

SARADHA GANGADHARAN COLLEGE

(AUTONOMOUS)

(Affiliated to Pondicherry University)



Bachelor of Computer Applications (Honors)

Bachelor of Computer Applications (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

This Bachelor of Computer Applications (B.C.A) course is designed to provide the student with a comprehensive understanding of Computer applications, covering a wide array of foundational concepts and practical skills. B.C.A program, students will explore the fundamental principles of Computer Science, Programming languages, Database Management, Software Development, and more.

This curriculum is crafted to equip the students with the knowledge and skills necessary to excel in the ever-evolving field of computer applications from building a strong foundation in programming to gaining insights into system analysis and design, the B.C.A program will prepare the students for a successful career in the dynamic and diverse world of IT.

1.2. Programme Outcomes

Upon completion of the Bachelor of Computer Applications (B.C.A.) Programme, students will demonstrate the following outcomes at:

UG Certificate Level

- Demonstrate proficiency in solving simple problem using programming.
- Develop a Multimedia application with animation.

UG Diploma Level

- Demonstrate the ability to analyze and solve more complex computational problems.
- Analyze and adapt Digital Marketing strategies based on comprehensive data analytics.

UG Degree Level

- Design and implement efficient solutions for real-world computing challenges.
- Demonstrate understanding of software project management principles.

UG Degree with Honors / Honors with Research

- Demonstrate advanced proficiency in programming languages and software development.
- Clearly articulate complex ideas to technical and non-technical audiences.
- Innovate and contribute to the development of efficient solutions.

- Engage in collaborative projects and demonstrate strong team work skills.
- Adapt to evolving technologies and continue professional development.

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 below).

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.C.A. 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 Multimedia and Animation 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 Applications 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 Applications 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 Applications 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 Applications. The students who secure a minimum of 160 credits, including 12 credits from a research project/dissertation, will be awarded UG Degree in Computer Applications (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.

- Bachelor of Computer Applications *
- Bachelor of Computer Applications (Honors) #
- Bachelor of Computer Applications (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 Multimedia and Animation 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 Applications 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 Applications (B.C.A) 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
2 nd Semester	Min: 40 Credits & Internship (one Month)	Certificate in Multimedia and Animation
4 th Semester	Min: 80 Credits & Internship (one Month)	Diploma in Computer Applications
6 th Semester	Min: 120 Credits & one Internship/ Mini Project	Bachelor of Computer Applications

4. STRUCTURE OF THE UNDERGRADUATE PROGRAMME

This B.C.A. 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 Multi-Disciplinary Courses Ability Enhancement Courses Value Added Courses Community Engagement and Service	Minor Disciplinary Skill Enhancement Courses Internship Research Dissertation Project

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 Department of Computer Applications offers the following 3 courses as MLD courses to other Department Students.

- a) Basics of Networks
- b) IT Enabled Services
- c) Business Analytics

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 (Two Courses)	
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 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 Studies
- c) Digital Technologies
- d) Health, Wellness, Yoga Education.

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 <i>Learn by Doing</i> 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 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/Web Technology, Database Management applications/DBMS) 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 programme) 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. Internal Assessment component is for 40 marks and the End Semester University exam is for 60 marks. In case of Practical, Project work etc., it is 50 marks for 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 Continuous 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	Evaluation Details given in Table 3
IA Test (Best 2)	10	
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	Practical	Theory	
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 and Model exam for all courses. All faculty members are expected to conduct these CIA tests and 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 categories 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 of 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>i. Theory Component:</i> 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. <i>ii. Practical Component:</i> 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)	40 Marks 20 Marks	3 Hours 3 Hours

7. CONSOLIDATION OF MARKS, MINIMUM PASSING MARKS, ARREAR EXAM AND SUPPLEMENTARY EXAMINATION

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 (outstanding)	10
71-79	A+ (Excellent)	9
66-70	A (Very good)	8
61-65	B+ (Good)	7
56-60	B (Above average)	6
50-55	C (Average)	5
40-49	P (Pass)	4
Below 40	F (Fail)	0
Absent (lack of attendance)	Ab (Absent)	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. $SGPA (S_i) = \frac{\sum(C_i \times G_i)}{\sum C_i}$

