. Taha, Operations Research An Introduction, 10 th Edn, Pearson.
5. Sharm J.K, Mathematical Models in Operation Research, TMH.

Unit Wise Question Distribution

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

Model Question paper

MSCSC01C01- Discrete Structures and Optimization

Time: 3 Hrs Max Marks: 80

SECTION-A

Answer any 5 questions. Each question carries 4 marks.

1. Draw the truth table of $P \rightarrow Q \wedge \sim R$. Explain with example the difference between tautology and contradiction.
2. Define: i) Isomorphism ii) Homomorphism iii) Automorphism
3. a) State Bayes' Theorem

   b)A bag contains 4 balls. Two balls are drawn at random without replacement and are found to be blue. What is the probability that all balls in the bag are blue?
4. What is Hamiltonian path ? Give an example.
5. Write a note on PERT and CPM.
6. Explain the relationship between primal and its dual.

(5 x 4 = 20 Marks)

SECTION-B

Answer any 3 questions. Each question carries 8 marks.

7. Explain different ways to represent a relation.
8. a) Determine whether (2,+,.)is a ring with binary operation.

   b) Prove that every cycle group is abelian
9. Define spanning tree. Prove that every connected graph contains a spanning tree.
10. Does the complete graph K_4 is Eulerian? Justify your answer.
11. Find the optimum solution to the transportation problem given in the Table for which the cost, origin-availabilities, and destination-requirements are given.

	D1	D2	D3	D4	Supply
O1	5	3	6	2	19
O2	4	7	9	1	37
O3	3	4	7	5	34
Demand	16	18	31	25	90

(3 x 8 = 24 Marks)

SECTION-C

Answer any 3 questions. Each question carries 12 marks.

12. a) Obtain PCNF and PDNF of (P->(Q^R))^(~P->(~Q^ ~R)).

    b) Let f and g be the functions from the set of integers to the set of integers defined by f (x) = 3x +2 and g (x) = x + 5. What is the composition of f and g ? What is the composition of g and f?

13. Determine whether the function $f(x)=x^2$ from the set of integers to the set of integers Is one-to-one.

14. a) Show that identity element in a group is unique

    b) Define fields with example

    c) Define pigeonhole principle

15. Explain Dijkstra's algorithm to find shortest path from a source vertex to all other vertices in a graph.

16. A company is manufacturing two different types of products, A and B. Each product has to be processes on two machines M1 and M2, Product A requires 2 hours on machine M1 and 1 hour on machine M2, product B requires 1 hour on machine M1 and 2 hours on machine M2. The available capacity of machine M1 is 104 hours and that of machine M2 is 76 hours. Profit per unit for product A is Rs.6 and that for B is Rs.11. Calculate i) Formulate the problem ii) Find out the optimal solution by Simplex method.

(3 x 12 = 36 Marks)

MSCSC01C02 - Computer System Architecture

Semester	Course Code	Hours per week	Credit	Exam Hours
1	MSCSC01C02	3	3	3

Course Outcomes

CO1	Familiarize digital logic circuits and data representations
CO2	Demonstrate the instruction execution in a processor
CO3	Understand the memory system and I/O Organization
CO4	Understand pipelining and parallel processing

SYLLABUS

Unit-1

Digital logic circuits: Digital Computers, Logic Gates, Boolean Algebra, Map Simplifications, Combinational Circuits, Flip-Flops, Sequential Circuits, Integrated Circuits, Decoders, Multiplexers, Registers and Counters.

Data Representation: Data Types, Complements, Fixed Point Representation, Floating Point Representation.

Unit-2

Instruction set Architecture: Memory Locations and Addresses, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language.

Basic Processing Unit : Fundamental concepts, Instruction execution, Hardware components, Instruction fetch and execution steps, control signals, Hardwired control, CICS style processors.

Unit-3

Basic I/O: Accessing I/O devices, Interrupts(Enabling and Disabling Interrupts, Handling Multiple Devices), Bus structure, Bus operation, arbitration.

Memory Systems: Direct Memory Access, Memory hierarchy, Cache memory, performance requirements, virtual memory

Unit- 4

Pipelining & Parallel Processing: Pipeline organization, issues, data dependencies, memory delays, branch delays. performance evaluation, superscalar operations, Hardware multithreading, Vector processing, Shared memory multiprocessors, message passing multi-computers.

Text Books:

1. M. Morris Mano, Computer System Architecture, 3rd Edition, Pearson Education.
2. Hamacher, Vranesic, Zaky, Manjikian, Computer Organization and Embedded Systems, 6th Edition,Tata McGraw Hill.

Reference Books:

1. William Stallings, Computer Organization & Architecture – Designing for Performance, 9th Edition, Pearson
2. John P. Hayes, Computer Architecture and Organization, 3rd Edn, Tata McGraw Hill

UNIT WISE QUESTION DISTRIBUTION			
Semester 2	Course: MSCSC01C02 - Computer System Architecture		
Unit	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

MSCSC01C02-Computer System Architecture

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

SECTION -A

Answer any 5 questions. Each question carries 4 marks

1. Simplify the following expression using boolean algebra (Problem Based)
   a. A+AB
   b. AB+AB'
   c. A'BC+AC
   d. A'B+ABC'+ABC

2. Convert the following numbers with the indicated bases to decimal (Problem Based)
   a. $(12121)_3$ $(4310)_5$, $(50)_7$, $(198)_{12}$

3. Write a note on Assembly Language.
4. Compare CISC and RISC style processors
5. Explain Bus Arbitration with a neat diagram
6. Explain vector processing with a neat diagram

(5x4=20)

SECTION-B

Answer any 3 questions. Each question carries 8 marks

7. Write a note on decoders and multiplexers
8. What are the different addressing modes?
9. Explain in detail about Program controlled I/O.
10. Explain the working of DMA in detail
11. Explain the concept of superscalar operations.

(3x8=24)

SECTION-C

Answer any 3 questions. Each question carries 12 marks

12. What is a flip-flop? Write a note on common type of flip-flops
13. Explain the instruction processing phases with a neat diagram of datapath in a processor.
14. Explain any two cache mapping functions.
15. Discuss the major issues related to pipelining
16. What are the features of a multiprocessor? Explain the shared memory multiprocessor in detail

(3x12=36)

MSCSC01C03 - Data Structures and Algorithms

Semester	Course Code	Hours per week	Credit	Exam Hours
1	MSCSC01C03	3	3	3

Course Outcomes

CO1	Learn various popular data structures and their representations
CO2	Learn, implement and use different algorithms
CO3	Analysis of algorithms which can be measured with time and space complexities
CO4	Develop analytical skills on data structure and use them efficiently

SYLLABUS

Unit-1

Introduction to the concept of algorithms - Mathematical background – Time and Space Complexity of algorithms, Best, average and worst-case analysis, Performance analysis of space and time complexity, Recursive and Iterative algorithm, Randomized algorithms, Asymptotic notations, Abstract Data Types (ADT). Introduction to data structures, Physical and Logical Data Structures, Linear Data Structures – Arrays: Operations on arrays.

Unit-2

Linked List: Singly Linked List, representation, operations (creation, deletion, search, traverse, reverse). Circular Linked Lists, Doubly Linked List (Basic ideas only). Polynomials: representation using array, operations (addition). Sparse Matrix: representation with arrays, operations (addition). Stack – representation using array and linked list, operations (push, pop), Applications: Evaluation of Arithmetic Expressions, operations (infix to postfix conversion, evaluation of postfix expression). Queue - representation using array and linked list, operations (insertion, deletion). Circular Queue, Priority Queue, Applications of queue.

Unit-3

Non-linear data structures – Tree, Binary Tree – Basic terminologies, tree traversal. Binary Search Tree – operations (creation, deletion, search). Threaded binary tree (TBT) – operations (inorder traversal). Applications of tree: AVL Tree – rotations, Heap – Heap sort, B Tree, B+ tree, B* tree (Basic ideas only). Hashing - Hash functions (types) - Collision Resolution Techniques. Graph - Representation of graph, basic terminologies, Traversal (DFS, BFS). Applications of graph: Dijkstra's algorithm, Minimum spanning tree – Prim's and Kruskal's algorithms.

Unit- 4

Algorithm Design Techniques - Greedy Algorithm: General Method, knapsack problem. Dynamic Programming: General Method, All pairs shortest path. Divide and conquer: General Method, Binary Search, Quick sort. Backtracking: General method, N-Queen problem, Hamiltonian cycles.

