SARADHA GANGADHARAN COLLEGE

(AUTONOMOUS)

(Affiliated to Pondicherry University)

B.Sc. Computer Science (Honors)

B.Sc. Computer Science (Honors with Research)

REGULATIONS, CURRICULUM & SYLLABUS

(Under the National Education Policy - NEP 2020)

Effective from the Academic Year 2025 - 2026

1. PREAMBLE & PROGRAMME OUTCOMES

1.1 Preamble

In the ever-evolving landscape of the digital age, Computer Science stands as a cornerstone of innovation, efficiency, and transformation. The B.Sc. Computer Science programme is designed to prepare students for the challenges and opportunities of this dynamic field. This program provides a commitment to nurture the next generation of IT professionals capable of addressing the complex technological needs of today's world. The main objectives of the course are to: The Bachelor of Science (B.Sc.) in Computer Science programme is a dynamic and comprehensive academic journey designed to equip students with a strong foundation in the principles and practices of computing. Rooted in the ever-evolving field of technology, this programme is crafted to cultivate a deep understanding of computer science theories, algorithms, and applications.

The curriculum encompasses a balanced blend of foundational courses and specialized electives on experiential learning, offering opportunities for internships, industry projects, and participation in coding competitions. Students will engage in practical applications of their knowledge, honing their skills through hands-on experiences that mirror the challenges and demands of the rapidly evolving technological landscape.

Recognizing the global nature of technology, the B.Sc. Computer Science incorporates an international perspective. Students will explore global technology trends, multicultural influences, and ethical considerations, preparing them to contribute responsibly to the global digital community.

B.Sc. Computer Science in this College is a transformative educational experience that empowers students to become adept problem solvers, innovators, and leaders in the field of computer science. By fostering a passion for continuous learning and providing a solid foundation in both theory and application, the programme sets the stage for a successful and fulfilling career in the dynamic world of technology.

1.2. Programme Outcomes

Upon completion of the Bachelor of Science (B.Sc.) Programme in Computer Science, students will demonstrate the following outcomes at:

UG Certificate Level

- Attain foundational knowledge in Computer Science.
- Demonstrate fundamental skills in problem-solving and programming

UG Diploma Level

- Develop intermediate-level understanding and skills in Computer Science.
- Apply problem-solving techniques and programming concepts to practical scenarios.

UG Degree Level

- Achieve advanced knowledge and proficiency in Computer Science.
- Demonstrate proficiency in problem solving, programming and system design.

UG Degree with Honors / Honors with Research

- Demonstrate proficiency in programming languages and software development.
- Apply principles of data structures and algorithms to solve complex problems.
- Design and implement efficient solutions for real-world computing challenges.
- Exhibit effective communication skills in conveying technical concepts orally and in writing.
- Engage in collaborative projects and demonstrate the ability to work effectively in a team.
- Apply ethical considerations in professional and societal contexts related to Computer Science.
- Possess a comprehensive understanding on their Specialization in Computer Science and in the chosen specialization.
- Exhibit a commitment to lifelong learning and adaptability to evolving technologies.

2. DEFINITIONS

Terms used in the NEP Regulations shall have the meaning assigned to them as given below unless the context otherwise requires:

A. Credit: A credit is the number of hours of instruction required per week for the given subject in a given semester of 16-18 weeks. One credit is equivalent to 15 hours of teaching (lecture or tutorial) or 30 hours of practice/field work/community engagement and service per Semester.

B. Academic Year: Means the year starting on 1st day of July and ends on the 30th day of June in the succeeding year.

C. Residence time: Means the time a student spends for attending classes in the College/Institution (either Online/Offline) as a full-time student and enrolled in any Academic programme of the Institution.

D. Semester: Means 18 weeks (90 Working days) of teaching-learning sessions of which two weeks shall be set apart for examinations and evaluation.

E. Grade: Means a letter grade assigned to a student in a Course for his/her performance at academic sessions as denoted in symbols of: O(Outstanding), A+ (Excellent), A (Very good), B+ (Good), B (Above average), C (Average), P (Pass), F (Fail), and Ab (Absent) with a numeric value of O=10, A+=9, A=8, B+=7, B=6, C=5, P=4, and F=0, Ab=0.

F. Grade Point Average (GPA): Means an average of the Grades secured by a student in all courses in a given academic session duly weighted by the number of credits associated to each of the courses.

G. Cumulative GPA (CGPA): Means the weighted average of all courses the student has taken in a given Programme.

H. A Common Course: Means the set of courses that all students who are admitted to any Programme of the University are required to study these courses include, Languages (English- Modern Indian Languages), NEP specific courses- viz. Understanding India, Environmental sciences/Education, Health and Wellbeing/Yoga, Digital & Technological solutions.

I. Major Discipline: Means the core subjects mandatory for the programme, Major

discipline may be a single discipline or interdisciplinary/ multidisciplinary courses. Eg. B.Sc. (Physics) or B.Sc. (Physics, Maths and Chemistry).

J. Minor Discipline: Means the courses which are specific to the specialization in Computer Science.

K. Credit Requirement: For a Degree/Diploma/Certificate Programme means the minimum number of credits that a student shall accumulate to achieve the status of being qualified to receive the said Degree, Diploma/Certificate as the case may be.

L. Exit option: Means the option exercised by the students, to leave the Programme at the end of any given Academic year.

M. Lateral entry: Means a student being admitted into an ongoing Programme of the College otherwise than in the 1st year of the programme.

N. Vocational Studies/Education: This refers to set of activities for participation in an approved project or practical or lab, practices of application of scientific theories, studio activities involving students in creative artistic activities, workshop-based activities, field-based shop-floor learning, and Community engagement services, etc. (These courses are expected to enable students to incorporate the learned skills in daily life and start up entrepreneurship.)

O. Skill-based learning/project: This refers to activities designed to understand the different socio- economic contexts, first-hand understanding of the policies, regulations, organizational structures, processes, and programmes that guide the development process.

P. Work-based internship: Means structured internships with Software Companies, Research and Higher Educational Institution Laboratories, Corporate offices, etc. which will further improve employability.

3. DURATION, ELIGIBILITY & AWARD OF UG DEGREE/ DIPLOMA/ CERTIFICATE

3.1. Duration of the Programme

The duration of the UG programme is 4 years or 8 semesters. Students who desire to undergo a Three- year UG Programme will be allowed to exit after completion of the 3rd year. If a student wants to leave after the completion of the first or second year, the student will be given a UG Certificate or UG Diploma, respectively, provided they secure the prescribed number of credits (as given in the Table 1).

3.2. Eligibility

Senior Secondary School Leaving Certificate or Higher Secondary (12th Grade) Certificate obtained after successful completion of Grade 12 or equivalent stage of education corresponding to Level-4 (Levels in NHEQF). **For detailed eligibility, refer the Admissions and Lateral Entry Section 5.**

3.3. Awarding of UG Certificate, UG Diploma and Degrees Nomenclature

Four years B.Sc. Degree Programme shall have options for earning a Certificate / Diploma / UG Degree / UG Degree (Honors) / UG Degree (Honors with Research) based on the exit option exercised by the candidates.

3.3.1. UG Certificate

Students who opt to exit after completion of the first year (2 Semesters) and have earned a minimum of 40 credits will be awarded a UG certificate in Problem Solving and Programming if, in addition, they complete work based vocational courses / internship of 4 credits during the summer vacation of the first year.

3.3.2. UG Diploma

Students who opt to exit after completion of the second year (4 Semesters) and have earned a minimum of 80 credits will be awarded the UG diploma in Computer Science if, in addition, they complete work based vocational courses / internship of 4 credits

during the summer vacation of the second year.

3.3.3. Three-year UG Degree

Students who wish to discontinue after the 3-years (6 Semesters) UG programme will be awarded a UG Degree in Computer Science after successful completion of three years, earning a minimum of 120 credits and satisfying the minimum credit requirements as mentioned in Table1.

3.3.4. Four-year UG Degree (Honors)

A four-year UG Honors degree in the Computer will be awarded to those who complete a four-years (8 Semesters) degree programme, earning a minimum of 160 credits and have satisfied the credit requirements as mentioned in Table 1.

3.3.5. Four-year UG Degree (Honors with Research)

Students who secure a minimum of 7.5 CGPA in the first six semesters and wish to undertake research at the undergraduate level can choose a research stream in the fourth year. They should do a research project or dissertation under the guidance of a faculty member of the Department.

The research project/dissertation will be in the major discipline, Computer Science. The students who secure a minimum of 160 credits, including 12 credits from a research project/dissertation, will be awarded UG Degree in Computer Science (Honors with Research).

3.3.6. Programme overview

As per the guidelines of NEP, students are mandated to complete 120 credits to complete a basic Bachelor's Degree in 3 years. With an additional 40 credits of course work one can pursue 4th Year Honors or Honors with Research Degree. The UG Programme will consist of the following categories

of courses and the minimum credit requirements for 3-year UG and 4-year UG(Honors) or UG (Honors with Research) programmes are given in Table 1.

Table 1: Breakup of Credits and Courses – Minimum Requirements

S.No.	Component	3 Year UG	4 Year UG (Honors/ Honors with research)
1	Major Disciplinary – Computer Science	60 Credits (15 Courses of 4 credits)	80 Credits (20 Courses of 4 credits)
2	Minor Disciplinary – Specialization Courses	24 Credits (6 Courses of 4 Credits)	32 Credits (8 Courses of 4 credits)
3	Multi-Disciplinary Courses	9 Credits (3 courses of 3 credits)	9 Credits (3 courses of 3 credits)
4	Ability Enhancement Courses	8 Credits (4 courses of 2 credits)	8 Credits (4 courses of 2 credits)
5	Skill Enhancement Course – On the chosen Specialization	9 Credits (3 courses of 3 credits)	9 Credits (3courses of 3 credits)
6	Value-added courses	8 Credits (4 courses of 2 credits)	8 Credits (4 courses of 2 credits)
7	Internship/ (Mini Project-I or one month internship)	12 Credits/ 4 Credits (Included in Major courses of 60 credits)	4 Credits (Included in Major courses of 80 credits)
8	Community engagement and service	2 Credits (1 Field based Course)	2 Credits (1 Field based Course)
9	Research Dissertation Project	-	12 Credits
	Total	**120**	**160**

Note: Honors students not undertaking research will do 3 courses for 12 credits in lieu of a Research Project / Dissertation.

3.3.7. Degree and Nomenclature

Candidates who complete Eight semesters and earn a minimum of 160 credits and have satisfied the credit requirements as mentioned in the Table 1 will be awarded either of the following degrees.

- B.Sc. Computer Science *
- B.Sc. Computer Science (Honors) #
- B.Sc. Computer Science (Honors with Research) ##

* for candidates who wish to exit at the end of third year with 120 credits earned and satisfied the other minimum requirements given in 3.3.9.

for candidates who complete 3 theory courses (MJD 21, MJD 22, and MJD 23) instead of the research project work in the Eighth Semester.

for candidates who complete a research project work in the Eighth Semester.

3.3.8. Degree with Specialization

Out of the above said 160 credits (Table1) the candidates shall earn 103 credits (83 credits out of 120 credits in the case of 3 year UG) from the Hardcore courses (Major Disciplinary, Multi-disciplinary, Ability Enhancement, Value added Courses and Community Engagement and Service) and the remaining 57 credits (37 credits in the case of 3 year UG) shall be earned from the subjects they choose to study from the list of Soft core courses. These 57 credits shall be earned through studying the specialization courses in Minor Disciplinary – Specialization Courses, Skill Enhancement Courses in all the semesters and the Research Project or the Courses the candidates choose to study in the Eighth Semester.

3.3.9. Exit Options and Nomenclature of Certificate, Diploma

Candidates can exercise the following exit options and obtain the said certificate or diploma or degree, if the minimum required credits are earned and other conditions are met. Students exercising the option of exit at the end of 2nd semester or 4th semester need to have completed an internship for atleast 8 weeks along with the necessary credit requirements to qualify for the relevant certificate or diploma. In any case, every student, whenever exit (or complete the 4 year programme), should have completed atleast one internship for a minimum period of 8 weeks.

Exit after 2nd Semester: Certificate in Problem Solving and Programming will be awarded for candidates who exit the course at the end of 2nd semester and earned a minimum of 40 credits and have completed a Summer Internship of 4 credits for a

minimum period of 8 weeks, during the summer vacation post 2nd semester.

Exit after 4th Semester: Diploma in Computer Science will be awarded for candidates who exit the course at the end of 4th semester and earned a minimum of 80 credits and have completed a Summer Internship of 4 credits for a minimum period of 8 weeks, during the summer vacation post 4th semester.

Exit after 6th Semester: UG Degree in Computer Science (B.Sc. (CS)) will be awarded for candidates who exit the course at the end of 6th semester and earned a minimum of 120 credits and have completed a Summer Internship of 4 credits for a minimum period of 8 weeks, during the summer vacation post 4th semester.

Exit after	Credits and other requirements	Awards
2nd Semester	Min: 40 Credits & Internship (one Month)	Certificate in Problem Solving and Programming
4th Semester	Min: 80 Credits & Internship (one month)	Diploma in Computer Science
6th Semester	Min: 120 Credits & one month Internship/ Mini project	B.Sc. Computer Science

4. STRUCTURE OF THE UNDERGRADUATE PROGRAMME

This B.Sc Honors programme is offered in the college shall confirm to the structure specified hereunder. As per the decided programme mandate, the students to complete 120 credits to complete a basic Bachelor's Degree in 3 years. With an additional 40 credits of course work one can pursue 4th Year Honors or Honors with Research Degree. The UG Programme will consist of the categories of courses and the minimum credit requirements for 3-year UG and 4-year UG (Honors) or UG (Honors with Research) programmes as given in Table1 at Section 3.3.6.

4.1. Types of Courses

Hardcore Courses	Soft core Courses (Specialization specific)
Major Disciplinary –Computer Science	Minor Disciplinary
Multi-Disciplinary Courses	Skill Enhancement Courses
Ability Enhancement Courses	Internship
Value Added Courses	Research Dissertation Project
Community Engagement and Service	

4.2. Description of Courses

The following are the types of courses in this programme

4.2.1. Major Discipline: 60 Credits - 3 Year UG, & 72 Credits - 4 Year UG

Major discipline (Computer Science): Students should secure the prescribed number of credits (not less than 50% of the total credits) through core courses in the major discipline. The major discipline would provide the opportunity for a student to pursue in-depth study of a particular subject or discipline. A student may choose to change the major discipline within the broad discipline at the end of the second semester provided all the prerequisites of the respective degree programme are fulfilled.

4.2.2. Minor Discipline / Specialization: 24 Credits - 3 Year UG & 40 Credits - 4 Year UG

Minor discipline helps a student to gain a broader understanding beyond the major discipline.

4.2.3. Multidisciplinary courses (MD): 9 Credits

All undergraduate students are mandated to pursue 9 credits worth of courses. The Computer Science offers the following 3 courses as MLD courses to other Department Students.

a) Fundamentals of Programming

b) Fundamentals of Web Designing

c) Basics of Artificial Intelligence

Students are expected to learn basic/introductory courses designed by other departments for this purpose.

4.2.4. Ability Enhancement Courses (AEC): 8 credits

All Undergraduate (UG) students are mandated to complete at least 8 Credits worth of Courses which focus on Communication and Linguistic skills, Critical reading, and Writing skills. These courses are expected to enhance the ability in articulation and presentation of their thoughts at workplace. Colleges may design these ability enhancement courses tuned to the requirements of given major discipline. For example, a course in Business Communication is more appropriate in place of literature/prose/poetry.

Ability Enhancement Course	
I. English Language a. English Language & Literature - 1 and 2 b. Functional English - 1 and 2 c. Communicative English - 1 and 2	**II. Modern Indian Language (two courses)** a. Indian language & Literature - 1 and 2 b. Functional language - 1 and 2 c. Communicative language - 1 and 2

4.2.5. Skill Enhancement Courses (SEC): 9 credits

These courses are aimed at imparting practical skills, hands-on training, soft skills, and other skills to enhance the employability of students. Courses are designed as per the students' needs with the available resources. Students can choose these courses from the list of courses offered in the chosen specialization as said in 4.2.2. Department may also outsource the Skill Enhancement Courses to AICTE approved agencies for conducting short term Training Workshops, Skill India initiatives of GOI and approved Trades by Skill development of corporation are to be considered.

4.2.6. Value-Added Courses (VAC) Common to All UG Students: 8 credits

Under NEP, the UGC has proposed for 6 to 8 credits worth of common courses which are likely to add value to overall knowledge base of the students. These courses

include:

a) Understanding India

b) Environmental Sciences / Education / Higher Order Thinking

c) Digital and Technological solutions

d) Health, Wellness, Yoga Education, Sports & Fitness / Universal Human Values.

The course structure and coverage of topics are suggested by UGC in its draft documents, colleges/UG Boards of Studies may design the methodology for conducting these value added courses.

4.2.7. Internship in Semester-VI : 12 Credits

Selected/ Eligible students will undergo Internships / Apprenticeships in a firm, industry, or organization or Training in labs with faculty and researchers in their own or other Higher Education Institutions / Research Institutions during the sixth semester. Students will be provided with opportunities for internships to actively engage with the practical side of their learning. A review report and award of grade on Work based learning by students is to be recorded and this will be provided by the respective organization/firm/industry/training lab. Along with this 12 credit internship they must do 2 major courses for 8 credits.

The other Students may continue their sixth semester with in the campus with 2 minor courses and mini project-I/One month internship.

4.2.8. Community Engagement and Service: 2 Credits

The curricular component of 'Community Engagement and Service' seeks to expose students to the socio-economic issues in society so that the theoretical learnings can be supplemented by actual life experiences to generate solutions to real-life problems. This can be part of summer term activity or part of a major or minor course. Community Engagement shall be conducted for a minimum of 2 weeks.

4.2.9. Research Project / Dissertation: 12 Credits

Students choosing a 4 Year Bachelor's degree (Honors with Research) are required to take up research projects under the guidance of a faculty member. The students are

expected to complete the Research Project in the eighth semester.

4.3. Levels of the Courses

Course codes are based on the academic rigor. The first four letters of the course code indicate the department/Centre, followed by the academic rigor level code in digits. The coding structure follows:

4.3.1. 0-99: Pre-requisite courses

It is required to undertake an introductory course which will be a pass or fail course with no credits.

4.3.2. 100-199: Foundation or introductory courses

These are courses which are intended for students to gain an understanding and basic knowledge about the subjects and help decide the subject or discipline of interest. These courses generally would focus on foundational theories, concepts, perspectives, principles, methods, and procedures of critical thinking in order to provide a broad basis for taking up more advanced courses.

4.3.3. 200-299: Intermediate-level courses including subject-specific courses

These courses are intended to meet the credit requirements for minor or major areas of learning. These courses can be part of a major and can be pre-requisite courses for advanced-level major courses.

4.3.4. 300-399: Higher-level Courses

These courses are required for majoring in a disciplinary/interdisciplinary area of study for the award of a degree.

4.3.5. 400-499: Advanced Courses

These courses which would include lecture courses with practicum, seminar-based course, term papers, research methodology, advanced laboratory experiments/software training, research projects, hands-on-training, internship/apprenticeship projects at the

undergraduate level or first year post- graduate theoretical and practical courses.

4.4. Credit-hours for different types of courses

A three-credit lecture course in a semester means three one-hour lectures per week with each one- hour lecture counted as one credit. One credit for tutorial work means one hour of engagement per week. A one-credit course in practicum or lab work, community engagement and services, and fieldwork in a semester mean two-hour engagement per week.

The Faculty to Student Ratio in all the practical / laboratory shall be maintained at 1:25.

In a semester of 15 weeks duration, a one-credit practicum in a course is equivalent to 30 hours of engagement. A one-credit of Seminar or Internship or Studio activities or Field practice / projects /

Community Engagement and service means two-hour engagements per week. Accordingly, in a semester of 15 weeks duration, one credit in these courses is equivalent to 30 hours of engagement.

4.4.1. Pedagogical Styles

In order to achieve the expected Learning outcomes, UGC Framework has specified different Pedagogical approaches for different courses at undergraduate level. These approaches include:

a) Lecture course
b) Tutorial course
c) Practice cum or laboratory courses
d) Seminar Course
e) Internship course
f) Studio activity-based course
g) Field practicing
h) Project work courses
i) Community engagement and service course

The details of these different types of Pedagogical methods are as follows:

Table2: Pedagogical Approaches

COURSE TYPES	APPROACH
Lecture Courses	Regular classroom lectures by qualified / experienced Expert Teachers ● These Lectures may also include classroom discussion, demonstrations, case analysis ● Use of Models, Audio-Visual contents, Documentaries, PPTs may supplement.
Tutorial Courses	Problem solving Exercise classes guided discussion, supplementary readings vocational training, etc.
Practical / Lab work	Practical Lab activity with Theoretical support Mini projects, Activity based engagement, Program executions, Data processing and presentation exercise.
Seminar Course	A course requiring student to design and participate in discussions, Group Discussions, Elocution and Debate, Oral Communication Paper presentations, Poster Presentation, Role play participation, Quiz competitions, Business plan preparation/presentation, etc.
Internship course	Courses requiring students to *Learn by Doing* in the workplace external to the educational Institutions. Internships involve working in Software Companies, Research and Higher Educational Institution Laboratories, Corporate Offices, etc. All Internships should be properly guided and inducted for focused learning.
Research Project	Students need to study and analyze the recent research publications from indexed/peer reviewed journals in their area of specialization. Outcome of the study and analysis need to be presented as a thesis or research report with necessary experimental results.

4.5. Semester-wise Break: for courses of 3 year UG and 4 Year UG(Hons) Degree programmes

Incorporating the focus of NEP in terms of different categories of courses and award of Certificates, Diplomas and Degrees during different stages of 4 year Degree programmes, a template for Semester- wise course work was designed by the UGC. Salient features of it are as follows:

- All courses shall carry specified number of credits.
- Every Semester shall have a minimum of 20 credits worth of courses.

- Credits for a course shall be decided on the basis of number of Contact hours of the teaching in a classroom.
- One credit means one hour of Teaching in case of Theory subject and at least 2 hours of conducting Practical in hours case of Lab subjects.
- All Major and Minor disciplinary Courses shall have 4 credits with 6 hours of work load (including 2 hours of tutorials)
- Language courses, ability enhancement, skill enhancement and value added common course also will have 2 hours of hands on training.
- Progress of Learning is measured in terms of credits earned by the students on successful completion of the course.
- Students can exercise his/her choice for exiting the course at the end of every Academic year.
- Graduate attributes listed by UGC shall be the focus of Teaching-Learning process.
- Semester I and II shall focus on introductory courses/subjects in Major/Minor disciplines and shall focus on providing knowledge in Multidisciplinary areas, skill enhancement and ability enhancement courses.
- Semester III and IV shall focus on Core disciplinary courses with a focus on building strong foundation in the given Discipline.
- Semester V and VI shall focus on providing in-depth knowledge and skills required for taking up a career in the given discipline.
- Semester VII and VIII shall focus on Advanced knowledge and shall direct the students to take up socially relevant projects/Research works newer applications of the knowledge.

5. ADMISSION ELIGIBILITY, LATERAL ENTRY

5.1 Admission Eligibility

The candidates for admission to this programme shall be required to have passed 10+2 / 10+3 system of examinations or equivalent with Mathematics / Business Mathematics / Applied Mathematics/ Computer Science / Computer Applications / Informatics Practices / any one of Computer Related Subjects (Artificial

Intelligence, Data Science, Multimedia, Typography and Computer Applications, Web Applications/WT, Database Management applications/DBMS) or Equivalent as one of the subjects of study with minimum 40% and minimum 35% for OBC,SC and ST candidates.

Students shall be admitted to this programme based on admissions criteria fixed by the Institution/ Affiliated University / Government of Puducherry from time to time.

5.2 Admissions by Lateral Entry

In this programme, where admission was carried out adopting approved procedures in preceding years, subject to availability, lateral entry admission shall be permitted, subject to:

Candidates seeking entry at the second, third and fourth year, should meet the necessary eligibility criteria with respect to the certificate / diploma / degree they possess, with necessary minimum credits banked in the Academic Bank of Credits (ABC). Such students who get admitted in later years, other than first year will be guided by the following clauses:

- that the Institution shall notify the admission process and number of vacancies open for lateral entry.
- that the Lateral entrants shall be admitted only after such transparent screening process and such procedure that the Institution may prescribe from time to time. Institution may prescribe different methods of screening for different programmes depending on the circumstances prevailing in each case.
- Lateral entry shall be permissible only in the beginning of years 2, 3, 4 of the Under Graduate / Honors programme; provided that the students seeking lateral entry shall have obtained the minimum pass marks / grades fixed by the Institution in their previous academic years.

5.3. Lateral Entry to Direct Second Year

For Lateral entry, Candidates who are passed Diploma in Computer Technology, Computer Application, Information Technology or any Diploma with relevant subjects/courses on regular/ vocational stream

(10+3 years program) awarded by Directorate of Technical Education of Tamil Nadu or other states shall be admitted to the second year of B.Sc(CS), BCA and B.Sc.(IT) Degree Programme based on availability of vacancies.

6. EVALUATION

All Credit courses are evaluated for 100 marks. Continuous Internal Assessment component is for 40 marks and the End Semester exam is for 60 marks. In case of practical, Project work etc., it is 50 marks for CIA and 50 Marks for End-Semester Exams.

6.1. Category of Courses

There are three category of courses as shown in 6.2. Category A, theory courses with lecture hours and tutorials are evaluated for an internal assessment component of 40 Marks and End Semester University Exam for 60 Marks.

Category A	Theory Courses with Lecture hours and hours allotted for Tutorials wherever required.
Category B	Practical Courses with only Practical hours or Laboratory hours. Laboratory Courses, Internships, Research Project Works and other courses allotted only with practical hours in the curriculum shall be under this category.
Category C	Theory & Practice combined Courses where Lecture and Practical hours allotted.

6.2. Learning Assessment - Category A (Theory papers)

Continuous Internal Assessment 40 Marks		**End Semester Assessment 60 Marks**
Evaluation Component	**Marks**	
IA Test (Best 2)	10	**Evaluation Details given in Table 3**
Model Exam	10	
Assignment	10	
Seminar and other Activities	05	
Attendance	05	
Total	**40**	

Category B For Practical and Internship

Continuous Internal Assessment 50 Marks		**End Semester Assessment 50 Marks**
Evaluation Component	**Marks**	
Weekly observation book report	15	**Evaluation Details given in Table 3**
Practical Record/Internship report	15	
Model Practical exam	15	
Attendance	05	
Total	**50**	

For Research Project work

Continuous Internal Assessment 50 Marks		**End Semester Assessment 50 Marks**
Evaluation Component	**Marks**	
Monthly Review (3 Reviews)	30	**Evaluation Details given in Table 3**
Project Work	15	
Attendance	05	
Total	**50**	

Category - C

Continuous Internal Assessment 40 Marks		**End Semester Assessment 60 Marks**
Evaluation Component	**Marks**	
Observation note book and Record note book	10	**Evaluation Details given in Table 3**
IA Test (Best 2)	10	
Model Exam	10	
Seminar and other Activities	05	
Attendance	05	
Total	**40**	

6.3. Marks for Attendance

Attendance %	Marks
Below 75%	0
75% - 80%	1
81% - 85%	2
86% - 90%	3
91% - 95%	4
96% - 100%	5

6.4. Internal Test Scheme

Principal of the College schedules the CIA tests an Model exam for all courses. All faculty members are expected to conduct this CIA tests an Model exam and evaluate, upload the marks to Controller of Examinations of College. College needs to preserve the answer books of the tests and Model exams until declaration of results by the College.

6.5. End Semester University Exam

Controller of Examinations (COE) of the College schedules the End-Semester exams for all three category of courses. Question Papers shall be set externally based on BOS approved syllabus. All students who have a minimum of 75% attendance are eligible to attend the end-semester exams. The breakup of end semester marks is as given below.

6.6. Break up of end semester marks

(All End Semester Exams shall be conducted by the CoE by Saradha Gangadharan College)

The question paper shall be set as per Bloom's Taxonomy. Table 3 below gives the details of evaluation methods for Category A, B, and C courses. Various levels, along with their description and sample questions, are as follows:

Knowledge: Recall or remember previously learned
information. Example: List the basic data types in Python

Comprehension: Demonstrate understanding of facts and ideas by organizing,

comparing, translating, interpreting, giving descriptions, and stating the main ideas.

Example: Explain how a stack data structure works.

Application: Apply knowledge and concepts to solve problems in new situations. Use learned information in a different context.

Example: Write a Python program to solve the deadlock problem.

Analysis: Break down information into parts and examine the relationships between the parts. Identify motives or causes.

Example: Analyse the efficiency of two sorting algorithms and compare their advantages and disadvantages.

Synthesis: Create a new whole by combining elements in novel ways. Use creativity to produce something original.

Example: Design a web application that can generate a time table of a school.

Table3: End Semester Assessment examination details for all three categories of courses

Course Components	Marks	Duration
Category A. Theory subjects: Sec A: 10 Multiple Choice Questions of 1 Mark each (10 Marks) Sec B: 5 either or question type with 4 marks each (20 Marks) Sec C: 3 out of 5 questions of 10 Marks each (30 Marks) **Questions from all units of the Syllabus are equally distributed.**	60 Marks	3 Hours
Category B. Skill Enhancement / Practical Courses Based on Practical Exams conducted by COE of SGC **Internship / Research Project Work:** Presentation of the work (10 marks) / Report (30 marks) / Viva-voce examinations (10 marks) conducted by COE of SGC	50 Marks	3 Hours --
Category C. Theory Subjects with Practical Components: **i. Theory Component:** Sec A: 10 Multiple Choice Questions of 1 Mark each (10 Marks) Sec B: 5 either or question type with 4 marks each (20 Marks) Sec C: 3 out of 5 questions of 10 Marks each (30 Marks) **Questions from all units of the Syllabus are equally distributed.** **The examination shall be conducted for 60 Marks and reduced to**	40 Marks	3 Hours

40 Marks. **ii. Practical Component:** Based on Practical Exams conducted by COE of SGC **The examination shall be conducted for 50 Marks and reduced to 20 Marks.** **TotalMarks:60(Theory:40Marks+Practical:20Marks)**	20 Marks	3 Hours

7. CONSOLIDATION OF MARKS, PASSING MINIMUM AND ARREAR EXAM

Controller of Examinations of the College consolidates the Internal Assessment marks uploaded by the Colleges and marks secured by students in end-semester examination. The total marks will be converted into letter grades as shown in the Section 8.1.

7.1. Passing Minimum

The passing minimum is 40% marks (CIA + End semester).

Minimum pass mark of CIA is 16 out of 40

Minimum pass mark of End semester is 24 out of 60

Minimum pass mark of End semester for practical is 20 out of 50

7.2. Arrear Exam

A student who failed to secure 40% marks in aggregate is declared as Failed. Failed students are eligible to take up supplementary examination by registering to the failed course in the following Semester. All other candidates who failed due to shortage of attendance, those who are seeking to improve the grade shall repeat the course.

7.3. Supplementary Examination

If necessary, supplementary examination for theory papers only shall be conducted after the publication of the results of even semesters of the UG and PG programmes.

Eligibility for Supplementary Examinations:

(a). Must have clear all the papers in the previous semesters;

(b). Must have failed is not more than two papers of the corresponding even semester and / or eligible for the supplementary examinations for those two papers;

(c). Candidates who were absent or detained for any papers are not eligible.

(d). Students who want to exit alone must be eligible.

(e). If the students continue the programme, they are not eligible for Supplementary Examination.

(f). Supplementary examination marks will be taken as the final.

8. LETTER GRADES AND RANGE OF MARKS

Total Marks secured by a student in each subject shall be converted into a letter grade. UGC Framework has suggested a Country wide uniform letter grades for all UG courses.

8.1. Letter Grades

The following Table shows the seven letter grades and corresponding meaning and the grade points for calculation of CGPA.

Range of Marks in %	Letter Grade Points for	Grade Points for
80-100	O	10
71-79	A+	9
66-70	A	8
61-65	B+	7
56-60	B	6
50-55	C	5
40-49	P	4
Below 40	F	0
Absent (lack of attendance)	Ab	0

9. CALCULATION OF SGPA & CGPA

Semester Grade Point Average (SGPA) is calculated by taking a weighted average of all grade points secured by a candidate from all subjects registered by him/her in the given Semester. The weights being the number of credits that each subject carries.

Cumulative Grade Point Average (CGPA) shall be calculated as the weighted average of credits that course carries and the value of Grade points averaged for all subjects.

9.1. Procedure of computation of SGPA and CGPA

The following procedure shall be followed to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

The SGPA is the ratio of the sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e. SGPA (Si) = $\Sigma(Ci \times Gi) / \Sigma Ci$, Where Ci is the number of credits of the i^{th} course and Gi is the grade point scored by the student in the i^{th} course.