Where C_i is the number of credits of the i^{th} course and G_i 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	$3 \times 8 = 24$
I	Course 2	4	B+	7	$4 \times 7 = 28$
I	Course 3	3	B	6	$3 \times 6 = 18$
I	Course 4	3	O	10	$3 \times 10 = 30$
I	Course 5	3	C	5	$3 \times 5 = 15$
I	Course 6	4	F	0	$4 \times 0 = 00$
		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	$3 \times 8 = 24$
I	Course 2	4	B+	7	$4 \times 7 = 28$
I	Course 3	3	F	0	$3 \times 0 = 00$
I	Course 4	3	B	6	$3 \times 6 = 18$
I	Course 5	3	C	5	$3 \times 5 = 15$
I	Course 6	4	F	0	$4 \times 0 = 00$
		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

BCA 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		Multimedia and Animation	S	4	3		2
3	SEC 1		Office Automation using AI Tools	S	3		2	2
4	MLD1		One course from the MLD Stream	H	3	3		
5	AEC1		English I	H	2	4		
6	VAC1		Environmental Studies	H	2	2		
7	VAC2		Understanding India	H	2	2		
Total Credits/Total Hours of Work					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		Digital Marketing	S	4	3		2
3	SEC 2		Python Programming	S	3	2		2
4	MLD2		One course from the MLD Stream	H	3	3		
5	AEC 2		Modern Indian Languages I	H	2	4		
6	VAC3		Health & Wellness/Yoga Education	H	2	2		
7	VAC4		Digital Technologies	H	2	2		
Total Credits/Total Hours of Work					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		Internet of Things	S	4	3		2
4	SEC 3		Data Visualization/3D Modelling & Animation/ Game Programming /Accounting Tools	S	3	2		2
5	MLD3		One course from the MLD Stream	H	3	3		
6	AEC 3		English II	H	2	4		
Total Credits/Total Hours of Work					20	26 Hours		

FOURTH SEMSESTER								
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	5		
4	MID4		Cloud Computing and IoT	S	4	3		2
5	AEC 4		Modern Indian Languages II	H	2	4		
6	PROJECT		Community Engagement and Service	H	2			4
Total Credits/Total Hours of Work					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	3		2
3	MJD10		Design and Analysis of Algorithms	H	4	3		2
4	MJD11		Operations Research	H	4	5		
5	MID5		Machine Learning in IoT	S	4	3		2
Total Credits/Total Hours of Work					20	25 Hours		

SIXTH SEMSESTER								
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	MID6		Visual Programming using C#	H	4	3		2
3	MJD14		Internship (6 months)	H	12			
Total Credits/Total Hours of Work					20			

SIXTH SEMSESTER								
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	H	4	3		2
4	MJD15		Mini Project/Internship(1month)	S	4			8
5	MID6		Visual Programming using C#	H	4	3		2
Total Credits/Total Hours of Work					20	28Hours		

SEVENTH SEMESTER								
S. No	Component	Course Code	Title of the Course	H/S	Credits	Hours/ Week		
						L	T	P
1	MJD16		Distributed Systems	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		Artificial Intelligence/UI/UX Design	S	4	3		2
5	MID8		E-Commerce Application Development/ Mobile Application Development	S	4	3		2
Total Credits/Total Hours of Work					20	25 Hours		

EIGHTH SEMSESTER (Honors)								
S. No	Component	Course Code	Title of the Course	H/S	Credits	Hours/ Week		
						L	T	P
1	MJD19		Data warehouse and Mining/ Data Science	S	4	3		2
2	MJD20		Data Analytics and Business Intelligence/ Machine Learning	S	4	3		2
3	MJD21		Robotic Process Automation	H	4	3		2
4	MJD22		Block chain Application Development	H	4	3		2
5	MJD23		Project	H	4			8
Total Credits/Total Hours of Work					20	28 Hours		

EIGHTH SEMESTER (Honors with Research)								
S. No	Component	Course Code	Title of the Course	H/S	Credits	Hours/ Week		
						L	T	P
1	MJD19		Data warehouse and Mining/ Data Science	S	4	3		2
3	MJD20		Data Analytics and Business Intelligence/ Machine Learning	S	4	3		2
5	MJD21		Research Project	H	4			5
6	MJD22		Project Report	H	4			5
7	MJD23		Project Viva-voce	H	4			5
Total Credits/Total Hours of Work					20	25 Hours		