Reference Books:

1. Horowitz, Sahni and Mehta, Fundamentals of Data Structures in C++, 2ndEdn, University Press
2. Horowitz, Sahni, Rajasekaran, Fundamentals of Algorithms, 2ndEdn, University Press
3. Langsam, Augenstein and Tenenbaum, Data Structures Using C and C++, 2ndedn, PHI.
4. Aho, Hopcroft and Ullman, Data Structures and Algorithms, Pearson Education.
5. Aho, Hopcroft, Ullman, The Design and analysis of computer algorithms, Pearson
6. A Levitin, Introduction to the Design and analysis of algorithms, 2ndedn, Person.

Unit Wise Question Distribution

Unit	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

MSCSC01C03- Data Structures and Algorithms

Time:3 Hours Max.Marks:80

SECTION-A

Answer any 5 questions, Each question carries 4 marks

1. What is a Data Structure?
2. Explain sparse matrix and its representation.
3. List out applications graph.
4. Explain N- Queen problem.
5. Explain complexities of algorithm.
6. Explain knapsack algorithm.

(5x4=20)

SECTION-B

Answer any 3 questions, Each question carries 8 marks

7. Explain asymptotic notations in detail.
8. Explain the difference between arrays and linked lists with examples.
9. With a suitable example explain Depth First Search.
10. What is hashing? what is the need for hashing.
11. State the principle of backtracking with examples.

(3x8=24)

SECTION-C

Answer any 3 questions, Each question carries 12 marks

12. Write algorithms of any 4 operations on arrays.
13. What is Queue? Why it is known as FIFO? Write an algorithm to insert and delete an element from a simple Queue.
14. Explain briefly about the rotations of AVL tree.
15. Discuss the running time of Divide-and-Conquer quick sort algorithm.
16. Explain evaluation of arithmetic expressions with algorithms.

(3x12=36)

MSCSC01C04 : Programming Languages

Semester	Course Code	Hours/Week	Credit	Exam Hours
1	MSCSC01C04	4	4	3

Course Outcomes

CO1	To study the concepts of procedure and object-oriented programming
CO2	To learn advanced features of Programming
CO3	Design and implement programs for simple computational problems.
CO4	Design and implement programs for solving real-life problems

SYLLABUS

Unit-1

Programming in C: Importance of C, Constants, Variables, and Data Types- Character Set, C Tokens, Keywords and Identifiers, Data Types, Declaration of Variables. Operators and Expressions, Reading and Writing Characters, Formatted Input/Output. Decision Making and Branching- Simple if. if.... else, nested if...else, else if ladder, switch, ? : operator, go to statement.

Unit-2

Decision Making and Looping - while, do-while and for statements. Arrays – one dimensional, two dimensional and multi-dimensional Arrays. Character Arrays and Strings, String Handling Functions. Functions-User defined and Library Functions, Function Definition, Declaration and Call, Category of functions, Call by value and reference, Recursion. Structures and Union, Pointers, File management- Opening and Closing Files, Input and Output Operations on Files. Command Line Arguments, Preprocessors.

Unit- 3

Programming in C++ : Principles of Object-Oriented Programming, Token, Expressions and Control Structures, Functions in C++ - Inline Functions, Call by Reference, Function Overloading, Friend Function, Classes and Objects - Specifying a Class, Defining member Functions, Constructors - Parameterized Constructors, Multiple Constructor in a class, Copy Constructor and destructors, Operator overloading- Overloading Unary Operators, Overloading Binary Operators, Overloading Binary Operators Using Friends, Manipulation of String Using Operators.

Unit -4

Inheritance - Types of Inheritance, Virtual Base Classes, Abstract Classes. Pointers- Pointers to Objects, this Printer, pointers to derived classes, Virtual Functions, Pure Virtual Functions. C++ Streams- C++ Stream Classes, Unformatted I/O Operations, Formatted I/O Operations, Managing Output with Manipulators, Working with Files, Templates - Class Templates, Class Templates with Multiple Parameters, Function Templates, Function Templates with Multiple Parameters, Overloading of Template functions.

Reference Books:

1. Programming in ANSI C, E Balagurusamy, 8th Edition, McGraw Hill India.
2. The C Programming Language, Brian W. Kernighan / Dennis Ritchie ,2e, Pearson India
3. Object Oriented Programming with C++, E Balagurusamy, 8th Edition, McGraw Hill India.
4. The C++ Programming Language, Bjarne Stroustrup, 3rd Edition, Pearson India.

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

MSCSC01C04: Programming Languages

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

SECTION-A

Answer any 5 questions. 4 marks each

1. Write the general syntax of switch statement. Explain with example
2. Write C program to find largest of three integer numbers using conditional operator.
3. Explain any four string handling functions in C with example.
4. Write a C++ program to check whether given integer number is prime or not
5. Define Virtual Functions. Explain with example.
6. Write object oriented program to find the largest number from n numbers.

(5 x 4 = 20)

SECTION-B

Answer any 3 questions. 8 marks each

7. Explain different types of Operators in C with example
8. Discuss different forms of looping statements in C with example.
9. Write C++ program to find the area of a square, rectangle and circle using functions. Overloading.
10. Define Constructors. Explain different types of Constructors with example.
11. Write Object oriented program to search a name in an array of n names

(8 x 3 = 24)

SECTION-C

Answer any 3 questions. 12 marks each

12. Explain different form *if* statement with example
13. Write C program to concatenate two string using Command Line Arguments.
14. Distinguish between structure and union in C with example.
15. Write object oriented program to concatenate two string using operator overloading.
16. Write C program to find sum of upper triangular of n x n matrix.

(12 x 3 = 36)

MSCSC01C05 -Research Methodology and Publication Ethics

Semester	Course Code	Hours/Week	Credit	Exam Hours
1	MSCSC01C05	3 (L) + 1(P)	3	3

Course Outcomes

CO1	Understand and comprehend the basics of research methodology and apply them in research/ project work
CO2	Helps student to select appropriate research design sampling techniques
CO3	Gain knowledge of intellectual property and ethics to present research output in an ethical manner
CO4	Learn to write research reports using LaTeX

SYLLABUS

Unit-1

Introduction to Research Methodology: Meaning and importance of research, Types of research: Descriptive Vs. Analytical, Applied Vs. Fundamental, Quantitative Vs. Qualitative, Conceptual Vs. Empirical, Significance of research, Research Methods versus Methodology,
Research process and research problems: Steps, Criteria of good research, Problems encountered by researchers in India, Defining and selecting a research problem, Technique involved in defining a problem.

Unit-2

Research Design: Meaning, need for research design, features, Important concepts, Different research designs, and Developing a Research Plan. Methods of Data Collection: Methods for collecting primary and secondary data, Selection of appropriate method, Case study method, Processing and Analysis of Data: Processing operations, Problems in processing, Types of analysis.
Sampling: - Steps in sampling design - Characteristics of a good sample design - Types of sample designs. Measurement scales, Tests of sound measurement, Sources of error in measurement.

Unit-3

Intellectual Property Rights: Definition and meaning, Relevance, Business impact, Protection of intellectual property, Copyrights - ownership and classes of copyrights - Copyrights of the author, Patents – steps to file a patent, Trademarks -eligibility criteria and who can apply for a trademark, Case study: Examples of violations of intellectual property.
Research and Publication Ethics: Ethical judgements in research, Managing scientific conduct: Types and integrity concepts, Research fraud: FFP, Ethics of publications: Individual and publisher level, Redundant publication, Selective reporting and misrepresentation of data, Concept of publication and research ethics, Types of research misconduct, Plagiarism: nature, levels, and penalties, Authorship and contributorship, Conflicts of interest, Concept of publication misconduct. Concept of citation, Citation databases, Author level and article level metrics.

Unit-4

Interpretation and Report Writing: Techniques of interpretation - Different steps in the writing research - Layout of the report - Types of the report - precautions for writing research reports.

Technical writing in Latex: Latex compilation, formatting, writing books as chapters, designing header and footer, designing chapters and sections, creating lists, tables, inserting images, setting labels and reference, index, list of figures and tables, math formulae, hyperlinks, bookmarks, bibliography.

Awareness of Software tools and journals: Turnitin, Urkund, Shodhganga, Overleaf, and other open-source software tools, Scimago, Springer, Elsevier, Jane, Wiley, Taylor & Francis, IEEE, etc.