9.2. Example for Computation of SGPA where candidate has not failed in any course.

Semester	Course	Credit	Letter Grade	Grade Point	Credit Point (Credit x Grade)
I	Course 1	3	A	8	3 X 8 = 24
I	Course 2	4	B+	7	4 X 7 = 28
I	Course 3	3	B	6	3 X 6 = 18
I	Course 4	3	O	10	3 X 10 = 30
I	Course 5	3	C	5	3 X 5 = 15
I	Course 6	4	B	6	4 X 6 = 24
		20			139
	SGPA				139/20=6.95

9.3. Example for Computation of SGPA where candidate has failed in one course.

Semester	Course	Credit	Letter Grade	Grade Point	Credit Point (Credit x Grade)
I	Course 1	3	A	8	3 X 8 = 24
I	Course 2	4	B+	7	4 X 7 = 28
I	Course 3	3	B	6	3 X 6 = 18
I	Course 4	3	O	10	3 X 10 = 30
I	Course 5	3	C	5	3 X 5 = 15
I	Course 6	4	F	0	4 X 0 = 00
		20			115
	SGPA				115/20=5.75

9.4. Example for Computation of SGPA where candidate has failed in two courses.

Semester	Course	Credit	Letter Grade	Grade point	Credit Point (Credit x Grade)
I	Course 1	3	A	8	3 X 8 = 24
I	Course 2	4	B+	7	4 X 7 = 28
I	Course 3	3	F	0	3 X 0 = 00
I	Course 4	3	B	6	3 X 6 = 18
I	Course 5	3	C	5	3 X 5 = 15
I	Course 6	4	F	0	4 X 0 = 00
		20			85
	SGPA				85/20=4.25

The CGPA shall also be calculated in similar way as shown in examples (i), (ii) and (iii) of SGPA for all subjects taken by the students in all the semesters. However, if any student fails more than once in the same subject, then while calculating CGPA, the credit and grade point related to the subject in which the student fails in multiple attempts will be restricted to one time only. The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

In case of audit courses offered, the students may be given (P) or (F) grade without any credits. This may be indicated in the mark sheet. Audit courses will not be considered towards the calculation of CGPA.

10. DECLARATION OF RESULTS

Controller of Examinations (COE) of the Institution shall declare the results of given UG programme following the CGPA secured by students by the end of 6th Semester and 8th Semester.

Pass Classes:

Range of CGPA	Result
9.0 -10	First Class with distinction
6.0 - 8.99	First Class
5.0 - 5.99	Second Class
4.0 - 4.99	Pass Class

B.Sc. COMPUTER SCIENCE CURRICULUM 2026-27 ONWARDS

FIRST SEMESTER								
S.No.	Component	Course Code	Title of the Course	H/S	Credits	Hours/Week		
						L	T	P
1	MJD1		Digital Logic Fundamentals	H	4	3		2
2	MID1		Microprocessor and Assembly Language Programming	S	4	3		2
3	MLD1		One course from the MLD streams	H	3	3		
4	AEC1		English I	H	2	4		
5	SEC1		Python Programming	S	3	1	1	2
6	VAC1		Environmental Studies	H	2	2		
7	VAC2		Understanding India	H	2	2		
Total					**20**	**25 Hours**		

SECOND SEMESTER								
S.No	Component	Course Code	Title of the Course	H/S	Credits	Hours/Week		
						L	T	P
1	MJD2		Problem Solving and Programming Fundamentals Using C	H	4	3		2
2	MID2		Microcontrollers Programming	S	4	3		2
3	MLD2		One course from the MLD streams	H	3	3		
4	AEC2		Modern Indian Languages I	H	2	4		
5	SEC2		Visual Programming using C#	S	3	1	1	2
6	VAC3		Health and Wellness/Yoga Education	H	2	2		
7	VAC4		Digital Technologies	H	2	2		
Total					**20**	**25 Hours**		

THIRD SEMESTER								
S.No	**Component**	**Course Code**	**Title of the Course**	**H/S**	**Credits**	**Hours/Week**		
						L	**T**	**P**
1	MJD3		Object Oriented Programming Using JAVA	H	4	3		2
2	MJD4		Data Structures	H	4	3		2
3	MID3		Artificial Intelligence	S	4	3		2
4	MLD3		One course from the MLD streams	H	3	3		
5	AEC3		English II	H	2	4		
6	SEC3		Choose from Table 3	S	3	1	1	2
Total					**20**	**26 Hours**		

FOURTH SEMESTER								
S.No	**Component**	**Course Code**	**Title of the Course**	**H/S**	**Credits**	**Hours/Week**		
						L	**T**	**P**
1	MJD5		Database Management Systems	H	4	3		2
2	MJD6		Operating Systems	H	4	3		2
3	MJD7		Mathematical Foundations of Computer Science	H	4	3		2
4	MID4		Machine Learning	S	4	3		2
5	AEC4		Modern Indian Languages II	H	2	4		
6	Project		Community Engagement and Service	H	2			4
Total					**20**	**28 Hours**		

FIFTH SEMESTER								
S.No.	**Component**	**Course Code**	**Title of the Course**	**H/S**	**Credits**	**Hours/Week**		
						L	**T**	**P**
1	MJD8		Computer System Architecture	H	4	3		2
2	MJD9		Computer Networks	H	4	5		
3	MJD10		Design and Analysis of Algorithms	H	4	3		2
4	MJD11		Operations Research	S	4	3		2
5	MID 5		Artificial Neural Networks	H	4			6
Total					**20**	**26 Hours**		

SIXTH SEMESTER								
S.No	**Component**	**Course Code**	**Title of the Course**	**H/S**	**Credits**	**Hours/Week**		
						L	**T**	**P**
1	MJD12		Software Engineering Theory and Practice	H	4	3		2
2	MJD13		Internship (6 months)	H	12			
3	MID 6		Compiler Design	H	4	3		2
Total					**20**			

Or

SIXTH SEMESTER								
S.No	**Component**	**Course Code**	**Title of the Course**	**H/S**	**Credits**	**Hours/Week**		
						L	**T**	**P**
1	MJD12		Software Engineering Theory and Practice	H	4	3		2
2	MJD13		Web Engineering	H	4	3		2
3	MJD14		Soft Computing		4	3		2
4	MJD15		Mini Project		4			6
5	MID 6		Compiler Design		4	3		2
Total					**20**	**26 Hours**		

SEVENTH SEMESTER								
S.No	**Component**	**Course Code**	**Title of the Course**	**H/S**	**Credits**	**Hours/Week**		
						L	**T**	**P**
1	MJD16		Distributed System	H	4	3		2
2	MJD17		System Modelling and Simulation	H	4	3		2
3	MJD18		Wireless Communication Networks	H	4	3		2
4	MID7		Theory of Computation / System Software	S	4	3		2
5	MID8		Cyber Security/ Internet of Things	S	4	3		2
Total					**20**	**25 Hours**		

EIGHTH SEMESTER–B.Sc. Computer Science (Honors)								
S.No	**Component**	**Course Code**	**Title of the Course**	**H/S**	**Credits**	**Hours/Week**		
						L	**T**	**P**
1	MJD19		Embedded Application Development/ Full Stack Development	S	4	3		2
2	MJD20		5G Communication Technologies/ Data Mining	S	4	3		2
3	MJD21		Cloud Computing	H	4	3		2
4	MJD22		Deep Learning	H	4	3		2
5	MJD23		Project	H	4			6
Total					**20**	**26 Hours**		

EIGHTH SEMESTER–B.Sc. Computer Science(Honors with Research)								
S.No	**Component**	**Course Code**	**Title of the Course**	**H/S**	**Credits**	**Hours/Week**		
						L	**T**	**P**
1	MJD19		Embedded Application Development/ Full Stack Development	S	4	3		2
3	MJD20		5G Communication Technologies/ Data Mining	S	4	3		2
5	MJD21		Research Project	H	4			6
6	MJD22		Project Report	H	4			6
7	MJD23		Project Viva-voce	H	4			6
Total					**20**	**28 Hours**		

Table:1 Major Disciplinary Courses					
S.No	**Component**	**Course Code**	**Title of the Course**	**Semester**	**Credits**
1.	MJD1		Digital Logic Fundamentals	I	4
2.	MJD2		Problem Solving and Programming Fundamentals using C	II	4
3.	MJD3		Object Oriented Programming using Java	III	4
4.	MJD4		Data Structures	III	4
5.	MJD5		Data base Management System	IV	4
6.	MJD6		Operating Systems	IV	4
7.	MJD7		Mathematical Foundations of Computer Science	IV	4
8.	MJD8		Computer System Architecture	V	4
9.	MJD9		Computer Networks	V	4
10.	MJD10		Design and Analysis of Algorithms	V	4
11.	MJD11		Operations Research	V	4
12.	MJD12		Software Engineering Theory and Practice	VI	4
13.	MJD13		Web Engineering	VI	4
14.	MJD14		Soft Computing	VI	4
15.	MJD15		Internship / Mini Project	VI	12/ 4
16.	MJD16		Distributed Systems	VII	4
17.	MJD17		System Modelling and Simulation	VII	4
18.	MJD18		Wireless Communication Networks	VII	4
19.	MJD19		Embedded Application Development / Full Stack Development	VIII	4
20.	MJD20		5G Communication Technologies /Data Mining	VIII	4
21.	MJD21		Cloud Computing (Honors)/ Research Project (Research)	VIII	4
22.	MJD22		Deep Learning (Honors)/ Project Report(Research)	VIII	4
23.	MJD23		Project (Honors) / Project Viva Voce(Research)	VIII	4

Table 2: List of Minor Disciplinary Courses (new)					
S.No	**Component**	**Course Code**	**Title of the Course**	**Sem**	**Credit**
1.	MID1		Microprocessor and Assembly Language Programming	I	4
2.	MID2		Microcontrollers Programming	II	4
3.	MID3		Artificial Intelligence	III	4
4.	MID4		Machine Learning	IV	4
5.	MID5		Artificial Neural Networks	V	4
6.	MID6		Compiler Design	VI	4
7.	MID7		Theory of Computation / System Software	VII	4
8.	MID8		Cyber Security/ Internet of Things	VII	4

Table 3:SEC1/SEC2/SEC3 –I/II/III SEMESTERS						
S.No.	**Component**	**Course Code**	**Title of the Course**	**H/S**	**Semester**	**Credits**
1	SEC1		Python Programming	S	I	3
2	SEC2		Visual Programming with C#	S	II	3
3	SEC3		R Programming / Programming for Mobile Devices / 3D Modelling and Animation / Game Programming	S	III	3

Table 4:List of Ability Enhancement Courses				
S.No	**Component**	**Course Code**	**Title of the Course**	**H/S**
1.	AEC1		English I/Modern Indian Languages I	H
2.	AEC2		English I/Modern Indian Languages I	H
3.	AEC3		English II/Modern Indian Languages II	H
3.	AEC4		English II/Modern Indian Languages II	H

Table 5:List of Value-Added Courses				
S.No	**Component**	**Course Code**	**Title of the Course**	**H/S**
1.	VAC1		Understanding India	H
2.	VAC2		Environmental Studies	H
3.	VAC3		Health & Wellness/Yoga Education	H
4.	VAC4		Digital Technologies	H

Table: 6 MLD Papers offered to other Department				
S.No	**Component**	**Course Code**	**Title of the Course**	**H/S**
1	MLD1		Fundamentals of Programming	H
2	MLD2		Fundamentals of Web Designing	H
3	MLD3		Basics of Artificial Intelligence	H

SEMESTER I

Year	I	**Course Code:**	**Credits**	4
Semester	I	**Course Title:** Digital Logic Fundamentals	**Hours**	45
			Category	C
Course Prerequisites, if any	Basic knowledge of Computers			
Course Outcomes	• Understand and describe the principles of digital systems and binary number operations • Apply Karnaugh mapping to simplify Boolean expressions and optimize digital circuits • Analyze and design basic combinational circuits using various digital components • Synthesize and evaluate synchronous sequential circuits using storage elements and HDL • Design and implement various types of registers and counters using HDL			
Unit No.	**Course Content**		**Hours**	
Theory Component				
Unit I	**Digital Systems and Binary Numbers** Digital Systems – Binary Numbers – Number-Base Conversions – Octal and Hexadecimal Numbers – Complements of Numbers – Signed Binary Numbers – Binary Codes – Binary Storage and Registers – Binary Logic – Axiomatic Definition of Boolean Algebra – Basic Theorems and Properties of Boolean Algebra – Boolean Functions – Canonical and Standard Forms – Other Logic Operations – Digital Logic Gates – Integrated Circuits		9	
Unit II	**Gate-Level Minimization** Map Method – Four-Variable K-Map – Product-of-Sums Simplification – Don't-Care Conditions – NAND and NOR Implementation – Other Two-Level Implementations – Exclusive-OR Function – Hardware Description Language		9	
Unit III	**Combinational Logic** Analysis Procedure – Design Procedure – Binary Adder– Subtractor – Decimal Adder – Binary Multiplier – Magnitude Comparator – Decoders – Encoders – Multiplexers – HDL Models of Combinational Circuits		9	
Unit IV	**Synchronous Sequential Logic** Storage Elements – Latches – Flip-Flops – Analysis of Clocked Sequential Circuits - Synthesizable HDL Models of Sequential Circuits – State Reduction and Assignment – Design Procedure		9	

Unit V	**Registers and Counters** Registers – Shift Registers – Ripple Counters – Synchronous Counters – Other Counters – HDL for Registers and Counters	9
Recommended Learning Resources		
Text Books	1. M. Morris Mano, Michael D. Ciletti, "Digital design with an introduction to the Verilog HDL", Pearson, Sixth Edition, 2018.	
Reference Books	1. M. Rafiquzzaman, "Fundamentals of Digital Logic and Microcomputer Design", John Wiley & Sons, Inc., Fifth Edition, 2009	

Practical Component		
Title of the Practical: Digital Logic Fundamentals		
Ex. No	**Exercises**	**Hours**
1	Binary to Decimal and vice-versa	**30**
2	Decimal to Hexadecimal and Vice-Versa	
3	Digital Logic Gates	
4	Simplification of Boolean Functions	
5	Combinational Logic Circuits i. Code Converters ii. Arithmetic (Adders, Subtractors, Multipliers, Comparators) iii. Data Handling (Multiplexers, Demultiplexers, Encoders & Decoders)	
6	Combinational Logic Circuit Design	
7	Binary Adder-Subtractor Simulation	
8	Decimal Adder Simulation	
9	Binary Multiplier Simulation	
10	Sequential Circuit Storage Elements: Flip-Flop Simulation	
Tools/Software to be used	Digital Trainer Kit, Simulator - LogiSim	

SARADHA GANGADHARAN COLLEGE (AUTONOMOUS)

B.Sc(CS) DEGREE EXAMINATION

Model Question Paper

MJD 1: Digital Logic Fundamentals

I Year/I Semester

Time: 3 Hours **Max. Marks: 60**

PART A

Answer All Questions (10 × 1 = 10 Marks)

1. Which of the following represents the decimal number 25 in binary form?
   a) 11001
   b) 10011
   c) 11101
   d) 10101
2. The 2's complement of binary number 10110 is:
   a) 01001
   b) 01010
   c) 01011
   d) 01100
3. The K-map simplification is mainly used for:
   a) Converting binary to decimal
   b) Minimizing Boolean expressions
   c) Performing binary addition
   d) Converting hexadecimal to binary
4. The term "don't care condition" in a K-map means:
   a) Invalid input combinations
   b) Output is always 0
   c) Output can be either 0 or 1
   d) Both a and c
5. A half adder circuit has:
   a) Two inputs and one output
   b) Two inputs and two outputs
   c) One input and two outputs
   d) Three inputs and one output
6. The function of a multiplexer is to:
   a) Decode binary data

b) Select one input from many and forward it to the output

c) Encode binary inputs

d) Perform logical AND operation

7. A flip-flop can store:

a) One bit of information

b) Two bits of information

c) Four bits of information

d) Eight bits of information

8. A JK flip-flop behaves as a T flip-flop when:

a) J = 0, K = 0

b) J = 1, K = 1

c) J = 0, K = 1

d) J = 1, K = 0

9. The number of flip-flops required for a mod-16 counter is:

a) 2

b) 3

c) 4

d) 5

10. In a shift register, data is transferred:

a) Parallel only

b) Serial only

c) Either serial or parallel

d) Both a and b

PART B

Answer All Questions (5 × 4 = 20 Marks)

11. a) Explain the concept of binary, octal, and hexadecimal number systems with examples.

(or)

b) Discuss the different types of complements and illustrate with examples.

12. a) Simplify the Boolean function F(A, B, C) = Σ(0, 2, 4, 6) using K-map.

(or)

b) Explain the implementation of logic functions using NAND and NOR gates.

13. a) Explain the design of a full adder and show how it differs from a half adder.

(or)

b) Write short notes on decoders and encoders with neat logic diagrams.

14. a) Describe the working principle of SR and JK flip-flops.

(or)

b) Explain the steps in the analysis of clocked sequential circuits.

15. a) Explain the working of a 4-bit shift register with a diagram.

(or)

b) Discuss synchronous and asynchronous counters with examples.

PART C

Answer Any Three Questions (3 × 10 = 30 Marks)

16. Discuss Boolean algebra and its basic theorems and properties.
17. (a) Explain the four-variable K-map simplification technique with an example.(5 marks)

    (b) Design a logic circuit for the function using only NOR gates.(5 marks)
18. Design a 4-bit binary adder–subtractor circuit using full adders.
19. (a) Describe in detail the design steps for a sequential circuit.(5 marks)

    (b) Write synthesizable HDL models for D and T flip-flops.(5 marks)
20. (a) Discuss the design and operation of ripple and synchronous counters.

Year	I	Course Code :	Credits	4
Sem.	I	Course Title : Microprocessor & Assembly Language Programming	Hours	75
			Category	C
Course Prerequisites, if any	• Number Systems (binary, octal, hexadecimal) and their conversions • Boolean Algebra, logic gates, flip-flops and registers • Concepts in Combinational and Sequential logic			
Course Outcomes	• Understand the concept of instruction of 8085, addressing modes and format of instructions • Learn the architecture & organization of 8085 Microprocessor • Understand and classify the instruction set of the 8085Microprocessor • Apply the memory & I/O Interfacing with 8085 Microprocessor • Analyze the architecture and operation of Programmable Interface			
Unit No.	**Course Content**		**Hours**	
Theory Component				
Unit I	**Introduction to Microprocessors** Microprocessors – computer languages – 8085 programming model – Instruction – Format – Types of instruction – Addressing Mode - Data format and storage – Execute a simple program.		9	
Unit II	**8085 Microprocessor architecture** Microprocessor Architecture and its operations – Memory – I/O Devices, 8085 MPU – 8085 based microcomputer - Instruction Set of 8085 – Data Transfer – arithmetic – Logic – Branch instruction.		9	
Unit III	**Programming 8085** Writing ALP and Debugging programs – Looping – Counting and Indexing – 16-bit Arithmetic instructions – Logic operations – Code conversion – BCD Arithmetic and 16-bit operations – BCD- Binary conversion – Binary to BCD conversion – BCD to seven segment LED code conversion – Binary to ASCII and ASCII to binary conversion – BCD addition and subtraction		9	
Unit IV	**Stack & Interfacing I/O Devices** Stack and subroutines – Restart – Conditional call and Return instruction – Advanced subroutine concepts – Counters and Time Delay- memory interfacing – 8155 memory segment Interfacing – Interfacing I/O devices: Basics – Interfacing input and output devices – memory mapped I/O.		9	
Unit V	**Interrupts & Programmable Devices** Interrupts: 8085 Interrupt – RST instructions – Software and Hardware interrupt – multiple Interrupts and Priorities – 8085 Vectored Interrupts – Restart as Software Instructions – 8155 – Multipurpose programmable Device – 8279 Programmable Keyboard/Display Interface – 8255 Programmable peripheral Interface		9	

Text Book	1. Ramesh S. Gaonkar, "Microprocessor – Architecture, Programming and Applications with the 8085", Penram International Publisher, Sixth Edition, 2013. (Unit I to V)	
Reference Books	1. Douglas V. Hall, "Microprocessors and Interfacing", Tata McGraw Hill publications, Third Edition, 2017. 2. A. P Mathus , Introdcution to Microprocessor, Tata McGraw Hill Publishsing Co, 3rd Edition.	

Practical Component		
Exercises	1. Assembly Language Programming for Arithmetic Operations like Addition, Subtraction, Multiplication and Division on 8, 16-bit data 2. Assembly Language Programming for different logical operations 3. Assembly Language Programming for code conversions 4. Assembly Language Programming for sorting 5. Assembly Language Programming for Searching 6. Assembly Language Programming for memory block transfer 7. Assembly Language Programming using subroutines 8. Assembly Language Programming using counters and time delay	30
Tools Required	8085 Microprocessor Kit (OR) 8085 Simulator (OR) GUNU Sim 8085	

MID1: Microprocessor & Assembly Language Programming

Model Question Paper

I Year/ I Semester

Time : 3 hours **Max. Marks : 60**

Part – A

Answer all the questions: **(10 x 1 = 10)**

1. In 8085 name the 16 bit registers.
   (a) Stack Pointer
   (b) Program Counter
   (c)IR
   (d) a and b
2. Which of the following is a one-byte instruction?
   a) MVI B, 05
   b) LDA 2500H
   c) IN 01
   d) MOV A,B
3. Which one of the following addressing modes is used in the instruction PUSH B?
   (a) Direct Addressing Mode
   (b) Register addressing Mode
   (c) Register indirect addressing mode
   (d) Immediate addressing mode
4. Consider the following features in an 8085 microprocessor system with memory-mapped I/O:

a) I/O devices have 16-bit addresses.
b) I/O devices accessed using IN and OUT instructions.
c) There can be a maximum of 256 input devices and 256 output devices.
d) Arithmetic and logic operations can be directly performed with the I/O data.

Select the correct answer using the codes given below:

   (a) 1, 2 and 4
   (b) 1, 3 and 4
   (c) 2 and 3
   (d) 1 and 4

5. In the 8085 microprocessor the value of the most significant bit of the result following the execution of any arithmetic or Boolean instruction is stored in
   (a) The carry status flag
   (b) The auxiliary carry status flag

(c) The sign status flag

(d) The zero status flag

6. The interrupt vector address for TRAP is

   a) 0000H

   b) 0024H

   c) 0018H

   d) 002CH

7. The time required to complete one operation; accessing either the memory or I/O device is

   a) Execution cycle

   b) b)T-State

   c) c)Machine cycle

   d) d)Instruction Cycle

8. Which of following is both level and edge sensitive?

   a) RST 7.5

   b) b)RST 5.5

   c) c) TRAP

   d) d) INTR

9. The contents of accumulator after the execution of following instructions will be

   MVI A, B7H

   ORA A

   RAL

   a) 6EH

   b) b) 4FH

   c) c) EEH

   d) d)EFH

10. MVI A,00

    MVI B,0F

    ADI 0C

    After executing the above instructions which flags in the Flag Register will get affected

    a) Zero Flag b) Parity Flag c) Carry Flag d) Auxiliary Carry Flag

Part B

Answer all questions 5 x 4 = 20

11. Explain 8085 program model (OR)

    What are different types instruction formats?

12. Draw and explain the timing diagram for MVI A,32H.(6) (OR)
    Explain different Data Transfer Instructions.
13. Write an ALP program to add to 8-bit numbers. (OR)
    Write a program to convert binary to BCD.
14. Explain about subroutines. (OR)
    Differentiate between I/O mapped and memory mapped I/O.
15. What is an interrupt? Explain software interrupts. (OR)
    Explain 8155 Multipurpose programmable Device.

PART C

Answer any 3 questions **3x10 =30**

16. Deduce the functional description of 8085 Microprocessor with neat diagram.
17. Explain different types Instruction set.
18. Differentiate between the following instructions clearly
    (i) Push and POP
    (ii) CALL and Jump
    (iii) ADD and ADC
    (iv)INC and INX
    (iv) MOVB,B and MOVB,A
19. Discuss about 8155 memory segment interface.
20. What do you mean by vectored interrupt? Explain maskable and non-maskable interrupts in 8085 microprocessor.

Year	I	**Course Code:**	**Credits**	3
Semester	I	**Course Title:** Python Programming	**Hours**	60
			Category	B
Course Prerequisites, if any	Basic Knowledge of Programming			
Course Outcomes	• Understand the basics of writing Python code • Implement programs using lists, tuples and dictionaries • Understand the use of control structures • Ability to write programs using packages • Understand the file manipulation			

Practical Component

Title of the Practical: Python Programming

Ex. No	Exercises	Hours
1	Exchange the values of two variables	**30**
2	Finding minimum among n variables	
3	Perform Simple sorting	
4	Generate Students' marks statement	
5	Find square root, GCD, exponentiation	
6	Sum the array of numbers	
7	Perform linear search, binary search	
8	Perform Matrix operations using NumPy	
9	(a) Perform Data frame operations using Pandas. (b) Use Matplotlib on the dataset and visualize	
10	Perform Word count, copy file operations	

Tools/Software to be used	Python 3

The above exercises are designed based on:

Python Basics: Variables, Data Types, Operators, Input and Output, Control Statements, Functions, Arrays, Searching Techniques (Linear Search, Binary Search), Sorting Techniques, Mathematical Functions (Square Root, GCD, Exponentiation), File Handling, Word Count, File Copy Operations.

NumPy : Array Creation, Matrix Operations, Mathematical Operations, Indexing and Slicing, Numerical Computation.

Pandas: Series, DataFrames, Data Manipulation, Data Analysis, Indexing, Dataframe Operations.

Matplotlib: Data Visualization, Plotting Graphs, Charts, Dataset Visualization, Figure Customization.

Recommended Learning Resources	
Text Books	1. Mark Lutz, "Learning Python", Fifth Edition, O'Reilly, 2013. 2. Daniel Liang, "Introduction to programming using Python", Pearson, First edition, 2021. 3. Wes Mc Kinney, "Python for Data Analysis", O'Reilly Media, 2012.
Reference Books	1. Tim Hall and J-P Stacey, "Python 3 for Absolute Beginners", Apress, First Edition, 2009. 2. Magnus Lie Hetland, "Beginning Python: From Novice to Professional", Apress, Second Edition, 2005.

Year	I	Course Code:	Credits	2
Semester	I	Course Title: Environmental Studies	Hours	45
			Category	A
Course Prerequisites, if any	NIL			
Course Outcomes	• Equip students with interdisciplinary knowledge, critical thinking, practical skills, and ethical awareness • Address environmental challenges and promote sustainable development.			
Unit No.	Course Content		Hours	
Theory Component				
Unit I	**Multidisciplinary nature of environmental studies** 1. Definition, scope and importance; Need for public awareness. 2. Environment Protection Act.		5	
Unit II	**Natural Resources, Renewable and Non-renewable Resources** 1. Forest resources: Use and over-exploitation, deforestation, Timber extraction. 2. Water resources: Use and over-utilization of surface and ground water, floods, drought, dams-benefits and problems. 3. Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources. 4. Land resources: Land as a resource, land degradation, soil erosion and desertification.		7	
Unit III	**Ecosystems** 1. Concept of an ecosystem 2. Energy flow in the ecosystem 3. Food chains, food webs and ecological pyramids 4. Characteristic features, structure and function of Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems.		7	
Unit IV	**Biodiversity and its conservation** 1. Introduction – Definition: Biogeographically classification of India, India as a mega- diversity nation. 2. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic values. 3. Hot-sports of biodiversity -Threats to biodiversity 4. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.		6	

Unit V	**Environmental Pollution** 1. Definition, cause, effects and control measures of: a) Air pollution b) Water pollution c) Soil pollution d) Noise pollution e) Nuclear hazards 2. Solid waste management: Causes, effects a nd control measures of urban and industrial wastes.	5
Recommended Learning Resources		
Reference Books	1. Odum, E. P., Barrett G., W., 2011, Fundamentals of Ecology, 5ed.,Cengage Learning. 2. ISBN-13: 978-8131500200 1. Sharma, P. D., 2011. Ecology and Environment, Rastogi Publications. ISBN -13: 978-8171339655	

Year	I	Course Code:	Credits	2
Semester	I	Course Title: Understanding India	Hours	45
			Category	A
Course Prerequisites	NIL			
Course Outcomes	• Equips students with a basic understanding of India's history, culture, values, and contemporary social issues • Fostering critical thinking, sensitivity, and analytical skills.			
Unit No.	Course Content		Hours	
Theory Component				
Unit I	**Geography of India** 1. India on the map of the world and its neighboring countries 2. Geographical diversities		5	
Unit II	**History of India** 3. India's Freedom Struggle 4. An introduction to Indian knowledge systems		6	
Unit III	**Communicating Culture** 5. Oral narratives: Myths, tales and folklore 6. Introduction to the Tribal Cultures of India		6	
Unit IV	**Indian Social Structure** 7. Continuity and change of the Indian Social Structure: Caste, Community, Class and Gender		5	
Unit V	**Understanding Indian Polity** 8. The evolution of State in India: Nature and origin 9. Constitution as a living document		8	
Recommended Learning Resources				
Text Books	2. Anuradha K. (2024) Understanding India (as per NEP Syllabus), Shanlax Publications, p.129. – This adheres to or is customized to the Pondicherry University syllabus. 3. Jain P. and Sharma R. (2023) Understanding India, Mahaveer Publications, p. 264.			
Reference Books	1. De S. (2024) Understanding India (English version) paper back, Techno World publication, p.155. 2. Ghosh S. and Chandra B. (2024) Understanding India, paper back, Global Net Publications, p. 190 3. Lochan K. (2025) Understanding India semester I for FYUGP students - NEP 2020, S chand and Company Ltd., 4. Raychaudhury B.(2023) Understanding India - A value added course, Notion Press, p.274. 5. Sen S. (2023) Understanding India: A text and reference book for all streams. Dibrugarh University as per NEP Syllabus: for four year undergraduate programme (FYUGP): Semester I (VAC), Ashok Publications, p.348.			

SEMESTER II

<table>
<tr><td>Year</td><td>I</td><td>Course Code:</td><td>Credits</td><td>4</td></tr>
<tr><td rowspan="2">Semester</td><td rowspan="2">II</td><td rowspan="2">Course Title: Problem Solving and Programming Fundamentals using ‘C’</td><td>Hours</td><td>75</td></tr>
<tr><td>Category</td><td>C</td></tr>
<tr><td>Course Prerequisites, if any</td><td colspan="4">NIL</td></tr>
<tr><td>Course Outcomes</td><td colspan="4">• Analyze problems and develop top-down designs.
• Write, compile, and debug basic programs.
• Implement logic with conditionals and loops, manipulating arrays and strings.
• Design and implement Functions, Structure and Union.
• Understand the concepts of Pointers and File handling.</td></tr>
<tr><td>Unit No.</td><td colspan="3">Course Content</td><td>Hours</td></tr>
<tr><td colspan="5">Theory Component</td></tr>
<tr><td>Unit I</td><td colspan="3">Introduction to Computer Problem-Solving:
Problem solving Aspect – Top-down Design – Implementation of Algorithms – Program Verification – Efficiency of Algorithms – Analysis of Algorithms- Basic Data types – Variables – Expressions – I/O statements – Compile and Run – Debugging</td><td>9</td></tr>
<tr><td>Unit II</td><td colspan="3">Decision Making – Branching & Looping:
Decision making – Relational Operators – Conditional statement, Looping Statements – Nested loops – Infinite loops – Switch Statements</td><td>9</td></tr>
<tr><td>Unit III</td><td colspan="3">Array Techniques & Functions:
Array Manipulation- Different operations– One dimensional Array – Two-dimensional Array – Multi- dimensional Array – Character – Arrays and Strings - Introduction to Functions – Importance of Design of Functions – Arguments – Parameters – Return Values – Local and Global Scope – Recursion</td><td>9</td></tr>
<tr><td>Unit IV</td><td colspan="3">Structure & Pointers:
Defining and processing - Structure initialization –Array of Structures – Array with in a Structures – Passing to a function - Union- Declarations and initialization of pointer variables, Passing to a function – Pointer of arrays – Array of Pointers - Pointer to Functions</td><td>9</td></tr>
<tr><td>Unit V</td><td colspan="3">File Handling & Pre-Processor:
Files: Create, Open, Close Files – Process unformatted data Files – Pre –Processor: Macro and its type – Command Line Arguments: Defining and using command Line Arguments. Dynamic Memory Allocation.</td><td>9</td></tr>
</table>

Recommended Learning Resources	
Text Books	1. R. G. Dromey, "How to Solve it by Computer", Pearson Education India, Thirteenth Edition, 2013. (Unit I) 2. E. E. Balagurusamy, "Programming in ANSI C", 8th Edition Tata McGraw Hill, 2019. (Unit II to V)
Reference Books	1. P. K. Sinha & Priti Sinha, "Computer Fundamentals", BPB Publications, 2007. 2. Byron S. Gottfried, "Programming with C", Schaum's Outline Series, TMH, 4th Edition 2018.