Table 1: List of Major Disciplinary Courses								
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	MJD2		Problem Solving and Programming Fundamentals Using ‘C’	H	4	3		2
3	MJD3		Object Oriented Programming Using ‘JAVA’	H	4	3		2
4	MJD4		Data Structures	H	4	3		2
5	MJD5		Database Management Systems	H	4	3		2
6	MJD6		Operating Systems	H	4	3		2
7	MJD7		Mathematical Foundations of Computer Science	H	4	5		
8	MJD8		Computer System Architecture	H	4	3		2
9	MJD9		Computer Networks	H	4	3		2
10	MJD10		Design and Analysis of Algorithm	S	4	3		2
11	MJD11		Operations Research	H	4	5		
12	MJD12		Software Engineering Theory and Practice	H	4	3		2
13	MJD13		Web Engineering	H	4	3		2
14	MJD14		Soft Computing	H	4	3		2
15	MJD15		Internship / Mini Project	H	12/4			8
16	MJD16		Distributed Systems	H	4	3		2
17	MJD17		System Modeling and Simulation	H	4	3		2
18	MJD18		Wireless Communication Networks	H	4	3		2
19	MJD19		Data warehouse and Mining/ Data Science	S	4	3		2
20	MJD20		Data Analytics and Business Intelligence/ Machine Learning	S	4	3		2
21	MJD21		Robotic Process Automation (Honors)/ Research Project (Research)		4	3		2
22	MJD22		Block Chain Application Development (Honors)/ Project Report (Research)		4	3		2
23	MJD23		Project (Honors)/ Project Viva-Voce(Research)		4			8

Table 2: List of Minor Disciplinary Courses								
S.No.	Component	Course Code	Title of the Course	H/S	Credits	Hours/Week		
						L	T	P
1	MID1		Multimedia & Animation	S	4	3		2
2	MID2		Digital Marketing	S	4	3		2
3	MID3		Internet of Things	S	4	3		2
4	MID4		Cloud Computing and IoT	S	4	3		2
5	MID5		Machine Learning in IoT	S	4	3		2
6	MID6		Visual Programming using C#	S	4	3		2
7	MID7		Artificial Intelligence/UI/UX Design	S	4	3		2
10	MID8		E-Commerce Application Development/ Mobile Application Development					

Table 3: SEC1/ SEC2/SEC3 – I /II /III SEMESTER								
S. No.	Component	Course Code	Title of the Course	H/S	Credits	Hours/Week		
						L	T	P
1	SEC 1		Office Automation using AI Tools	S	3	2		2
2	SEC 2		Python Programming	S	3	2		2
3	SEC 3		Data Visualization Tools / 3D Modelling & Animation/Game Programming/ Accounting tools	S	3	2		2

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

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

Table 6: MLD Offering to other Disciplines								
S. No.	Component	Course Code	Title of the Course	H/S	Credits	Hours/ Week		
						L	T	P
1	MLD1		Basics of Networking	H	2	3		
2	MLD2		IT Enabled Services	H	2	3		
3	MLD3		Business Analytics	H	2	3		

BCA SYLLABUS

SEMESTER I

Year	I	Course Code:	Credits	4
Semester	I	Course Title: Digital Logic Fundamentals	Hours	75
			Category	C
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	2. 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 - Logi Sim

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 $F(A, B, C) = \Sigma(0, 2, 4, 6)$ 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. Discuss the design and operation of ripple and synchronous counters.

Year	I	Course Code:	Credits	4
Semester	I	Course Title: Multimedia and Animation	Hours	75
			Category	C
Prerequisites, if any	Nil			
Course Outcomes	- Describe the various elements and aspects of multimedia and Animation - Learn to work with text and images - Learn to work with audio processing tools - Learn to work with video editing tools - To make an animated movies using Animation and rendering tools			
Unit No.	Course Content			Hours
Theory Component				
Unit I	Multimedia Overview Presentation and production – Characteristics – Hardware and software requirements – Uses – Presentation in Multimedia.			9
Unit II	Text and Image Types of Text – Unicode Standard – Font – Text Compression – File Formats – Image Data Representation – Image Acquisition and Processing – Binary and Color Image Processing – Image File Formats			9
Unit III	Audio Types and Properties of sound - Components of audio – Digital Audio - Synthesizers – Musical Instrument Digital Interface (MIDI) – Digital Audio Processing – Speech – Sound Card – Audio File Formats			9
Unit IV	Video Analog Video - Signal Representation - Digital Video - Digital Video Processing - Recording and Storage Formats - File formats – Editing - Video Processing Software			9
Unit V	Animation Uses – Traditional Animation – Principles of Animation – Computer Based Animation – 3D animation – Rendering Algorithms – Animation File Formats and Software			9
Recommended Learning Resources				
Text Books	1. Ranjan Parekh, “Principles of Multimedia”, Second Edition, Tata McGraw Hill, 2013.			
Reference Books	2. Tay Vaughan, “Multimedia Making It Works”, Eighth Edition,Tata McGraw Hill, 2013.			