Reference Books:

1. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. 418p.
2. Bhardwaj, M. (n.d.). Intellectual Property A Primer for Academia (https://www.icsi.edu/media/website/IntellectualPropertyRightLaws&Practice.pdf)
3. Dr. Summanta Dutta, Research and Publication Ethics in Social Science
4. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to
5. Research Methodology, RBSA Publishers.
6. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Publications. 2 volumes.
7. Helmut Kopka and Patrick W.Daly, Guide to LATEX, fourth edition

1. Unit Wise Question Distribution

Unit	Section A	Section B	Section C
I	2	1	1
II	2	1	1
III	1	2	2
IV	1	1	1
Total Questions	**6**	**5**	**5**

Question Paper Pattern

MSCSC01C05 -Research Methodology and Publication Ethics

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

SECTION-A
Answer any 5 questions. 4 marks each

1. What do you mean by research design and research problem?
2. Write any two differences between research methods and methodology.
3. Explain different types of data analysis methods.
4. Explain the case study method.
5. What is the purpose of intellectual property rights and explain different types of intellectual property rights?
6. Explain the techniques of interpretation.

(5 x 4 = 20)

SECTION-B
Answer any 3 questions. 8 marks each

7. Write a note on types of research?
8. Explain the steps to develop a Research Plan.
9. What is copyright? (2 mark) Explain the following:
    a. Explain the ownership copyrights (2 marks)
    b. Explain the classes of copyrights (4 marks)
10. Explain the ethics of publications: Individual and publisher level (4 marks each)
11. Answer the following questions:
    a. What is LaTeX? (1 mark)
    b. Write LaTeX code for creating lists and tables (4 marks)
    c. Explain the layout of the report (3 marks)

(3 x 8 = 24)

SECTION-C
Answer any 3 questions. 12 marks each

12. Answer the following
    a. Techniques involved in defining a problem. (6 marks each)
    b. Steps and criteria for good research (3 marks each)
13. Write a note on
    a. Experimental and non-experimental hypothesis-testing research (3 marks)
    b. Descriptive and diagnostic research studies (9 marks)
14. Answer the following:
    a. Define the concept of citation (4 marks)
    b. Explain different types of citation databases (4 marks)
    c. **Explain** author level and article level metrics (4 marks each)
15. Answer the following:
    a. Explain different steps in the writing research reports (6 marks)
    b. What are the precautions for writing research reports (6 marks).
16. Explain with an example the concept of publication misconduct.

(3x12 = 36)

MSCSC01C06 :LAB-1 : C, C++ and Data Structures

Semester	Course Code	Hours per week	Credit	Exam Hours
1	MSCSC01C06	8	4	3

Faculty-in-charge shall prepare a list of experiments at the beginning of the semester. For the ESE, question will be selected from this list. All exercises must be done under Linux environment.

SECTION-A
C and C++

C Programs

1. Simple if, if..else, nested if , elseif ladder, switch.
2. while, do-while and for, nested loops.
3. One dimensional and two-dimensional arrays (Integer and character)
4. Functions, Recursion
5. Structures and Union
6. Pointers
7. Files
8. Command Line Arguments,
9. Preprocessors

C++ Programs

1. inline Functions
2. new, delete
3. Function Overloading
4. Friend Function and class
5. Classes and Objects
6. Constructors - Parameterized Constructors, Multiple Constructor in a class, Copy Constructor and destructors.
7. Operator overloading -Binary and Unary
8. Inheritance- single, multiple, multi-level, hierarchical and Hybrid
9. Virtual Base Classes, Virtual Functions
10. C++ Files
11. Class Templates and function Templates

SECTION-B

Data Structures

1. Linked list operations.
2. Polynomial addition using arrays.
3. Sparse matrix addition using arrays.
4. Stack using linked list.
5. Queue operations (array or linked list)
6. Evaluation of arithmetic expressions.
7. BST operations.
8. Heap sort
9. Hashing
10. Binary search
11. Quick sort
12. N-queen problem using backtracking algorithm

MSCAI01C01- Mathematical Foundations for Machine Learning

Semester	Course Code	Hours per week	Credit	Exam Hours
1	MSCAI01C01	3	3	3

Course Outcomes

CO1	Represent objects as sets and to identify functions and their relations
CO2	Identify assertions and apply inference rules to solve problems
CO3	Solve problems using Bayes Theorem
CO4	Explain the basics of Vectors and apply PCA for Dimensionality reduction

SYLLABUS

Unit-1

Sets: representation of sets, set operations, Cartesian product, using set notation with quantifiers, truth sets of quantifiers, computer representation of sets. Functions – one-to-one and onto functions, inverse functions and compositions of functions.

Relations – properties, functions as relations, relations on a set, combining relations, n-ary relations and their applications, representing relations, closures of relations, Basics of counting, basic counting principles, the inclusion-exclusion principle, the pigeonhole principle, the generalized pigeonhole principle

Unit-2

Propositional logic – Propositions, truth tables, converse, contra positive and inverse, compound statements and their truth tables, translating natural language sentences to logical statements, tautology, contradiction, logical equivalence, De Morgan's laws, normal forms.

Predicate logic – predicates, universal and existential quantifiers, binding variables, translating natural language sentences to logical statements.

Unit-3

Probability Theory: Discrete and Continuous Random Variables, Joint and Marginal Distributions, Markov, Chebyshev, Jensen and Hausdorff Inequalities, Law of Large Numbers, Central Limit Theorem (No proof). Classification and Estimation: Bayes classifier, maximum likelihood and Bayesian estimation techniques.

Unit-4

Linear Algebra: System of Linear equations, Matrices, Solving System of Linear equations, Linear Independence, Vector Spaces, Basis, Rank, Linear mapping, Scalars, Addition, Scalar multiplication, dot product, vector projection, cosine similarity. Orthogonal Decomposition algorithms: Eigen Decomposition, Singular Value Decomposition, Principal component analysis, LU, QR, Cholesky Decompositions, Least Squares Approximation

Reference Books

1. Kenneth H. Rosen, Discrete Mathematics and Applications, TMH 2003
2. Mathematics for Machine Learning, A. Aldo Faisal, Cheng Soon Ong, and Marc Peter Deisenroth, Edition, 2020, Cambridge University Press.
3. R. S. Ross, Introduction to Probability and Statistics for Engineers and Scientists, Academic Press, 2014.

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

MSCAI01C01- Mathematical Foundations for Machine Learning

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

SECTION-A

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

1. Let R be a relation on set A .Prove that if R is reflexive then R^{-1} is also reflexive
2. Show that the set of all integers are countable.
3. Let X={1,2,3,4} and R be the relation defined on the set X as R={<x,y>,x≤y}.Write the relation
4. Show that $A \cup_{i=1}^{n} Bi = \cap_{i=1}^{n} (A - Bi)$
5. Differentiate between discrete and continuous random variables
6. Consider a vector space $V = R^m$ and the span of the vectors $a_1, a_2, \ldots, a_n$ of the vector space V. What is the maximum possible dimension of the span of the vectors $a_1, a_2, \ldots, a_n$ of the vector space?

SECTION-B

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

7. a) If 9 books are to be kept in 4 shelves, there must be at least one shelf which contains at least 3 books. Justify
   b) Prove that if a relation R on set A is transitive & irreflexive, then it is asymmetric.
8. Let p, q, r be the statements given as
   p: Arjun studies. q: He plays cricket r : He passes Data Structures.
   Let p_1, p_2, p_3 denote the premises
   p_1:If Arjun studies, then he will pass Data Structures.
   p_2:If he doesn't play cricket, then he will study.
   p_3:He failed Data Structures.
   Determine whether the argument $(p_1 \wedge p_1 \wedge p_1) \rightarrow q$ is valid.
9. In a Normal Distribution, if 6% of the items are below 60 and 39% are above 70, then find the mean and standard deviation.
10. Three boys A, B, C are throwing a ball to each other. A always throws the ball to B and B always throws the ball to C, but C is as likely to throw the ball to B as to A. Show that the process is Markovian. Find the transition probability matrix and classify the states.
11. Find the values of λ and μ for which the system of equations
    $2x + 3y + 5z = 9$
    $7x + 3y - 2z = 8$
    $2x + 3y + \lambda z = \mu$
    has (i) no solution (ii) a unique solution and (iii) infinite solution

SECTION-C

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

12. a) Prove the validity of the following argument:

If Rochelle gets the supervisor's position and works hard, then she will get a pay raise. If she gets the pay raise, then she will buy a new car. She has not purchased a new car. Therefore either Rochelle did not get the Supervisor's position or she did not work hard.

b) Negate and simplify the statement:

$$\forall x[p(x) \rightarrow q(x)]$$

13. a) The relation R on Z + is defined by aRb if 'a divides b'. Check whether R is

(i) reflexive (ii) symmetric (iii) transitive. Is R an equivalence relation ?

b) Let A= { 1, 2, 3 }. Consider the relation R on A defined as R= {(1,2), (2,1), (2,3)}. Is R symmetric?, antisymmetric?