Practical Component		
Title of the Practical: Problem Solving & Programming Fundamentals using 'C'		
Ex. No	**Exercises**	**Hours**
1	Program to exchange the values of two variables without using a third variable	**30**
2	Program that takes an integer as input and reverses its digits	
3	Program to compute sum of N numbers using loop	
4	Program to generate the Fibonacci sequence up to a specified limit	
5	Program to implement control structures	
6	Program to array counting, array order reversal & find the maximum & minimum number in a set	
7	Program that takes a list of numbers as input and counts the total number of elements in the list	
8	Program to implement String Manipulation	
9	Program to compute the sine of an angle (in degrees) using a series expansion using function	
10	Program to compute the factorial using recursion	
11	Program to display a student mark statement using structure	
12	Program to process an employee payroll using structure	
13	Program to swap to two numbers using pointers	
14	Program to read, write, open, copy a file	
15	Program to read a Command Line argument and print the output	
Tools/Software to be used	TURBO C	

Model Question Paper
MJD 2: PROBLEM SOLVING AND PROGRAMMING FUNDAMENTALS USING 'C'
I Year/ II Semester

Time: 3 hrs Maximum: 60 marks

PART – A
Answer ALL the Questions (10 x 1 = 10) marks

1.To complete each activity in a computer, we follow a sequence of steps. This sequence of steps is known as

a) Problem

b) Algorithm

c) Problem Analysis

d) None of the above

2. A flowchart is a diagram made up of _____.

a) Boxes

b) Diamonds

c) Shapes

d) All of the above

3. The conditional operator are also known as

a) Relational operator

b) Binary operator

c) Ternary operator

d) Arithmetic operator

4. Which of the following is an invalid if-else statement?

a) if (if (a == 1)){}

b) if (a){}

c) if ((char) a){}

d) if (func1 (a)){}

5. Which keyword is used to make the array size optional in C language during array declaration?

a) auto

b) static

c) extern

d) register

6. An array of similar data types which themselves are a collection of dissimilar data type are _____

a) Linked Lists

b) Trees

c) Array of Structure

d) All of the mentioned

7. Comment on the following pointer declaration. int *ptr, p;

a) ptr is a pointer to integer, p is not

b) ptr and p, both are pointers to integer

c) ptr is a pointer to integer, p may or may not be

d) ptr and p both are not pointers to integer

8. A C Structure or User defined data type is also called.?

a) Derived data type

b) Secondary data type

c) Aggregate data type

d) All the above

9. FILE reserved word is?

a) A structure tag declared in stdio.h

b) One of the basic datatypes in c

c) Pointer to the structure defined in stdio.h

d) It is a type name defined in stdio.h

10. Which type of files can't be opened using fopen()?

a). .txt

b). .bin

c) .c

d) None of the above

PART B

Answer ALL the Questions (5 x 4 = 20 marks)

11. a) Explain the problem solving techniques.

(or)

b) What is Token? What are the different types of token available in C

12. a) Show how break and continue statements are used in a C program, with example

(or)

b) Explain with syntax, the different loops used in 'C' program

13. a) Explain with syntax and example, the different **s**tring manipulation library functions with example.

(or)

b) What is function? Explain the type of functions based on parameters.

14. a) What is pointer**?** Explain how the pointer variable declared and initialized?

(or)

b) Differentiate between call by value and call by reference with examples.

15. a) Explain different type of storage class in C?

(or)

b) Explain static and dynamic memory allocation?

PART C

Answer any THREE Questions (3*10=30) marks

16. Write a calculator program in C language to do simple Operations like addition, subtraction, multiplication and Division. Use switch statement in your program.
17. Explain the Conditional Statement with program in C Language.
18. Explain array of structure and structure within a structure with an example
19. Discuss File IO Operation in C Language.
20. Write a C program to maintain a record of „n" students details using an array of structures with Fields (rollno, name, marks, and grade). Assume appropriate data type for each field. Print the marks of the student given the Student name as input.

Year	I	Course Code: Course Title: Microcontrollers Programming	Credits	4
Sem.	II		Hours	75
			Category	C
Course Prerequisites, if any	• Digital Logic Fundamentals • Microprocessors • Assembly Language Programming			
Course Outcomes	• Understand the internal design of 8051 microcontroller along with the features and their programming • To learn the programming concept of 8051 • Design different interfacing applications using microcontrollers and peripherals • Build systems using microcontrollers for real time applications. • To learn the basic embedded C language for Intel 8051microcontroller and study programming using Assembly & Embedded C language for timers/counters.			
Unit No.	**Course Content**		**Hours**	
Theory Component				
Unit I	**Microprocessors and Microcontrollers** Microprocessors vs Microcontrollers – 8051 Architecture – Input / Output Pins – Ports – External Memory – Counter and Timers – Serial Data I/O – Interrupts. (Text Book1)		9	
Unit II	**Programming 8051** Addressing Modes – External Data Moves – Code Memory Read-Only Data Moves – PUSH and POP Opcodes – Data Exchanges – Logical Operations – Arithmetic Operations – Jump and Call Opcodes (Text Book1)		9	
Unit III	**8051 Microcontroller Design** Microcontroller Specification – Design – Testing – Timing Subroutines – Lookup Tables for 8051 – Serial Data Transmission. (Text Book1)		9	
Unit IV	**Applications** Keyboards – Displays – Pulse Measurement – D/A and A/D Conversions – Multiple Interrupts. (Text Book1)		9	
Unit V	**Serial Data Communication** 8051 Serial Communication: Data communication, Basics of Serial Data Communication, 8051 Serial Communication, connections to RS-232, Serial port programming (Transmitting a character, and receiving a character using serial communication) using Assembly and Embedded C.		9	
Text Books	1. Kenneth J. Ayala, "The 8051 Microcontroller Architecture, Programming, and Applications", Delmar Cengage Learning, Third Edition, 2004. 2. The 8051 Microcontroller and Embedded Systems – using assembly and C", Muhammad Ali Mazidi, Janice Gillespie Mazidi and Rollin D. McKinlay; PHI,			

	Pearson, 2006 (Unit V)	
Reference Book	1. Hubert Henry Ward, "C Programming for the PIC Microcontroller- Demystify Coding with Embedded Programming", Apress, UK, 2020 https://doi.org/10.1007/978-1-4842-5525-4	

Practical Component		
Exercises	1. Blinking LED 2. Digital Counter with Seven-Segment Display 3. Analog-to-Digital Conversion (ADC) 4. UART Communication 5. Timer Interrupt - Using a timer interrupt to perform a task at regular intervals 6. External Interrupt 7. Temperature Sensor (DS18B20) Interface 8. Matrix Keypad Interface 9. LCD Display Interface 10. Traffic Light Controller 11. Develop a program to interface a Stepper Motor with 8051	30
Tools Required	Edsim 5.1	

MID2: Microcontrollers Programming

Model Question Paper

Time: Three Hours **Max. Marks: 60 Marks**

Part A – (10 X 1 = 10marks)

Answer All Questions

1. When 8051 wakes up then 0x00 is loaded to which register?

a) PSWb) SP

c) PCd) both a & b

2. On power up, the 8051 uses which RAM locations for register R0- R7

a) 00-2Fb) 00-07

c) 00-7Fd) 00-0F

3. If we push data onto the stack then the stack pointer

a) Increases with every push b) decreases with every push

c) Increases& decreases with every push d) none of the above

4. MOV A, @ R1 will:

a) Copy R1 to the accumulator

b) Copy the accumulator to R1

c) Copy the contents of memory whose address is in R1 to the accumulator

d) Copy the accumulator to the contents of memory whose address is in R1

5.The 8051 has _____ 16-bit counter/timers

a) 1b) 2

c) 3 d) 4

6. Which of the following is/are available reset in 8051?

a) Power on resetb) reset by push button

c) Both a and bd) neither a nor b

7. Which of the following can be associated with bouncing contacts?

a)Push button switchesb)Toggle Switches

c)Both a & b d)neither a nor b

8. To get 2 displayed by a 7 segment display (common mode), what should be the combination of 8051 pins (P1.7 – P1.0)?

a)01111101 b)10111110

c)01011011d) 10100100

9. The asynchronous transmission always begins with _____.

a)Start bitb) stop bit

c)Parity bitd) sync bit

10.In serial control (SCON) register, SCON.5 is used to

a) Transmit Interrupt Flag b) Receive Interrupt Flag

c) Used for Multi-processor Communication d) Receive Enable

Part B – (4 X 5 = 20 marks)

Answer All Questions

11.a) Differentiate between Microprocessors and Microcontrollers.

OR

b) Write short notes on port pin circuits.

12. a) Describe the logical operations in 8051 with examples.

OR

b) Discuss on Push & Pop opcodes.

13. a) Enumerate the steps involved in testing an 8051 Microcontroller Design.

OR

b) Explain the significance of Timing Subroutines in 8051.

14. a) Discuss the design and interface of a 4X4 Matrix Keyboard.

OR

b) Illustrate Interrupt Handling in the 8051 Microcontroller.

15. a) Elaborate the Point-to-Point Network Configuration in Serial Communication.

OR

b) Briefly discuss on Data communication modes supported by 8051 Microcontroller.

Part C – (3 X 10 = 30 marks)

Answer any THREE Questions

16.Explain in detail about the architecture of 8051 with a neat diagram.

17. Discuss External Data moves, code memory moves, and read-only moves with example.

18.Explain the significance of a Microcontroller Design with External ROM & RAM.

19. Describe the working of D/A and A/D conversions in Microcontrollers Systems.

20. Interpret the Serial Data Transmission in the 8051.

Year	I	Course Code:	Credits	3
Semester	II	Course Title: Visual Programming with c#	Hours	60
			Category	B
Course Prerequisites, if any	Basic Knowledge of Programming			
Course Outcomes	• Understand the key components of the .NET Framework related to C# development • Learn the basic syntax and structure of C# programs • Design C# applications by integrating various object-oriented programming techniques in the .NET framework • Analyze the significance of graphical user interface (GUI) components and the Event Handling Model using C# programming • Learn and apply the fundamental skills to efficiently develop, test, and deploy ASP.Net Core applications			

Practical Component

Title of the Practical:

Ex. No	Exercises	Hours
1	Installation of Visual Studio and creation of Simple Console Application	30
2	Create a simple C# program for the following concepts: a. To Check whether a given number is an Armstrong or not b. To Check whether the alphabet is a vowel or not using switch case c. To Check whether the given string is palindrome or not using arrays	
3	Create a program to demonstrate boxing and unboxing operations	
4	Implement the basic OOP concepts	
5	Implement Interfaces and Operator Overloading	
6	Create a GUI using standard controls, SDI & MDI forms	
7	Design an application with menu options and a Common Dialog box	
8	create a simple web application using ASP.Net	
9	Develop any ONE case study listed below: a. Inventory Control b. Retail Shop Management	

	c. Employee Information System d. Personal Assistant Program e. Students' Information System	
Tools/Software to be used	Microsoft Visual Studio 2010 Professional Edition (OR) Microsoft Visual Studio 2008 Professional Edition	

The above exercises are designed based on the following concepts:

.Net Framework: Framework Components - The Common Language Runtime (CLR) - .NET Base Class Library - Common Language Specification (CLS) - Common Type System (CTS) - Metadata and Assemblies - .NET Namespaces - MSIL - JIT Compilers

Program Structure of C#: Data Types- Operators-Statements and Expressions- Branching- Looping and loop control statements- Arrays- Strings manipulation- Boxing and Unboxing- Pre-processors- Namespaces

Object Oriented Programming concepts in C#: Class- Objects- Encapsulation- Constructors and its types- Inheritance- Polymorphism-Interface-Abstract class- Operator overloading-Properties- Indexers- Delegates- Collections

Windows Forms: Windows Forms and various controls-SDI and MDI applications- Menu Creation, Common Dialog Boxes- Events and event handling

ASP.Net: ASP.NET Core project, ASP.NET Core application.

Recommended Learning Resources	
Text Books	1. Herbert Schildt, "C# 4.0: The Complete Reference", First Edition**,** McGraw Hill Education, 2017. 2. Albahari. J, "C# 10 in a Nutshell: The Definitive Reference", First Edition, O'Reilly, 2022. 3. Adam Freeman. A, "Pro ASP.NET Core 7", Tenth Edition. Manning Publication, 2023.

Year	I	Course Code:	Credits	2
Semester	II	Course Title: Health & Wellness/ Yoga Education	Hours	45
			Category	A
Course Prerequisites, if any	NIL			
Course Outcomes	• Gain knowledge and skills in physical fitness, mental well-being, nutrition, mindfulness • Gain practical knowledge on yoga practices • promoting holistic health and lifestyle management.			

Unit No.	Course Content	Hours
	Theory Component	
Unit I	**HEALTH & WELLNESS** Define and differentiate health and wellness Components of health wellness and their relationship between physical activity Local, demographic, societal issues and factors affecting health and wellness. -Diet and nutrition for health & wellness Essential components of balanced diet for healthy living with specific reference to the role of carbohydrates, proteins, fats, vitamins & minerals - malnutrition, under nutrition and over nutrition.	8
Unit II	**MANAGEMENT OF HEALTH AND WELLNESS** Meaning & importance of various dimensions of wellness. Relationship of physical fitness in achieving wellness. Drugs, doping and wellness. Role of diet and exercise in health management.	7
Unit III	**YOGA EDUCATION** Meaning and definition of yoga and its aims and objectives - Basic principles of yoga and its importance in our daily life Yoga for mental attitude - Mind, body, breath and emotional level for higher plan of living.	5
Unit IV	**YOGA PRACTICES** Types and limbs of Yoga postures Asana Breathing Practices - Pranayama Relaxation- Meditation Mudra.	5

Unit V	**FITNESS ACTIVITIES** Types of fitness activities - Outdoor activities - Basic movement patterns. Indoor activity Aerobics/Dance Fitness, Resistance Training for fitness.	5

Recommended Learning Resources	
Text Books	1. Health Promotion: Mobilizing Strengths to Enhance Health, Wellness, and Well- being [1 ed.] F.A. Davis Company 2. Principles of Public Health Administration 2023, Hanlon, John.J.
Reference Books	1. Physical Activity and Health by Claude Bouchard, Steven N. Blair, William L. Haskell. Mental Health Workbook by Emily Attached &Marzia Fernandez, 2021. 2. Mental Health Workbook for Women: Exercises to Transform Negative Thoughts and Improve Well-being by NashayLorick, 2022 3. Lifestyle Diseases: Lifestyle Disease Management, by C. Nyambichu& Jeff Lumiri, 2018. 4. Physical Activity and Mental Health by Angela Clow& Sarah Edmunds, 2013.

Year	I	Course Code: Course Title: Digital Technologies	Credits	2
Sem.	II		Hours	45
			Category	A
Course Prerequisites, if any	NIL			
Course Outcomes	• Learn about digital paradigm • Understand the importance of digital technology, digital financial tools, e-commerce • Analyze the concepts of communication and networks. • Understand the e-governance and digital India initiatives. • Understand the use & applications of digital technology. • Learn the applications of machine learning and big data.			
Unit No.				**Hours**
Unit I	Introduction & evolution of Digital Systems . Role & Significance of Digital Technology. Information & Communication Technology & Tools. Computer System & its working. Software and its type. Operating Systems: Types and functions. Problem Solving : Algorithms and Flowcharts.			7
Unit II	Communication Systems: Principles, Model & Transmission Media. Computer Networks & Internet : Concepts & Applications , WWW , Web Browser, Search Engines, Messaging , Email, Social Networking. Computer Based Information System: Significance & Types. E-Commerce & Digital Marketing : Basic Concepts & Challenges.			7
Unit III	Digital India & e- Governance : Initiatives , Infrastructure , Services and Empowerment . Digital Financial Tools: Unified Payment Interface, Aadhar Enabled Payment System, USSD, Credit/Debit Cards, e-Wallets, Internet Banking , NEFT/RTGS and IMPS, Online Bill Payments and PoS. Cyber Security: Threats, Significance, Challenges , Precautions , Safety Measures & Tools and ethical perspectives.			7
Unit IV	Emerging Technologies & their applications :Overview of cloud computing , Big Data, Internet of Things , Virtual Reality.			7
Unit V	Emerging Technologies & their applications : Block Chain & Crypto currency, Robotics, Machine Learning & Artificial Intelligence , 3D Printing, Digital Signature			7
	Practical Components			
	1. Operating System Installation and Configuration 2. Application Software Installation and Configuration 3. Hardware understanding and minor troubleshooting. 4. Networking, Cabling , Configuration.			10

	Text Books: 1. Pramod Kumar, Anuradha Tomar, R. Sharmila, "Emerging Technologies in Computing - Theory, Practice, and Advances", Chapman and Hall / CRC, First Edition, 2021, https://doi.org/10.1201/9781003121466. 2. V. Rajaraman, "Introduction to Information Technology", PHI, Third Edition, 2018. 3. Dr. S. Jayakumar, B. Chitra, "The Handbook on Digital Technology Education"	

SEMESTER III

Year	II	Course code:	Credits	4
Semester	III	Course Title: Object Oriented Programming using 'JAVA'	Hours	75
			Category	C
Course Prerequisites		Knowledge in Programming Concepts		
Course Outcomes		• To understand the concepts of Object Oriented Programming • To learn the multi-threading programming • To learn the GUI Programming structure • To learn about database programming • To analyze various File System methods and Disk scheduling algorithms • To implement Files and Streams		

Theory Component

Unit-No	Content	Hours
Unit-I	Basic concepts of OOPS, Java Features, Objects and Classes, Accessing Class Members, Data types, Types of Operators, Control statements – Arrays Strings – String Buffer Classes – Wrapper Classes - Constructor & Methods- Types of Constructors – Overloading & overriding	9
Unit-II	Inheritance – Types of Inheritance – Final Keyword - Interface – package – Accessing Package - Introduction to Multithreading – Life cycle of Thread, Thread Methods	9
Unit-III	Exception Handling – Try and catch – throws and finally statement , Files, Streams & Object Serialization – Introduction – Files & Streams – Sequential Access Text Files.	9
Unit-IV	GUI components – Introduction – Overview of Swing components – Swing vs AWT – AWT Controls, Container, Introduction to Event Handling with Nested Classes - Common GUI Event Types and Listener Interfaces - How Event Handling Works – various Event Handling – Layout Manager	9
Unit-V	Applets & Java Web Start – Applet Life-Cycle – Graphics class & Methods – Java web start & Java Network Launch Protocol (JNLP) – JDBC Architecture, Types of JDBC Drivers, Accessing databases with java database connectivity (JDBC)	9

Recommended Learning Resources	
Text Books	1. Java: The Complete Reference, 11th Edition, Herbert Schildt, McGraw-Hill Publication, Dec 2018, 2. Programming with Java, 7th Edition, E. Balagurusamy', McGraw Hill Publication
Reference Books	1. Java 2 Programming: Black Book, Steven Holzner,Dreamtech Press 2015 2. Advanced Java Concepts and Implementation, A.A. Puntambekar, Technical Publications,2021

Practical Component		
Title of the Practical: Object Oriented Programming using JAVA		
Ex. No	**Exercises**	**Hours**
1	Write a program to implement different control structures	**30**
2	Write a program to implement String and String Buffer Classes	
3	Write a program using Wrapper class.	
4	Write a program to implement different types of constructors.	
5	Write a program to implement inheritance concepts	
6	Write a program to implement multiple inheritance using interface concepts	
7	Write a program to demonstrate exception handling.	
8	Write a programs to implement multi threading	
9	Write a program to implement packages in java	
10	Write a program to design GUI using different AWT controls.	
11	Write a program to create menu bar with various menu items and sub menu items.	
12	Write a program to design GUI using layout manager	
13	Write a program to design a calculator in grid layout using swing components	
14	Write a program to implement database connectivity using JDBC	
Tools/Software to be used	JDK 1.8, MySQL, Oracle	

Model Question Paper
MJD3: Object Oriented Programming Using JAVA

Year II/Semester IV

Time: 3 Hours **Max. Marks: 60**

PART A

Answer All Questions (10 × 1 = 10 Marks)

1. Which one of the following is not a Java feature?
   a) Object-oriented
   b) Use of pointers
   c) Portable
   d) Dynamic and Extensible

2. A data type is converted into another data type by the programmer is known as _____?
   a) Type Conversion
   b) Implicit conversion
   c). Type Casting
   d). None of the above

3. Java method overloading implements the OOPS concept ___.
   a) Inheritance
   b) Polymorphism
   c). Encapsulation
   d) None

4. Which of the following statements about inheritance is false?
   a) Java supports single inheritance.
   b) The super keyword can be used to invoke the parent class constructor.
   c) Java allows multiple class inheritance using extends.
   d) Interfaces can be used to achieve multiple inheritance.

5. Which class is used to read characters from a character-based input stream in Java?
   a) InputStreamReader
   b) FileReader
   c) BufferedReader
   d) Scanner

6. What happens if you access an invalid index of an array in Java?
   a) ArrayIndexOutOfBoundsException
   b) NullPointerException
   c) Segmentation Fault
   d) No Error

7. Which one of the following is correct?
   a) Java applets can not be written in any programming language
   b) An applet is not a small program
   c) An applet can be run on its own
   d) Applets are embedded in another applications

8. Which is a component in AWT that can contain another components like buttons, textfields, labels etc.?
   a). Window
   b) Container
   c) Panel
   d) Frame

9. Which class provides many methods for graphics programming?
   a). java.awt
   b) java.Graphics
   c) java.awt.Graphics
   d). None of the above

10. Before executing any SQL query, which method must be called to establish a database connection?
   a) DriverManager.registerDriver()
   b) Connection.prepare()
   c) DriverManager.getConnection()
   d) DriverManager.createConnection()

PART B

Answer All Questions (5 × 4 = 20 Marks)

11. a) Explain the control structures in Java

OR

b)Write short notes on constructor with example.

12. a) Explain the use of final keyword.

OR

b) Explain the life cycle of a thread.

13. a) Write a short note on user-defined exception

OR

b) Explain about streams and files in java

14. a) Describe the AWT Controls in brief.

OR

b) Discuss about Swing components

15. a) Explain the life cycle of an Applet

OR

b) Briefly describe about JDBC connectivity.

PART C

Answer Any Three Questions (3 × 10 = 30 Marks)

16. Explain various features of OOPS Concepts.

17 a) Write the difference between String and StringBuffer class (6 M)

b) Write a program to implement overriding concepts (4 M)

18. Explain about exception handling mechanism with an example

19. Develop a GUI application to implement layout manager.

20.a) Explain about applet methods (5 M)

b) Explain the JDBC Driver class with suitable example (5M)

Year	II	**Course code**:	**Credits**	4
Semester	III	**Course Title**: Data Structures	**Hours**	75
			Category	C
Course Prerequisites		Introductory Knowledge about computing		
Course Outcomes		• Learn basic concepts of and Data structures and algorithms using searching and sorting techniques • Understand the concept of polynomial addition and sparse matrices using arrays. • Apply linked lists to solve problems related to stacks, queues, and sparse matrices. • Understand the operations and traversals of binary trees. • Apply graph algorithms to solve problems like topological sorting & finding minimum cost spanning trees.		
Theory Component				
Unit-No		**Content**		**Hours**
Unit-I		**Introduction** Data Structures: Basic Terminologies – Linear and Nonlinear Data Structures – Algorithm: Properties – Analyzing algorithms. Searching Techniques: Linear search, Binary Search, Fibonacci search. Sorting techniques: Selection Sort, Bubble Sort, Quick Sort, Insertion Sort, Heap Sort and Merge Sort.		11
Unit-II		**Arrays, Stacks and Queues** Arrays: Representation – Polynomial Addition – Sparse Matrices - Multidimensional Arrays. Stacks: Stack ADT - Operations – Applications - Evaluation of Expressions. Queues: Queue ADT - Operations – Applications – Multiple Stacks and Queues.		9
Unit-III		**Lists** Singly Linked Lists – Linked Stacks and Queues – Operations - Circularly Linked Lists – Equivalence Relations – Sparse Matrices - Doubly Linked Lists.		9
Unit-IV		**Trees** Tree: Basic Terminologies - Binary trees – Representation – operations – Traversals, Types - Applications of Trees – AVL trees.		7

Unit-V	**Graphs** Graph: Basic Terminologies – Representation – Operations - Traversals – Applications - Spanning trees, Shortest path Problem, Transitive closure, Topological sort.	9
Recommended Learning Resources		
Text Books	1. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, ―Fundamentals of Data Structures in C, Second Edition, University Press, 2008.	
Reference Books	2. D. Samanta, Classic Data Structures, Second Edition, Prentice-Hall of India, Pvt. Ltd., India, 2012.Computer Organization — Carl Hamacher et al. 3. Richard Gilberg, Behrouz and A. Forouzan, "Data Structures: A Pseudocode Approach with C", Second edition, India Edition 2005.	

Practical Component		
Title of the Practical: Data Structures		
Ex. No	**Exercises**	**Hours**
1.	Search Algorithms (with the number of key comparisons) – Sequential, Binary and Fibonacci search algorithms	30
2.	Evaluation of arithmetic expression	
3.	Stack, Queue, Circular Queue, priority queue	
4.	Singly Linked List, Doubly Linked List, Circular Linked List	
5.	Tree Traversal Techniques	
6.	Graph Traversal Techniques	
7.	Dijkstra's Algorithm to obtain shortest paths	
Tools/Software to be used	**C / Python**	

Model Question Paper
MJD4: Data Structures

II Year/ IV Semester

Time: 3 Hours **Max. Marks: 60**

PART A
Answer All Questions (10 × 1 = 10 Marks)

1. Which of the following is a linear data structure?
   a) Graph
   b) Tree
   c) Array
   d) Hash Table

2. What is the maximum number of swaps that can be performed in the Selection Sort algorithm?
   a) n-1
   b) n
   c 1
   d) n-2

3. Which data structure is used for implementing recursion?
   a) Stack
   b) Queue
   c) List
   d) Array

4. The prefix form of A-B/ (C * D ^ E) is?
   a) -A/B*C^DE
   b) -A/BC*^DE
   c) -ABCD*^DE
   d -/*^ACBDE

3. What is the time complexity to insert an element to the rear of a Linked List (head pointer given)?
   a) O(n)
   b) O(1)
   c) O(nlogn)

d) O(n*logn)

6. Which of the following points is/are not true about Linked List data structure when it is compared with an array?

a) Random access is not allowed in a typical implementation of Linked Lists

b) Access of elements in linked list takes less time than compared to arrays

c) Arrays have better cache locality that can make them better in terms of performance

d) It is easy to insert and delete elements in Linked List

7. Which of the following statements is true about AVL Trees?

a) The difference between the heights of left & right nodes cannot be more than 1

b) The height of an AVL Tree always remains of the order of O(logn)

c) AVL Trees are a type of self – balancing Binary Search Trees

d) All of the above

8. Which of the following represents the Post Order Traversal of a Binary Tree?

a) Left -> Right -> Root

b) Left -> Root -> Right

c) Right -> Left -> Root

d) Right -> Root -> Left

9. In a graph of n nodes and n edges, how many cycles will be present?

a) Exactly 1

b) Utmost 1

c) Utmost 2

d) Depends on the graph

10. Which of the following are applications of Topological Sort of a graph?

a) Sentence Ordering

b) Course Scheduling

c) OS Deadlock Detection

d) All the above

PART B

Answer All Questions (5 × 4 = 20 Marks)

11. a) Write a short notes on analyzing algorithms.

or

b) Write an algorithm to implement Bubble sort with suitable example.

12. a) How Polynomial manipulations are performed with linear data structure? Explain the operations.

or

b) Explain the addition and deletion operations performed on a circular queue with necessary algorithms.

13. a) Explain the linked list implementation of Stack.

or

b) Discuss on Sparse Matrix and its representation.

14. a) Write a function to implement Tree Traversal Techniques.

or

b) Explain the AVL tree insertion and deletion with suitable example.

15. a) What is topological sort? Explain with an example.

or

b) Explain Dijkstra's algorithm with an example.

PART C

Answer Any Three Questions (3 × 10 = 30 Marks)

16. (a) Write a program for searching an element using Binary Search (6 marks)

(b) Explain various operations performed on Data Structures. (4 marks)

17. (a) Write an algorithm to evaluate Postfix Expression. (5 marks)

(b) Write an algorithm to delete an element in the queue. (5 marks)

18. (a) Define a Linked List. Explain different types of linked list, Mention the advantages of linked list. (6 marks)

(b) Write an algorithm to insert a node at the beginning of linked list. (4 marks)

19. (a) Create a binary search tree for the following numbers starting from an empty binary Search tree 45,26,10,60,70,30,40. (5 marks)

(b) Delete keys 10,60 and 45 one after the other and show the trees at each stage. (5 marks)

20. Discuss on Graph Traversal Techniques with suitable example.

Year	II	Course Code: Course Title: Artificial Intelligence	Credits	4
Sem.	III		Hours	75
			Category	C
Course Prerequisites, If any	Exposure to Algorithms, Data structure and Mathematical Logic.			
Course Outcomes	• Explore basic concepts of AI and understand the importance of agents. • Understand various search strategies. • Analyze knowledge representation and reasoning approaches. • Understand the importance of planning in real world scenarios. • Evaluate the architecture of expert systems.			
Unit No.	**Course Content**		**Hours**	
Theory Component				
Unit I	**Introduction** AI – Foundations of AI, Intelligent Agents – Agents and Environments – Good Behavior –Nature of Environments – Structure of Agents.		9	
Unit II	**Problem solving** Problem Solving Agents – Searching for solutionsUninformed Search Strategies – Informed Search Strategies, Heuristic functions - Adversarial search - Local search algorithms and optimization problems – Searching with nondeterministic actions, Constraint satisfaction problems.		9	
Unit III	**Knowledge and reasoning** Logical Agents: Wumpus world - Propositional logic - First order logic: Inference, forward and backward chaining, Resolution		9	
Unit IV	**Planning** Classical planning – Algorithms – Approaches - Planning and acting in real world – Hierarchical planning – Multiagent planning		9	
Unit V	**Expert systems** Expert systems – Introduction – Difference between expert system and conventional programs– Expert system organization – Architecture of Expert system – Knowledge representation techniques- Knowledge		9	

	acquisition techniques - Inference Engine- Explanation systems.	
Text Books	**TEXT BOOKS:** 1. Stuart J Russell and Peter Norvig**,** Artificial Intelligence – A Modern Approach, PHI Learning, Fourth Edition, 2022. 2. Patterson W D, Introduction to Artificial Intelligence and Expert Systems, PHI Learning, First Edition, 1995.	
Reference Book	1. Elaine Rich and Kelvin Knight, Artificial Intelligence, TMH, Third Edition, 2009.	

Practical Component		
Title of the Practical: Artificial Intelligence		
Ex.No	**Exercises**	**Hours**
1	Implement Breadth First Search using Python.	30
2	Implement Depth First Search using Python.	
3	Implement Hill Climbing Algorithm.	
4	Implement A* Algorithm.	
5	Implement Tic-Tac-Toe game using Python.	
6	Implement 8-Puzzle problem.	
7	Implement Water-Jug problem	
8	Implement Travelling Salesman Problem.	
9	Implement Tower of Hanoi using Python.	
10	Implement Monkey Banana Problem.	
11	Implement Alpha-Beta Pruning.	
12	Implement 8-Queens Problem.	
Tools/Software to be used	Python	

MJD: Artificial Intelligence

Model Question Paper

II Year/ III Semester

Time: 3 Hours **Max. Marks: 60**

PART A

Answer All Questions (10 × 1 = 10 Marks)

1. Artificial Intelligence mainly deals with
   a) Natural intelligence
   b) Machine intelligence
   c) Biological intelligence
   d) Emotional intelligence

2. Which of the following is an example of AI application?
   a) Calculator
   b) Compiler
   c) Expert System
   d) Text Editor

3· Intelligent agent perceives its environment using
   a) Sensors
   b) Actuators
   c) Compiler
   d) Interpreter

4. Which search algorithm guarantees optimal solution?
   a) Depth First Search
   b) Breadth First Search
   c) Hill Climbing
   d) Greedy Search

5. Heuristic function is used to
   a) Store data
   b) Estimate cost
   c) Reduce memory
   d) Generate rules

6. Machine Learning is a subset of
   a) Data Mining
   b) Artificial Intelligence
   c) Software Engineering
   d) Database System

7. Which learning uses labeled data?
    a) Reinforcement learning
    b) Unsupervised learning
    c) Supervised learning
    d) Online learning

8. Knowledge base contains
    a) Rules and facts
    b) Only data
    c) Programs
    d) Sensors

9.Which logic is used in AI reasoning?
    a) Boolean logic
    b) Fuzzy logic
    c) Propositional logic
    d) All of the above

10.Turing Test is proposed by
    a) John McCarthy
    b) Alan Turing
    c) Marvin Minsky
    d) Herbert Simon

PART - B

Answer All Questions (5 × 4 = 20 Marks)

11. a) Define Artificial Intelligence and explain its goals.