Practical Component		
Title of the Practical: Multimedia and Animation		
Ex. No	Exercises	Hours
1	Design a multimedia presentation on a topic of your choice. Include text, images, audio, and video elements	30
2	Identify the essential tools and equipment needed to create high-quality multimedia content	
3	Choose an existing multimedia project or create one, and develop a promotional strategy for it	
4	Create a simple document, such as a poster or brochure, with varying fonts, sizes, and styles	
5	Perform basic image processing tasks like resizing, cropping, and applying colour filters to the image using image editing software	
6	Set up a simple audio system that includes a microphone, amplifier, audio mixer, and loudspeaker	
7	Design a visual representation of the flow of video signals from an analog video camera to a digital format	
8	Create a short tutorial video demonstrating basic editing functions of a chosen video editing software	
9	Create a storyboard for a 3D animation project. Outline key scenes, characters, and movements	
10	Design an interactive web animation prototype. Use any animation software to create a sample animation that responds to user interactions on a webpage	
Tools/Software to be used		Flash 8, Photoshop 7, Power point

Model Question Paper
MID 1: Multimedia and Animation
I Year/ I Semester

Time: 3 Hours

Max. Marks: 60

PART – A

Answer ALL the Questions (10 x 1 = 10) marks

1. Multimedia combines:
a) Text and Graphics b) Sound and Video
c) Animation and Interactivity d) All of the above
2. A device required for video input is:
a) Microphone b) Webcam c) Speaker d) Scanner
3. Unicode standard is used for:
a) Sound encoding b) Text representation
c) Image compression d) File conversion
4. BMP stands for:
a) Bit Map Picture b) Binary Map Pattern
c) Block Media Picture d) Bit Motion Picture
5. Sound in digital form is stored as:
a) Frames b) Samples c) Pixels d) Strings
6. MIDI stands for:
a) Musical Instrument Digital Interface b) Multimedia Input Device Integration
c) Music ID Data Interface d) Motion Input Data Interface
7. Analog video is represented by:
a) Discrete signal b) Continuous signal
c) Binary code d) None
8. Which of these is NOT a video format?
a) AVI b) MOV c) WAV d) MP4
9. Traditional animation uses:
a) Key frames b) Hand-drawn frames c) Computer models d) None
10. Rendering is used in:
a) Text editing b) Sound mixing c) Image generation d) File compression

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

11. a) Define multimedia and explain its characteristics.
or
b) Explain hardware and software requirements for multimedia production.
12. a) Explain types of text used in multimedia with examples.
or

- b) Discuss binary and color image processing.
13. a) Write short notes on types & properties of sound and components of audio.
or
b) Explain MIDI and its role in digital audio systems.
14. a) Explain the difference between analog and digital video.
or
b) Discuss various digital video file formats.
15. a) Explain the principles of animation.
or
b) Compare traditional and computer-based animation methods.

PART C - Answer any THREE Questions (3 x 10 = 30 marks)

16. a) Explain the multimedia production process in detail (5marks).
b) Describe various uses of multimedia in education and business (5marks).
17. a) Explain image data representation and acquisition process (5marks).
b) Compare various image file formats (5marks).
18. Discuss audio compression techniques and file formats.
19. a) Explain digital video processing and editing workflow (5marks).
b) Describe various recording and storage formats used in multimedia (5marks).
20. (a) Explain rendering algorithms and discuss major animation software. (6 marks)
(b) Write a note on 3D animation techniques (4 marks)