14. We seek to classify documents as being about sports or not. Each document is associated with a pair ($\underline{x}$, y), where $\underline{x}$ is a feature vector of word counts of the document and y is the label for whether it is about sports (y = 1 if yes, y = 0 if false). The vocabulary is size 3, so feature vectors look like (0, 1, 5), (1, 1, 1), etc.

Consider a naive Bayes model with the following conditional probability table:

word type	1	2	2
P(w | y = 1)	1/10	2/10	7/10
P(w | y = 0)	5/10	2/10	3/10

and the following prior probabilities over classes:

P(y = 1)	P(y = 0)
4/10	6/10

Consider the document with counts $\underline{x}$ = (1, 0, 1).

a. Which class has the highest posterior probability?

b. What is the posterior probability that the document is about sports?

15. Let A $\in R^{3\times2}$ be a matrix given by

$$\begin{bmatrix} 1 & 2 \\ 2 & 2 \\ 2 & 1 \end{bmatrix}$$

with singular-value decomposition given as $A = U\Sigma V^T$. The eigenvalue decomposition of $B = A^TA$ has 1 and 17 as its two non-zero eigenvalues and one of the two normalised eigenvectors is $q = \frac{1}{\sqrt{2}} [1\ 1]^T$

(a) Determine the matrix V.

(b) Determine the singular values of A, that is, the matrix Σ

(c) Determine the determinant of the matrix B.

16. a) Solve the system of equations by Gauss elimination method.

$x + 2y + 3z = 1$

$2x + 3y + 2z = 2$

$3x + 3y + 4z = 1$

b) Find the eigenvalues and eigenvectors of

$$\begin{bmatrix} 4 & 2 & -2 \\ 2 & 5 & 0 \\ -2 & 0 & 3 \end{bmatrix}$$

MSCAI01C02-Machine Learning

Semester	Course Code	Hours per week	Credit	Exam Hours
1	MSCAI01C02	3	3	3

Course Outcomes

CO1	Differentiate different learning approaches, and to contrast different dimensionality reduction techniques
CO2	Understand how to evaluate models generated from data
CO3	Apply and analyse different types of supervised learning methods to solve problems
CO4	Illustrate and apply clustering algorithms and identify its applicability in real life problems

SYLLABUS

Unit-1

Introduction: Basic definitions and applications, types of learning, hypothesis space, Find S Algorithm, version space, Candidate elimination algorithm, inductive bias, Bias/variance Tradeoff, Bootstrapping, Cross Validation, Evaluation Measures, ROC curve. Basics of parameter estimation - maximum likelihood estimation (MLE) and maximum a posteriori estimation (MAP). Dimensionality reduction – Subset selection, Principal Component Analysis, Linear Discriminant Analysis.

Unit-2

Regression - Linear regression with one variable, Linear regression with multiple variables,

Cost function, gradient descent algorithm, concept of Underfitting and Overfitting, ways to avoid overfitting in regression. **Classification** - K-nearest neighbour algorithm, logistic regression, Naive Bayes, Decision tree algorithm: ID3, ways to avoid overfitting in Decision tree, CART

Unit-3

Neural Networks- Perceptron, Activation Functions, Training Feed Forward Network by Back Propagation. **Support Vector Machine**- Optimal Separating hyperplane, Soft-margin hyperplane, Kernels for learning non-linear functions, polynomial kernel, Radial Basis Function (RBF). **Hidden Markov models**, Three basic problems of HMMs- Evaluation problem, finding state sequence, Learning model parameters.

Unit-4

Improving model performance with ensemble learning, Bagging and Boosting.Introduction to random forest. **Unsupervised Learning**, Partitional Clustering, Hierarchical Clustering, Density-based Clustering. Case study

Textbooks

1. Alpaydin, Ethem. Introduction to machine learning. MIT press, 2009.
2. Tom Mitchell, Machine Learning, McGraw Hill, 1997
3. S. Haykin. Neural networks and learning machines. Pearson 2008.
4. Margaret H. Dunham, Data mining introductory and advanced topics, Pearson 2006

Reference Books:

1. The Elements of Statistical Learning, by Trevor Hastie, Robert Tibshirani, Jerome H. Friedman
2. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006
3. Simon Rogers, Mark Girolami, "A First course in Machine Learning", CRC Press, First Indian reprint, 2015.
4. J. Han and M. Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann/Elsevier India, 2001

Unit Wise Question Distribution

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

Model Question Paper

MSCAI01C02-Machine Learning

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

SECTION-A

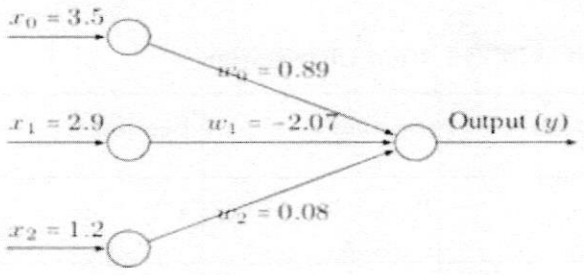
(Answer any 5 Questions. Each question carries 4 marks)

1 Compare Cross validation with Bootstrapping Techniques.

2 Explain the general MLE method for estimating the parameters of a probability distribution.

3 Differentiate Classification and regression with suitable examples.

4 Compute the output of the following neuron if the activation function is
(i) threshold function (ii) sigmoid function (assume bias 0.5).



5 What is the purpose of Kernel functions used in Support Vector Machines?

6 Write K means algorithm. How do we evaluate the performance of a clustering algorithm?

SECTION-B

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

7 Differentiate between supervised and unsupervised training. Explain with suitable examples.

8 What is meant by ordinary least square estimation? The following table shows the results of a recently conducted study on the correlation of the number of hours spent driving with the risk of developing acute back-ache. Find the least square error for this regression

$Y = 4.59x + 12.58.$

Number of hours spent driving (x)	Risk score on a scale of 0-100 (y)
10	95
9	80
2	10
15	50
10	45
16	98
11	38
16	93

9 Explain how Support Vector Machine can be used for classification of linearly separable data. What is the significance of optimal separating hyperplanes in SVM?

10 Explain how an Artificial Neural Network adjusts weights?

11 a) What are the distance measures that can be used in hierarchical clustering methods

(3 Marks)

b) Consider the similarity matrix given below. Show the hierarchy of clustering created by the single-link clustering algorithm.

	P1	P2	P3	P4	P5	P6
P1	1.00	0.70	0.65	0.40	0.20	0.05
P2	0.70	1.00	0.95	0.70	0.50	0.35
P3	0.65	0.95	1.00	0.75	0.55	0.40
P4	0.40	0.70	0.75	1.00	0.80	0.65
P5	0.20	0.50	0.55	0.80	1.00	0.85
P6	0.05	0.35	0.40	0.65	0.85	1.00

(5 Marks)

SECTION-C

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

12 a) Define Hypothesis space and Version space. Find Version space for the given training set which includes a user profile for web browsing.

Dom.	Plat.	Browser	Day	Screen	Cont.	Click?
edu	Mac	Net3	Mon.	XVGA	America	Yes
com	Mac	NetCom	Tue.	XVGA	America	Yes
com	PC	IE	Sat.	VGA	Eur.	No
org	Unix	Net2	Wed.	XVGA	America	Yes

(7Marks)

b) Explain the procedure for performing a Principal Component Analysis (PCA) on a given data set. **(5 Marks)**

13 a) Explain the intuition behind Logistic Regression in detail. **(7 Marks)**

b) What are the benefits of pruning in decision tree induction? Explain different approaches to tree pruning? **(5 Marks)**

14 a) Illustrate Naïve Bayes algorithm for the dataset having n features. **(7 Marks)**

b) For the following set of training samples, find which attribute can be chosen as the root for decision tree classification

Humidity	Sunny	Wind	Play
L	N	S	No
H	N	W	Yes
H	Y	S	Yes
H	N	W	Yes
L	Y	S	No

(5 Marks)

15 a) State the mathematical formulation of the SVM problem. Give an overview of the method for solving the problem. **(6 Marks)**

b) Write the basic problems of Hidden Markov Models. How do we compute the probability of an observation sequence produced by the model? **(6 Marks)**

16 a) Explain DBSCAN algorithm for density based clustering. List out its advantages. **(6 Marks)**

b) Explain the bagging and boosting methods used in learning algorithms. **(6 Marks)**

Semester-2

MSCSC02C07 - Data Communication and Computer Networks

Semester	Course Code	Hours per week	Credit	Exam Hours
2	MSCSC02C07	3	3	3

Course Outcomes

CO1	Familiarize data communication standards
CO2	Understand the layers of TCP/IP
CO3	Understand the different routing algorithms
CO4	Understand the protocols in different layers

SYLLABUS

Unit-1

Data Communications, Networks, Network Types, Protocol Layering, TCP/IP Protocol Suite, The OSI Model. **Physical Layer:** Signals, Signal Impairment, Digital Transmission, Analog Transmission, Multiplexing, Transmission Media, Switching-Circuit Switching, packet switching.