OR

b) Discuss any two real-time applications of AI with examples.

12. a) Explain the structure of an Intelligent Agent.

OR

b) Describe the role of heuristic function in search algorithms.

13. a) Explain the need for Knowledge Representation in AI systems.

OR

b) Describe the inference process in a knowledge-based system.

14. a) Explain supervised learning with suitable example.

OR

b) Compare supervised and unsupervised learning.

15. a) Explain the architecture of an Expert System.

OR

b) Discuss ethical issues involved in Artificial Intelligence.

PART C

Answer Any Three Questions (3 × 10 = 30 Marks)

16. a) Explain the history and evolution of Artificial Intelligence by describing its major stages of development. (6)

b) Differentiate between Strong AI and Weak AI with suitable examples. (4)

17. Explain the working of Breadth First Search (BFS) algorithm with a suitable example. (5)

b) Explain the importance of heuristic function in informed search techniques. (5)

18. a) Explain Propositional Logic used in Artificial Intelligence with suitable examples.(6)

b) Describe the role of inference mechanism in a knowledge-based system. (4)

19. a) Explain supervised and unsupervised learning techniques with suitable examples. (5)

b) Compare supervised learning and unsupervised learning. (5)

20. a) Explain the ethical issues involved in Artificial Intelligence with real-time examples. (6)
    b) Explain the future scope of Artificial Intelligence. (4)

Year	II	**Course Code:**	**Credits**	3
Semester	III	**Course Title: R Programming**	**Hours**	60
			Category	B
Course Prerequisites, if any	**Basic Computer Knowledge**			
Course Outcomes	• Learn the basics in R programming • Understand to accessing variables and managing subsets of data • Design simple applications using the functions of R programming • Analyze the performance of the plotting tools in R programming • Create a project using the Lattice Package in R programming			

Ex. No	Practical Component	Hours
1	Install R and RStudio, create and execute your first R script, generate basic plots using both base R and ggplot2, install and utilize R packages, and import and explore a dataset	**30**
2	Access specific variables from a data frame and manage subsets of data	
3	Combine two datasets with a common identifier and export your final data set	
4	Read data, explore structure using head(), summary(), and str()	
5	Handle missing values, remove duplicates with duplicated()	
6	Create plots (scatter, line, bar) using ggplot2	
7	Create plots (pie, bar and strip chart, boxplot, Cleveland dotplots, pairplot, coplot) and a composite plot that combines multiple plot types, using R's graphing capabilities	
8	Create advanced visualizations (multipanel scatterplots, boxplots, Cleveland dotplots, histograms, panel functions) using lattice functions in R	
9	Create 3-D scatterplots and surface and contour plots to explore complex data relationships	

The above exercises are designed based on following concepts:

Installing R – Script code – Graphing Facilities in R – Packages – General Issues in R – Getting Data into R – Importing Data

Accessing variables from a Data Frame: – Accessing Subsets of Data – Combining Two Datasets with a Common Identifier – Exporting Data – Recoding Categorical Variables

Simple Functions: The tapply Function – The sapply and lapply Functions – The summary Function – The table Function

Plotting Tools: The plot Function – Symbols, Colours, and Sizes – Adding a Smoothing Line – Loops and Functions

Graphing Tools: Pie Chart – Bar Chart and Strip Chart – Boxplot – Cleveland Dotplots – Pairplot – Coplot – Combining Types of Plots

Lattice Package: High-level Lattice Functions – Multipanel Scatterplots – Multipanel Boxplots – Multipanel Cleveland Dotplots – Multipanel Histograms – Panel Functions – 3-D Scatterplots and Surface and Contour Plots

Recommended Learning Resources	
Text Books	4. Alain F. Zuur, "A Beginner's Guide to R", Springer-Verlag New York Inc., 2019. 5. Robert Knell, "Introductory R: A Beginner's Guide to Data Visualisation, Statistical Analysis and Programming in R", Amazon Digital South Asia Services Inc, Revised Edition, 2014.

Year	II	Course Code:	Credits	3
Semester	III	Course Title: Programming for Mobile Devices	Hours	60
			Category	B
Course Prerequisites	Basic Computer Programming Skill			
Course Outcomes	• Understand the basics of Android Ecosystem • Learn to use the Android Ecosystem • Understand the programming constructs in Kotlin • Understand the process of building interactive apps, Games, Social Media apps • Understand the process of building apps for TVs, Wearable and Android Auto			

Ex. No	Practical Component	Hours
1	Configure Android Studio and set the development environment	30
2	Build a basic Android app for numerical calculations	
3	Build an Android app to use various sensors of the device	
4	Case study: Build a calendar for Tablets	
5	Case Study: Build a diet planner app	

The above exercises are designed based on following concepts:

Configure Android Studio: Installing Software tools - creating an Android App - examining a basic Android app - Improving the App.

Android Studio: Kotlin for Java programmers – Kotlin for Everyone – Object Orientation in Kotlin – Functional Programming in Kotlin – An Introduction to XML.

Jetpack – Building foundations for the App – Architecture of the App – Defining App's behaviour – Interactivity

Building a Game in Android – Case study of building a Social Media App – Building Native applications

Apps for Tablets – Developing for Android Wear – Developing Android TV apps – Case study of App building with Android Auto

Recommended Learning Resources	
Text Books	6. Barry Burd, John Paul Mueller, "Android Application Development: All in–one for Dummies", Third Edition, Wiley India, 2021. 7. Dawn Griffiths, David Griffiths, "Head First Android Development: A Learner's Guide to Building Android Apps with Kotlin", Third Edition, O'Reilly, 2021.

Year	II	**Course Code:**	**Credits**	3
Semester	III	**Course Title:** 3D Modelling & Animation	**Hours**	60
			Category	B
Course Prerequisites, if any	Basic Computer Knowledge			
Course Outcomes	• Understand the basics of 3D modeling and animation concepts. • Learn the various stages of the production pipeline. • Acquire skills to handle digital images, videos, and process them • Become proficient in the usage of 3D modeling and adding visual effects, lighting, and rendering • Develop a model for a given specification • Develop an animated game, story, virtual tour of a building, etc.			

Ex. No	Practical Component	Hours
1	Implementing basic rendering techniques and effects	**30**
2	Developing storyboards, scripts/screenplay, 3D Production layout for a sample scene Ex: Friends meeting at a bus stop	
3	Creating 3D models of characters, props, and environments for the above scene	
4	Adding visual effects to the above scene	
5	Adding texturing and minimal animation to the above scene	
6	Setting up lighting and rendering scenes to achieve desired visual results for early morning moon and night time happening of the above scene	
7	Animating the above scene when the friends board the bus and the bus moves	
8	Developing an animated game	
9	Developing an animated story	
10	Developing an animated virtual building tool	
Tools/Software to be used		

The above exercises are designed based on Blender Foundation tools and concepts:

Rendering and Visual Effects: Rendering Techniques, Shading and Materials, Compositing, Visual Effects, Camera Setup, Scene Rendering

Storyboarding and Scene Layout: Grease Pencil, Storyboarding, Script Visualization, Scene Blocking, Production Layout, Environment Setup

3D Modeling: Character Modeling, Prop Modeling, Environment Modeling, Mesh Editing, Sculpting, Modifiers

Texturing and Materials: UV Mapping, Material Creation, Texture Mapping, Surface Detailing

Lighting: Lighting Setup, Light Types, Shadow Control, Day/Night Scene Creation, Scene Illumination

Animation: Keyframing, Object Animation, Character Animation, Rigging, Timeline, Graph Editor

Virtual Scene and Animation Development: Animated Story Creation, Scene Development, Virtual Building Visualization, Walkthrough Animation

Recommended Learning Resources	
Text Books	8. Andy Beane, "3D Animation Essentials", First Edition, Wiley & Sons, 2012. 9. Magesh Chandramouli, "3D Modeling & Animation: A Primer", CRC Press, 2021. 10. Tony Mullen, "Introducing Character Animation with Blender", Second Edition, Wiley Publishers, 2011.

Year	II	Course Code:	Credits	3
Semester	III	**Course Title:** Game Programming	Hours	60
			Category	B
Course Prerequisites, if any	Basic Programming Knowledge, Computer Graphics			
Course Outcomes	• Understand the concepts of designing a Game • Understand the concepts of 3D programming • Understand the basics of Game Programming • Able to design game play modules • Able to integrate music and sounds in game			

Ex. No	Practical Component	Hours
1	Developing a Puzzle game	30
2	Developing a Multiplayer game using unity.	
3	Developing a 2D game.	
4	Developing a 3D game	
5	Understand and develop the UI design in games	
6	Understanding and apply the role of AI in games	
7	Developing a Character Controller	
8	Implementing Collision Detection and Physics	
9	Adding Sound Effects and Background Music	
10	Creating Game Menus and Scene Navigation	
Tools/Software to be used	Python	

The above exercises are designed based on Unity and core Game Development concepts:

Game Design Fundamentals: Magic Words, Importance of Game Designer Skills, Five Kinds of Listening, Creative Thinking, Player Experience Design

3D Programming Concepts: 3D Models, Shapes, Transformations (Translation, Rotation, Scaling), Rendering, Scene Graphs, 3D Audio, Animation, Basic Programming Concepts

Game Programming Basics: Torque Script, Strings, Objects, Data-Blocks, Game Structure, Client-Server Architecture, Initialization, Player Control

Game Play Modules: Modules, Folder Structure, Control Modules (Client & Server), GUI Creation, Game Execution

Game Sound and Music: Player Sounds, Footsteps, Weapon Sounds, Vehicle Sounds, Environmental Sounds, Interface Sounds, Background Music

Puzzle Game Development: Game Logic Design, Level Design, User Interaction, Scoring System

Multiplayer Game Development: Networking Concepts, Client-Server Communication, Synchronization, Real-Time Interaction

2D Game Development: Sprites, 2D Physics, Animation, Scene Management

3D Game Development: 3D Environment Design, Lighting, Physics, Camera Control

Game UI and AI Development: UI Design, HUD Creation, Menu Systems, Artificial Intelligence, NPC Behavior, Pathfinding

Recommended Learning Resources	
Text Books	1. Jesse Schell, "Art of Game Design", Third Edition, A K Peters/CRC Press, 2019. 2. Kenneth C. Finney, "3D Game Programming – All in One", Third Edition, Cengage Learning, Inc, 2012.

SEMESTER - IV

Year	II	**Course code:**	**Credits**	4
Semester	IV	**Course Title:** Database Management Systems	**Hours**	75
			Category	C
Course Prerequisites		Knowledge of Data Structures and File-Handling		
Course Outcomes		• Understand the fundamentals of Relational Model • Design Real Time applications using Database Query Language (SQL) • Familiarize with the different kinds of PL/SQL Objects • Understand the various Database applications using the Relational Model, ER model and EER model • Construct and normalize conceptual Data Models		

Theory Component

Unit-No	Content	Hours
Unit-I	**Introduction to Relational model** Structure of relational database, Database schema, Keys, Schema diagram, Relational Query language, Relational Algebra.	9
Unit-II	**Introduction to SQL** SQL data definition, basic structure of SQL Queries, set operations, null values, aggregate functions, nested subqueries	9
Unit-III	**Intermediate and advanced SQL** Join expressions, views, transaction, integrity constraints, functions and procedures, triggers.	9
Unit-IV	**Database design using ER model** The Entity-Relationship model, complex attributes, mapping cardinalities, primary key, removing redundant attributes in entity sets, reducing ER diagrams to relational schemas, extended ER features.	9
Unit-V	**Relational database design** Decomposition using functional dependencies, normal forms, First Normal Form, Second Normal Form, Third Normal Form, BCNF, Fourth Normal Form, Fifth Normal Form, functional dependency theory, algorithms for decomposition using functional dependencies, decomposition using multivalued dependencies.	9

Recommended Learning Resources		
Text Books	1. Abraham Silberschatz, Henry F. Korth and S.Sundarshan, "Database System Concepts", Seventh Edition, McGraw Hill International Edition, 2021. 2. Brumm.B, "Beginning Oracle SQL for Oracle Database 18c: From Novice to Professional", First Edition, Apress, 2019.	

Practical Component		
Title of the Practical: Database Management Systems		
Ex.No	**Exercises**	**Hours**
1	To implement the DDL commands using SQL	30
2	To implement the DML commands.	
3	To implement the DDL constraints, DCL, and TCL commands	
4	To implement various built functions and aggregate functions.	
5	To implement the various join operations.	
6	To implement the various nested subqueries.	
7	Creation and manipulation of Views.	
8	To practice the basics of PL/SQL [control structures].	
9	To create the functions and procedures using PL/SQL.	
10	To create the Triggers using PL/SQL.	
Tools/Software to be used	Oracle Database, MySQL	

Model Question Paper

MJD 5: Database Management Systems

II Year/IV Semester

Time: 3 Hours **Max. Marks: 60**

PART A

Answer All Questions (10 × 1 = 10 Marks)

1. Which of the following uniquely identifies a tuple in a relation?
   a) Foreign key
   b) Super key
   c) Primary key
   d) Candidate attribute
2. Which operation is used to combine two relations based on a condition?
   a) Selection
   b) Projection
   c) Join
   d) Union
3. Which SQL clause is used to remove duplicate rows in a query result?
   a) UNIQUE
   b) DISTINCT
   c) REMOVE
   d) DELETE
4. Which aggregate function returns the total number of rows?
   a) SUM()
   b) COUNT()
   c) AVG()
   d) MAX()
5. Which join returns only matching rows from both tables?
   a) Left Join
   b) Right Join
   c) Full Join
   d) Inner Join
6. Which SQL object is automatically executed when a specific event occurs?
   a) View
   b) Procedure
   c) Trigger
   d) Function
7. Which of the following represents a weak entity?
   a) Single rectangle

b) Double rectangle
c) Diamond
d) Oval

8. Which constraint specifies the number of entity instances participating in a relationship?
   a) Cardinality
   b) Degree
   c) Attribute
   d) Key
9. A relation is in 2NF if it is in 1NF and has no:
   a) Transitive dependency
   b) Multivalued dependency
   c) Partial dependency
   d) Functional dependency
10. Which dependency is used in Fourth Normal Form?
    a) Functional dependency
    b) Transitive dependency
    c) Multivalued dependency
    d) Join dependency

PART B

Answer All Questions (5× 4 = 20 Marks)

11. a) Explain the structure of a relational database with an example.

(or)

b) Explain relational algebra and its basic operations.

12. a) Explain SQL data definition language (DDL) commands with examples.

(or)

b) Explain nested subqueries with a suitable example.

13. a) Explain different types of joins in SQL with examples.

(or)

b) Explain integrity constraints in SQL.

14. a) Explain the Entity–Relationship (ER) model with suitable symbols.

(or)

b) Explain complex attributes and mapping cardinalities.

15. a) Explain functional dependencies with examples.

(or)

b) Explain normalization and its importance in database design.

PART C

Answer Any Three Questions (3 × 10 = 30 Marks)

16. Explain the Relational Data Model in detail. (5 Marks)
17. a) Explain SQL set operations with examples. (5 Marks)
    b) Explain NULL values in SQL and their significance. (5 Marks)
18. Explain SQL Joins & types in detail.
19. a) Explain ER diagram with an example. (5 Marks)
    b) Explain mapping ER diagrams to relational schemas. (5 Marks)
20. a) Explain normalization up to Third Normal Form (3NF). (6 Marks)
    b) Explain decomposition using multivalued dependencies. (4 Marks)

Year	II	**Course code**:	**Credits**	4
Semester	IV	**Course Title**: Operating Systems	**Hours**	75
			Category	C
Course Prerequisites		Knowledge of computers & computer organization		
Course Outcomes		• To understand the basic concepts of Operating System and Process • To learn the various mechanisms of CPU scheduling, process synchronization and deadlocks • To understand how the memory is utilized • To analyze various File System methods and Disk scheduling algorithms • Evaluate system structures in various operating systems, such as Linux and Windows and identifying similarities and differences		

Theory Component

Unit-No	Content	Hours
Unit-I	**Overview and Process management** Introduction: Operating System Structures – Operating systems services – System calls. Process Management: Process Concept – process scheduling – operation on processes –CPU Scheduling: Basic Concepts – Scheduling Algorithms Inter process communications – Threads	9
Unit-II	**Process Synchronization and Deadlock** Inter process communications – Threads - Process Synchronization: Critical Section problem – Semaphores – Classical problems of synchronization : Dining Philosopher, Producer and Consumer problem – Deadlock: Deadlock Characterization – Deadlock Handling – Deadlock Prevention – Deadlock Avoidance – Deadlock Detection – Deadlock Recovery	9
Unit-III	**Memory Management** Main Memory: Contiguous Memory Allocation – Relocatable Partitioned Allocation-Paging – Structure of the Page Table – Swapping Virtual Memory: Demand Paging – Page Replacement – Thrashing	9
Unit-IV	**Storage Management** Mass Storage structure: Overview – HDD (Disk) Scheduling – storage management – RAID Structure File Systems: File concepts – Access methods – Directory Structure – File Protection – File system	9

	Implementation – File System Structure – File System Operations – Allocation methods	
Unit-V	**Case Studies** The Linux system: Design principles – kernel modules – process management – Scheduling – Memory Management – Linux File System Windows Operating system: Systems components – Windows File System	9
Recommended Learning Resources		
Text Books	1. Abraham Silberschatz Peter B Galvin, G. Gagne, "Operating Systems Concepts", Tenth Edition, Addison Wesley, 2018. 2. William Stallings, "Operating Systems: Internals and Design Principles", Tenth Edition, Prentice Hall, 2021.	

Practical Component		
Title of the Practical: Operating System		
Ex. No	**Exercises**	**Hours**
1	Practice File handling utilities, Process utilities, Disk utilities, and Networking commands	**30**
2	Write a program to implement various system call operations	
3	Write a program to demonstrate various File management operations	
4	Write a program to simulate CPU scheduling algorithms: FCFS, SJF, Round Robin, and priority	
5	Write a program to simulate solutions to Classical Process Synchronization Problems: Dining Philosophers, Producer – Consumer	
6	Write a program to simulate Bankers Algorithm for Deadlock Avoidance	
7	Write a program to simulate Page Replacement Algorithms: FIFO, Optima	
8	Write a programs to simulate implementation of disk Scheduling Algorithms	
Tools/Software to be used	**1. C / Python** **2. Linux OS**	

Model Question Paper

MJD 6 : Operating Systems

Year II/ Semester IV

Time: 3 Hours **Max. Marks: 60**

PART A

Answer All Questions (10 × 1 = 10 Marks)

1. What is the main function of the command interpreter?
   a) to provide the interface between the API and application program
   b) to handle the files in the operating system
   c) to get and execute the next user-specified command
   d) none of the mentioned
2. To access the services of the operating system, the interface is provided by the _____
   a) Library
   b) System calls
   c) Assembly instructions
   d) API
3. A deadlock avoidance algorithm dynamically examines the _____ to ensure that a circular wait condition can never exist.
   a) operating system
   b) resources
   c) system storage state
   d) resource allocation state
4. Thread is a
   a) Light Weight Process
   b) Heavy Weight Process
   c) Multi Process
   d) I/O processor
5. Where is the operating system placed in the memory?
   a) either low or high memory (depending on the location of interrupt vector)
   b) in the low memory
   c) in the high memory
   d) none of the mentioned
6. The operating system maintains a _____ table that keeps track of how many frames have been allocated, how many are there, and how many are available.
   a) memory
   b) mapping

c) page
d) frame

7. The time taken to move the disk arm to the desired cylinder is called the _____
   a) positioning time
   b) random access time
   c) seek time
   d) rotational latency

8. Which file is a sequence of bytes organized into blocks understandable by the system's linker?
   a) object file
   b) source file
   c) executable file
   d) text file

9. Which of the following statements is true about Linux?
   a) It is a proprietary operating system
   b) It is only used on servers
   c) It is an open-source operating system
   d) It does not support multitasking

10. What does the 'ls -a' command do?
   a) Lists all files except hidden ones
   b) Lists all files including hidden ones
   c) Lists only directories
   d) Lists files in a detailed format

PART B

Answer All Questions (5 × 4 = 20 Marks)

11. a) Explain about System Calls.

OR

b) Explain Round Robin Scheduling Algorithm with an example

12. a) Explain the format of critical section Problem

OR

b) Explain the characteristics of Deadlock .

13. a) Illustrate Single Contagious Memory management technique.

OR

b) Explain about demand paging.

14. a) Explain RAID structure

OR

b) Discuss about File Allocation methods

15. a)Design Principles of Linux Operating System

OR

b) Briefly describe about Kernel Modules.

PART C

Answer Any Three Questions (3 × 10 = 30 Marks)

16. Explain various CPU scheduling algorithms with gnat chart.
17. (a)Explain about Semaphore and its operations.(4 M)

(b) Explain Bankers Algorithm with an example (6 M)

18. a) Explain about paging techniques (5 M)

b) Elucidate about LRU page replacement algorithm with an example. (5 M)

19. Explain various Disk Scheduling Algorithms
20. a) Explain about Linux File System.(5 M)

b) State features and benefits of NTFS in windows. (5 M)

<table>
<tr><td>Year</td><td>II</td><td rowspan="2">Course Code:

Course Title: Mathematical Foundations of Computer Science</td><td>Credits</td><td>4</td></tr>
<tr><td rowspan="2">Semester</td><td rowspan="2">IV</td><td>Hours</td><td>75</td></tr>
<tr><td>Category</td><td>A</td></tr>
<tr><td>Course Prerequisites, if any</td><td colspan="3">• Knowledge of functions, algebra, and pre-calculus</td></tr>
<tr><td>Course Outcomes</td><td colspan="3">• Understand logical statement structures
• Apply operations in problem-solving
• Analyze integer representations and congruences
• Understand counting principles
• Evaluate combinatorial solutions</td></tr>
<tr><td>Unit No.</td><td colspan="2">Course Content</td><td>Hours</td></tr>
<tr><td colspan="4">Theory Component</td></tr>
<tr><td>Unit I</td><td colspan="2">Logic and Proofs
Propositional Logic – Predicates and Quantifiers – Rules of Inference - Proofs – Methods and Strategy</td><td>15</td></tr>
<tr><td>Unit II</td><td colspan="2">Basic Structures
Sets – Functions – Sequences and Summations– Matrices Relations – properties – representation</td><td>15</td></tr>
<tr><td>Unit III</td><td colspan="2">Number Theory
Divisibility and Modular Arithmetic – Integer Representations and Algorithms – Primes and Greatest Common Divisors – Congruences</td><td>15</td></tr>
<tr><td>Unit IV</td><td colspan="2">Induction and Recursion
Mathematical Induction - Strong Induction and Well Ordering - Recursive Definitions and Structural Induction</td><td>15</td></tr>
<tr><td>Unit V</td><td colspan="2">Counting
Basics – Pigeonhole principle – Permutations and Combinations – Binomial Coefficients</td><td>15</td></tr>
<tr><td colspan="4">Recommended Learning Resources</td></tr>
<tr><td>Text Books</td><td colspan="3">1. Kenneth H. Rosen, “Discrete Mathematics and its Applications”, Seventh Edition, McGraw Hill, Seventh Edition, 2017.
2. Trembley. J.P and Manohar. R., “Discrete Mathematical Structures with Applications to Computer Science”, Tata McGraw Hill,, 2020.</td></tr>
</table>

Model Question Paper

MJD 7: Mathematical Foundations of Computer Science

I Year/I Semester

Time: 3 Hours **Max. Marks: 60**

PART A

Answer All Questions (10 × 1 = 10 Marks)

1. Which of the following is the negation of the statement "p ∧ q"?
a) ¬p ∧ ¬q
b) ¬p ∨ ¬q
c) p ∨ q
d) p → q
2. The rule of inference "If p → q and p is true, then q is true" is called:
a) Modus Tollens
b) Hypothetical Syllogism
c) Modus Ponens
d) Resolution
3. If A = {1, 2, 3} and B = {2, 3, 4}, then A ∪ B is:
a) {2, 3}
b) {1, 4}
c) {1, 2, 3, 4}
d) {1, 2, 4}
4. A relation R on a set A is called reflexive if:
a) (a, b) ∈ R implies (b, a) ∈ R
b) (a, a) ∈ R for every a ∈ A
c) (a, b) and (b, c) imply (a, c)
d) (a, b) ∉ R for all a, b ∈ A
5. Which of the following numbers is a prime number?
a) 15
b) 21
c) 29
d) 35
6. What is the remainder when 37 is divided by 5?
a) 0
b) 1
c) 2
d) 3
7. The first step in a proof by mathematical induction is:
a) Induction hypothesis
b) Recursive step

c) Contradiction
d) Base case
8. The value of 4! is:
a) 16
b) 12
c) 24
d) 20
9. How many permutations can be formed using the letters A, B, and C?
a) 3
b) 6
c) 9
d) 12
10. According to the Pigeonhole Principle, if 11 objects are placed into 10 boxes, then:
a) Every box contains exactly one object
b) One box contains at least two objects
c) All boxes contain two objects
d) One box remains empty

PART B

Answer All Questions (5 × 4 = 20 Marks)

11. a) Construct the truth table for the compound proposition ((p \land q) \rightarrow p) and verify whether it is a tautology.

(or)

b) Explain predicates and quantifiers with suitable examples. Distinguish between universal and xistential quantifiers.

12. a) Let (A = {1,2,3,4,5}) and (B = {3,4,5,6,7}). Find:

- (A \cup B)
- (A \cap B)
- (A - B)
- (B - A)

(or)

b) Define a relation. Explain the properties of relations: reflexive, symmetric and transitive with examples.

13. a) Find the GCD of 84 and 30 using the Euclidean Algorithm.

(or)

b) Explain modular arithmetic. Evaluate:

- (29 \bmod 6)
- (45 \bmod 8)
- ((7 + 9) \bmod 5)

14. a) Prove by mathematical induction that

[
1 + 3 + 5 + \cdots + (2n-1) = n^2
]
for all positive integers (n).

(or)

b) Define recursion. Write a recursive definition for the factorial function and compute (5!).

15. a) Explain permutations and combinations. Find:

- (^{6}P_{3})
- (^{6}C_{3})

(or)

b) State the Pigeonhole Principle and illustrate it with a suitable example. Show that among 13 people, at least two have birthdays in the same month.

PART C

Answer Any Three Questions (3 × 10 = 30 Marks)

16. a) Explain predicates and quantifiers with examples. (5 Marks)

b) Discuss the various methods of proof: direct proof, proof by contradiction, and proof by contrapositive. (5 Marks)

17. a) i) Explain the operations on sets with suitable examples. (5 Marks)

b) Define a function and explain injective, surjective, and bijective functions with examples. (5 Marks)

18. a) Explain divisibility and modular arithmetic with suitable examples. Solve the following:

- (37 \bmod 5)
- (52 \bmod 7)
- ((15+18) \bmod 6)

19. a) i) State the Principle of Mathematical Induction. (7 Marks)

ii) Prove that
[
1+2+3+\cdots+n=\frac{n(n+1)}{2}
]
for all positive integers (n) using mathematical induction.
Explain strong induction and the well-ordering principle. (3 Marks)

20**. a)** State and explain the Pigeonhole Principle with an example. (4 Marks)

b) i) Explain permutations and combinations with suitable examples. (6 Marks)

ii) Find:

- (^{8}P_{3})
- (^{8}C_{3})
- (^{10}C_{4}) (5 Marks)

<table>
<tr><td>Year</td><td>II</td><td colspan="2" rowspan="3">Course Code:
Course Title: Machine Learning</td><td>Credits</td><td>4</td></tr>
<tr><td rowspan="2">Sem.</td><td rowspan="2">IV</td><td>Hours</td><td>75</td></tr>
<tr><td>Category</td><td>C</td></tr>
<tr><td>Course Prerequisites, If any</td><td colspan="5">• Probability and Statistics</td></tr>
<tr><td>Course Outcomes</td><td colspan="5">• Understand the basic concepts and types of Machine Learning (ML)
• Prepare the data for ML model, train the model and evaluate the model's performance
• Understand the fundamentals of features and feature engineering
• Build a ML model with the appropriate supervised algorithm for the data
• Build a ML model with the appropriate unsupervised algorithm for the data</td></tr>
<tr><td>Unit No.</td><td colspan="4">Course Content</td><td>Hours</td></tr>
<tr><td colspan="6">Theory Component</td></tr>
<tr><td>Unit I</td><td colspan="4">Introduction to Machine Learning
Human Learning – MachineLearning –Types of Machine Learning – Supervised learning – Unsupervised Learning – Reinforcement Learning – Applications
Preparing to model
Types of data – structure – quality and remediation – pre–processing</td><td>9</td></tr>
<tr><td>Unit II</td><td colspan="4">Modelling and Evaluation
Selecting – Training – Model representation and interpretability – Performance evaluation
Feature Engineering
Introduction – Transformation – Feature subset selection – Issues in high dimensional data – Feature selection – Key drivers – Measures – process – Approaches</td><td>9</td></tr>
<tr><td>Unit III</td><td colspan="4">Supervised Learning – Classification
Introduction – Example – Model – Learning steps – Algorithms – k– Nearest neighbor – Decision tree – Random Forest model – Support Vector machines</td><td>9</td></tr>
<tr><td>Unit IV</td><td colspan="4">Supervised Learning – Regression
Introduction – Example – Model – Algorithms – Simple and Multiple linearregression – Assumptions – Main problemsin regression analysis – Logistic regression – Maximum Likelihood estimation</td><td>9</td></tr>
</table>

Unit V	**Unsupervised Learning** Introduction – Applications – Clustering – Types – Partitioning methods – Hierarchical clustering – Density-based methods – DBSCAN – The Apriori algorithm for association rule learning	9
Text Books	**TEXT BOOKS:** 1. Saikat Dutt, Chandramouli.S, Amit Kumar Das., " Machine Learning", Pearson, 2018. 2. Alpaydin, E., "Introduction to Machine Learning", MIT Press,Fourth Edition, 2020	

Practical Component		
Title of the Practical: Machine Learning		
Ex.No	**Exercises**	**Hours**
1	Write a python program to compute a. Central Tendency Measures: Mean, Median, Mode b. Measure of Dispersion: Variance, Standard Deviation	30
2	Develop a program to create histograms for all numerical features and analyze the distribution of each feature.	
3	Develop a program to demonstrate the working of the decision tree algorithm use any dataset.	
4	To implement KNN classifier using any dataset.	
5	To Implement Support Vector Machines use iris dataset.	
6	To Implementation of Logistic Regression	
7	To implement Linear Regression.	
8	To implement clustering algorithms.	
9	Apriori algorithm for association rule learning	
10	Performance analysis of Classification Algorithms on a specific dataset (Mini Project)	
Tools/Software to be used	Python	

Model Question Paper
MJD 20: Machine Learning
II Year/ III Semester

Time: 3 Hours **Max. Marks: 60**

PART A
Answer All Questions (10 × 1 = 10 Marks)

1. Which of the following is an example of **Supervised Learning**?
a) K-means clustering
b) Linear regression
c) DBSCAN
d) Reinforcement learning

2. What is the primary goal of **Reinforcement Learning**?
a) To find patterns in unlabeled data
b) To predict a continuous value
c) To learn by interacting with the environment
d) To classify objects into categories

3. Which technique is used to **evaluate the performance of a machine learning model**?
a) Cross-validation
b) Principal component analysis (PCA)
c) Data normalization
d) Feature extraction

4. **Feature selection** is used to:
a) Increase the number of features
b) Select the most important features
c) Eliminate irrelevant data
d) Preprocess the data for normalization

5. Which algorithm is a **classification model**?
a) K-means
b) Decision Tree
c) Linear Regression
d) DBSCAN

6. The **Support Vector Machine (SVM)** algorithm is most commonly used for:
a) Clustering data

b) Classification tasks
c) Regression analysis
d) Dimensionality reduction

7. **Logistic Regression** is used to predict:
a) Continuous values
b) Binary outcomes
c) Cluster assignments
d) Data distribution

8. In **linear regression**, the relationship between variables is assumed to be:
a) Non-linear
b) Exponential
c) Linear
d) Logarithmic

9. Which of the following is a **clustering algorithm**?
a) K-means
b) Linear regression
c) Decision Tree
d) Naive Bayes

10. **DBSCAN** is a density-based clustering algorithm. What does DBSCAN stand for?
a) Density-Based Spatial Clustering of Applications with Noise
b) Data-Based Supervised Clustering and Noise
c) Density-Based Structured Clustering Algorithm
d) Decision-Based Spatial Classification Algorithm

.

PART B

Answer All Questions (5 × 4 = 20 Marks)

11. a) Define machine learning and explain the types of machine learning in brief.

or

b) Describe the role of data pre-processing in machine learning.

12. a) Discuss the importance of feature engineering and feature selection in machine learning.

or

b) What are the steps involved in model performance evaluation?

13. a) Explain the concept and working of k-Nearest Neighbor (k-NN) algorithm.

or

b) Describe how the Random Forest algorithm works with an example.