Year	I	Course Code:	Credits	3
Semester	I	Course Title: Office Automation using AI Tools	Hours	60
			Category	B
Prerequisites, if any	Nil			
Course Outcomes	• Understand the basics of office management tools • Able to create and format document using Word Processor • Able to store and analyze data using Spreadsheet • Skills to create and deliver effective presentations • Able to design and manage data using database			
Ex. No.	Practical Component			Hours
1	Design a personalized business card, including your name, contact information, and any relevant details, using shapes and text boxes			30
2	Develop a professional resume showcasing your skills, education, and work experience. Utilize appropriate formatting for headings and bullet points			
3	Develop a newsletter layout with multiple columns, images, and articles			
4	Create a personal budget spreadsheet that includes income, expenses, and a summary of the financial situation. Utilize Excel's functions for calculations			
5	Develop a grade tracker for a semester, including columns for subjects, grades, and credits. Calculate the GPA using Excel formulas			
6	Build a photo album slideshow with captions. Apply slide transitions for smooth navigation between images			
7	Create an interactive quiz presentation. Include questions on different slides, and use hyperlinks to navigate to correct or incorrect answers			
8	Present the findings of a scientific experiment. Include graphs, charts, and visuals to illustrate the experiment process and results			
9	Create tables for student details, courses, and grades.			
10	Design a database to manage inventory for a small business			
Tools/Software to be used		MS Office Package, AI Assistance Tools(Copilot,Claude, Canva, Gemini, ChatGPT..)		

Essential Tools and Key Topics covered to implement the Exercises:

Introduction to MS Office & AI: Overview of MS Office Suite (Word, Excel, PowerPoint, Outlook). Role of AI in productivity tools, AI-powered assistants, Benefits of integrating AI with MS Office

MS Word Fundamentals with AI: Creating, formatting, and editing documents, shapes, Image Insertion, Layout. AI-assisted content generation. Smart document design with template.

MS Excel Fundamentals with AI: Basics-Worksheets, formulas, Functions, charts, Data entry and formatting shortcuts. Introduction to AI data insights in Excel. AI-driven data analysis and forecasting, Power Query & Power Pivot with AI, Automating reports, AI for error detection & optimization

MS PowerPoint Fundamentals with AI: Creating slides, layouts, themes and Visual Representation, AI-powered design suggestions, Smart slide structuring & storytelling with AI, Adding animations and transitions efficiently. Advanced PowerPoint with AI, AI-based presentation rehearsal & feedback, AI for creating charts & infographics, Converting text into presentation automatically.

Microsoft Access with AI: Database Design, Tables, Fields, Records, Data Entry, Relationships, Primary Keys. MS Outlook & AI Productivity, Managing emails, calendars, and tasks, AI for email drafting & scheduling, Smart filtering & prioritization of messages. AI Tools Incorporated.

Recommended Learning Resources	
Text Books	1. Joyce Cox, Joan Lombert, Curtis Fyre, “Step by Step, Microsoft Office Professional 2010”, First Edition, 2010.

Value Added Course I

Year	I	Course code:	Credits	2
Semester	I	Course Title: Environmental Studies	Hours	45
			Category	A
Prerequisites, if any				
Course Outcomes		The course aims to train learners to cater to the need of ecological citizenship through developing a strong foundation on the critical linkages between ecology- society-economy.		
Theory Component				
Unit No.		Content	Hours	
Unit I		Multidisciplinary nature of environmental studies 1. Definition, scope and importance; Need for public awareness. 2. Environment Protection Act.	9	
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.	9	
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	9	
Unit IV		4: 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-spots of biodiversity -Threats to biodiversity 4. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.	9	
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 and control measures of urban and industrial wastes	9	
Recommended Learning Resources				
Text Books		1. Odum, E. P., Barrett G., W., 2011, Fundamentals of Ecology, 5ed.,Cengage Learning. ISBN-13: 978-8131500200 2. Sharma, P. D., 2011. Ecology and Environment, Rastogi Publications. ISBN-13: 978- 8171339655		

Value Added Course II

Year	I	Course code:	Credits	2
Semester	I	Course Title: Understanding India	Hours	45
			Category	A
Course Outcomes	The course aims at enabling the students to acquire and demonstrate the knowledge and understanding of contemporary India with its historical perspective, the basic framework of the goals and policies of national development, and the constitutional obligations with special emphasis on constitutional values and fundamental rights and duties. The course would also focus on developing an understanding among students of Indian society, Indian knowledge systems and cultural heritage			
Theory Component				
Unit No.	Content			Hours
Unit I	Geography of India - India on the map of the world and its neighbouring countries - Geographical diversities			9
Unit II	History of India - India’s Freedom Struggle - An introduction to Indian knowledge systems			9
Unit III	Communicating Culture - Oral narratives: Myths, tales and folklore - Introduction to the Tribal Cultures of India			9
Unit IV	Indian Social Structure Continuity and change of the Indian Social Structure: Caste, Community, Class and Gender			9
Unit V	Understanding Indian Polity - The evolution of State in India: Nature and origin - Constitution as a living document			9
Recommended Learning Resources				
Text Books	1. Anuradha K. (2024) Understanding India (as per NEP Syllabus), Shanlax Publications, p.129. – This adheres to or is customized to the Pondicherry University syllabus. 2.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 (Arts, Science & Commerce) under Dibrugarh University as per NEP Syllabus: for four year undergraduate programme (FYUGP): Semester I (VAC), Ashok Publications, p.348.			