Unit-2

Data-Link Layer: Error Detection and Correction- Block coding, Cyclic Codes, Checksum, Data Link Control-Framing, Flow and Error Control, Protocols-Noisy and Noiseless, HDLC, PPP. Media Access Control: Random Access-ALOHA, CSMA, CSMA/CD, Controlled Access, Channelization-FDMA, TDMA, CDMA.

Unit-3

Network Layer: Logical Addressing- IPv4, IPV6, Network layer protocols-IP, ICMPv4, Mobile IP, Routing Algorithms-Distance Vector, Link State, Path-Vector Routing, Multicast Routing, IGMP.

Unit-4

Transport Layer: Process-To-Process Delivery, User Datagram Protocol (UDP), Transmission Control Protocol (TCP). **Application Layer:** Protocols, DNS, Telnet, www and HTTP. Network security, security in the internet-IPSec, VPN, IKE, SSL/TLS, PGP and Firewalls.

Reference Books:

1. Forouzan, "Data Communications and Networking", 5th Edition, McGraw Hill,2013.
2. Andrews. Tanenbaum, "Computer Networks" , 5th edition . Prentice-Hall.
3. William Stallings, "Data and Computer Communication", 8th edition

Unit Wise Question Distribution

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

MSCSC02C07 - Data Communication and Computer Networks

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

SECTION-A

Answer any 5 questions. Each question carries 4 marks

1. List out and explain the different transmission modes.
2. Explain bandwidth, throughput, and latency with an example.
3. Given the dataword 101001111 and the divisor 10111, show the generation of the CRC codeword at the sender site using binary division (Problem Based)
4. An Organization is granted the block 130.56.0.0/16. the administrator has to create 1024 subnets.
    a. Find the number of addresses in each subnet
    b. Find the subnet prefix
    c. Find the first and last address in the first subnet
    d. Find the first and last address in the last subnet (Problem based on subnetting)
5. Write a note on DNS
6. Describe the various services provided by IPSec.

(5x4=20)

SECTION-B

Answer any 3 questions. Each question carries 8 marks

7. Differentiate between circuit switching and packet switching
8. Explain Point-to-Point Protocol frame format. Also briefly describe the different transition phases of PPP in establishing connection from home PC to ISP.
9. Explain different network layer protocols.
10. Write a note on UDP. Explain how to calculate checksum for UDP.
11. Write a note on transport layer security

(3x8=24)

SECTION-C

Answer any 3 questions. Each question carries 12 marks

12. Describe various layers of OSI reference model.
13. Discuss any two noisy channel protocols.
14. Explain the different multiple access protocols
15. Write a note on different routing algorithms
16. List and explain various TCP services.

(3x12=36)

MSCSC02C08-Database Management Systems

Semester	Course Code	Hours per week	Credit	Exam Hours
2	MSCSC02C08	3	3	3

Course Outcomes

CO1	Develop a solid understanding of the principles and techniques involved in designing databases.
CO2	Acquire skills in querying and implementing databases.
CO3	Learn the principles of data storage and query processing.
CO4	Gain knowledge of Transaction management and database system architecture.

Unit-1

Database System Concepts: Purpose, Applications, View of Data, Instances and Schemas, Database Administrator, Database Users, Transaction Management, Database System Structure, Two-tier and Three-tier architectures. Data Models. **ER Model:** Basic Concepts, constraints, Keys, Design Issues, ER Diagram, Weak Entity Sets, Extended E-R Features, Design of an E-R Database Schema, Unified Modeling Language (UML). **Relational Model:** Basic Structure, Database Schema, Schema Diagram, Relational Algebra, Relational Algebra operations, Tuple Relational Calculus and Domain Relational Calculus. Functional Dependency, Normalization: INF, 2NF, 3NF, BCNF, 4NF and 5NF.

Unit-2

SQL: Database languages; DDL- create, alter, drop; DML- Insert, Select, Update, Delete; DCL, TCL, Data types in SQL; Creation and deletion of database and user. Operators and built-in functions, aggregate functions. Developing queries and sub-queries; Rename, string and set operations, join operations – natural, inner and outer (left/right/full) joins. Integrity constraints, views, user-defined functions, Triggers and Sequences. Indices, transactions and cursors, PL/SQL programming.

Unit-3

Data storage: File Organization; Organization of Records in Files, Data-Dictionary Storage, Indexing and hashing, basic concepts, Ordered Indices, B+-Tree Index Files, B-Tree Index Files (structure only, algorithms not required), static hashing, dynamic hashing, multiple key accesses.

Query processing: Overview, Measures of Query Cost, Selection Operation, Sorting, Join Operation, and Other Operations. Evaluation of Expressions; Materialization, Pipelining. **Query Optimization:** Overview, Estimating Statistics of Expression Results, Transformation of Relational Expressions, Choice of Evaluation Plans, Materialized Views.

Unit-4

Transaction Management: Concepts, state, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation. Concurrency control; Lock-Based Protocols, Timestamp-Based Protocols, Validation-Based Protocols, Multiple Granularity, Deadlock Handling.

Database System Architectures: Centralized and Client-Server Architectures, Parallel Systems and Distributed Systems (Basic concepts). Introduction to Data Warehousing, Data Mining and NoSQL databases (examples from MongoDB).

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Reference Books

1. Silbersehatz, Korth and Sudarshan, Database System Concepts, 6th edition MGH 2011.
2. Elmasri and Navathe, Fundamentals of Database Systems, 5thEdition, Pearson 2009.
3. MySQL: The Complete Reference, Vikram Vaswani, 2004.
4. O'Reilly, Practical PostgreSQL Shroff Publishers (SPD) 2002.
5. Adam Fowler, NoSQL for Dummies, John Wiley & Sons, 2015

Unit-Wise Question Distribution

Semester 2	Course: MSCSC02C08 - Database Management Systems		
Unit	Section-A	Section-B	Section-C
1	1	1	2
2	2	1	1
3	1	2	1
4	2	1	1
Total Questions	6	5	5

Model Question Paper

MSCSC02C08 - Database Management Systems

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

SECTION-A

Answer any 5 questions. Each question carries 4 marks

1. Explain the concept of tuple and domain relational calculus with suitable examples.
2. Write the basic structure of SQL queries. Explain DDL and DML.
3. What are triggers? Give example.
4. Describe the various hashing techniques with appropriate examples.
5. What are the ACID properties of transactions? Explain.
6. Explain the concepts of NoSQL databases.

(5x4=20)

SECTION-B

Answer any 3 questions. Each question carries 8 marks

7. What are the basic relational algebraic operators? How to represent the division and join operations using basic operators?
8. Briefly explain the following with respect to SQL with suitable examples.
   i) Views
   ii) Aggregate functions.
9. Discuss the techniques of query processing with suitable examples.
10. Discuss dense and sparse indices in detail.
11. Define conflict serializability. Check whether S1 is conflict serializable.
    S1: r1(x) r3(y) w1(x) w2(y) r3(x) w2(x)

(3x8=24)

SECTION-C

Answer any 3 questions. Each question carries 12 marks

12. State 1NF, 2NF, 3NF. Consider the unnormalized relation R (A, B, C, D, E, F, G, H, I, J) with FDs AB-->C A--->DE B-->F F-->GH D-->IJ. Perform normalization.
13. With a neat diagram, discuss the important components of ER diagram for a banking system.
14. With a suitable example explain how SQL provides features to support the integrity constraints of the relational model.
15. What is Query optimization? Briefly explain cost-based optimization.
16. Compare and contrast significant features of Parallel Systems and Distributed Systems.

(3x12=36)

MSCSC02C09 -Theory of Computation

Semester	Course Code	Hours/Week	Credit	Exam Hours
2	MSCSC02C09	3	3	3

Course Outcomes

CO1	Learn the fundamental concepts of Formal Languages and formal definitions of machine models (Automata theory)
CO2	Illustrate the design of Context Free Grammar for any language set and differentiate regular, context-free, and recursively enumerable languages
CO3	Demonstrate the push-down automaton model for the given language
CO4	Make use of the Turing machine concept to solve the simple problems
CO5	Explain the decidability and intractability of various problems

SYLLABUS

Unit-1

Theory of Computation: Basic concepts of languages, Grammars and Automata, Formal definition of computation, Computational and Non-Computational Problems, Chomsky Hierarchy of Languages, Some Applications of Formal Languages, and grammars **Regular Language Models:** Deterministic Finite Automaton (DFA), Non-Deterministic Finite Automaton (NDFA), Equivalence of DFA and NDFA, Minimization of DFA.