14. a) Define regression analysis. Explain the assumptions in linear regression.

or

b) Discuss logistic regression and its applications in machine learning.

15. a) What is clustering? Explain the working of hierarchical clustering.

or

b) Discuss DBSCAN and its application in density-based clustering.

PART C

Answer Any Three Questions (3 × 10 = 30 Marks)

16. Explain supervised learning with examples. Discuss its various algorithms and their applications.

17 (a) Define feature selection in machine learning and discuss the methods used for feature selection.(5 marks)

(b) What are the challenges faced in high-dimensional data and how can they be addressed? (5 marks)

18. Discuss in detail the decision tree algorithm. Explain how it is used in classification problems.

19 (a) Explain simple linear regression with an example. How do you evaluate the performance of a linear regression model? (6 marks)

(b) Discuss about multiple linear regression and its applications.(5 marks)

20 (a) Define clustering and explain the types of clustering methods used in unsupervised learning. (5 marks)

(b) Discuss the Apriori algorithm and its application in association rule learning.(5 marks)

Semester-V

Year	III	Course code:	Credits	4
Semester	V	**Course Title**: Computer System Architecture	Hours	75
			Category	C
Course Prerequisites		Basic knowledge of Computer and Digital Logic		
Course Outcomes		• Understand the basic functions of computer • Working with binary and arithmetic operations • Understand the organization of CPU and working principles • Understand the Input-Output organization in a computer • Understand the Memory organization in a computer		

Theory Component

Unit-No	Content	Hours
Unit-I	**Introduction to Computer Systems** Evolution of computers and computer generations - Basic functional units of a computer - Computer organization vs. computer architecture - Instruction execution cycle - Types of computer systems (desktop, server, embedded systems) - Performance metrics: clock rate, CPI, MIPS, MFLOPS	9
Unit-II	**Data Representation and Transfer** Datatypes - Complements - Fixed - Point Representation - Floating Point Representation - Register Transfer - Bus and Memory Transfer - Arithmetic - Logic and Shift Micro operations	9
Unit-III	**CPU Organization** Register and Stack - Instruction Format - Addressing Modes - Data Transfer and Manipulation - Program Control - RISC - Basics of Pipelining	9
Unit-IV	**Input-Output Organization** Peripheral devices - I/O Interface - Asynchronous data transfer - Modes of transfer - Priority Interrupt - DMA - Serial Communication	9
Unit-V	**Memory Organization** Memory Hierarchy - Main Memory - Auxiliary Memory - Associative Memory - Cache Memory - Virtual Memory – Memory Management Hardware	9

Recommended Learning Resources

Text Books	1. Morris Mano, "Computer System Architecture", Pearson Education, 2017. 2. Computer Organization and Architecture — William Stallings.

Reference Books	1.Structured Computer Organization — A.S. Tanenbaum 2.Computer Organization — Carl Hamacher et al.

Practical Component		
Title of the Practical: Computer system Architecture		
Ex. No	**Exercises**	**Hours**
1.	Simplify Boolean expressions using Karnaugh maps.	30
2.	Design a combinational circuit	
3.	Implementing Logical Left and Right Shifts	
4.	Understand different data types and how to calculate complements	
5.	Evaluate performance improvement through instruction level parallelism	
6.	Analyze the effect of cache performance on system performance.	
7.	Understand the impact of memory hierarchy on access time.	
Tools/Software to be used	Logisim - win – 2.7.1 / SimulatorNew	

Model Question Paper
MJD8: Computer System Architecture

III Year/ V Semester

Time: 3 Hours **Max. Marks: 60**

PART A

Answer All Questions (10 × 1 = 10 Marks)

1. Which of the following was a major characteristic of the First Generation of computers?
   a) Use of microprocessors
   b) Use of transistors instead of vacuum tubes
   c) Use of vacuum tubes and punched cards
   d) Use of integrated circuits (ICs)

2. Which of the following is **NOT** considered a basic functional unit of a computer system?
   a) Arithmetic Logic Unit (ALU)
   b) Control Unit (CU)
   c) Input / Output Unit
   d) Cache Memory

3. Which of the following is the correct 2's complement representation for the decimal number -5, assuming 8-bit representation?

   a) 11111011
   b) 11111001
   c) 110011001
   d) 101011001

4. In the **Register Transfer** language, the operation R1 ← R2 + R3 represents:

   a) Transfer the contents of R2 to R1
   b) Transfer the contents of R3 to R1
   c) Add the contents of R2 and R3, and store the result in R1
   d) Add the contents of R1 and R2, and store the result in R3

5. Which of the following is the primary purpose of the **stack** in CPU organization?

   a) To store the instruction set of the program
   b) To hold temporary data for function calls and returns
   c) To store the final output of computations
   d) To maintain the memory management unit (MMU)

6. Which of the following addressing modes uses the **effective address** of the operand as the memory address to access the data
   a) Direct Addressing
   b) Indirect Addressing
   c) Register Addressing
   d) Immediate Addressing

7. Which of the following is the primary function of an **I/O interface**?
   a) To manage and schedule CPU tasks
   b) To translate between different data formats used by CPU and peripheral devices
   c) To execute arithmetic operations on data
   d) To store program instructions and data

8. Which of the following is a key advantage of **Direct Memory Access (DMA)** over **programmed I/O (PIO)**?
   a) It requires no CPU intervention during data transfer
   b) It requires frequent CPU involvement in data transfer
   c) It operates only with peripheral devices connected to serial ports
   d) It is faster than any interrupt-driven I/O mechanism

9. In the **memory hierarchy**, which of the following memory types is the **fastest** and closest to the **CPU**?
   a) Main Memory (RAM)
   b) Auxiliary Memory (Hard Disk)
   c) Cache Memory
   d) Virtual Memory

10. Which of the following is true regarding **virtual memory**?
   a) It allows programs to exceed the physical memory limit by using disk storage
   b) It is faster than main memory
   c) It is a type of auxiliary memory
   d) It directly improves the speed of the CPU

PART B

Answer All Questions (5 × 4 = 20 Marks)

11. a) Explain the different generations of computers and the technological advancements that characterized each generation.

or

   b) Explain the key performance metrics used to evaluate the performance of a computer system.

12. a) Explain the differences between fixed-point and floating-point representation of numbers in a computer system.

or

b) Explain the various types of micro-operations.

13. a) Explain the different types of instruction formats used in a computer's CPU.

or

b) Explain the concepts of pipelining in CPU design.

14. a) Explain the concept of asynchronous data transfer and its significance in an I/O interface.

or

b) Describe the working of Direct Memory Access (DMA) and its advantages over program-controlled I/O.

15. a) Explain the role of cache memory in improving system performance.

or

b) Explain the concept of virtual memory and how memory management hardware supports its implementation.

PART C

Answer Any Three Questions (3 × 10 = 30 Marks)

16. Explain the steps involved in the Instruction Execution Cycle

17. Describe the process of performing register transfer, bus, and memory transfer for an arithmetic operation.

18. (a) Discuss the concept of **RISC** (Reduced Instruction Set Computer) and its advantages over **CISC** (Complex Instruction Set Computer). (5 marks)

(b) Explain the different addressing modes in a CPU, their significance. (5 marks)

19. (a) Explain the concept of priority interrupts. (5 marks)

(b) Explain the concept of Serial communication. (5 marks)

20. (a) Describe the role of memory management hardware in the efficient functioning of a computer system. (6 marks)

(b) Distinguish between Associative memory and Auxiliary memory. (4 marks)

Year	III	**Course code**:	**Credits**	4
Semester	V	**Course Title**: Computer Networks	**Hours**	75
			Category	C
Course Prerequisites		Fundamentals of computers		
Course Outcomes		• Learn the basics of Network topology • Learn about the various physical network media • Understand the functionalities of all the network layers • Familiarize the protocols of different layers • Implement the various network protocols		

Theory Component

Unit-No	Content	Hours
Unit-I	**Introduction and Physical Layer** Introduction to Networks, Topology, Network Architecture, Reference Models, Transmission Media: Guided Media & Unguided Media, Multiplexing & De-Multiplexing, Switching.	9
Unit-II	**Data link layer** Data link layer Design Issues, Error Detection and Correction , Elementary Data Link Protocols, Sliding window Protocols	9
Unit-III	**Network Layer** Design Issues, Routing , Logical Addressing, IP Working- IPV4 Vs IPV6, Address Mapping, delivery, Forwarding, Routing Algorithm: Distance Vector – Link State – Flooding-Broadcast-Multicast.	9
Unit-IV	**Transport Layer** The Transport Service, Service provided to the Upper Layers, Flow Control & Buffering, TCP Congestion Control, UDP , TCP Vs UDP	9
Unit-V	**Upper Layers** Session Layer functions: Dialogue control and Synchronization Presentation Layer functions: Data Compression, Encryption & Decryption, and Translation. Application Layer functions: Domain Naming System, DNS Namespace, Resource Records, Name Servers, Electronic mail, Messages Formats, Message Transfer.	9

Recommended Learning Resources

Text Books	1. Andrew S. Tanenbaum, David J. Wetherall, “Computer Networks”, Fifth Edition, Prentice Hall publisher, 2022. 2.Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Fifth Edition, Morgan Kaufmann Publishers Inc., 2015.

Reference Books	1.James F. Kurose, Keith W. Ross," Computer Networking - A Top-Down Approach Featuring the Internet", Seventh Edition, Pearson Education, 2022.

Practical Component		
Title of the Practical: Computer Networks		
Ex. No	**Exercises**	**Hours**
1	Implementation of Basic Chat	**30**
2	Implementation of File Transmission	
3	Implementation of Client Server Application using RMI	
4	Implementation of Client Server Application Using Socket	
5	Implementation of Error Detection Techniques	
6	Implementation of Error Correction Techniques	
7	Implementation Sliding Window Protocol	
8	Implementation of Routing Algorithms.	
9	Implementation of congestion control strategy	
10	Implementation of RSA Algorithm	
Tools/Software to be used	**Java JDK/Python**	

Model Question Paper

MJD 7: Computer Networks

Year III/ Semester V

Time: 3 Hours **Max. Marks: 60**

PART A

Answer All Questions (10 × 1 = 10 Marks)

1. What is the full form of OSI?
   a) Optical service implementation
   b) Open service Internet
   c) Open system interconnection
   d) Operating system interface
2. Which topology requires a multipoint connection
   a) Ring
   b) Bus
   c) Star
   d) Mesh
3. Communication at the data-link layer is
   a) end-to-end
   b) node-to-node
   c) Process-to-process
   d) None of the choices are correct
4. Which error detection methods use one's complement arithmetic?
   a) Simple parity check
   b) Checksum
   c) Two-dimensional parity check
   d) CRC
5. In a block, the prefix length is /24; what is the mask?
   a) 255.255.255.0
   b)255.255.242.0
   c) 255.255.0.0
   d) 255.254.240.0
6. _____ is not a function of network layer
   a) routing
   b) inter-networking

c) congestion control

d) error control

7. What is the size of the UDP Packet Header in the Transport Layer?

a) 8 bytes

b) 16 bytes

c) 20 bytes

d) 12 bytes

8. What TCP Port is used for SMTP

a) port 21

b) port 25

c) port 22

d) port 23

9. What is the primary function of the Session Layer

a) Routing packets

b) Error detection

c) Establishing, managing, and terminating connections/sessions

d) Converting data to signals

10. Protocols like HTTP, FTP, and SMTP operate at which layer

a) Presentation Layer

b) Session Layer

c) Application Layer

d) Network Layer

PART B

Answer All Questions (5 × 4 = 20 Marks)

11. a) Explain the various physical topologies with neat sketches.

OR

b) Explain Twister pair? It's types.

12. a) A bit stream 10011101 is transmitted using the CRC method. The generator Polynomial is x3 + l. Show the actual bit string transmitted.

OR

b) What is framing? Explain different types of framing protocols with their format

13. a) Explain the purposes of using ARP and RARP in the network layer.

OR

b) Write short notes on ICMP and DHCP protocols.

14. a) Demonstrate the TCP segment structure.

OR

b) Demonstrate the UDP segment structure.

15. a) Explain the role of SMTP in email transmission with a diagram

OR

b) .Explain the traditional cryptography used for network security and privacy

PART C

Answer Any Three Questions (3 × 10 = 30 Marks)

16. Explain OSI Reference model with neat diagram (10 marks)
17. Describe the sliding window protocol for data link layer (10 marks)
18. Explain how routing performed using link state algorithm is. Illustrate with an Example (10 marks)
19. Describe the TCP congestion control approaches with necessary diagrams (10 marks)
20. (a) Explain Message format in Application layer. (5 marks)

    (b) How DNS help in Internet? Illustrate the namespace of DNS. (5 marks)

Year	III	**Course code**:	**Credits**	4
Semester	V	**Course Title**: Design and Analysis of Algorithms	**Hours**	75
			Category	C
Course Prerequisites		Basic Knowledge in Data Structures and Programming		
Course Outcomes		• Analyze the efficiency of algorithms and compare their performance using • appropriate metrics • Understand the general approach of Brute Force and Divide and Conquer • algorithms • Understand the principles of the Greedy Method in algorithm design • Understand the principles of Dynamic Programming • • Understand the principles of Backtracking and branch and bound strategies		

Theory Component

Unit-No	Content	Hours
Unit-I	**Introduction** Notation of Algorithm – Analysis of Algorithm Efficiency – Asymptotic Notations and Basic Efficiency classes – Mathematical Analysis of Non recursive and recursive Algorithms	9
Unit-II	**Divide and Conquer** Brute Force and Divide and conquer – Binary Search – Finding the maximum and minimum – merge sort – quick sort	9
Unit-III	**Greedy Method** General method – Knapsack problem – Job Sequencing – Spanning Trees – Prims's Algorithm and Kruskal's Algorithm	9
Unit-IV	**Dynamic Programming** General method – Principle of Optimality – Multistage Graphs – 0/1 Knapsack – Travelling Salesman Problem	9
Unit-V	**Backtracking & Branch Bound** Backtracking – General Method – 8-Queen Problem – Sum of Subsets – Hamiltonian Cycles – Branch and Bound: Introduction FIFO Solution – LC Branch and Bound – 0/1 Knapsack	9

Recommended Learning Resources

Text Books:	1. Horowitz E. and Sahani S., "Fundamentals of Computer Algorithms", Second Edition, Universities press, 2008. i.S. Sridar, "Design and Analysis of Algorithms", Oxford University Press, 2014

Practical Component		
Title of the Practical: Design and Analysis of Algorithm		
Ex. No	**Exercises**	**Hours**
1	Write recursive and iterative algorithms and analyze the time complexities of using Big-O notation	**30**
2	Implement and compare the efficiency of sorting algorithms (e.g., bubble sort, quicksort) on different input sizes	
3	Implement merge sort and analyze its time complexity with different input sizes	
4	Implement binary search algorithm	
5	Implement a greedy algorithm for the knapsack problem and analyze its efficiency	
6	Implement Prim's algorithm for finding the minimum cost spanning tree	
7	Implement Kruskal's algorithm for the same purpose and compare the results	
8	Solve the 0/1 knapsack problem using dynamic programming and analyze the time complexity	
9	Implement a backtracking solution for the subset sum problem and analyze its efficiency	
10	Implement backtracking solution for 8-Queens problem	
Tools/Software to be used	**Python / JAVA / C**	

Model Question Paper

MJD10: Design and Analysis of Algorithms

Year: III / Semester: V

Time: 3 Hours **Max. Marks: 60**

PART A

Answer All Questions (10 × 1 = 10 Marks)

1. Which of the following best describes space complexity?
   a) The amount of time an algorithm takes to run
   b) The amount of memory an algorithm requires to execute
   c) The number of inputs an algorithm can handle
   d). The number of times an algorithm loops
2. Which asymptotic notation represents the worst-case time complexity of an algorithm?
   a) Θ(n)
   b) O(n)
   c) Ω(n)
   d). All of the above
3. What is the time complexity of merge sort in all cases?
   a) O(n)
   b) O(n log n)
   c) O(n^2)
   d) O(log n)
4. Quick sort is an example of a sorting algorithm based on which strategy?
   a) Dynamic programming
   b) Greedy approach
   c) Divide and conquer
   d) Backtracking

5. Which of the following algorithms is the best approach for solving Huffman codes?
   a) greedy algorithm
   b) exhaustive search
   c) divide and conquer algorithm
   d) brute force algorithm
6. Which of the following is false in the case of a spanning tree of a graph G?
   a) It is tree that spans G

b) It is a subgraph of the G

c) It includes every vertex of the G

d) It can be either cyclic or acyclic

7. Which of the following is/are property/properties of a dynamic programming problem?

A . Optimal substructure

B . Overlapping subproblems

C . Greedy approach

D . Both optimal substructure and overlapping subproblems

8. What does the "0/1" in "0/1 Knapsack Problem" signify?

A . Each item can only be used once.

B . Each item can be divided into smaller parts.

C . Each item is available in unlimited quantities.

D . Each item has no value or weight.

9. How many possible solutions exist for an 8-queen problem?

A . 100

B . 98

C . 92

D . 88

10. In the context of solving the 0/1 Knapsack problem, what does the `bound` represent?

A . The minimum weight of items to be included in the knapsack.

B . The maximum value that can be achieved from the items left after branching.

C . The total weight capacity of the knapsack.

D . The number of items that can be chosen.

PART B

Answer All Questions (5 × 4 = 20 Marks)

11. a) Explain about the properties of an algorithm **(OR)**

b) Briefly describe about empirical analysis of algorithm

12. a) Explain about divide and conquer method **(OR)**

b) Write an algorithm for finding the maximum of N numbers.

13. a) List the pros and cons of greedy method **(OR)**

b) Define spanning tree. List out the properties of spanning tree.

14. a) Discuss about the principles of optimality **(OR)**

b) Elucidate on multistage graph

15. a) How does branch and bound technique work? **(OR)**

b) Write the algorithm and explain about Hamilton cycle with example

PART C

Answer Any Three Questions (3 × 10 = 30 Marks)

16. a) Discuss on recursive algorithm and analyze it .**(5Marks)**

b) Explain about asymptotic notations.**(5 Marks)**

17. With an example write the algorithm for quick sort.

18. Write a note on Prim's and Kruskal's algorithm about constructing a spanning tree.

19.a) Find the optimal solution of the fractional Knapsack problem with n=7 and the knapsack capacity of m=15. The profits and weights of the items are given below. **(7 Marks)**

Objects: 1 2 3 4 5 6 7

Profit (P): 5 10 15 7 8 9 4

Weight (w): 1 3 5 4 1 3 2

b) Briefly describe the difference between greedy method and dynamic programming. **(3 Marks)**

20. a) Highlight the working principle of 8 –Queens problem. **(5 Marks)**

b) Explain about sum of subset problem with example. **(5 Marks)**

Year	III	Course Code:	Credits	4
Semester	V	Course Title: Operations Research	Hours	75
			Category	A
Course Prerequisites, if any	● Basic Mathematical and Problem Solving Skills			
Course Outcomes	● Understand and comprehend the basics of Linear Programing Problem (LPP) ● Learn LPP solving methods and explore duality in LPP ● Solve assignment problem and their variants ● Find the feasible and optimal solutions for transportation problems ● Perform critical path analysis and reviewing of a project			
Unit No.	**Course Content**		**Hours**	
Theory Component				
Unit I	**Introduction** Operation Research – Definition – Characteristics – Techniques – Applications. LPP – Introduction – Applications and components of LPP – Steps in solving LPP.		15	
Unit II	**LPP** Mathematical formulation – Graphical method – Simplex method – Artificial variables – Big-M method - Two-phase method – Degeneracy and unbound solutions – Duality in LPP – Formulation – Relationship between primal and dual problems.		15	
Unit III	**Assignment Model** Mathematical formulations - Hungarian Method – Variants of the Assignment problem.		15	
Unit IV	**Transportation Problem** Mathematical formulation – Finding basic feasible solutions – NWCR, LCM and VAM – Optimal solution – MODI method.		15	
Unit V	**Network Scheduling** Introduction – Basic components – Logical sequencing – Rules of network construction – Concurrent Activities – Critical Path Analysis -Activity Time and Floats – Project Evaluation and Review Technique (PERT) – Three Time Estimates – Critical Path Analysis of PERT network – Probability of completion of Project.		15	
Recommended Learning Resources				
Print Resources	1. Kanti Swarup, P.K. Gupta, Man Mohan, "Operations Research", 20th Edition, Sultan Chand & Sons, 2023. 2. Taha H.A., "Operations Research: An Introduction", 10th Edition, Pearson Education, 2019.			

<table>
<tr><td>Year</td><td>III</td><td rowspan="2">Course Code:
Course Title: Artificial Neural Networks</td><td>Credits</td><td>4</td></tr>
<tr><td rowspan="2">Sem.</td><td rowspan="2">V</td><td>Hours</td><td>75</td></tr>
<tr><td></td><td>Category</td><td>C</td></tr>
<tr><td>Course Prerequisites, If any</td><td colspan="4">Basic knowledge in Artificial Intelligence and Machine Learning</td></tr>
<tr><td>Course Outcomes</td><td colspan="4">• Understand various learning techniques in machine learning.
• Understand linear regression and implement it on various datasets
• Learn linear classification techniques and ensemble classifiers
• Understand perceptron’s and its architecture
• Understand neural networks and its applications</td></tr>
<tr><td>Unit No.</td><td colspan="3">Course Content</td><td>Hours</td></tr>
<tr><td colspan="5">Theory Component</td></tr>
<tr><td>Unit I</td><td colspan="3">INTRODUCTION

Machine Learning- Basic definitions- Types of learning: Unsupervised learning – Reinforcement Learning – Supervised Learning – hypothesis space and inductive bias – Probably Approximately Correct (PAC) Learning – Learning multiple classes – Model selection and Generalization - Evaluation and Cross validation.</td><td>9</td></tr>
<tr><td>Unit II</td><td colspan="3">REGRESSION AND CLASSIFICATION

Linear Regression - Least Squares -Under-fitting / Overfitting - Validation – Logistic Regression- Gradient Linear Models - Support Vector Machines – Kernel Methods -Instance based Methods - K-Nearest Neighbours - Tree based Methods – Decision Trees</td><td>9</td></tr>
<tr><td>Unit III</td><td colspan="3">ENSEMBLE METHODS & MLP

Bagging- Random forest - Boosting - GBDT- Stacking - Cascading - Multilayer Perceptrons: Introduction – Perceptron – Training a Perceptron – Learning Boolean Functions</td><td>9</td></tr>
<tr><td>Unit IV</td><td colspan="3">NEURAL NETWORKS
Neural Networks – Biological Motivation-– Feed Forward Network – Back Propagation - Activation and Loss Functions - from shallow networks to deep networks – vanishing gradient problem – hyperparameter tuning - batch normalization - regularization - dropout</td><td>9</td></tr>
</table>

Unit V	**APPLICATIONS** Stock Prediction - Handwriting digit classification - Disease prediction - Weather forecasting	9
Text Books **Reference Books**	1. Stephen Marsland, "Machine Learning: An Algorithmic Perspective", Chapman & Hall/CRC, 2nd Edition, 2014. 2. Kevin Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2nd edition, 2020 3. Ethem Alpaydin, "Introduction to Machine Learning", 4th Edition, Adaptive Computation and Machine Learning Series, MIT Press, 4th edition, 2020 4. Tom M Mitchell, "Machine Learning", McGraw Hill Education, 2013.	

Practical Component		
Title of the Practical: Artificial Neural Networks		
Ex. No	**Exercises**	**Hours**
1	Implement a simple vector addition in TensorFlow.	**30**
2	Implement a basic matrix operation in TensorFlow.	
3	Implement a regression model in Keras.	
4	Implement a perceptron in Tensor Flow/Keras Environment.	
5	Implement a Feed-Forward Network in Tensor Flow/Keras.	
6	Using a pre-trained model on Keras for Transfer Learning	
7	Implement an Image Classifier using CNN in Tensor Flow/Keras.	
8	Implement any simple Reinforcement Algorithm for an NLP problem	
9	Implement an Object Detection using CNN in Tensor Flow	
10	Implement a Transfer Learning concept in Image Classification.	
Tools/Software to be used	**Python Frameworks – Tensor Flow / PyTorch /Keras**	

SEMESTER - VI

Year	III	**Course code**:	**Credits**	4
Semester	VI	**Course Title**: Software Engineering Theory and Practice	**Hours**	75
			Category	C
Course Prerequisites		Basic knowledge of programming and information systems		
Course Outcomes		• Understand the fundamental concepts of design thinking • Analyze and document the software requirements • Apply appropriate software engineering design concepts to develop software. • Apply software testing strategies • Understand and consider the significance of security in software development process		

Theory Component

Unit-No	Content	Hours
Unit-I	**Introduction to Design Thinking** Design process – Traditional design - Design thinking – Existing sample design projects - Study on designs around us- Compositions/structure of a design -Innovative design - Breaking of patterns - Reframe existing design problems – Principles of creativity Empathy - Customer Needs – Insight –leaving from the lives of others/standing on the shoes of others -Observation.	9
Unit-II	**Software Engineering and Software Requirements** Defining software engineering, Software lifecycle models ,Selection of a life cycle model - Requirements engineering, Types of requirements, Feasibility studies, Requirements elicitation, Requirement analysis, Requirement documentation, Requirement validation.	9
Unit-III	**Software Project Planning** Size estimation, Cost estimation, Models ,Constructive cost model, Software risk management, Software design, Modularity, Strategy of design, Function oriented design, Object oriented design.	9
Unit-IV	**Testing Strategies** A strategic approach to software testing, Test strategies for conventional software, Black – Box and White – Box testing, Validation testing, System testing, The art of Debugging.	9

Unit-V	**Secure Software Engineering** Introduction - The problem - Software assurance and software security-Threats to software security – Software in security - Benefits of detecting software security defects early - Managing secure software development –Defining Properties – Influencing the security properties of software –To assert and specify desired security Properties.	9
Recommended Learning Resources		
Text Books:	1. Tim Brown, "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation", 1"edition, HarperCollins Publishers Ltd, 2019. 2.Roger S. Pressman, Bruce Maxim, "Software Engineering, A Practitioner's Approach", 9'"edition, McGraw Hill International Edition, 2023.	
Reference Books	1. Allen, "Software Security Engineering: A Guide for Project Managers", 1"edition, 2008.	

Practical Component		
Title of the Practical: Software Engineering Theory and Practice		
Ex. No	**Exercises**	**Hours**
1	Study of Software Engineering & Life Cycle Models	**30**
2	Library System	
3	Course Registration System	
4	Quiz System	
5	Student marks analyzing system	
6	Online ticket reservation system	
7	Stock maintenance System	
8	Test Strategy Development	
9	Requirement Validation	
10	Software Project Planning	
Tools/Software to be used	**Star UML**	

Model Question Paper

MJD12: Software Engineering Theory and Practice

III Year/ VI Semester

Time: 3 Hours **Max. Marks: 60**

PART A

Answer All Questions (10 × 1 = 10 Marks)

1. What is the primary goal of the "Empathize" stage in Design Thinking?

a) To create high-fidelity software models.

b) To understand users' emotions, needs, and motivations.

c) To finalize technical specifications.

d) To brainstorm numerous solutions.

2. Which is NOT a core stage in the typical Design Thinking process?

a) Empathize

b) Define

c) Iterate

d) Test

3. What are types of requirements?

(a) Availability

(b) Reliability

(c) Usability

(d) All of the mentioned.

4. Which is NOT a step of Requirement Engineering?

(a) Elicitation

(b) Design

(c) Analysis

(d) Documentation.

5. Which of the following is an important factor that can affect the accuracy and efficacy of estimates?

a) Project size

b) Planning process

c) Project complexity

d) Degree of structural uncertainty

6. What describes the data and control to be processed?

a) Planning process

b) Software scope

c) External hardware

d) Project complexity

7. In the context of software testing, what is the "Master Test Plan"?

a) A document outlining the entire testing process

b) A tool used for automated testing

c) A set of predefined test cases

d) A defect in the code

8. How does "Static Analysis" contribute to software testing?

a) By analyzing code without executing it

b) By executing test cases in a dynamic environment

c) By focusing only on manual testing

d) By evaluating the user interface

9. Which of the following is a layer of protection for Security ?

a) Platform-level protection

b) Application-level protection

c) Record-level protection

d) All of the mentioned

10. What are security controls?

a) Controls that are intended to ensure that attacks are unsuccessful

b) Controls that are intended to detect and repel attacks

c) Controls that are intended to support recovery from problems

d) All of the mentioned

PART B

Answer All Questions (5 × 4 = 20 Marks)

11. a). Explain Design Thinking with example?

or

b). What are the test stages of design thinking?

12. a) Describe the phases of a generic software life cycle.

or

b) What are the characteristics of a good SRS document?

13. a) Explain LOC and Function Point metrics

or

b) What is software cost estimation? Why is it important?

14. a) Explain black-box testing techniques.

or

b) Explain the relationship between testing and debugging.

15. a) Explain common threats to software security

or

b) Describe the CIA triad in software security.

PART C

Answer Any Three Questions (3 × 10 = 30 Marks)

16. Describe in detail any 3 prototyping methods with examples.
17. (a) Describe different types of software requirements with suitable examples. (5 marks)
    (b) What is the importance of selecting an appropriate life cycle model? (5 marks)
18. Analyze the advantages and limitations of the COCOMO model.
19. (a) Explain white-box testing techniques with suitable examples. (5 marks)
    (b) Explain the testing life cycle with a neat diagram. (5 marks)
20. (a) Explain different threats to software security in detail. (6 marks)
    (b) Describe techniques for influencing security properties of software. (4 marks)

Year	III	Course code:	Credits	4
Semester	VI	Course Title: Web Engineering	Hours	75
			Category	C
Prerequisites, if any		Nil		
Course Outcomes		• Understand the process of web publishing • Acquire skills developing web pages using HTML • Acquire skills to style the web pages using CSS • Acquire skills to build server-side web components • Explore the mobile web development process		

Theory Component

Unit-No	Content	Hours
Unit-I	**Introduction to World Wide Web** Introduction to web publishing – Web browsers – Web servers – Uniform Resource Locators – Using browser-based developer tools.	9
Unit-II	**Introduction to HTML and CSS** Structuring a web page with HTML – Basic elements – Lists – Links – Tables – Images – Forms. Using CSS to style a site – CSS for positioning – Integrating Multimedia elements	9
Unit-III	**Introduction to JavaScript** The structure – Operators – Variables – Control structures – Functions – Arrays – Objects – Validation	9
Unit-IV	**Introduction to PHP** Setting up the server – PHP language basics – built–in functions – library functions – using includes – database connectivity – sending email – cookies and sessions – File uploads	9
Unit-V	**Mobile Web** Mobile browsing needs – text on mobile web – design and page layout – links – images and multimedia – CSS for mobile – making use mobile features – Best practices	9

Recommended Learning Resources

Text Books	1. Laura Lemay, Rafe Coburn, Jennifer Kyrnin, “Sams Teach yourself HTML, CSS & Javascript Web Publishing, Pearson Education, 2016.

Practical Component		
Title of the Practical: Web Engineering		
Ex. No	**Exercises**	**Hours**
1	Build your resume using simple static html	**30**
2	Enrich your resume with CSS	
3	Implement an HTML Form with JavaScript validation	
4	Build a web application to demonstrate event handling in JavaScript	
5	Add a server-side component to the task #3	
6	Build a server-side data storage web application	
7	Build a web application to demonstrate session handling	
8	Build a web application to demonstrate cookies handling	
9	Implement mobile web application	
10	Implement file uploads in a web application	
11	Select and Develop any one Case Study from the list provided below: 1. E-Commerce Web Application (Mobile-Friendly Online Shopping System) 2. Food Delivery Web Application (Zomato/Swiggy Style) 3. Social Media Web Application (Instagram-like System) 4. Smart Job Portal Website (Naukri/LinkedIn Style) 5. Mobile-First Travel Booking Website	
Tools/Software to be used	HTML, Javascript, PHP	

.

Model Question Paper

MJD 13: Web Engineering

III Year/VI Semester

Time: 3 Hours **Max. Marks: 60**

PART A

Answer All Questions (10 × 1 = 10 Marks)

1. What is a web browser?
   a) A person who likes to look at websites.
   b) A computer that stores WWW files.
   c) A software program that allows you to access sites on the World Wide Web.
   d) A spider that crawls the internet.