SEMESTER II

Year	I	Course Code:	Credits	4
Semester	II	Course Title: Problem Solving and Programming Fundamentals using ‘C’	Hours	75
			Category	C
Prerequisites, if any	NIL			
Course Outcomes	- 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.			
Unit No.	Course Content		Hours	
Theory Component				
Unit I	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		9	
Unit II	Decision Making – Branching & Looping: Decision making – Relational Operators – Conditional statement, Looping Statements – Nested loops – Infinite loops – Switch Statements		9	
Unit III	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		9	
Unit IV	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.		9	
Unit V	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.		9	
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. 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 string 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:	Credits	4
Semester	II	Course Title: Digital Marketing	Hours	75
			Category	C
Prerequisites, if any	Nil			
Course Outcomes	• Understand the fundamental components and strategies of Digital Marketing • Develop and implement effective SEO and SEM strategies • Apply the various types of email marketing and automation techniques • Utilize social media platforms to create engaging content and successful campaigns • Analyze and adapt Digital Marketing strategies based on comprehensive data analytics			
Unit No.	Course Content			Hours
Theory Component				
Unit I	Introduction to Online Market Online Market space- Digital Marketing Strategy- Components - Opportunities for building Brand Website - Planning and Creation - Content Marketing.			9
Unit II	Search Engine Optimization Search Engine optimization - Keyword Strategy- SEO Strategy - SEO success factors - On-Page Techniques - Off-Page Techniques. Search Engine Marketing - SEM components - PPC advertising			9
Unit III	E- Mail Marketing Types of E- Mail Marketing - Email Automation – Integrating Email - Email campaign - Mobile Marketing - Location based - Context based - SMS Campaigns - Profiling and targeting			9
Unit IV	Social Media Marketing Social Media Channels- Leveraging social media for brand conversations and buzz. Benchmark social media campaigns. Engagement Marketing- Creating Loyalty drivers - Influencer Marketing.			9
Unit V	Digital Transformation Digital Transformation & Channel Attribution- Analytics- Ad-words, Email, Mobile, social media, Web Analytics - Changing your strategy based on analysis- Recent trends in Digital marketing.			9
Recommended Learning Resources				
Text Books	1. Puneet Singh Bhatia, “Fundamentals of Digital Marketing, Pearson Education”, First Edition, 2017.			

Practical Component		
Title of the Practical: Digital Marketing		
Ex. No	Exercises	Hours
1	Create a content calendar for a month, detailing blog post topics, social media posts, and email newsletters	30
2	Optimize an existing webpage (or a sample webpage) by updating meta titles, meta descriptions, headers, and including relevant keywords in the content	
3	Create a simple email campaign for a product launch or promotional event using an email marketing tool	
4	Select a brand and analyze its social media presence across three different platforms (e.g., Facebook, Instagram, Twitter).	
5	Analyze a mock digital marketing report with data from various channels (AdWords, email, social media).	
6	A Case Study on recent trends in Digital Marketing.	
Tools/Software to be used		Power point, Canvas, Facebook, Instagram, YouTube