Unit-2

Regular Languages and Regular Grammars: Regular Expressions, Regular Languages, Connection between Regular Expressions and Regular Languages, Regular Grammars, Equivalence of Regular Languages and Regular Grammars, Properties of Regular Language, Non-Regular Languages - Pigeonhole Principle and Pumping Lemma.

Unit-3

Context Free Languages and Models: Context Free Grammar, Derivation Trees, Parsing and Ambiguity, Methods for Transforming Grammars, Chomsky and Greibach Normal Forms, Membership Algorithm, Pushdown Automaton (PDA), Non-Deterministic Pushdown Automaton, Equivalence of PDA's, and Context Free Grammars; Properties of Context Free Language, Pumping Lemma for Context-Free Languages.

Unit-4

Turing Machines (TM): Formal Definition of TM and Examples, Variants of TMs, Universal Turing Machines, Church-Turing thesis; Recursive and Recursively Enumerable Languages; Context-Sensitive Languages, Unrestricted Grammars, Construction of TM, Halting Problem, Post Correspondence Problem (PCP) and Modified PCP, Undecidable Problems for Recursively Enumerable Languages, Unsolvable Problems for CFL, Tractable and Intractable Problems.

Reference Books:

2. Linz P., "An Introduction to Formal Languages and Automata", Sixth Edition, Narosa Publishing House, 2019
3. Michael Sipzer, "Introduction to the Theory of Computation", Third Edition, Cengage Learning, 2012.
4. Martin and John, "Introduction to Languages and the Theory of Computation", New York, McGraw Hill, 2002.
5. J. E. Hopcroft, R. Motwani and J. D. Ullman, "Introduction to Automata Theory, Languages, and Computation", Third Edition, Addison-Wesley, 2007.

Unit Wise Question Distribution

Unit	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

MSCSC02C09 -Theory of Computation

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

SECTION-A

Answer any 5 questions. 4 marks each

17. Convert ε – NFA into an equivalent minimized deterministic finite automaton. Illustrate the computation of your model on any sample input.
18. Prove that for every L recognized by an NFA, there exists an equivalent DFA accepting the same language L.
19. Prove that regular expressions are closed under union, intersection, and Kleene closure.
20. Identify a language L, such that L* = L+.
21. Write CFG to accept the language defined by, L $\{a^i b^j c^k | i, j, k>=0$ and $i = j+k\}$.
22. Explain with an example Post's correspondence problem.

(5 x 4 = 20)

SECTION-B

Answer any 3 questions. 8 marks each

23. Find a minimum State Deterministic Finite Automata recognizing the language corresponding to the regular expression (0*10 + 1 * 0) (01)*.
24. Write the regular expression for the following
    i). All strings that contain no more than one occurrence of aa
    ii). Even number of a's and even number of b's of a string w = {a, b}*
25. Design a pushdown automaton to recognize the language, L defined by, $L = \{wcw^c | w \in \{0,1\}^*$, and w^c is the one's complement of w$\}$.
26. Convert the following grammar to Chomsky Normal form.
    S → A|AB0|A1A
    A → A0| Є
    B → B1|BC
    C → CB|CA|1B
27. Define the language recognized by any Turing Machine and explain what are recursive languages.

(3 x 8 = 24)

SECTION-C

Answer any 3 questions. 12 marks each

28. Construct an appropriate model to recognize the language L defined by,
    $L = \{a^n b^m | n, m >= 0\}$.
29. Prove that the following languages are not regular using pumping lemma.
    i) All unary strings of length prime.
    ii) $L = \{uu | u \in \{0, 1\}^*\}$.
30. What language over {0, 1} does the CFG with productions
    S → 00S|11S|S00|S11|01S01|01S10|10S10|10S01|Є generate? Justify your answer
31. Prove that Universal language is recursively enumerable but not recursive.
32. Design a Turing Machine to recognize the language $\{0^n 1^n 0^n | n>=1\}$

(3x12 = 36)

MSCSC02C10- Computer Graphics

Semester	Course Code	Hours per week	Credit	Exam Hours
2	MSCSC02C10	3	3	3

Course Outcomes

CO1	To explore the basic features of graphics hardware components and graphics software packages and the implementation of attribute primitives.
CO2	To possess knowledge of two-dimensional modeling transformations and geometric transformations, as well as how they work.
CO3	To construct a scene and then, applying three-dimensional geometric transformations, provide views of the scene on an output device.
CO4	To learn about the characteristics of these kinds of representational systems and how computer graphics applications employ them.

SYLLABUS

Unit-1

Introduction to Computer Graphics: Definition, types, and applications.

Output devices: Refresh Cathode-Ray Tubes, Raster-Scan Displays, Random-Scan Displays, Color CRT Monitors, Flat-Panel Displays, Three-Dimensional Viewing Devices, Stereoscopic and Virtual-Reality Systems, Raster-Scan Systems, Graphics Workstations and Viewing Systems, Input Devices and Input Primitives, Hard-Copy Devices, Graphics Networks, Graphics on the Internet. Computer Graphics Software, Introduction to OpenGL.

Graphics Output Primitives: Coordinate Reference Frames. Fill-Area Primitives, Polygon Fill Areas, Character Primitives.

Attributes of Graphics Primitives: Color and Grayscale, Point Attributes, Line Attributes, Curve Attributes, Fill-Area Attributes, Character Attributes, Antialiasing.

Implementation Algorithms for Graphics Primitives and Attributes: Line-Drawing Algorithms (DDA Algorithm, Bresenham's Line Algorithm), Circle-Generating Algorithms (Midpoint Circle Algorithm), Ellipse-Generating Algorithms (Midpoint Ellipse Algorithm). Pixel Addressing and Object Geometry, Attribute Implementations for Straight-Line Segments and Curves, General Scan-Line Polygon-Fill Algorithm, Scan-Line Fill of Convex Polygons, Scan-Line Fill for Regions with Curved Boundaries.

Fill Methods for Areas with Irregular Boundaries: Boundary-Fill Algorithm, Flood-Fill Algorithm.

Unit-2

Two-Dimensional Geometric Transformations: Basic Two-Dimensional Geometric Transformations (Two-Dimensional Translation, Two-Dimensional Rotation and Two-Dimensional Scaling). Matrix Representations and Homogeneous Coordinates, Inverse Transformations, Two-Dimensional Composite Transformations. Other Two-Dimensional Transformations (Reflection and Shear), Raster Methods for Geometric Transformations, Transformations between Two-Dimensional Coordinate Systems.

Two-Dimensional Viewing: The Two-Dimensional Viewing Pipeline, The Clipping Window, Normalization and Viewport Transformations.

Clipping Algorithms: Two-Dimensional Point Clipping, Two-Dimensional Line Clipping (Cohen-Sutherland Line Clipping, Liang-Barsky Line Clipping and Nicholl-Lee-Nicholl Line Clipping), Polygon Fill-Area Clipping (Sutherland--Hodgman Polygon Clipping and Weiler-Atherton Polygon Clipping), Curve Clipping, Text Clipping.

Unit-3

Three-Dimensional Geometric Transformations: Three-Dimensional Translation, Three-Dimensional Rotation (coordinate axis rotation, General 3-d rotation, Quaternion methods for 3D rotation), Three-Dimensional Scaling, Composite Three-Dimensional Transformations, Other Three-Dimensional Transformations Three-Dimensional Reflections and Three-Dimensional Shears), Transformations between Three-Dimensional Coordinate Systems, Affine Transformations.

Three-Dimensional Viewing: Overview of Three-Dimensional Viewing Concepts, The Three-Dimensional Viewing Pipeline, Three-Dimensional Viewing-Coordinate Parameters, Transformation from World to Viewing Coordinates, Projection Transformations, Orthogonal Projections axonometric and isometric, orthogonal projection coordinates, clipping window and orthogonal projection view volume, Normalization transformation), Oblique Parallel Projections (Cavalier and cabinet projections, Clipping window and Oblique parallel-projection view volume, Oblique parallel projection transformation matrix, normalization transformation), Perspective Projections (transformation coordinates, perspective projection equations, vanishing points, view volume, transformation matrix, symmetric and oblique perspective-projection frustum, Normalized perspective-projection transformation coordinates), The Viewport Transformation and Three-Dimensional Screen Coordinates, Three-Dimensional Clipping Algorithms (region codes, point and line clipping, polygon clipping, Three-Dimensional Polygon Clipping, Three-Dimensional Curve Clipping, Arbitrary Clipping Planes).