2. Which of the following is NOT a popular web browser?
   a) Google Chrome
   b) Safari
   c) Firefox
   d) Microsoft Word

3. Which HTML tag is used to define an internal style sheet?
   a) <css>
   b) <script>
   c) <style>
   d) <link>

4. Which attribute is used to provide a unique name to an HTML element?
   a) class
   b) type
   c) id
   d) name

5. JavaScript is an _____ language?
   a) Object-Based
   b) Procedural
   c) Object-Oriented
   d) None of the above

6. How do you stop an interval timer in JavaScript?
   a) clearInterval()
   b) clearTimer()
   c) stopInterval()
   d) stopTimer()

7. What does PHP stand for?
   a) Personal Home Page
   b) Hypertext Preprocessor
   c) Pretext Hypertext Processor
   d) Both a and b

8. Who is considered the father of PHP?
   a) Drek Kolkevi
   b) Rasmus Lerdorf
   c) Willam Makepiece
   d) List Barely

9. What does GSM stand for in mobile communication?
   a) Global System for Mobile Communications
   b) General Service Module
   c) Grouped Signal Management
   d) Global Standard Mobile

10. Which class is the parent of all Activity widgets in Android?
   a) ViewGroup
   b) View
   c) Layout
   d) Widget

PART B

Answer All Questions (5 × 4 = 20 Marks)

11. a).List and Explain about any four Web Servers with suitable example.

(or)

   b).Discuss about some web based developer Tools in detail.

12. a) Describe about HTML Lists with example.

(or)

   b) How Forms are used in HTML for web pages. Explain

13. a) Derive the importance of Operators and their uses in Javascript

(or)

b) Explain about the need of Arrays in Javascript.

14. a) Briefly discuss about Built in Functions and their uses in PHP Programming

(or)

b) List and explain Cookies and Sessions in PHP.

15. a) Explain about Mobile Apps in detail with practical examples

(or)

b) Discuss how to link images and Multimedia in Mobile apps.

PART C

Answer Any Three Questions (3 × 10 = 30 Marks)

16. Discuss briefly about Uniform Resource Locator with suitable Example.

17. (a) Explain the role of Cascading Style Sheets in designing the web pages with examples.

(b) List and Explain any Integrating Multimedia components in detail.

18. Briefly explain about various Validation Techniques used in Javascript with example.

19. (a) Explain about database connectivity in PHP

(b) Discuss about PHP in Server Side Scripting Language with suitable Example.

20. (a) Discuss about Sources of new mobile features with practical Examples.

(b) List and discuss about Text Components used in Mobile Web.

Year	III	Course code:	Credits	4
Semester	VI	**Course Title:** Soft Computing	Hours	75
			Category	C
Course Prerequisites		Basic knowledge of mathematics, programming concepts, algorithms, familiarity with problem-solving and logical reasoning.		
Course Outcomes		• Understanding of different soft computing techniques • Ability to identify, analyze and apply suitable soft computing techniques to solve real life problems • Apply genetic algorithms for real-time search, optimization, and design problems • Apply neural networks for pattern recognition and prediction tasks • Apply fuzzy reasoning for real-time control systems		

Theory Component

Unit-No	Content	Hours
Unit-I	**Introduction to Soft Computing:** Introduction, Soft Computing vs Hard computing, Soft computing characteristics, Constituents of soft computing, From conventional AI to Computational Intelligence	9
Unit-II	**Fuzzy Set Theory, Fuzzy Logic and Fuzzy Reasoning**: Introduction, Fuzzy Set and Fuzzy Logic, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Decision Making, Fuzzy Clustering, Fuzzy Expert System.	9
Unit-III	**Genetic Algorithms:** Introduction to Optimization, Basic Concepts of Genetic Algorithms (GA), Working principle, Encoding, Fitness function, Genetic Operators - Selection, Crossover, Mutation, Convergence of GA, Variants of GA, Multi-objective Optimizations with GA, Applications of GA	9
Unit-IV	**Neural Network:** Introduction to machine learning with Neural Networks, Types of learning, Neural network architectures, Single layer networks, Multilayer networks with backpropagation learning, Radial basis function Networks, Unsupervised learning with Neural Networks, Advances in Neural Networks, Applications of neural networks, Overview of Reinforcement Learning	9

Unit-V	**Hybrid systems:** Types of Hybridizations, Neuro-fuzzy systems, Neuro-genetic Systems, Fuzzy genetic systems, Applications of hybrid systems	9
Recommended Learning Resources		
Text Books	1. Jyh Shing Roger Jang, Chuen Tsai Sun, Eiji Mizutani, Neuro-Fuzzy and Soft Computing, Prentice Hall of India, 2003 2. S.N.Sivanandam, S.N.Deepa, Principles of Soft Computing, Wiley India Pvt. Ltd	

Practical Component		
Title of the Practical: Soft Computing		
Ex.No	**Exercises**	**Hours**
1	Implementation of Single layer networks	**30**
2	Implementation of Multilayer networks with Backpropagation algorithms	
3	Use of neural networks for classification applications-1	
4	Use of neural networks for classification applications-2	
5	Use of neural networks for regression applications	
6	Working with genetic algorithms	
7	Using GA for various optimization problems	
8	Design of Fuzzy control systems	
9	Application development using Fuzzy control systems	
10	Implementation of fuzzy C-means clustering	
11	Study of hybrid systems	
Tools/Software to be used	Python	

Model Question Paper

MJD 14: Soft Computing

III Year/VI Semester

Time: 3 Hours **Max. Marks: 60**

PART A Answer All Questions (10 × 1 = 10 Marks)

1. Soft Computing is primarily characterized by:
   a) Exact solutions
   b) Deterministic approaches
   c) Tolerance for imprecision and uncertainty
   d) Strict mathematical modeling

2. Which of the following is NOT a constituent of Soft Computing?
   a) Fuzzy Logic
   b) Neural Networks
   c) Genetic Algorithms
   d) Relational Databases

3. A fuzzy set is characterized by:
   a) Binary membership
   b) Partial membership
   c) No membership
   d) Fixed membership

4. The function that maps an element to a value between 0 and 1 is called:
   a) Objective Function
   b) Membership Function
   c) Fitness Function
   d) Activation Function

5. Which genetic operator combines information from two parent chromosomes?
   a) Mutation
   b) Selection
   c) Crossover
   d) Replacement

6. The fitness function in a Genetic Algorithm is used to:
   a) Encode solutions
   b) Evaluate solution quality
   c) Perform mutation
   d) Create populations

7. Backpropagation learning is associated with:
   a) Single Layer Perceptron

b) Multilayer Neural Networks
c) Genetic Algorithms
d) Fuzzy Systems

8. Which learning type does not require labeled training data?
a) Supervised Learning
b) Reinforcement Learning
c) Unsupervised Learning
d) Backpropagation Learning

9. Neuro-Fuzzy systems combine:
a) Neural Networks and Databases
b) Neural Networks and Fuzzy Logic
c) Genetic Algorithms and Databases
d) Fuzzy Logic and Data Mining

10. Reinforcement Learning is based on:
a) Reward and Punishment
b) Membership Functions
c) Crossover Operations
d) Clustering Techniques

PART B Answer All Questions (5 × 4 = 20 Marks)

11. a) Differentiate between Soft Computing and Hard Computing.

(or)

b) Explain the characteristics and constituents of Soft Computing.

12. a) Define Fuzzy Sets and explain operations on fuzzy sets.

(or)

b) Discuss membership functions with suitable examples.

13. a) Explain the working principle of Genetic Algorithms.

(or)

b) Describe the role of selection, crossover, and mutation operators in Genetic Algorithms.

14. a) Explain different types of learning in Neural Networks.

(or)

b) Discuss the architecture of a Multilayer Neural Network.

15 a) Explain Fuzzy Inference Systems and their applications.

(or)

b) Describe Neuro-Fuzzy Systems and their advantages.

Year	III	Course Code:	Credits	4
Sem.	VI		Hours	75
		Course Title: Compiler Design	Category	C
Course Prerequisites, if any	• Knowledge in Assembly Programming			
Course Outcomes	• To understand the various phases of designing a compiler . To use grammars for parsing. • Analyze and differentiate between various parsing techniques • Evaluate and integrate syntax-directed definitions and type checking in compiler construction • To understand the concept of code optimization and code generation			
Unit No.	**Course Content**			**Hours**
Theory Component				
Unit I	Introduction to Compiler – Compliers – Analysis of the source program – Phases of compiler – cousins of the compiler – grouping of phases – compiler construction tools – simple one pass compiler – overview – syntax definition – syntax directed translation – parsing – lexical analysis – incorporating symbol table.			9
Unit II	Lexical analysis – role of lexical analyzer – input buffering – specification of tokens – recognition of token – finite automata – from a regular expression to NFA – design of a lexical analyzer generator – optimization of DFA based pattern matches			9
Unit III	Syntax Analysis – role of the parser – top-down parsing – bottom-up parsing - operator precedence parsing – LR parsers – using ambiguous grammar – syntax directed translation – syntax directed definitions – construction of syntax trees .			9
Unit IV	Runtime environment – source language issues – storage organization – storage allocation strategies – storage allocation in C, parameter parsing – intermediate code generation – intermediate languages – declaration – assignment statements			9
Unit V	Code generation – issues in the design of a code generator – runtime storage management – basic blocks and flow graph – register allocation and assignment – DAG representation of basic blocks, generating code from DAGs- introduction to code			9

	generation – introduction – principle sources of optimization – peephole optimization.	
	Text Book 1. Alfred Aho, Jeffrey D.Ullman, Ravi Sethi , "Compiler Design-Principles Techniques and Tools", 2nd edition, Pearson Education, 2011 (Unit 1 to 5) **REFERENCES:** 1. V. Raghavan, Principles of Compiler Design‖, Tata McGraw Hill Education Publishers, 2010.	
Practical Component		
Exercises	1. Write a Program for Token separation with a given expression. 2. Write a Program for Token separation with a given file. 3. Write a Program for Lexical analysis using LEX tools. 4. Write a Program to identify whether a given line is a comment or not. 5. Write a Program to check whether a given identifier is valid or not. 6. Write a Program to recognize strings under 'a', 'a*b+', 'abb'. 7. Write a Program to simulate lexical analyzer for validating operators. 8. Write a Program for implementation of Operator Precedence Parser. 9. Study of LEX and YACC tools: (i) Write a Program for implementation of calculator using YACC tool. (ii) Write a Program for implementation of Recursive Descent Parser using LEX tool.	30

Model Question Paper

MID 3: Compiler Design

Time : 3 Hrs Marks : 60

PART – A

Answer ALL the Questions (10*1=10 Mark)

1. Compiler is a program that
   a) Accepts a program written in a high level language and produces an object program
   b) Appears to execute a source program as if it were machine language
   c) Automates the translation of assembly language into machine language
   b) Places programs into memory and prepares them for execution

2. The lexical analyzer takes ____ as input and produces a list of ___ of output.
   a) Machine code, mnemonic
   b) Tokens, source code
   c) Source code, tokens
   d) Both a and b

3. A top-down parser generates
   a) Left-most derivation in reverse
   b) Left-most derivation
   c) Right-most derivation in reverse
   d) Right –most derivation

4. What is the similarity between LR, LALR and SLR?
   a) Use same algorithm, but different parsing table
   b) Same parsing table, but different algorithm
   c) Their Parsing tables and algorithm are similar but uses top down approach
   d) Both Parsing tables and algorithm are different

5. Syntax-directed translation is based on
   a) Tokens
   b) Symbol table
   c) **Parse tree structure**
   d) Target machine

6. Static type checking is performed at
   a) Run time
   b) **Compile time**
   c) Load time
   d) Execution end

7. Type checking is normally done during
    a) Code optimization
    b) Syntax directed translation
    c) Lexical analysis
    d) Syntax analysis

8. Which of the following cannot be used as an intermediate code form?
    a) Quadruples
    b) Syntax trees
    c) Three address codes
    d) Post fix notation

9. Input to code generator is _____
    a) Source code
    b) Intermediate code
    c) Target code
    d) All of the mentioned

10. DAG representation of a basic block allows _____
    a) Automatic detection of local common sub expressions
    b) Detection of induction variables
    c) Automatic detection of loop variant
    d) None of the mentioned

PART – B

Answer ALL the Questions 5*4=20 Mark)

11. Draw the phases of compiler and describe each phase of it.

(OR)

12. Define finite automata. Explain the two types of finite automata with suitable example.
13. Write Rules to construct FIRST Function and FOLLOW Function. compute first and follow functions

    E->E+T / T; T->T*F / F; F->(E) / a / b

(OR)

14. Construct LALR parsing table for the following grammar: E-> E+T | T; T-> T*F | F; F->id
15. Write the quadruples, triples and indirect triples for the expression: (a*b)+(c+d)-(a+b+c+d).

(OR)

16. Explain about Symbol Table.
17. Explain how a syntax tree is used in type checking.

(OR)

18. Explain implicit and explicit type conversions
19. State and explain peephole optimization as an effective techinuque to improve the locally target code.

(OR)

20. Write a short note on optimization of basic blocks using Directed Acyclic Graph (DAG) and draw the syntax tree and DAG for the following expression: (a*b)+(c-d)*(a*b)+b.

PART – C

Answer Any THREE Questions (3*10=30 Mark)

21. Create DFA the following NFA.
    M=({q0,q1},{0,1},δ,q0,{q1})
    Where δ(q0,0)={q0,q1}
    δ (q0,1)={q1}
    δ(q1,0)=ϕ
    δ(q1,1)={q0,q1}
22. Construct Stack implementation of shift reduce parsing for the grammar
    E->E+E
    E->E*E
    E->(E)
    E->id and the input string id1+id2*id3
23. Explain about intermediate code generation and its types.
24. Explain Storage Allocation Strategies and Parameter Passing.
25. Construct the DAG for the following basic blocks
    1. t1:=4*i
    2. t2:=a[t1]
    3. t3:=4*i
    4. t4:=b[t3]
    5. t5:=t2*t4
    6. t6:=prod+t5
    7. prod:=t6
    8. t7:=i+1
    9. i:=t7
    10. if i<=20 goto 1

Year	IV	Course Code:	Credits	4
Semester	VII	**Course Title:** Distributed Systems	Hours	75
			Category	C
Course Prerequisites, if any	Basic knowledge of Operating Systems and Computer Networks			
Course Outcomes	• Learn basic concepts of Distributed Systems • Understand state-of-the-art distributed system • Design and develop Client / Server Applications • Learn to setup fault tolerance and replication servers • Design and implement CORBA and DCOM			

Unit No.	Course Content	Hours
	Theory Component	
Unit I	**Introduction** Definition – Goals – Hardware and Software Concepts – Client / Server Model Communication – Layered Protocols RPC – Remote Object Invocation – Message Oriented Communication	9
Unit II	**Client Server** Client Server and Naming Entity – Threads – Client Server – Code Migration – S/W Agents – Naming Entity – Location Mobile Entity	9
Unit III	**Synchronization** Distributed Transactions – Synchronization – Clock Synchronization – Logical Clocks – Global States – Election Algorithms – Mutual Exclusion	9
Unit IV	**Distributed Transactions and Recovery** Distributed Transaction Consistency and Replication – Data Centric Consistency – Fault Tolerance – Distributed Commit – Recovery - Distributed Object Database System – CORBA – DCOM – GLOBE	9
Unit V	**Distributed File System** Introduction - Distributed File System – Distributed Document based System – WWW – Distributed Coordination based System – JINI	9

Recommended Learning Resources	
Text Books	1. Andrew S. Tanenbaum, Maarten van Steer, "Distributed Systems Principles and Paradigms", Third Edition, Prentice Hall India, 2017. 2. George Couloursis, Jean Dollomore and Tim Kinderberg, "Distributed Systems - Concepts and Design", Fifth Edition, Addison-Wesley, 2011.

Practical Component		
Title of the Practical: Distributed Systems		
Ex. No	**Exercises**	**Hours**
1	Perform arithmetic operation using RMI	**30**
2	Calculate simple and compound interest using RMI	
3	Implementation of ATM using RMI	
4	Implementation of Telephone Directory using RMI	
5	Implementation of Quiz Server using Servlets.	
6	Implementation of Online Shopping System using servlets	
7	Implementation of Matrimonial System using servlets	
8	Implementation of servlet-based Airline Reservation System	
9	Create a Word Document with text using DCOM and Visual Basic.	
10	Develop any ONE case study listed below: 1. Google File System (GFS) 2. Amazon Dynamo (NoSQL Key-Value Store) 3. Apache Hadoop (HDFS + MapReduce) 4. Domain Name System (DNS) 5. World Wide Web Architecture	
Tools/Software to be used	Java/Python	

Model Question Paper
MJD 16: Distributed Systems
IV Year/ VII Semester

Time: 3 Hours **Max. Marks: 60**

PART A
Answer All Questions (10 × 1 = 10 Marks)

1.The main goal of a distributed system is to:
a) Centralize resources
b) Improve resource sharing and transparency
c) Reduce hardware usage
d) Eliminate communication

2.RPC stands for:
a) Remote Program Control
b) Remote Procedure Call
c) Reliable Process Communication
d) Remote Protocol Communication

3. A naming entity in a distributed system is used to:
a) Store data
b) Identify and locate resources
c) Synchronize clocks
d) Detect failures

4. Code migration in client-server systems refers to:
a) Data replication
b) Moving code between systems
c) Thread synchronization
d) Naming resolution

5. Logical clocks are used in distributed systems to:
a) Measure real time
b) Order events
c) Synchronize hardware clocks
d) Detect failures

6. Mutual exclusion ensures that:
a) All processes execute concurrently

b) Only one process accesses a critical section at a time
c) Resources are replicated
d) Deadlocks never occur

7. CORBA enables communication between:
a) Homogeneous systems only
b) Distributed objects across platforms
c) Databases only
d) File systems

8. DCOM is primarily associated with:
a) Java-based systems
b) Microsoft distributed object model
c) Web-based applications
d) Open-source middleware

9. A distributed file system allows users to:
a) Access remote files as if they were local
b) Store data only locally
c) Avoid file replication
d) Eliminate networking

10. JINI is mainly used for:
a) Distributed coordination and service discovery
b) File compression
c) Data encryption
d) Clock synchronization

PART B

Answer All Questions (5 × 4 = 20 Marks)

11. a) Define a distributed system and explain its goals.

(or)

b) Explain the client/server model of communication.

12. a) Discuss the role of threads in client-server systems.

(or)

b) Explain code migration and software agents.

13. a) Explain clock synchronization in distributed systems.

(or)

b) Describe mutual exclusion in distributed systems.

14. a) Explain the architecture and features of CORBA.

(or)

b) Discuss DCOM and its role in distributed object systems.

15. a) Explain the concept of a distributed file system.

(or)

b) Describe the World Wide Web as a distributed document-based system.

PART C

Answer Any Three Questions (3 × 10 = 30 Marks)

16. Explain layered protocols, RPC, and message-oriented communication in distributed systems.

17. (a) Explain naming entities and location of mobile entities. (5 marks)
(b) Discuss software agents in client-server environments. (5 marks)

18. Explain distributed transactions, two-phase commit, and recovery mechanisms in distributed systems.

19. (a) Explain logical clocks and global states. (5 marks)
(b) Describe election algorithms in distributed systems. (5 marks)

20. (a) Explain the architecture and working of a distributed file system. (6 marks)
(b) Discuss JINI as a distributed coordination-based system. (4 marks)

Year	IV	**Course Code:**	**Credits**	4
		Course Title: System Modelling and Simulation	**Hours**	75
Semester	VII		**Category**	C
Course Prerequisites, if any	Basic knowledge in Statistics			
Course Outcomes	• Understand the fundamentals of modelling and simulation • Learn about statistical models and input modelling • Understand the techniques for random number generation • Perform the simulation of dynamic systems • Able to verify the simulation models			
Unit No.	**Course Content**		**Hours**	
Theory Component				
Unit I	**Introduction** Simulation tool - Advantages and disadvantages of Simulation - Areas of application- Systems and system environment - Components of a system; Discrete and continuous systems - Model of a system; Types of Models - Discrete-Event System Simulation example - Simulation of queuing systems - General Principles.		9	
Unit II	**Statistical Models in Simulation** Review of terminology and concepts - Useful statistical models - Discrete distributions - Continuous distributions - Poisson process - Empirical distributions - General Principles - Characteristics of queuing systems - Queuing notation - Long- run measures of performance of queuing systems –Steady-State Behaviour of finite population models (M/M/C/K/K)		9	
Unit III	**Random-Number Generation** Properties of random numbers - Generation of pseudo-random numbers - Techniques for generating random numbers - Tests for Random Numbers		9	
Unit IV	**Input Modeling** Data Collection - Identifying the distribution with data - Parameter estimation - Goodness of Fit Tests - Fitting a non-stationary Poisson process - Selecting input models without data – Multivariate & Time - Series input models.		9	
Unit V	**Simulation Models** Verification, Calibration and Validation - Optimization, Model building, verification and validation - Verification of simulation models - Verification of simulation models - Calibration and validation of models, Optimization via Simulation.		9	
Recommended Learning Resources				

Text Books	1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol, "Discrete-Event System Simulation", Fifth Edition, Pearson Education, 2013. 2. Lawrence M. Leemis, Stephen K. Park, "Discrete – Event Simulation: A First Course", Pearson Education, 2013.	

Practical Component		
Title of the Practical: System Modelling and Simulation		
Ex. No	**Exercises**	**Hours**
1	Computer Generation of Random Numbers.	**30**
2	Chi-square goodness-of-fit test	
3	One-sample Kolmogorov-Smirnov test	
4	Test for Standard Normal Distribution	
5	Monte-Carlo Simulation.	
6	Simulation of Single Server Queuing System.	
7	Simulation of Two-Server Queuing System.	
8	Simulate and control a conveyor belt system	
9	Two-sample Kolmogorov-Smirnov test	
10.	Case studies	
Tools/Software to be used	**JAVA / PYTHON / SPSS TOOLS**	

Model Question Paper

MJD: SYSTEM MODELLING AND SIMULATION

IV Year / VII Semester

Time: 3 Hours **Max. Marks: 60**

PART A

Answer All Questions (10 × 1 = 10 Marks)

1. Which of the following is an advantage of a simulation?
   a) Gives exact optimal solution always
   b) Can study complex systems without disturbing the real system
   c) Requires no data collection
   d) Eliminates uncertainty
2. In the Able and baker call centre problem, Able and Baker represent:
   a) Customers
   b) Arrival events
   c) Two service channels (servers)
   d) Queue disciplines
3. Which of the following is a discrete probability distribution?
   a) Normal Distribution
   b) Exponential Distribution
   c) Poisson Distribution
   d) Uniform Distribution
4. In Queueing notation M/M/1,the last number 1 denotes,
   a) Arrival rate
   b) Service rate
   c) Number of servers
   d) Queue length
5. A good random number should possess:
   a) Predictability
   b) Uniformity and Independence
   c) Repetition
   d) Correlation
6. Which of the following is a technique for generating pseudo-random numbers?
   a) Monte Carlo Method
   b) Linear Congruential Method
   c) Queueing Method
   d) Event Scheduling Method

7. Which of the following is the first step in input modeling?
   a) Validation
   b) Data Collection
   c) Optimization
   d) Calibration.
8. Which test is commonly used to determine whether a theoretical distribution fit observed data?
   a) Runs Test
   b) Goodness-of-Fit Test
   c) t-Test
   d) F-Test.
9. Verification of a simulation model answers the question:
   a) Are we building the right model?
   b) Are we building the model right?
   c) Is the system profitable?
   d) Is the data random
10. Validation of a simulation model is used to:
   a) Generate random numbers
   b) Fit distributions
   c) Determine whether the model accurately represents the real system
   d) Estimate parameters.

PART B

Answer All Questions (5 × 4 = 20 Marks)

11. (a) When is simulation an appropriate tool and when is it not appropriate?

(OR)

(b) Discuss the situations in which simulation should and should not be used.

12. (a) Distinguish between discrete and continuous probability distributions with examples.

(OR)

(b) Explain the Poisson process and its applications in simulation.

13. (a) Explain the properties of random numbers.

(OR)

(b) What are pseudo-random numbers? Explain their importance in simulation.

14. (a) Explain the steps involved in data collection for simulation studies.

(OR)

(b) What is parameter estimation? Explain any one method of estimating parameters.

15. (a) Differentiate between verification and validation.

(OR)

(b) Explain the steps involved in model building.

PART C

Answer Any Three Questions (3 × 10 = 30 Marks)

16. Explain the Event Scheduling Algorithm used in Discrete-Event Simulation. Describe in detail the execution of Arrival Events and Departure Events in a Single-Channel Queueing System with a suitable example.
17. Explain the characteristics of queueing systems and queueing notation.
18. Apply the Chi-Square Test for Uniformity to a given sequence of random numbers.
19. Explain the concept of Input Modeling in simulation. Discuss data collection, identification of probability distributions, parameter estimation, Goodness-of-Fit tests, and the selection of input models.
20. Explain the process of model building in simulation. Discuss verification, calibration, validation, and optimization via simulation in detail.

Year	IV	Course Code:	Credits	4
Semester	VII	**Course Title:** Wireless Communication Networks	Hours	75
			Category	C
Course Prerequisites, if any		Knowledge in Computer Networks		
Course Outcomes		• Understand basics of Wireless Communication Networks • Understand the Satellite Communication Concepts and compare generations of wireless communications. • Explore IEEE 802.11 WLAN standard • Explore WAP and its application • Understand WLAN Technologies		

Unit No.	Course Content	Hours
	Theory Component	
Unit-I	**Introduction** Wireless Communication Technology- Antennas and Propagation - Antennas, Propagation Modes, Line-of-Sight Transmission, Fading in the Mobile Environment. Signal Encoding Techniques- Signal Encoding Criteria, Digital Data- Analog Signals, Analog Data-Analog Signals, Analog Data-Digital Signals.	9
Unit-II	**Satellite Communications** Wireless Networking - Satellite Communications- Satellite Parameters and Configurations, Capacity Allocation-Frequency Division, Capacity Allocation-Time Division Cellular Wireless Networks- Principles of Cellular Networks, First-Generation Analog, Second-Generation - TDMA, CDMA, 3G Systems	9
Unit-III	**Wireless LAN Standards** Evolution of IEEE 802.11 – Introduction to IEEE 802.11 – General Description – Medium Access Control (MAC) for the IEEE 802.11 – WLANs Physical Layer for IEEE 802.11 – WLANs; Radio systems – IR Systems Applications.	9
Unit-IV	**Mobile IP :** Introduction, operation of Mobile IP, Mobile IP terminologies, Wireless Access Protocols: Introduction, Architecture overview, Wireless application environment	9
Unit-V	**Wireless LAN technology:** Wireless LAN- application, requirements, Technology: Infrared, spread spectrum, Narrowband microwave (radio), Introduction Bluetooth Technologies (Only Overview).	9

Recommended Learning Resources		
Text Books	1. Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks", Fifth Edition, Prentice Hall publisher, 2022. 2. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Fifth Edition, Morgan Kaufmann Publishers Inc., 2015.	
Reference Books	**3.** James F. Kurose, Keith W. Ross," Computer Networking - A Top-Down Approach Featuring the Internet", Seventh Edition, Pearson Education, 2022.	

Practical Component		
Title of the Practical: Wireless Communication Networks		
Ex. No	**Exercises**	**Hours**
1	Study about different Wireless devices like Wi-Fi Dongler, Wireless Access Point, Antenna, Wi-Fi Router.	**30**
2	Develop a Wireless Signal Transmission (Basic simulation idea)	
3	Design a cellular network with frequency reuse to analyze capacity improvement	
4	Design a Satellite Link Budget	
5	Configure a wireless LAN using CISCO Packet Tracer	
6	Develop a client server application using Wireless LAN	
7	Simulate CSMA/CA to observe how WLAN avoids collisions or Packet Tracer	
8	Mobile IP operation and simulate handoff between home network and foreign network.	
9	WAP Architecture Simulation	
10	Simulate Blue Tooth Communication after pairing in CISCO packet Tracer.	
	Select and Deveop any one case study from the list provided below: 1. Cellular Network in Urban Areas 2. Satellite Communication for Remote Areas 3. Wi-Fi Network Deployment in a College Campus 4. Mobile IP for Seamless Roaming 5. Bluetooth Communication in Smart Devices	
Tools/Software to be used	MATLAB, Python, Packet Tracer, Scilab	

Model Question Paper

MJD 18: Wireless Communication Networks

IV Year/ VII Semester

Time: 3 Hours **Max. Marks: 60**

PART A

Answer All Questions (10 × 1 = 10 Marks)

1. Signal encoding criteria mainly focus on:
   a) Cost and size
   b) Bandwidth and error performance
   c) Color and shape
   d) Distance only
2. Which technique converts analog data into digital signals?
   a) ASK
   b) FSK
   c) PCM
   d) AM
3. FDMA stands for:
   a) Frequency Division Multiple Access
   b) Fast Data Mobile Access
   c) Fixed Data Multiple Allocation
   d) Frequency Digital Modulation Access
4. Which multiple access technique is used in 2G GSM?
   a) CDMA
   b) FDMA only
   c) TDMA
   d) OFDM
5. The Physical layer of WLAN defines:
   a) Routing
   b) Security
   c) Transmission techniques
   d) Addressing
6. WLANs are best suited for:
   a) Long-distance communication
   b) Mobile and indoor networking
   c) Satellite links
   d) Submarine cables
7. Wireless Application Protocol (WAP) is mainly designed for:
   a) Desktop computers
   b) Mobile devices
   c) Servers
   d) Routers

8. Mobile IP tunneling is used to:
   a) Compress data
   b) Secure data
   c) Deliver packets to mobile node
   d) Increase speed
9. Which spread spectrum technique uses hopping frequencies?
   a) DSSS
   b) FHSS
   c) PCM
   d) QAM
10. Bluetooth devices form a network called:
   a) Cell
   b) WLAN
   c) Piconet
   d) Cluster

PART B

Answer All Questions (5 × 4 = 20 Marks)

11. a) Explain the different propagation modes used in wireless communication.

OR

b) Discuss fading in the mobile environment and its types.

12. a) Explain satellite parameters and configurations.

OR

b) Describe capacity allocation using FDMA and TDMA.

13. a) Explain the evolution of IEEE 802.11 standards.

OR

b) Describe the MAC layer functions in IEEE 802.11 WLANs.

14. a) Explain the terminologies used in Mobile IP.

OR

b) Describe the architecture of Wireless Application Protocol (WAP)

15. a) Explain the applications and requirements of Wireless LANs.

OR

b) Write a short note on Bluetooth technology

PART C

Answer Any Three Questions (3 × 10 = 30 Marks)

16. a) Explain antennas and propagation in wireless communication. (5 Marks)
   b) Discuss line-of-sight transmission and fading effects in detail. (5 Marks)

17. a) Explain the principles of cellular wireless networks. (5 Marks)
    b) Discuss the evolution from 1G analog systems to 2G (TDMA, CDMA) and 3G systems. (5 Marks)

18. Explain radio systems and infrared systems used in WLANs with applications. (10 Marks)

19. Explain Wireless Access Protocols and describe the Wireless Application Environment (WAE). (10 Marks)

20. Explain Wireless LAN architecture and Technologies with advantages and limitations. (10 Marks)

Year-IV	Course Code:			Credits: 4
Semester: VII	Course Title:	**Theory of Computation**	Hours	75
			Category	C
Course Prerequisites	Knowledge in Mathematics for Computer Science			
Course Outcomes	• Understand foundational concepts of formal languages • Apply regular expressions to create DFA for lexical analyzers • Analyze equivalence and transformations between NFA, DFA, and TG • Evaluate context-free grammars and limitations of regular grammars • Design models using PDA			

Theory Component

Unit-No	Content	Hours
Unit-I	**Languages:** Alphabets – String – Language – Basic Operations on Language – Concatenation – Union – Kleene Star	9
Unit-II	**Regular Expressions and Finite Automata:** Regular expressions**,** Deterministic Finite Automata (DFA), Non-deterministic Finite Automata (NFA), relationship between NFA and DFA, Transition Graphs (TG), properties of regular languages, the relationship between regular languages and finite automata, Kleene's theorem.	9
Unit-III	**Non-Regular Languages and Context Free Grammars** Pumping Lemma for Regular Grammars – Context-Free Grammars (CFG)	9
Unit-IV	**PDA and Context-Free Languages (CFL)** Deterministic And Non-Deterministic Pushdown Automata (PDA) – Parse Trees – Leftmost Derivation – Pumping Lemma for CFL – Properties Of CFL	9
Unit-V	**Turing Machine**: Turing Machines- Introduction – Formal definition of Turing machines – Instantaneous descriptions- Turing Machine as Acceptors – Turing Machine as Transducers Computable Languages and functions – Turing Machine constructions	9

Recommended Learning Resources	
Print Resources	**Text Books:** 1. Cohen, D. I. A, "Introduction to Computer Theory", Second Edition, Wiley India, 2011. 2. Lewis, H.R. & Papadimitriou, H. R., "Elements of the Theory of Computation", 3.Hopcroft J.E., Motwani R. and Ullman J.D, Introduction to Automata Theory, Languages and Computations, Pearson Education, Second Edition, 2008. **Reference**: Introduction to the "Theory of COMPUTATION" by MICHAEL SIPSER 3rd edition www.cengage.com

Practical Component		
Title of the Practical: Theory of Computation		
Ex. No	**Exercises**	**Hours**
1	Design a DFA over the input set {a,b} accept all the string starting with symbol a.	**30**
2	Design a DFA over the input set {0,1}. Accept all the Strings Starting with 0 and ending with 1.	
3	Design a Program for creating machine that accepts three consecutive one.	
4	Design a Program for creating machine that accepts the string always ending with 101.	
5	Design a Program for Mode 3 Machine	
6	Design a program for accepting binary number divisible by 2.	
7	Design a program for creating a machine which accepts string having even no. of 1's and 0's.	
8	Design a program for creating a machine which count number of 1's and 0's in a given string.	
9	Design a Program to find 2's complement of a given binary number.	