Model Question Paper
MID 2: DIGITAL MARKETING
I Year/ II Semester

Time: 3 hrs

Maximum: 60 marks

PART – A

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

1. Which of the following is a core component of a digital marketing strategy?
a) Traditional retail layout b) Content marketing
c) Physical distribution d) Manual customer tracking
2. The primary purpose of content marketing is to:
a) Directly sell products only b) Enter new physical markets
c) Attract and engage target audiences d) Reduce production cost
3. Which SEO technique involves optimizing meta tags, headings, and content?
a) Off-page SEO b) Technical SEO c) On-page SEO d) Local SEO
4. In Search Engine Marketing (SEM), PPC stands for:
a) Pay Per Click b) Pay Per Conversion
c) Page Performance Click d) Paid Promotion Content
5. Which type of email marketing is triggered automatically based on user actions?
a) Promotional email b) Transactional email
c) Automated email d) Broadcast email
6. Location-based mobile marketing mainly uses:
a) Email servers b) GPS and mobile networks
c) Search engines d) Desktop cookies
7. Which metric is most commonly used to measure engagement marketing?
a) Bounce rate b) Likes, shares, and comments
c) Page loading time d) Cost per click
8. Influencer marketing is most effective when influencers:
a) Have maximum followers only b) Post frequently
c) Have high relevance and audience trust d) Use paid advertisements
9. Which tool is primarily used to analyze website traffic and user behavior?
a) AdWords b) Email Automation c) Web Analytics d) SMS Gateway
10. Channel attribution in digital marketing refers to:
a) Assigning budget equally to all channels
b) Identifying which channel contributed to conversion
c) Creating new digital platforms
d) Automating social media posts

PART – B Answer ALL the Questions (5*4=20) marks

11. a) Explain the concept of an online marketplace and how it differs from traditional marketplaces.
(or)
b) Describe the opportunities for building a brand website and explain the importance of content marketing.
12. a) Explain Search Engine Optimisation (SEO).
(or)
b) Describe Search Engine Marketing (SEM) and explain the components of PPC advertising.
13. a) Explain the different types of marketing.
(or)
b) Discuss the role of location-based marketing in reaching customers with personalized offers.
14. a) Explain various social media channels and how they are used to create brand conversations and buzz.
(or)
b) Discuss engagement marketing and explain how influencer marketing helps in creating customer loyalty.
15. a) Explain digital transformation in marketing and discuss the concept of channel attribution.
(or)
b) Explain the role of digital marketing analytics and how strategies are changed based on analysis and recent trends.

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

16. Explain the evolution of the online market space. Discuss how businesses identify and exploit digital opportunities through effective digital marketing planning and strategy formulation
17. a) Explain the difference between on-page and off-page SEO techniques with examples(5marks)
b) Discuss how search engines rank websites and the challenges involved in achieving long-term SEO performance.(5 marks)
18. Explain the process of designing an effective email marketing campaign. Discuss email integration, profiling, and targeting strategies used to improve campaign performance.
19. a) Explain the role of social media marketing in brand building. (5 marks)
b) Discuss benchmarking social media campaigns and strategies used to generate sustained customer engagement.(5 marks)
20. a) Discuss the role of AdWords, email, mobile, social media, and web analytics in measuring performance and adapting marketing strategies to recent digital trends.(6 marks)
b) Explain digital transformation in marketing organizations (4 marks)

Year	I	Course Code:	Credits	3
Semester	II	Course Title: Python Programming	Hours	60
			Category	B
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				
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 Dataframe 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		

Required Concepts and Topics covered to implement the Exercises:

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.

Value Added Course III

Year	I	Course code:	Credits	2
Semester	II	Course Title: Health & Wellness/Yoga Education	Hours	45
			Category	A
Prerequisites, if any				
Course Outcomes		1. Describing Health & Wellness programs and services offered how to access them, and their value to their well-being. 2. Learn that principles of nutrition are all important parts of overall wellness. 3. To learn the basic concept of wellbeing. 4. Demonstrate how to get healthy and stay healthy using multiple strategies. 5. Identify healthy behaviors and practices that help to avoid and reduce health risks. 6. Yoga education to practice mental hygiene, to integrate moral values and to possess emotional stability. 7. Learn the physical fitness management.		
Theory Component				
Unit No.		Content	Hours	
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.	11	
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	9	
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.	9	
Unit IV		YOGA PRACTICES Types and limbs of Yoga postures Asana Breathing Practices - Pranayama Relaxation- Meditation Mudra.	8	
Unit V		FITNESS ACTIVITIES Types of fitness activities - Outdoor activities - Basic movement patterns. Indoor activity Aerobics/Dance Fitness, Resistance Training for fitness	8	

Recommended Learning Resources	
Text Books	1. Health Promotion: Mobilizing Strengths to Enhance Health, Wellness, and Well-being [1 ed.] F.A. Davis Company 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. 2. 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 Nashay Lorick, 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.