Unit-4

Three-Dimensional Object Representations: Polyhedra, Curved Surfaces, Quadric Surfaces, Superquadrics, Spline Representations.

Visible-Surface Detection Methods: Classification of Visible-Surface Detection Algorithms, Back-Face Detection, Depth-Buffer Method, A-Buffer Method, Scan-Line Method, Depth-Sorting Method, BSP-Tree Method, Area-Subdivision Method, Octree Methods, Ray-Casting Method, Comparison of Visibility-Detection Methods, Curved Surfaces, Wire-Frame Visibility Methods.

Illumination Models and Surface-Rendering Methods: Light Sources, Surface Lighting Effects, Basic Illumination Models (Ambient light, Diffuse reflection, Specular reflection and the Phong model), Transparent Surfaces, Atmospheric Effects, Shadows, Camera Parameters, Displaying Light Intensities, Halftone Patterns and Dithering Techniques, Polygon Rendering Methods (constant intensity surface rendering, Gouraud surface rendering, Phong surface rendering),Global Illumination (Ray-Tracing Methods, Radiosity Lighting Model, Environment Mapping, Photon Mapping).

Reference Books:

1) Computer Graphics with Open GL Hearn Baker Carithers Fourth Edition, Pearson Education Limited 2014.
2) Computer Graphics using OpenGL, Third Edition, F. S. Hill, Jr. and S. Kelley, Prentice Hall 2007.
3) OpenGL Programming Guide: The Official Guide to Learning OpenGL- Version 4.3, Dave Shreiner, Graham Sellers, John Kessenich, Bill Licea-Kane, Eighth Edition, Addison-Wesley 2013.

4) Computer Graphics: Principles and Practice, Third Edition, John F Hughes, Kurt Akeley, David F Sklar, Morgan McGuire, James D. Foley, Steven K. Feiner and Andries van Dam, Pearson Education 2019.
5) OpenGL Programming Guide, Seventh Edition,Dave Shreiner, Pearson Education, Inc 2010.
6) Computer graphics: A Programming approach, Steven Harrington, McGraw Hill, Second Edition 1987.

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

MSCSC02C10- Computer Graphics

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

SECTION-A

Answer any 5 questions. 4 marks each

1. What are colour CRT monitors? Explain the shadow mask and beam penetration methods.
2. What is use of flood fill techniques?
3. What is the need of Cartesian and homogeneous coordinate system?
4. Explain the 2-D viewing devices.
5. Define orthographic projection.
6. Explain the Z-buffer and A-buffer algorithm for hidden surface.

(5 x 4 = 20)

SECTION-B

Answer any 3 questions. 8 marks each

7. What is active and passive computer graphics? Discuss various applications of computer graphics.
8. Write notes on the Sutherland Hodgeman algorithm.
9. What is Transformation? Explain in detail the basic three-Dimensional Geometric Transformations.
10. Explain 3-D Transformation from World to Viewing Coordinates.
11. What is use of constant intensity method?

(3 x 8 = 24)

SECTION-C

Answer any 3 questions. 12 marks each

12. Differentiate random and raster scan systems in detail.
13. What is the significance of geometric transformations in 2-D? Explain the procedure to rotate on object about X and Y axis.
14. What is use of transformation? Explain the working of translation, rotation and shearing in 3-dimensional graphics.
15. What is the role of Global Illumination in computer graphics? Explain with examples.
16. Discuss the significance and working principle of Gouraud and Phong shading methods.

(3 x 12 = 36)

MSCSC02C11 - Python Programming

Semester	Course Code	Hours Per Week	Credit	Exam Hrs
2	MSCSC02C11	4	4	3

Course Outcomes

CO1	Learn the fundamental and advanced concepts of Python programming
CO2	Learn how to approach various programming tasks and implement effective solutions using Python.
CO3	Learn how to develop basic python applications
CO4	Learn the basis of data manipulation and analysis using Python

Unit 1

Features of Python, Different Methods to run Python (Jupyter notebook, Colab etc.), Data types (numeric, sequence (string, list, tuple), dictionary, set, Boolean), Indentation, Input and Output in Python, Operators in Python, Branching (if, else, elif), Iteration (while, for), range and enumerate functions, Objects (mutable and immutable). Functions: definition and call, Function Arguments (Required, Keyword, Default), Recursion, Modules, Built-in Modules, User defined Modules.

Unit 2

File Handling (Opening, Closing, Writing, Reading), Exceptions, Examples of Exceptions, Handling Exceptions, User Define Exceptions. OOPs: Features, Class definition, Object creation, Built-in Attribute Methods. Arrays: Numpy Module, ndarray, Creating Arrays (array, zeros, ones, empty, linspace, arrange, random), Iterating, Indexing, Slicing. Two-Dimensional Array, Indexing, Slicing, Iterating, Copying, Splitting, Shape Manipulation (reshape, transpose, resize).

Unit 3

Data Visualization: matplotlib module, pyplot, plot(), scatter, bar charts, Formatting, figure(), subplot(), text(), xlabel(), ylabel(), title(), Plotting Simple Mathematical Functions (sin x, x^2). Connecting to a Database, Basic Operations on Database (Create, Insert, Update, Delete), Fetching Data from a Database, Transaction Control.

Unit 4

GUI Programming using Tkinter, Tkinter Widgets (Label, Message, Entry, Text, Button, tkMessagebox, RadioButton, Checkbutton, Listbox, Menu, Menubutton, Scale, Scrollbar, Canvas), Layout Managers. Pandas - Series, dataframe, handling missing data, groupby, merging, joining and concatenating dataframe, reading and writing data. Introduction to OpenCV, read and save images, basic operations on images.

Books for Reference:

1. Taming Python by Programming, Dr. Jeeva Jose, Khanna Publishing
2. Introduction to Computation and Programming Using Python with Application to Understanding Data - John V. Guttag, PHI (2016)
3. Python: The Complete Reference by Martin C. Brown

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

Model Question paper

MSCSC02C11 - Python Programming

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

SECTION-A

Answer any 5 questions, each question carries 4 marks

1. Write on input output functions in python.
2. Write on exceptions in python?
3. Write code for plotting x^2.
4. Explain missing data concepts.
5. Explain the subplot() function.
6. Write on dataframe in pandas.

(5x4 = 20)

SECTION-B

Answer any 3 questions, each question carries 8 marks

7. Write on decision making statements in python.
8. Explain file handling in python.
9. Explain the concept of data visualization using matplotlib.
10. Explain any five Tkinter widgets.
11. Write a python program to find the given number is prime or not.

(3x8 = 24)

SECTION-C

Answer any 3 questions, each question carries 12 marks

12. Explain sequence data types in detail.
13. Explain array manipulation using NumPy in detail.
14. Explain the steps in connecting to a database.
15. Explain the concept of pandas with example.
16. Write an object-oriented program to read and display details of students.

(3x12 = 36)

MSCSC02C13: LAB-2 : Python Programming and DBMS

Semester	Course Code	Hours per week	Credit	Exam Hours
2	MSCSC02C13	9	4	3

SECTION-A

Python Programs

1. Write a program to generate first n perfect numbers.
2. Write a program to perform binary search.
3. Write a program to generate Fibonacci series using recursion.
4. Create a function *lcm(a, b)* that calculates and returns the least common multiple of two numbers.
5. Write a program which reads the contents of a file having numbers, then write the odd numbers to a file and even numbers to another file.
6. Write a Python program that creates an array of 10 random integers and finds the sum and average of its elements.
7. Write a Python program using NumPy to create a 1D array and perform the following statistical operations:
   a) Calculate the mean, median, and standard deviation of the array.
   b) Find the minimum and maximum values in the array.
   c) Normalize the array by subtracting the mean and dividing by the standard deviation.
8. Write a Python program using NumPy to create a 3x3 matrix and perform the following operations:
   a) Reshape the matrix into a 1x9 array.
   b) Transpose the matrix and print the result.
   c) Flatten the matrix into a 1D array and print it.
   d) Extract the diagonal elements of the matrix and calculate their sum.
9. Write a Python program to handle ZeroDivisionError.
10. Write a Python program to plot a sine wave (sin x) over a specified range of x values.
11. Write a Python program to connect to a database and create a table "student" with columns for "name," "roll number," and "marks."
12. Write a Python program to insert data for three students into the "student" table and then fetch all the records from the table.

13. Design a basic calculator application using Tkinter with buttons for digits 0-9, arithmetic operations (+, -, *, /), a clear button, and an equal button to evaluate expressions.
14. Write a Python program that reads data from a CSV file into a DataFrame, removes rows with missing data, and calculates the mean and standard deviation of a specific column.
15. Write a Python program to read an image using OpenCV, display it on the screen, and save a grayscale version of the image.