Model Question Paper
MID5: Theory of Computation

Year IV/Semester VII

Time: 3 Hours **Max. Marks: 60**

PART A

Answer All Questions (10 × 1 = 10 Marks)

1. If we consider an arbitrary NFA (non-deterministic finite automaton) with N states in total, the maximum number of states that are there in an equivalent DFA (minimized) is at least:

a) N
b) 2N
c) 2^N
d) N^2

2. The entity which generates Language is termed as:
a) Automata
b) Tokens
c) Grammar
d) Data

3. Which of the following is used to denote alphabets?

a) W

b) ∑

c) |W|

d) ~

4. Empty string is denoted by ____.

a) 0

b) E

c) $

d) ε

5. A finite automaton is a collection of how many tuples

a) 5

b) 4

c) 3

d) 2

6. Which of the following indicates accepting or final states?

a) Double circles

b) Triangle

c) Double dash

d) Circle

7. DFA Transition function can be defined as ____.

a) δ: Q x ∑→Q

b) W: Q x ∑→Q

c) δ: Q x ∑→W

d) δ: Q x ∑→F

8. Which types of languages are accepted by regular expressions?

a) Regular language

b) Consistent language

c) Kleen language

d) Series language

9 What will be the regular expression for the language accepting all the strings which are starting with 1 and ending with 0, over ∑ = {0, 1}?

a) R = 1 (0+1)* 1

b) R = 1 (0+1)+ 0

c) R = 1 (0+1)* 0

d) R = 1 (0+1)+1

10. The derivation tree is also known as ____.

a) Comprehend tree

b) Deviated tree

c) Decipher tree

d) Parse tree

PART B

Answer All Questions (5 × 4==20 Marks)

11. a) To design **a DFA** that accepts set of even number of **a's**

OR

b) Explain the basic operations on languages with examples

12. a) Briefly discuss about the **NFA** with **€** moves

OR

b) Explain the differentiate between **DFA&NDFA**

13. a) Construct a TG for (**ab+ba**)*

OR

b) Briefly explain about the Kleene's Theorem with example

14. a) Construct the CFG for the Regular Expression (0+1)*

OR

b) State and explain the Pumping Lemma for regular language

15. a) Construct a PDA for L={$0^n1^n|n\geq0$}

OR

b) Explain the Pumping Lemma for CFL with an example

PART C

Answer Any Three Questions (3 × 10 = 30 Marks)

16. Explain closure properties of languages with proof and examples.

17. Construct a DFA for (i) Even number of **a**' s, (ii)Odd number of **b'** s

18. Explain in detail context-free grammars with derivations and examples

19. Write a Regular Expression that accept all strings over an alphabet {**a,b**} that have string start with **a** and ends with **b**

20. Construct a PDA for L={$\mathbf{a^nb^nc^n|n\geq0}$}show derivation steps

Year: IV	Course code:		Credits	4
Semester: VII	Course Title:	**System software**	Hours	75
			Category	C
Course Prerequisites	• Knowledge of digital logic design • Introductory knowledge in problem Solving			
Course Outcomes	• Understand basic computer architecture via Simplified Instructional Computer (SIC) • Analyze differences in assemblers and machine features • Apply dynamic linking and bootstrap loaders in program preparation • Design macros demonstrating machine features • Apply machine-independent compiler features in design			

Theory Component

Unit-No	Content	Hours
Unit-I	Introduction System Software and Machine Architecture – Simplified Instructional Computer (SIC) – Traditional (CISC) Machines – RISC Machines	9
Unit-II	Assemblers Basic Assembler Functions – Machine Dependent and Machine Independent Assembler Features – One-Pass Assemblers – Multi Pass Assemblers – MASM assembler – SPARC assembler	9
Unit-III	Loaders and Linkers Basic Loader Functions – Machine Dependent and Machine Independent Loader Features – Linkage Editors – Dynamic Linking - Bootstrap Loaders	9
Unit-IV	Macro Processors Basic Macro Processor Functions – Machine Dependent and Machine Independent Macro Processor Features – Macro Processor Design Options	9
Unit-V	Compilers Basic Compiler Functions – Machine-Dependent Compiler Features – Machine Independent Compiler Features – Compiler Design Options – YACC	9

Recommended Learning Resources

Print Resources	**Text Books:** 1. Leland L. Beck, D. Manjula "System Software – An Introduction to Systems Programming", Third Edition, Pearson India, 2007. 2. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, "Compilers: Principles, Techniques, and Tools", Second Edition, Pearson Addison Wesley, 2023.

Practical Component		
Title of the Practical: System Software		
Ex.No	**Exercises**	**Hours**
1	Simulate a simple arithmetic operation (e.g., addition, subtraction) in both a CISC-like and RISC-like manner. The CISC simulation should perform the operation in a single step, while the RISC simulation should break it down into simpler steps	**30**
2	Design a program that translates a small set of assembly-like instructions (define your simple instruction set) into a simulated machine code. Your program should handle basic operations like load, store, add, and subtract	
3	Design a program that simulates the basic functions of a linker and loader for a simplified computational system	
4	Implement a simple macro processor that allows for the definition and expansion of macros within a text file. The macros should perform simple text replacement or predefined operations (like incrementing a number)	
5	Design and implement a simple arithmetic expression evaluator using YACC. The evaluator should be capable of handling basic arithmetic operations (+, -, *, /) and correctly respects the standard mathematical precedence of operations and handles parentheses to alter the precedence order	
Tools/Software to be used	Flex and gcc Compiler Peterhigginson online simulator	

Model Question Paper

MID : System Software

III Year/ VII Semester

Time: 3 Hours **Max. Marks: 60**

PART A

Answer All Questions (10 × 1 = 10 Marks)

1. Which statement is generally TRUE for CISC processors?
   a) Instructions take multiple clock cycles.
   b) Memory access is only through load/store.
   c) They have fewer addressing modes.
   d) Design is simpler than RISC
2. RISC processors typically use which type of control unit for faster execution?
   a) Micro programmed control
   b) Hardwired control
   c) Hybrid control
   d) Nano programmed control
3. Assembler is used as a translator for?
   a) Low level language
   b) High Level Language
   c) COBOL
   d) C
4. In MASM and other assemblers, which extension is typically used for the source program file?
   a) .OBJ
   b) .EXE
   c) .ASM
   d) PGM
5. The loader that runs when the system starts up (OS loading) is called the:
   a) Relocating loader
   b) Bootstrap loader
   c) Dynamic loader
   d) Absolute loader
6. Dynamic linking allows:
   a) Linking only at compile time.
   b) Resolving external references at runtime.

c) Loading programs from disk to tape.

d) Faster compilation.

7. What is the primary goal of a Machine-Dependent Macro Processor?

a) To produce code that runs on all platforms.

b) To optimize code for specific CPU features like cache or registers.

c) To simplify macro definitions using abstract concepts.

d) To handle complex control structures universally

8. Which construct allows macro arguments to be specified in any order?

a) Positional parameters

b) Macro-time variables

c) Keyword parameters

d) Subroutines

9. Which data structure is primarily used by the compiler to store information about variable names, types, and scopes?

a) Stack

b) Queue

c) Symbol Table

d) Hash Map (distinct from general hash table for implementation)

10. Which of the following tools helps in lexical analysis?

a) YACC

b) LEX

c) BISON

d) GCC

PART B

Answer All Questions (5 × 4 = 20 Marks)

11. a).Explain SIC machine architecture. (OR)

b). Explain RISC architecture.

12. a) Explain Assembler directives. (OR)

b) Explain one-pass assembler.

13. a) Discuss about absolute loader. (OR)

b) Explain linkage editor.

14. a) Write the algorithm for macro preprocessor. (OR)

b) Explain how a recursive macro expansion can be included in microprocessor design?

15. a) Explain different phases of compiler. (OR)

b) What are the features of YACC

PART C

Answer Any Three Questions (3 × 10 = 30 Marks)

16. a)Explain SIC/XE machine architecture (7 Marks)

b) What difference between System Software and application software? (3 Marks)

17. Explain machine Independent Assembler?

18. a) Explain about Dynamic Linking. (5 Marks)

b) Discuss in detail about Bootstrap Loaders (5 Marks)

19. Give the algorithm for macro processor and explain various data structures used.

20. (a) Explain Basic Compiler Functions (6 marks)

(b) What are the various compiler design options.(4 marks)

Year: IV	**Course code:**		**Credits**	4
Semester: VII	**Course Title:**	**Cyber Security**	**Hours**	75
			Category	C
Course Prerequisites if any	Basic Knowledge of Programming and Information Security Principles			
Course Outcomes	• Learn the definitions and categories of cybercrimes • Comprehend the tools and techniques employed in cybercrimes • Examine the legal frameworks surrounding cybercrime legislation • Assess the effectiveness of cyber security measures • Examine current cyber threats and vulnerabilities			
Unit-No	**Course Component**		**Hours**	
Theory Component				
Unit-I	**Introduction to Cybercrime** Cybercrime Definition – Cybercrime and Information Security – Classification of Cybercrimes – Email Spoofing, Spamming, Data Diddling, Web Jacking, Hacking, Password Sniffing – Categories of Cybercrime – Passive attack – Active attack – Reconnaissance		9	
Unit-II	**Tools and Methods used in Cybercrime** Cyberstalking – Cybercafe and Cybercrimes – Botnets – Proxy Servers and Anonymizers – Password Cracking – Keyloggers and Spyware – DoS and DDoS attacks – Virus and Worms – Trojan horses and Backdoors – SQL injection – Steganography		9	
Unit-III	**Mobile and Wireless Devices** Proliferation of Mobile and Wireless Devices – Trends in Mobility – Security Challenges Posed by Mobile Devices – Authentication Service Security – Attacks on mobiles and cellphones – Credits Card Frauds in mobile and Wireless Computing Era – Organizational measures for Handling Mobile		9	
Unit-IV	**Phishing and Identify Theft** Buffer Overflow – Phishing: Methods of Phishing, Phishing Techniques, Spear Phishing, Types of Phishing Scams, Phishing Tool Kits and Spy Phishing, Phishing Countermeasures – Identify Theft (ID Theft): Types of Identify Theft, Techniques of ID theft – ID Theft Counter Measures – Personally Identifiable Information		9	
Unit-V	**Cybercrime and Cyber Security Legal Perspectives** The Indian IT Act – Challenges to Indian Law and Cybercrime Scenario in India – Digital Signatures and The Indian IT Act – Amendments to the Indian IT Act – Cybercrime and Punishment		9	

Recommended Learning Resources	
Print Resources	**Text Books:** 1. Nina Godbole and Sumit Belapure, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", First Edition, Wiley India Pvt. Ltd., 2011. 2. Anand Shinde, "Introduction to Cyber Security: Guide to the World of Cyber Security", First Edition, Notion Press, 2021

Practical Component		
Exercises		**Hours**
	1. Create a simple program that encrypts and decrypts a text message using a basic cipher (e.g., Caesar cipher). Demonstrate encryption of a given plaintext and then decryption back to the original text 2. Simulate a basic SQL injection attack against a sample web application. Demonstrate how unauthorized access to data can be obtained through poorly sanitized input fields. Show the effect of the attack and suggest mitigation strategies 3. Use a password cracking tool on a set of hashed passwords. Demonstrate the process of cracking by identifying weak passwords from the hash values. Discuss the importance of strong password policies 4. Set up and configure a basic firewall on a network or computer system. Demonstrate how to block and allow specific traffic types. Test the firewall setup by attempting to access the protected resources with varying types of network traffic 5. Analyze a set of emails to identify characteristics of phishing attempts. Explain the indicators of phishing and suggest methods for verifying the authenticity of suspicious emails. Discuss the impact of phishing attacks and preventive measures 6. Create virtualized network environments with cybersecurity simulation software, guiding participants through defense strategies against various cyber-attacks 7. Equip participants with forensic analysis tools, presenting simulated cyber-attack scenarios to investigate, analyze evidence, and prepare forensic reports	**30**

Model Question Paper

MID: 8 – Cyber Security

IV Year/ VII Semester

Time: 3 Hours **Max. Marks: 60**

PART A

Answer All Questions (10 × 1 = 10 Marks)

21. Which of the following is an example of email spoofing?
    a) Sending bulk emails
    b) Hiding data inside images
    c) Forging sender's email address
    d) Stealing passwords

22. A passive attack primarily aims to
    a) Modify data
    b) Destroy systems
    c) Monitor or eavesdrop on data
    d) Stop network services

23. Botnets are
    a) Legal software tools
    b) Networks of infected computers controlled remotely
    c) Firewalls
    d) Antivirus program

24. A DDoS attack targets
    a) A single computer using one system
    b) A system using multiple compromised systems
    c) Only databases
    d) Wireless devices only

25. Authentication service security ensures
    a) Faster internet
    b) Proper identification of users
    c) Virus removal
    d) Data compression

26. Organizational measures for mobile security include
    a) Ignoring security policies
    b) Strong password policies and access control
    c) Using free public Wi-Fi
    d) Disabling authentication

27. Spear phishing is
    a) Random phishing attacks
    b) Targeted phishing attacks
    c) Phone-based phishing
    d) Email encryption

28. Identity theft mainly involves
a) Stealing hardware
b) Stealing personal information for fraud
c) Network monitoring
d) Software testing

29. Digital signatures are used to ensure
a) Faster communication
b) Data compression
c) Authentication and integrity
d) Virus detection

Cybercrime punishment under IT Act includes

a) Rewards

b) Imprisonment and fines

c) Warning letters only

d) No punishment

PART B

Answer All Questions (5 × 4 = 20 Marks)

30. a) Define cybercrime and explain its classification

OR

b) Explain passive attacks and active attacks with suitable examples.

31. a) Explain Cyberstalking and cybercafe related cybercrimes

OR

b) What are botnets? Explain the role of proxy servers and anonymizers in cybercrime.

32. a) Explain the security challenges posed by mobile and wireless devices.

OR

b) Describe authentication service security in mobile computing.

33. a) Explain phishing techniques and types of phishing scams.

OR

b) What is identity theft? Explain its types and techniques.

34. a) Explain the objectives and features of the Indian IT Act.

OR

b) Explain digital signatures and their legal significance under the Indian IT Act.

PART C

Answer Any Three Questions (3 × 10 = 30 Marks)

1. Explain different types of cybercrimes such as email spoofing, spamming, data diddling, web jacking, hacking, and password sniffing.
2. Explain various cybercrime tools and methods including Keyloggers, spyware, DoS/DDoS attacks, viruses, worms, Trojan horses, and backdoors.
3. Discuss attacks on mobile and wireless devices and explain organizational measures for handling mobile security.
4. Explain phishing in detail, including methods, spear phishing, phishing toolkits, and countermeasures.
5. Discuss cybercrime and punishment under the Indian IT Act and explain the challenges faced by Indian cyber laws.

Year: IV	**Course code:**		Credits	4
Semester: VII	**Course Title:**	**Internet of Things**	Hours	75
			Category	C
Course Prerequisites	• Basic knowledge of programming and networking • Various applications in I O T Platforms and its uses.			
Course Outcomes	• Understand IoT fundamentals, including design, protocols, and technologies • Explore domain-specific applications such as home automation and industry • Learn about M2M applications and system management • Develop IoT systems using platforms like Raspberry Pi • Manage IoT server and cloud infrastructure, focusing on security			

Theory Component

Unit-No	Content	Hours
Unit-I	**Introduction** Definition, Characteristics of IoT, Physical Design of IoT, Protocols, Logical Design of IoT, IoT Enabled Technologies, IoT Levels and Templates	9
Unit-II	**Domain Specific IoT Applications** Home Automation, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle	9
Unit-III	**M2M and IoT System Management** M2M Applications, Software Defined Networks, Network Function Virtualization. Need for IoT System Management, Simple Network Management Protocol, IoT System Management with NETCOZF-YANG	9
Unit-IV	**Developing IoT Systems** IoT Platforms Design Methodology, Steps for IoT Design, Case Study on IoT System for Weather Monitoring, Introduction to Raspberry PI, Interfaces (serial, SPI, I2C), Programming Raspberry Pi, IoT Devices	9
Unit-V	**IoT Server and Cloud Management** Introduction to Cloud Storage Models and Communication APIs, Webserver – Web Server for IoT, Cloud for IoT, Security Management in an IoT System	9

Recommended Learning Resources

Print Resources	**Text Books:** 1. Arshdeep Bahga and Vijay Madisetti, "Internet of Things - A Hands-on Approach", First Edition, Orient Blackswan Private Limited, 2015.
	Reference: 1. Rajesh Singh, Anita Gehlot, Bhupendra Singh, Sushabhan Choudhury, " Internet of Things (IoT) Enabled Automation in Agriculture", Second Edition, CRC Press, 2022

Practical Component		
Title of the Practical: Internet of Things		
Ex.No	Exercises	**Hours**
1	Identify and list different types of IoT devices and their functionalities	**30**
2	Sketch a physical design for a home automation system using IoT devices	
3	Compare and contrast different IoT protocols such as MQTT, CoAP, and HTTP	
4	Set up a basic communication protocol between two IoT devices using MQTT	
5	Discuss the role of cloud computing in enabling IoT solutions	
6	Implement a simulation of the home automation system using IoT platforms like Arduino or Raspberry Pi	
7	Explore different cloud storage models (e.g., public, private, hybrid) and their suitability for IoT applications	
8	Implement security measures such as encryption and authentication in an IoT system using cloud-based services	

Model Question Paper

MJD /MID: INTERNET OF THINGS

Year/ Semester: IV / VII

Time: 3 Hours **Max. Marks: 60**

PART A

Answer All Questions (10 × 1 = 10 Marks)

1. Which of the following is a fundamental component of an IoT system?

a) Physical Object + Internet
b) Controller + Internet
c) Physical Object + Sensor/Actuator + Internet
d) Only Controller + Sensor

2. Things in I O T can exchange data with other connected devices using

a) Wired connection only
b) Wireless connection only
c) Li-Fi connection only
d) All the above

3. Which of the following is a common application of I O T Technology?

a) Automated email system
b) Voice activated shopping
c) Smart homes
d) Text messaging

4. What are the challenges in IoT?

a) Energy Consumption
b) Security
c) Network Congestion
d) All of the above

5. M2M is mostly

a) Hardware centric
b) Software centric
c) Both
d) None

6. The relation between I O T and M2M is,

a) I o T is part of M2M
b) M2M is the part of I o T
c) Both are the same
d) None

7. What is an IoT network?

a) Collection of networked devices
b) Collection of Interconnected devices
c) Collection of signaled devices
d) None of the above

8. Which of the following things is mandatory for the IoT gateway to provide?

a) Simple and secure installation
b) Data network and storage
c) Software Security
d) Protocol abstraction

9. Which is at the lowest layer in I O T Architecture

a) Smart devices
b) Gate way
c) Cloud
d) None of the above

10. Which technology enables IoT devices to connect wirelessly over short distances?

a) Cellular (4G/5G)
b) Bluetooth
c) Satellite
d) Ethernet

PART B

Answer All Questions (5 × 4 = 20 Marks)

11. a).List out the Characteristics of IoT with suitable example.

or

b).Differentiate between Logical and Physical design of IoT

12. a) Describe about the role of IoT in Home Automation.

or

b) How IoT helps in our daily Health and Lifestyle. Explain

13. a) Derive the System Components of M2M.

or

b) Explain neatly about Simple Network Management Protocol.

14. a) Briefly discuss about the steps involved in designing an IoT Device.

or

b) List any 4 IoT devices and their role play in Human Life.

15. a) Explain about Cloud Storage Model in detail

or

b) Discuss about Web Server for an IoT System.

PART C

Answer Any Three Questions (3 × 10 = 30 Marks)

16. Discuss briefly about IoT Enabled Technologies with suitable Example.

17. (a) Explain the role of IoT Applications in the field of Retail and Logistics.
(b) List and Explain any 2 IoT devices that helps farmers in agriculture

18. Briefly explain about IoT System Management with NETCOZFYANG.

19. (a) How will you program for Raspberry pi in IoT applications?
(b) How will you design IoT system for Weather Monitoring?

20. (a) Discuss about IoT Platforms for future AI world
(b) List any 4 Cloud based IoT devices with its features

Year: IV	**Course code:**		**Credits**	**4**
Semester: VIII	**Course Title:**	**Embedded Application Development**	**Hours**	**75**
			Category	**C**
Course Prerequisites	• Microprocessor & Microcontrollers introduction • Assembly Language Programming			
Course Outcomes	• Understand the basics of Embedded Systems • Appreciate the application domains of Embedded Systems • Gain proficiency in programming embedded systems • Explore interfacing techniques for sensors, actuators, and other peripheral devices • Develop skills in designing, implementing, and debugging embedded software			

Theory Component

Unit-No	Content	Hours
Unit-I	Introduction Embedded Systems and General-purpose Computer Systems – History – Classifications – Applications – Purpose of Embedded Systems – Characteristics and Quality Attributes	9
Unit-II	Embedded Systems Application specific – washing machine – domain specific – automotive Embedded Hardware: Memory – I/O – Interrupt – Processors – External peripherals Peripheral: Control and Status Registers – Device Driver – Timer Driver – Watchdog Timers	9
Unit-III	Microcontrollers Microcontrollers and Embedded processors – Overview of 8051 family. 8051 hardware – I/O pins – Ports – Circuits – External Memory Programming: Data Types – I/O Programming – Logic operations – Data conversion Programs	9
Unit-IV	Designing Embedded System with 8051 Microcontroller Factors to be considered in selecting a controller – 8051 Microcontroller – Designing with 8051 Programming: Structure of embedded program – infinite loop – compiling, linking & debugging	9
Unit-V	Real Time Operating System (RTOS) :Operating system basics – Types of OS – Real-Time Characteristics – Selection Process of an RTOS Design and Development: Embedded system development Environment – IDE – types of files generated, disassembler – de-compiler – simulator – emulator and debugging, embedded product development life-cycle, trends in embedded industry	9

Recommended Learning Resources	
Text Books	1. Shibu K V, "Introduction to Embedded Systems" Second Edition, Tata McGraw Hill, 2017. 2. Rajkamal, “Embedded Systems - Architecture, Programming and Design", Third Edition, McGraw Hill Education, 2008.

Practical Component		
Title of the Practical: Embedded Application Development		
Ex.No	**Exercises**	**Hours**
1	Write a program to implement the Addition of two numbers in AT89C51 Microcontroller using Keil software	30
2	Write a program to implement the Subtraction of two numbers in AT89C51 Microcontroller using Keil software	
3	Write a program to implement the Multiplication and Division of two numbers in AT89C51 Microcontroller using Keil software	
4	Write a program to generate the square wave in AT89C51 Microcontroller using Keil software	
5	Write a program to generate the Triangle wave in AT89C51 Microcontroller using Keil software	
6	Write a program to generate the traffic light signal in AT89C51 Microcontroller using Keil software	
7	Write a program to implement the Data increment and decrement in AT89C51 Microcontroller using Keil software	
8	Write a program to generate the Seven Segment LED display in AT89C51 Microcontroller using Keil software	
9	Write a program to Configure timer control registers of 8051 and develop a program to generate given time delay	
10	Write a program to use one of the four ports of 8051 Microcontroller	
11	Write programs to store and retrieve data from non-volatile memory (e.g., EEPROM or Flash). Implement dynamic memory allocation techniques using RAM	
12	Write a program to Generate PWM signals to control the brightness of LEDs or the speed of a motor. Experiment with different duty cycles and frequencies	
Tools/Software to be used	**Keil µVision5**	

Model Question Paper
MID4: Embedded Application Development

Year IV/Semester VIII

Time: 3 Hours **Max. Marks: 60**

PART A

Answer All Questions (10 × 1 = 10 Marks)

1. An embedded system combines:
   a) Software,
   b) Hardware,
   c) **Both software and hardware,**
   d) Devices.

2. What does API stand for?
   a) Address Programming Interface,
   b) **Application Programming Interface,**
   c) Accessing Peripheral Interface,
   d) Address Program Interface.

3.what does UART stand for?
   a) **Universal Asynchronous Receiver Transmitter**
   b) Unified Analog Radio Terminal
   c) Universal Address Receiver Transmitter
   d) Universal Automate Receiver Transmitter

4)Which of the following is a part of RTOS kernel?
   a) register
   b) ISR
   c) memory
   d) input

5)Which memory storage is widely used in PCs and Embedded Systems?
   a) EEPROM
   b) Flash memory
   c) SRAM
   d) **DRAM**

6) Which type of memory is suitable for low volume production of embedded systems?
   a) Non-volatile
   b) RAM
   c) Volatile
   d) ROM

7) What is the range of values an 8-bit register can store?

a) 128
b) 64
c) 256
d) 32

8) Which of the following are medical applications of embedded systems?
a) CT
b) MRI
c) PET
d)**All the above**

9) DMA stands for _____.
a) Directed Memory Access
b) Direct Medium Access
c) Direction Media Access
d) None of the above

10) Which of the following embedded system software converts each line of assembly-based code to machine-based code at a time?
a) Compiler
b) Assembler
c) Debugger
d) Both a and b

PART B

Answer All Questions (5 × 4 = 20 Marks)

11. a) Explain the Purpose of Embedded Systems

OR

b) Write short notes on Characteristics and Quality Attributes in Embedded Systems.

12. a) Explain the external peripherals in Embedded Systems.

OR

b) Explain the Control and Status Registers.

13. a) Write short notes on External Memory in 8051 Microcontroller

OR

b) Explain about Embedded processors

14. a) Describe the compiling, linking & debugging in 8051 Microcontroller.

OR

b) Discuss about Structure of embedded program

15. a) Explain the Real Time Operating System (RTOS)

OR

b) Briefly describe about embedded product development life -cycle.

PART C

Answer Any Three Questions (3 × 10 = 30 Marks)

16. Explain the differentiate between Embedded Systems and General-purpose Computer Systems.
17. Explain the Embedded System application specific in washing machine
18. Explain about 8051 I/O pins and ports with neat diagram
19. Explain what is the Factors to be considered in selecting a controller

20 Explain the Embedded system development Environment

Year: IV	**Course code:**		**Credits**	**3**
Semester: VIII	**Course Title:**	**Full Stack Development**	**Hours**	**75**
			Category	**C**
Course Prerequisites	• Basic programming concepts, OOPs, Web Technology, Database • Basic Scripting Languages concepts			
Course Outcomes	• Create responsive web pages using HTML and CSS • Develop interactive web applications with JavaScript • Understand the concept of ReactJS component-based architecture • Develop RESTful APIs with Node.js and Express.js • Design scalable MongoDB database schemas for web applications			

Theory Component

Unit-No	Content	Hours
Unit-I	**HTML and CSS** Tags – Attribute and Elements – Comments – Lists and Links – Images and Tables – CSS to HTML – Selectors – Properties and Values – CSS Box Model – Margins – Padding – Borders – Text,Font Properties	9
Unit-II	**Java Script** Internal and external script – Document and Window Object – Variables and Operators – Data Types and Type Conversion – Math and String Manipulation – Objects and Arrays – Conditional Statements – Functions – Java libraries – jQuery – Angular	9
Unit-III	**ReactJS Development** Templating using JSX – Components – State and Props – Lifecycle of Components – Rendering List and Portals – Error Handling – Routers – Redux and Redux Saga – Immutable.js – Service Side Rendering – Unit Testing – Webpack	9
Unit-IV	**NodeJS Development** Basics and Setup Console – Node js Command Utilities – Node js Module – Concepts – Events – Node js with Express js – Node js Database Access	9
Unit-V	**MongoDB** SQL and NoSql Concepts – Create and Manage MongoDB – Migration of Data – MongoDB with PHP – MongoDB with NodeJS – Services – MongoDB with Python	9

Recommended Learning Resources

Print Resources	1. ShamaHoque, "Full Stack React Projects: Learn MERN stack development by building modern web apps using MongoDB, Express, React, and Node.js", Second Edition, 2020.

	2. Eric Sarrion, “JavaScript from Frontend to Backend: Learn full stack JavaScript development using the MEVN stack with quick and easy steps” Packt, 2022

Practical Component		
Title of the Practical: Full Stack Development		
Ex. No	**Exercises**	**Hours**
1	Applying all the concept of HTML and CSS for the building of Web portal	**30**
2	Create a dynamic and interactive web page to interact with visitors and execute complex actions	
3	Build complex UI interactions that communicate with the server in record time with JavaScript–driven pages	
4	Build back–end services like APIs, Web App or Mobile App using Nodejs	
5	Using JSON store structure and unstructured data	

Model Question Paper
MID: Full Stack Development

Year IV/Semester VIII

Time: 3 Hours **Max. Marks: 60**

PART A

Answer All Questions (10 × 1 = 10 Marks)

1. Which HTML tag is used to link an external CSS file?
a) <style rel="stylesheet" href="style.css">
b) <link rel="stylesheet" src="style.css">
c) <link rel="stylesheet" href="style.css">
d) <csssrc="style.css"

2. Which HTML tag is used to link an external CSS file?
a) <style rel="stylesheet" href="style.css">
b) <link rel="stylesheet" src="style.css">
c) <link rel="stylesheet" href="style.css">
d) <csssrc="style.css"

3. JSON was natively constructed on which language?
a) Java
b) C++
c) JavaScript
d) Python

4. Which of the following methods can be used to display data in some form using Javascript?
a) document.write()
b) window.alert()
c) window.write()
d) Both a and b

5. In React.js, which of the following is used to create an instance of a class for inheritance?
a) this
b) super()
c) extends

d) inherits

6. What is ReactJS mainly used for building?
a) Database
b) Connectivity
c) User Interface
d) Design platform

7. What is a primary use case for Node.js?
a) Building front-end UIs
b) Running SQL queries
c) Developing server-side applications
d) Managing client-side state

8. How do you create an HTTP server in Node.js?
a) startServer()
b) listenServer()
c) createServer()
d) createHttpServer()

9. What type of database is MongoDB?
a) Relational
b) NoSQL document store
c) Key-value store
d) Graph database

10. How does MongoDB store data?
a) In tables
b) In rows
c) In JSON-like (BSON) documents
d) In flat files

PART B

Answer All Questions (5 × 4 = 20 Marks)

11. a) How do you create a list in HTML? Describe the difference between ordered and unordered lists. (or)

b) Describe the process of adding an image to an HTML page using CSS for styling.

12. a) Describe the purpose of functions in JavaScript with example.

(or)

b) Explain the structure of conditional statements in JavaScript? Give an example.

13. a) What is the lifecycle of the components in ReactJS?

(or)

b) What is error handling in ReactJS? Describe one way of handling errors in components.

14. a) What is NodeJS? What are the core modules available in Node.js?

(or)

b) What are Node.js command utilities? Give examples.

15.a) Describe the process of creating a MongoDB database and adding a collection to it.

(or)

b) How do you connect MongoDB with PHP? Briefly explain the steps involved.

PART C

Answer Any Three Questions (3 × 10 = 30 Marks)

16. Explain how Images and Tables are created in HTML. Give example.
17. Describe the Document Object and Window Object in JavaScript.
18. Explain State and Props in React with examples.
19. Explain the Event-driven model in NodeJS
20. Explain MongoDB services and features**.**

Year: IV	Course code:		Credits	4
Semester: VII	Course Title:	**5G Communication Technologies**	Hours	75
			Category	C
Course Prerequisites	Basic Knowledge of computers			
Course Outcomes	• Understand the basics of 5G Communication • Understand the fundamentals of 5G Architecture • Understand the various 5G Radio-Access Technologies • Understand the various 5G Enabling Technologies • Learn about the 5G Use Cases			

Theory Component

Unit-No	Content	Hours
Unit-I	**Background** Introduction to Cellular Technologies: Frequency reuse – Handoff – Capacity – Evolution of 1G, 2G, 3G, 4G standards and architectures Propagation Mechanisms: Doppler Spread – Delay Spread – Coherence time and bandwidth – all types of fading (non – detail study alone).	9
Unit-II	**5G Architecture** Introduction – 5G Architecture options – 5G Core Network Architecture – 5G RAN Architecture – Network Slicing – 5G Physical Layer – 5G Multiple Access Principle – Physical channels and signals – frame structure – Channel Structures and beamforming bacics – Random Access - Downlink and uplink User Data Transmission.	9
Unit-III	**5G Radio Access Technologies** Access design principles for multi-user communications – Orthogonal multiple- access systems – Spread Spectrum multiple access systems – Capacity limits of multiple-access methods – OFDM numerology for small-cell deployments – Radio access for dense deployments – Radio access for V2X Communication.	9
Unit-IV	**5G Enabling Technologies** MIMO: Introduction – Single User and Multi user MIMO – Capacity of Massive MIMO – Resource allocation and transceiver algorithms – Channel models – mmwave – Channel Propagation – Hardware Technologies – Architecture and mobility – Beamforming – Physical Layer Techniques.	9
Unit-V	**5G Use Cases** Machine type Communication: Fundamental techniques – Massive MTC – Ultra-reliable low-latency MTC Device to Device Communication: Radio Resource Management for mobile broadband D2D – Multi-hop D2d	9

	Communication for proximity and emergency services – Multi-operator D2D Communication.	
Recommended Learning Resources		
Print Resources	**Text Books:** 4. Theodore S. Rappaport, "Wireless Communications: Principles and Practice", Cambridge University Press, 2024. [Unit 1] 5. Osseiran, Afif, Jose F. Monserrat, and Patrick Marsch, "5G Mobile and Wireless Communications Technology", First edition, Cambridge University Press, 2016.	
	Reference: 1. Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks", First Edition, Wiley, 2015. 2. Harri Holma, Antti Toskala, Takehiro Nakamura, "5G Technology 3GPP New Radio", First Edition, John Wiley & Sons, 2020.	