SECTION-B
Database Management Systems

Use PostgreSQL/MySQL for the lab exercises.

SQL –1

Create table students with fields sno, sname, sex, mark, Subject with sno as primary key and assign suitable constraints for each attribute. Create a table department with fields Depno, Depname, Subject and Teachername, depno as primary key.

1. Insert five records in both tables.
2. Create an index for the values in the subject column of the student table.
3. Apply aggregate functions on the field 'mark'.
4. Add an attribute phonenos in the student table. Define the phonenos column as an array of text. Add the phone numbers of the students.
5. Display the name and the first phone number of all students.
6. *Write a function to get the average mark of the subject.*
7. Create a query to display the sno and sname for all students who got more than the average mark. Sorts the results in descending order of mark.
8. Create a sequence named "star" to be used with the student table's primary key column-sno. The sequence should start with 10 & max value 99.
9. Display the name of the students, who are studying under the teacher "John".
10. Illustration of Cursor.

SQL-2

Create a table Department with fields deptid as primary key and dname as not null. Create another table Employee with fields empid, ename, salary, deptid and DOB. Assign constraints for empid as primary key, deptid as foreign key, ename, salary and DOB as not null.

1. Insert five records into both tables.
2. Count the employees in each department who got a salary greater than 25000.
3. Implement different types of character functions.
4. Display the dname, ename and salary of employees who got salary of more than 5000.
5. Rename the field ename with empname.
6. Create a view named empview with fileds empid, empname and DOB. Display the view.
7. Display the name of the department with no employees.
8. Increment the salary of all employees by 20%.

9. Display the ename and salary of the employees in the Accounting Department.
10. Illustration of a Trigger – The trigger should display a message whether the insertion of salary <10000.

SQL-3

Create a table Depositor with fields accno as primary key, depositor_name, branch and balance. Assign suitable constraints for each attributes. Create another table Borrower with fields loan_no as primary key, accno as foreign key and amount as not null.

1. Insert five records into the tables.
2. Display the count of depositors according to their branch.
3. Display the name of customers who have an account but not a loan.
4. Create a sequence named 'deposeq' with minimum value 1010, maximum value 1025 and increment by 1.
5. Insert two records into the Depositor table using the sequence 'deposeq'.
6. Illustration of inner and outer join operations.
7. Illustration of set operations.
8. Find the customers who have a loan at the 'perryridge' branch.
9. Create a view named 'custv' with fields accno,loan_no and amount.
10. Write the queries using various Number functions.

SQL - 4

Create a table Teacher with fields staff_id, name, dno, salary and designation with staff_id as primary key, name as not null, dno as foreign key, salary and designation are not null. Create another table Dept with fields dno as primary key dname as not null.

1. Insert five records into the tables.
2. Write the queries using various character functions on the name field.
3. Display the number of staff in each department.
4. Add 10% extra salary to all employees who work in the Physics department.
5. Display the name of teachers who works in the CS department
6. Delete all teachers who got salaries less than the average salary.
7. Create a view named V1 with fields staff_id, name and dname. Display the view.
8. Create a sequence to be used with the Teacher's Table's primary key column. The Sequence should start at 60 and have a maximum value of 200. Have your sequence increment by 10 numbers. Write a script to display the following information about your sequences like Sequence name, maximum value, increment size and last number.
9. Insert two records using newly created sequence.
10. Write a query that will display the staff_id, name for all teachers who work in a department with any employee whose name contains a 'T'.

SQL- 5

Create a table Customer with fields cust_id, cust_name, city, gender with cust_id as primary key and assign suitable constraints for each attribute. Create another table Order with fields order_id as primary key, cust_id as foreign key, ordered_item and order_date.

1. Insert 5 records into the tables.
2. Display the name of all customers who is residing in 'Kannur' city.
3. Display the customer name and order Id of a customer with oder_id '278'.
4. Display the details of customers whose name contains the second letter as 'e'.

5. Display the name and city of customers with the order date 24/10/2019.
6. Add one more filed order_status into Order table.
7. Create view named 'cust' with the details of customers who did not order. Display the view.
8. Illustration of transaction.
9. Illustration of a cursor.
10. Count the customers according to their gender and the ordered item as 'watch' using the group by and having clause.

SQL - 6

Create a table BookInfo with fields id, title, price and author with id as primary key and assign suitable constraints for each attribute. Create a sequence named 'seqbook' with a minimum value 101, a maximum value 1000 and increment by 2.

1. Insert five records into the table. Use sequence to insert book id.
2. Display the title and author of all books written by 'Balaguruswami'.
3. Write a function to update tuples in Bookinfo table.
4. Display the book id and price all books for id 103, 105 or 107.
5. Display the name of author and number of books.
6. Delete the details of book having the highest price.
7. Illustration of Indices.
8. Apply any three mathematical functions on the field 'price'.
9. Drop the table and sequence.
10. Create another table employee with field's empid, empname, basicpay, gradepay, DA, HRA, HTA, grossalary, GLI, SLI, incometax, LIC and netpay. Create a trigger to set DA, grossalary and netpay.

MSCAI02C13: LAB-2 : Machine Learning and DBMS

Semester	Course Code	Hours per week	Credit	Exam Hours
2	MSCAI02C13	9	4	3

SECTION-A
Machine Learning

1. Download Dermatology data set from UCI repository and perform exploratory data analysis.
2. Implement Feature extraction using Principal Component Analysis (PCA) from scratch.
3. Perform linear regression with multiple variables Using Gradient Decent Algorithm (do from Scratch) on a dataset.
4. Perform Classification task on a specific data set using logistic regression and Support Vector Machine (SVM) and do comparative study on classification accuracy. Classification report, confusion matrix and comparison graph must be shown as output.
5. Perform Classification task on a specific data set using Decision Tree and Random Forest algorithms and do comparative study on classification accuracy. Perform a Grid search for finding the optimal hyperparameters of the algorithms.
6. Implement logistic regression (do from Scratch) and show accuracy on the data sets.
7. Implement K-nearest neighbour algorithm (do from scratch) and show accuracy on the dataset.
8. Implement Naive Bayes algorithm (do from scratch) and show accuracy on the dataset.
9. Implement SVM algorithm (do from Scratch) and show accuracy on the data sets.
10. Perform Part of Speech tagging with Hidden Markov model. Optimize HMM with Viterbi algorithm.
11. Download data sets Iris from UCI machine learning repository.
    a. Find number of clusters through Elbow method.
    b. Perform Clustering (K-means Algorithm) (do from Scratch)
12. Implement and evaluate density-based clustering on IRIS dataset.
13. Implement a feed forward artificial neural network with backpropagation to optimize network weights.

SECTION-B
Database Management Systems

Use PostgreSQL/MySQL for the lab exercises.

SQL –1

Create table students with fields sno, sname, sex, mark, Subject with sno as primary key and assign suitable constraints for each attribute. Create a table department with fields Depno, Depname, Subject and Teachername, depno as primary key.

11. Insert five records in both tables.
12. Create an index for the values in the subject column of the student table.
13. Apply aggregate functions on the field 'mark'.
14. Add an attribute phonenos in the student table. Define the phonenos column as an array of text. Add the phone numbers of the students.
15. Display the name and the first phone number of all students.
16. *Write a function to get the average mark of the subject.*
17. Create a query to display the sno and sname for all students who got more than the average mark. Sorts the results in descending order of mark.
18. Create a sequence named "star" to be used with the student table's primary key column-sno. The sequence should start with 10 & max value 99.
19. Display the name of the students, who are studying under the teacher "John".
20. Illustration of Cursor.

SQL-2

Create a table Department with fields deptid as primary key and dname as not null. Create another table Employee with fields empid, ename, salary, deptid and DOB. Assign constraints for empid as primary key, deptid as foreign key, ename, salary and DOB as not null.

11. Insert five records into both tables.
12. Count the employees in each department who got a salary greater than 25000.
13. Implement different types of character functions.
14. Display the dname, ename and salary of employees who got salary of more than 5000.
15. Rename the field ename with empname.
16. Create a view named empview with fileds empid, empname and DOB. Display the view.
17. Display the name of the department with no employees.
18. Increment the salary of all employees by 20%.
19. Display the ename and salary of the employees in the Accounting Department.
20. Illustration of a Trigger – The trigger should display a message whether the insertion of salary <10000.

SQL-3

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14. Create a sequence named 'deposeq' with minimum value 1010, maximum value 1025 and increment by 1.
15. Insert two records into the Depositor table using the sequence 'deposeq'.
16. Illustration of inner and outer join operations.
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