Practical Component		
Title of the Practical: 5G Communication Technologies		
Ex.No	**Exercises**	**Hours**
1.	Study and simulation of Handoff techniques	30
2.	Study and simulation of types of fading	
3.	Computation of channel capacity	
4.	Calculation of bandwidth of different generations	
5.	Problems based on 5G Frame Structure	
6.	5G Communications Link Analysis with Ray Tracing	
7.	Model and analyze 5G NR Waveforms generation	
8.	Channel modelling in 5G	
9.	MIMO Wireless System Design for 5G	
10.	5G Beamforming Design	

Model Question Paper

MJD: 5G Communication technologies

II Year/ IV Semester

Time: 3 Hours **Max. Marks: 60**

PART A

Answer All Questions (10 × 1 = 10 Marks)

1. The main purpose of frequency reuse in cellular systems is to
   A) increase battery life
   B) increase coverage area
   C) increase capacity
   D) reduce interference
2. Rapid signal strength variation due to multipath over short time is called
   A) shadowing
   B) path loss
   C) slow fading
   D) fast fading
3. Network slicing in 5G mainly enables
   A) higher tower height
   B) separate logical networks on same infrastructure
   C) reduction of bandwidth
   D) removal of core network
4. Beamforming is primarily used to
   A) reduce device cost
   B) direct signals toward the user
   C) increase SIM memory
   D) avoid encryption
5. Which technique divides bandwidth into many orthogonal subcarriers?
   A) CDMA
   B) TDMA
   C) OFDM
   D) FDMA
6. Small cell deployment mainly helps to
   A) decrease data rate
   B) improve coverage and capacity
   C) remove interference completely

D) avoid handoff

7. Massive MIMO improves performance by using
   A) single antenna
   B) multiple antennas at base station
   C) satellite links
   D) optical fiber only
8. mmWave communication operates at
   A) very low frequencies
   B) medium frequencies
   C) microwave oven frequencies
   D) extremely high frequencies
9. URLLC is designed for
   A) movie downloading
   B) delay tolerant traffic
   C) mission-critical low latency services
   D) social networking
10. D2D communication allows devices to
   A) connect only via satellite
   B) communicate directly without base station
   C) increase SIM memory
   D) disable mobility

PART B

Answer All Questions (5 × 4 = 20 Marks)

11. (a) Explain the concept of frequency reuse and its importance in cellular systems.

OR

(b) Describe different types of fading in wireless communication.

12. (a) Draw and explain the basic 5G network architecture.

OR

(b) What is network slicing? Explain its benefits.

13. (a) Explain the principles of orthogonal multiple access techniques.

OR

(b) What is OFDM numerology in 5G? Explain.

14. (a) Differentiate between Single User MIMO and Massive MIMO.

OR

(b) Explain the challenges in mmWave propagation.

15. (a) What is URLLC? Mention its key requirements.

OR

(b) Explain the concept of Device-to-Device communication.

PART C

Answer Any Three Questions (3 × 10 = 30 Marks)

16. (a) Explain the evolution of mobile communication from 1G to 4G. (5)

(b) Discuss handoff techniques used in cellular networks. (5)

17. (a) Describe the 5G RAN architecture with neat diagram. (6)

(b) Explain uplink and downlink transmission in 5G. (4)

18. (a) Explain multiple access design for dense network deployment. (6)

(b) Discuss radio access support for V2X communication. (4)

19. (a) Explain the working of beamforming in 5G systems. (5)

(b) Describe channel models used for 5G communication. (5)

20. (a) Explain Massive Machine Type Communication. (5)

(b) Discuss multi-hop D2D communication for emergency services. (5)

Year: IV	Course code:		Credits	4
Semester: VIII	Course Title:	**Data Mining**	Hours	75
			Category	C
Course Prerequisites	Basic Knowledge of Database and Data Warehouse.			
Course Outcomes	• To understand the concepts of Data Mining. • To learn about Classification, prediction and cluster analysis techniques.			

Theory Component

Unit-No	Content	Hours
Unit-I	**Introduction to Data Mining:** Definition of data mining - Stages of the Data Mining Process – Basic data types – Major building blocks –Scope of Data Mining – Data Mining working – Data Mining Architecture – Data Mining implementation process – Data Mining Techniques – Advantages & Disadvantages.	9
Unit-II	**Data:** Types of Data, Data quality, Data preprocessing- Measures of similarity and dissimilarity – Exploring data: summary statistics, visualization, OLAP and multi dimensional data analysis.	9
Unit-III	**Data preprocessing:** Data preprocessing introduction, Data cleaning - Data integration - Data reduction – Data transformation and data Discretization.	9
Unit-IV	**Classification:** Problem definition - General approach - Decision tree induction - Rule based classifiers – nearest neighbor - Bayesian classifiers - Pattern Mining – Introduction- pattern mining in multilevel, multi-dimensional space - Frequent Pattern Mining Model.	9
Unit-V	**Cluster analysis basic concepts and methods:** Introduction – requirements for cluster analysis – Over view of clustering methods. Data mining Applications	9

Recommended Learning Resources

Print Resources	**Text Books:** 1. Data Mining: Concepts and Techniques by Jiawei Han and Micheline Kamber, Elsevier, 2010. 2. Introduction to Data Mining by Pang-Ning Tan, Michael Steinbach and Vipin Kumar, 2005.

Practical Component		
Title of the Practical: Data Mining		
Ex.No	Exercises	**Hours**
1	Perform data preprocessing tasks and Demonstrate performing association rule mining on data sets	**30**
2	Data cleaning techniques a) smoothing by bin means b) smoothing by bin medians c) smoothing by bin boundaries	
3	Data Transformation techniques a) Min-Max normalization b) z-score normalization c) Normalization by decimal scaling.	
4	Classification techniques a) Bayes classification. b) Nearest Neighbor classification.(NNC)	
5	Demonstrate performing classification on data sets.	
6	k-means clustering technique.	
7	Demonstrate performing clustering on data sets Clustering Tab	
Tools/Software to be used	**C/C++** **WEKA Tool**	

Model Question Paper

MJD : Data Mining

Year : IV / Semester :VIII

Time: 3 Hours **Max. Marks: 60**

PART A

Answer All Questions (10 × 1 = 10 Marks)

1. What is data mining?
   a) Deleting unnecessary data
   b) Sorting data alphabetically
   c) Storing data securely
   d) Extracting useful patterns or information from large datasets
2. Data mining techniques are used in social media for:
   (a) Analyzing user behavior and trends
   (b) Enhancing video resolution
   (c) Developing new mobile devices
   (d) Setting up Wi-Fi connections
3. Which of the following is not important in determining data quality?
   a) Accuracy
   b) Consistency
   c) Completeness
   d) Database
4. Data that can be modeled as dimension attributes and measure attributes are called _____ data.
   a) Multi-dimensional
   b) Single-dimensional
   c) Measured
   d) Dimensional
5. Which of the following techniques is often used to generate the most probable value to fill in the missing value?
   a) Spooling
   b) Decision tree
   c) Data cleaning
   d) Numerosity reduction
6. Which of the following is true about bottom up discretization?
   a) All the values are treated as potential split points
   b) Some the values are treated as potential split points
   c) Only one value are treated as potential split points

d) Split points are not considered

7. Class/Concept Description has _____ number of tasks.

a) 2

b) 4

c) 3

d) 8

8. Data Characterization can be done by 2 operations. One of them is roll up operation. The other one is _____

a) Drill down

b) Dice

c) Attribute oriented induction

d) Slice.

9. Which of the following is required by K-means clustering?

a) defined distance metric

b) number of clusters

c) initial guess as to cluster centroids

d) all of the mentioned

10. Point out the wrong statement.

a) k-means clustering is a method of vector quantization

b) k-means clustering aims to partition n observations into k clusters

c) k-nearest neighbor is same as k-means

d) none of the mentioned

PART B

Answer All Questions (5 × 4 = 20 Marks)

11. a) Discuss in detail about the Data Mining Functionalities **(OR)**

b) Briefly describe about advantages and disadvantages of data mining.

12. a) What is data? How different type of data and attributes can be designed? **(OR)**

b) Discuss whether or not each of the following activities is a data mining task.

1. Credit card fraud detection using transaction records.
2. Dividing the customers of a company according to their gender.
3. Computing the total sales of a company
4. Predicting the future stock price of a company using historical records.
5. Monitoring seismic waves for earthquake activities.

13. a) Describe about data transformation methods **(OR)**

b) Explain data cleaning techniques..

14. a) what is Bayesian belief network? Explain in detail. **(OR)**

    b) Write a note on attribute selection measures.

15. a) Discuss the ways to access cluster quality **(OR)**

    b) Write a note on K-means clustering algorithm

PART C

Answer Any Three Questions (3 × 10 = 30 Marks)

16. a) Discuss on the various stages in data mining process .**(5 Marks)**

    b) Explain about mining architecture.**(5 Marks)**

17. Explain about various OLAP operations in detail.

18. What is data reduction? Discuss in detail.

19. Describe in detail about Rule based Classification.

20. a) Classify various Clustering methods. **(5 Marks)**

    b) Write any one Partitioning based clustering methods **.(5 Marks)**

Instructions to the question paper setter:

a) 2 MCQ from each unit for Part-A

b) One set of either…or question from each unit for Part-B

c) One question from each unit for Part-C

d) No repetition of questions

e) Use subdivision for Part-C by splitting the marks based on the weightage of the answer

Year	IV	**Course Code:** **Course Title:** Cloud Computing	**Credits**	4
			Hours	75
Sem.	VIII		**Category**	C
Course Prerequisites, if any	• Knowledge of Distributed Systems and Databases			
Course Outcomes	• Understand cloud computing's evolution and characteristics • Comprehend the architecture of cloud computing and differentiate between Infrastructure as a Service (IaaS) and Software as a Service (SaaS) • Recognize PaaS features and examples • Compare scaling hardware using SLAs and billing principles • Evaluate cloud security measures			
Unit No.	**Course Content**			**Hours**
Theory Component				
UNIT I	Introduction Overview of Computing Paradigm – Recent trends in Computing – Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing – Evolution of cloud computing – Cloud Computing (NIST Model) Characteristics – Pros and Cons of Cloud Computing, Cloud computing vs. Cluster computing vs Grid computing – Role of Open Standards			9
UNIT II	Infrastructure as a Service (IaaS) & Software as a Service SaaS Cloud Computing Architecture – Cloud computing stack – Service Models (XaaS) – Deployment Models. Infrastructure as a Service (IaaS) – Introduction – Virtualization, Hypervisors, Machine Image, Virtual Machine (VM) – Examples			9
UNIT III	Platform as a Service (PaaS) Platform as a Service (PaaS) – Introduction – Cloud Platform and Management –Examples, Microsoft Azure, SalesForce.com – Software as a Service – Introduction – Web services – Web 2.0 – Web OS – Case Study on SaaS			9
UNIT IV	Service Management in Cloud Computing Service Management in Cloud Computing – Service Level Agreements (SLAs) – Billing & Accounting – Comparing Scaling Hardware: Traditional vs. Cloud – Economics of scaling, Scalability & Cloud Services			9

UNIT V	Cloud Security Cloud Security – Infrastructure Security – Data security and Storage – Data privacy and security Issues, Jurisdictional issues – Identity & Access Management – Access Control – Trust, Reputation, Risk	9
Recommended Learning References		
Print Resources	1. Rajkumar Buyya, James Broberg, Andrzej Goscinski, "Cloud Computing: Principles and Paradigms", First Edition, Wiley, 2013. 2. Ronald L. Krutz, Russell Dean Vines, "Cloud Security: A Comprehensive Guide to Secure Cloud Computing", First Edition, Wiley, 2010.	

Practical Component		
Title of the Practical: Cloud computing		
Ex.No	**Exercises**	**Hours**
1.	Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8	30
2.	Install a C compiler in the virtual machine created using virtual box and execute Simple Programs	
3.	Install Google App Engine. Create 'hello world' app and other simple web applications using python/java	
4.	Use GAE launcher to launch the web applications	
5.	Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim	
6.	Find a procedure to transfer the files from one virtual machine to another virtual machine	
7.	Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)	
8.	Install Hadoop single node cluster and run simple applications like word count	
Tools/Software to be used		

Model Question Paper

MJD: Cloud Computing

VIII Semester

Time: 3 Hours **Max. Marks: 60**

PART A

Answer All Questions (10 × 1 = 10 Marks)

1. Which organization defined the standard characteristics of Cloud Computing?
   a) IEEE
   b) ISO
   c) NIST
   d) W3C
2. In which computing model are geographically distributed resources shared to solve large problems?
   a) Cluster computing
   b) Grid computing
   c) Stand-alone computing
   d) Parallel computing
3. Which layer of cloud provides virtual machines and storage to users?
   a) PaaS
   b) SaaS
   c) IaaS
   d) DaaS
4. The software that creates and manages virtual machines is called:
   a) Container
   b) Hypervisor
   c) Middleware
   d) Kernel
5. Which of the following is the best example of a PaaS provider?
   a) Google App Engine
   b) Gmail
   c) Dropbox
   d) VirtualBox
6. Web 2.0 mainly focuses on:
   a) Static websites
   b) User interaction and collaboration

c) Hardware virtualization

d) Network routing

7. SLA in cloud computing stands for:

a) System Level Agreement

b) Service Level Agreement

c) Security Level Agreement

d) Software Level Agreement

8. The ability of a cloud system to increase resources when demand grows is called:

a) Virtualization

b) Provisioning

c) Scalability

d) Metering

9. Which mechanism ensures that only authorized users can access cloud resources?

a) Load balancing

b) Identity and Access Management

c) Virtualization

d) Resource pooling

10. Protecting personal and sensitive information in the cloud refers to:

a) Elasticity

b) Interoperability

c) Data privacy

d) Multi-tenancy

PART B

Answer All Questions (5 × 4 = 20 Marks)

11. a) Explain the essential characteristics of cloud computing as defined by NIST.

OR

b) Compare cloud computing with cluster computing.

12. a) Explain virtualization and the role of hypervisors in cloud computing.

OR

b) Describe Infrastructure as a Service (IaaS) with suitable examples.

13. a) What is Platform as a Service? Explain its features.

OR

b) Describe cloud platforms with reference to Microsoft Azure.

14. a) What is an SLA? Explain its components.

OR

b) Discuss scalability in cloud computing.

15. a) Explain Identity and Access Management in cloud.

OR

b) Discuss data privacy issues in cloud computing.

PART C

Answer Any Three Questions (3 × 10 = 30 Marks)

16. a) Explain the essential characteristics of cloud computing.

b) Discuss the advantages and disadvantages of cloud computing.

17. a) Explain virtualization in cloud computing. Describe the types of hypervisors.

b) Give examples of Infrastructure as a Service providers.

18. a) Explain the features of Platform as a Service (PaaS).

b) Describe Microsoft Azure as a cloud platform.

19. a) What is Service Level Agreement (SLA)? Explain its major components.

b) Write short notes on cloud scalability.

20. a) Explain Identity and Access Management (IAM).

b) Discuss risks and trust issues in cloud computing.

Year: IV	Course code:		Credits	4
Semester: VIII	Course Title:	**Deep Learning**	Hours	75
			Category	
Course Prerequisites	Machine Learning			
Course Outcomes	• Understand the basic architecture and workings of neural networks • Understand the fundamentals of deep neural networks • Understand the architectures and workings of deep networks • Build the model for data variants using deep network • Build and train CNN and RNN deep learning architectures			

Theory Component

Unit-No	Content	Hours
Unit-I	Foundations of Neural Networks and Deep Learning Neural Networks – Training Neural Networks – Activation Functions – LossFunctions – Hyperparameters	9
Unit-II	Fundamentals of Deep Networks Defining Deep Learning – Common Architectural Principles of Deep Networks – Parameters – Layers – Activation Functions – Loss Functions – Optimization Algorithms – Hyperparameters – Building Blocks of Deep Networks – RBMs– Autoencoders – Variational Autoencoders	9
Unit-III	Major Architectures of Deep Networks Unsupervised Pretrained Networks – Convolutional Neural Networks (CNNs) – Architecture – Input, Convolutional, Pooling, fully connected Layers – Applications – Recurrent Neural Networks (RNN) – Modeling the Time Dimension – 3D Volumetric Input – Architecture – LSTM Networks	9
Unit-IV	Building Deep Networks Matching Deep Networks to the Right Problem – Modeling CSV Data with Multilayer Perceptron Networks – Modeling Handwritten Images Using CNNs – Modeling Sequence Data using RNN	9
Unit-V	Tuning Deep Networks Concepts: Matching Input Data and Network Architectures – Relating Model Goal and Output Layers – Working with Layer Count, Parameter Count, and Memory – Feed-Forward Multilayer Neural Networks – Controlling Layer and Parameter Counts – Weight Initialization Strategies – Using Activation Functions – Applying Loss Functions – Understanding Learning Rates – Applying Methods of Optimization – Controlling Epochs and	9

	Mini – Batch Size – Regularization – Max–Norm Regularization – Dropout– Dealing with Overfitting	
Recommended Learning Resources		
Print Resources	**Text Books:** 1. Josh Patterson and Adam Gibson, "Deep Learning – A Practitioner's Approach", O'Reilly Media, First Edition, 2017. 2. Nikhil Buduma and Nicholas Locascio, "Fundamentals of Deep Learning: Designing Next Generation Machine Intelligence Algorithms", O'Reilly Media, Frist Edition, 2017.	

Practical Component		
Title of the Practical: Deep Learning		
Ex.No	**Exercises**	**Hours**
1.	Implement a simple perceptron model and train it to perform binary classification on a given dataset. Use the sigmoid activation function and gradient descent for training	30
2.	Build a multilayer feed–forward neural network from scratch. Train the network using the backpropagation algorithm on a given dataset	
3.	Implement and train the CNN on the MNIST dataset for handwritten digit classification	
4.	Develop a RNN using Keras or PyTorch and train it to generate text based on a given dataset	
5.	Fine–tune a pre–trained CNN model using python	
Tools/Software to be used	Python Framework PyTorch / Keras	

MLD Paper for Other Department

Year	I	Course Code:	Credits	3
Sem.	I	Course Title: Fundamentals of Programming	Hours	60
			Category	A
Course Prerequisites, If any	NIL			
Course Outcomes	• To Focus Fundamentals of Computers and Peripherals • To Introduce programming language and aware the students about programming paradigm • To Focus Concept and Methodology of Programming • Understand the use of control structures, functions & Array • Understand basic object-oriented principles.			
Unit No.	**Course Content**		**Hours**	
Theory Component				
Unit I	**Introduction to computer**: Introduction, Basic block diagram and functions of various components of computer **Input/ Output Devices:** Understanding common input devices (keyboard, mouse, scanners) and output devices (monitors, printers). **Computer Memory:** Primary (RAM, ROM) and secondary storage (hard drives, SSDs).		12	
Unit II	**Introduction to Programming**: Basic Difference between Procedure Oriented Language and Object Oriented Language, Concepts of Machine level, Assembly level and High level programming.		12	
Unit III	**Basic Programming Concepts:** Variables, Scope of variable, data types, operators, I/O statements, Control Statements: Test Conditions, Conditional execution and selection, Iteration and Repetitive Executions, Nested loops.		12	
Unit IV	**Arrays:** Introduction to contiguous data types. One dimensional arrays, multidimensional arrays, Array as strings, multidimensional character arrays. Operations on strings. **Functions**: Concept of modular programming, Using functions, Parameters definition and passing, Recursive functions.		12	
Unit V	**Concepts of Object Oriented Programming**: Fundamentals, Features like class, object, polymorphism, inheritance, data encapsulation and abstraction.		12	

Print Resources	**Recommended Learning Resources** 1. Computer Fundamentals – Pradeep K. Sinha & Priti Sinha. 2. Programming Fundamentals A Modular Structured Approach, 2nd Edition Kenneth Leroy Busbee And Dave Braunschweig. 3. "Object Oriented Programming with C++" - E. Balagurusamy , Tata McGraw Hill, 4th Edition.	
	Practical Component 1. Write a program for addition of two numbers 2. Write a program for check whether the number is prime or not 3. Write a program for check whether the number is odd or even 4. Write a program for factorial of n numbers. 5. Write a program for sum of n number. **6.** Write a program for addition of two matrices.	

Model Question

Marks :60 **Duration : 3hrs**

PART – A (10*1=10)
Answer All the Question

1. Which of the following not output device?
   a. Printer
   b. VDU
   c. Scanner
   d. All of the above.
2. Which of the following is the correct definition of Computer?
   a. Computer is a machine or device that can be programmed to perform arithmetical or logic operation sequences automatically
   b. Computer understands only binary language which is written in the form of 0s & 1s
   c. Computer is a programmable electronic device that stores, retrieves, and processes the data
   d. All of the mentioned
3. What is programming?
   a. The Process of designing computer hardware
   b. The process of writing instructions for a computer to perform tasks
   c. The process of repairing computer software
   d. The process of analysing computer algorithms.
4. Procedure Oriented Programming follows:
   a. Top-down approach

b. Down-top approach
c. Random approach
d. Normal approach

5. **What is the default return type of a function in C if not explicitly specified?**
   a. Int
   b. Void
   c. Float
   d. Char

6. Give a statement to increase the value of variable N by 10.
   a. N = 10;
   b. N = N + 10;
   c. 10 = N
   d. N = 10 + 10;

7. Which of the following correctly declares an array?
   a. int array[10];
   b. int array;
   c. array{10};
   d. array array[10];

8. What is the correct syntax to declare a function in C?
   a. return_typefunction_name(parameters);
   b. function_name(parameters) return_type;
   c. return_type(parameters) function_name;
   d. function_namereturn_type(parameters);

9. which of the is not a feature of object oriented programming?

   a. Encapsulation
   b. Polymorphism
   c. Inheritance
   d. Pointer Arithmetic

10. Which of the following principles uses base and derived classes?
    a. Encapsulation
    b. Inheritance
    c. Polymorphism
    d. Data hiding

PART – B

Answer All the Questions (5*4=20)

11. a) Briefly explain about memory and its types.

(OR)

b) Briefly explain about the input devices.

12. a) Explain about different kinds of programming languages.

(OR)

b) Differentiate procedural oriented programming versus object oriented

programming

13. a) Write a Program to perform arithmetic operations using switch case.

(OR)

b) Evaluate the following expressions:

i. 22 + 3 < 6 && !5 || 22 = =7 && 22 – 2 > +5

ii. a + 2 > b || !c && a = = d *a – 2 < = e Where a=11, b=6, c=0, d = 7 and e=5.

14. a) What is an array? How a single dimension and two dimension arrays are declared and initialized?

(OR)

b)Write a program to calculate the factorial of a given number using recursion.

15. a) Explain about basic concept of oops.

(OR)

b) Explain about how to create a class and object with example

PART – C

Answer Any THREE Questions (3*10=30)

16. With a neat diagram explain the basic structure of a computer and its functions
17. a) What is constant? Explain different constants in C. [6]

(b) What is variable? Give the rules for variable declaration[4]

18. write a program for addition of two matrix .

19. a) what is function? What is function definition and function call? [5]

b) Write a program to compute the sum of first 10 even numbers using function.[5]

20. Explain the concept of inheritance with its types and example program

Year	I	Course Code:	Credits	3
Sem.	II	Course Title: Fundamentals of Web Designing	Hours	60
			Category	A
Course Prerequisites, If any	Basic Computer Knowledge			
Course Outcomes	• To Focus Fundamentals of Internet Concepts • To develop Simple web pages using Formatting tags • To learn about List items and hyperlinks • To develop website with frameset and tables • To design colorful web pages using Style sheets			
Unit No.	**Course Content**		**Hours**	
Theory Component				
Unit I	**Internet & World Wide Web Basics:** Introduction to the internet, protocols (HTTP, FTP), and the World Wide Web (WWW), Role of web browsers and web servers. URL Static vs. Dynamic websites.		12	
Unit II	**Introduction to HTML:** Introduction to HTML, Essential Tags, Tags and Attributes, Text Styles and Text Arrangements, Text, Effects, Exposure to Various Tags (DIV, MARQUEE), Color and Background of Web Pages,		12	
Unit III	**List In HTML :** Types of lists :Order list, Unordered list, Description List – Nested list, Graphics and Image Formats – Graphics in HTML document- image and hyperlink anchors – Image maps		12	
Unit IV	**Tables:** Creation of Tables in HTML, Frames. Introduction to style sheets – Inline style information – External Style sheets – Cascading Style sheets.		12	
Unit V	**Case Study:** Design a website for Pondicherry Tourism Department using hyperlink, images frames and CSS.		12	
Text Books	1. Robert W. Sebesta, "Programming the World Wide Web", Addison Wesley, 2011 (UNIT-1) 2. Elisabeth Freeman and Eric Freeman, "Head First HTML with CSS & XHTML(Head First",O'Reilly,2005			
Reference Book	Web Technologies, Black Book, Dream tech Press, 2018			

MLD: Fundamental of Web Designing

Duration : 3 hours **Total Marks : 60**

Part – A

Answer all the questions: (10 x 1 = 10)

1. What is the purpose of a web server?
   - A Stores files
   - B Executes scripts
   - C Delivers web pages to clients
   - D Manages databases

2. **The web browser on your computer is one-----**
   - A. HTTP
   - B. serer
   - C. navigation
   - **D. client**

3. ----------which is also known as a Web, is a collection of websites or web pages stored in web servers and connected to local computers through the internet.
   - A. client
   - B. HTTP
   - C. World Wide Web
   - D. FTP

4. Which tag is used to define the main heading of an HTML document?
   - A <head>
   - B <title>
   - C <h1>
   - D <header>

5. Which attribute is required in all <img> tags?
   - A src
   - B alt
   - C Both src and alt
   - D None

6. What does CSS stand for?
   - A Cascading Style Sheets
   - B Creative Style Sheets
   - C Computer Style Sheets
   - D Colorful Style Sheets

7. Which of the following is not the element associated with HTML table layout?
   a) size
   b) spanning
   c) alignment
   d) color
8. Which of the following is not the value for align attribute?
   a) justify
   b) char
   c) middle
   d) left
9. Which of the following is not set with font-style property?
   a) font-style: normal
   b) font-style: italic
   c) font-style: oblique
   d) font-style: capitalize
10. Which works similar to <i> element?
   a)
   b)
   c) <b>
   d) <blockquote>

Part – B

Answer all the questions: **(5 x 4 = 20)**

11. Explain about the following
    1.Client 2. Server 3. URL 4. Website (OR)
    Explain features of Internet.
12. Explain elementary tags in HTML (OR)
    Explain about text formatting tags.
13. Explain the purpose and way of creating Ordered lists in HTML with an example (OR)
    Illustrate different image formats used in HTML.
14. Explain external style sheet with an example. (OR)
    Discuss briefly about Frames with an example?
15. Explain the about frames in HTML.
    Discuss about table attributes with example.

Part – C

Answer any three of the following questions: (3 x 10 = 30)

16. Explain different types of Browsers and Features of Internet.
17. Explain types of list in HTMLM WITH Example.
18. Define Table tag and their attributes with an example.
19. Explain about Cascading Style Sheets with an example
20. Develop a web page for automobile shop using HTML form elements.

Year	I	Course Code:	Credits	3
Sem.	I	Course Title: Basics of Artificial Intelligence	Hours	60
			Category	A
Course Prerequisites, If any	Basic Computer Knowledge			
Course Outcomes	After learning the course, the students should be able to • Understand AI Problems and building blocks of AI • Learn the types of AI & its Applications • Understand knowledge representation types • Understand how Expert System is designed • Learn about the basics of robot functions			
Unit No.	**Course Content**		**Hours**	
Theory Component				
Unit I	**Introduction:** Artificial Intelligence, Major areas of Artificial Intelligence, Introduction to AI Problems and applications, Building Blocks of AI , Intelligent Agent, Structure of Agents		9	
Unit II	**Types of AI:** Types of AI Based on Capabilities & Functionalities, Humanoid Robot and AI, Generative AI & Predictive AI, Real-World Applications of Generative AI		9	
Unit III	**Applications of Artificial Intelligence:** Areas of Application of AI, Applications of AI in Commerce, AI Analysis, Types of AI Analytics **Knowledge Representation:** Introduction, Approaches to Knowledge Representation, Types of Knowledge		9	
Unit IV	**Learning:** Definition, Rote learning, learning by taking advice, Learning in problem solving, Learning from Examples: Forms of Learning - Supervised Learning - Decision Trees - Regression and Classification **Expert Systems (ES):** Advantages and characteristics of Expert System, Knowledge Engineering, Steps in Developing an Expert System, Mycin		9	
Unit V	**Robotics:** Robot Hardware, Robotic Perception, Robotic Software Architectures - The Present and Future AI **Case Studies:** AI in Retail (Alibaba, Walmart) - AI in Social Media Services (Facebook). Home and workplace Automation with AI		9	
Text Book	Artificial Intelligence: A Modern Approach, Stuart J. Russell, Peter Norvig Pearson Publishing, Third edition 2020			

Reference Book	1. E.Rich, K.Knight, Artificial Intelligence, TMH. 2. Giarratano, Expert System Principles and Programming. 3. Bernard Marr, Artificial Intelligence in Practice 2019 Wiley Publications, 1st Edition	

MLD : Basics of Artificial Intelligence

Time : 3 hours **Max. Marks : 60**

Part – A

Answer all the questions: **(10 x 1 = 10)**

1. What is Artificial Intelligence>
   a) Putting your intelligence into Computer
   b) Programming with your own intelligence
   c) Making a Machine intelligent
   d) Putting more memory into Computer
2. Devices that transforms electrical signals into physical movements
   a) Sensors
   b) Actuators
   c) Switches
   d) Display
3. Computer programs that mimic the way the human brain processes information is called as
   a) Machine Learning
   b) Deep Learning
   c) Neural Networks
   d) None of the above
4. Stron AI is_____
   a) The embodiment of human intellectual capabilities within a computer.
   b) A set of computer programs that produce output that would be considered to reflect intelligence if it were generated by humans.
   c) The study of mental faculties through the use of mental models implemented on a computer
   d) All of the above
5. Which of the following is an application of Artificial Intelligence?
   a) It helps to exploit vulnerabilities to secure the firm

b) Language understanding and problem-solving (Text analytics and NLP)
c) Easy to create a website
d) It helps to deploy applications on the cloud

6. Which of the following machine requires input from the humans but can interpret the outputs themselves?
   a) Actuators
   b) Sensor
   c) Agents
   d) AI system
7. What will take place as the agent observes its interactions with the world?
   a) Learning
   b) Hearing
   c) Perceiving
   d) Speech
8. Automated vehicle is an example of _____
   a) Supervised learning
   b) Unsupervised learning
   c) Active learning
   d) Reinforcement learning
9. How many types of recognition are there in AI?
   a) 5
   b) 3
   c) 2
   d) 1
10. Which of the following is not an application of artificial intelligence?
    a) Computer Vision
    b) Natural Language Processing
    c) Digital Assistants
    d) Database Management System

Part – B

Answer the following questions: **(5 x 4 = 20)**

11. Write short notes on Intelligent Agent (or)
    Explain the building blocks of AI.
12. Differentiate between generative AI and predictive AI (or)

Discuss the real-world application of Generative AI.

13. Write short notes on AI Analytics. (or)
    Explain the four types of knowledge representation.
14. Explain any two examples of an expert systems. (or)
    Explain the learning by taking advice in short.
15. Write short notes on robotic software architecture. (or)
    Describe the current trends of artificial intelligence in business.

Part – C

Answer any three of the following questions: (3 x 10 = 30)

16. Explain the major areas of AI
17. Describe the types of AI based on capabilities and functionalities.
18. Describe the Applications of AI in detail.
19. Explain the types of learning models in AI.
20. Describe the Robotics perception in detail.