Value Added Course IV

Year	I	Course code:	Credits	2
Semester	II	Course Title: Digital Technologies	Hours	45
			Category	A
Prerequisites, if any	Basics of Computers			
Course Outcomes	• Get introduced to the digital systems and its building blocks • Understand how the Digital Communication happens and to Learn the advantages and disadvantages including Cybersecurity • Learn the day to day digital activities and the initiatives on Digital India • Acquire knowledge on current Technologies and Trends in Digital Space • Explore the applications on the state of the art in Digital Technologies			
Theory Component				
Unit No.	Content			Hours
Unit I	Introduction: Introduction & Evolution of Digital Systems- Roles & significance of Digital Technology -Information & Communication Technology - ICT Tools. Computer System and its working – Software and its types– Hardware - Operating System – types and functions-problem solving: Algorithms - Flowcharts.			9
Unit II	Communication Systems: Principle-Model &Transmission media - Computer Networks &Internet: concepts & applications - Web Browsers - Search Engines - Messaging, Email – Social Networking. Computer Based Information System: Significance and type-E-commerce & Digital marketing: Basic Concepts, Benefits & challenges.			9
Unit III	Digital India & e-Governance Initiatives –Infrastructure, services and empowerment. Digital Financial tools: Unified Payment Interface - Aadhar enabled payment system-Ussd, online services - Credit / Debit Cards - e-Wallets – Mobile and Internet Banking – NEFT / RTGS / IMPS – Online bill Payments and PoS. Cybersecurity: Threats, Significance, Challenges, Precautions, Safety Measures & tools legal and ethical perspectives.			9
Unit IV	Emerging Technologies & Applications: Overview of Cloud Computing, Big Data, Internet of Things, Virtual Reality.			9
Unit V	Emerging Technologies & Applications: Blockchain & Crypto currency, Robotics, Machine learning & Artificial Intelligence, 3D printing, Digital Signatures			9
Recommended Learning Resources				
Text Books	1. Pramod Kumar, Anuradha Tomar, R. Sharmila, “Emerging Technologies in Computing - Theory, Practice, and Advances”, Chapman and Hall / CRC, 1st Edition, 2021, eBook ISBN: 9781003121466. https://doi.org/10.1201/9781003121466. 2. V. Rajaraman, “Introduction to Information Technology”, PHI, 3rd Edition, 2018, ISBN-10: 9387472299, ISBN-13: 978-9387472297. 3. Dr. S. Jayakumar, B. Chitra, “The Handbook on Digital Technology Education”			

Practical		
Ex. No.	Exercises	Hours
1	Operating System Installation and Configuration	30
2	Application Software Installation and configuration	
3	Hardware understanding and minor troubleshooting	
4	Networking, cabling, configuration	

Model Question Paper
VAC 4: Digital Technologies
I year/ II semester

Time: 3 hrs

Maximum Marks: 60

PART A - Answer all the Questions (10*1 = 10)

1. Skype stands for _____.
 - a) System software b) Application software
 - c) Hardware d) None of these

2. The chip/chips present on the motherboard is/are:
 - a) RAM b) ROM c) MICR d) Both 1 and 2

3. Multimedia software helps in _____.
 - a) Allowing users to manipulate
 - b) Allowing users to create new designs and layouts of books, journals
 - c) Allowing users to combine images
 - d) Allowing users to store a large amount of data

4. What is the meaning of Bandwidth in Network?
 - a) Transmission capacity of a communication channels
 - b) Connected Computers in the Network
 - c) Class of IP used in Network d) None of Above

5. Bridge works in which layer of the OSI model?
 - a) Application layer b) Transport layer
 - c) Network layer d) Datalink layer

6. How many layers are in the TCP/IP model?
 - a) 4 layers b) 5 layers c) 6 layers d) 7 layers

7. Cyber Security provide security against what?
 - a) Against Malware b) against cyber-terrorists
 - c) defends a device from threat. d) All mentioned options

8. Which one of the following options can be considered as the Cloud?
a) Hadoop b) Intranet c) Web Applications d.) All of the mentioned
9. Which one of the following is Cloud Platform by Amazon?
a) Azure b) AWS c) Cloudera d) All of the mentioned
10. Which technology allows IoT devices to communicate over very short distances?
a) Bluetooth b) Satellite c) Fiber optics d) Dial-up

PART B -Answer the following Questions (5*4=20)

11. a) What is Algorithm? Explain any one Algorithm.
(or)
b) What type of protocol used in Web Browser? Explain briefly.
12. a) Discuss Virtual Reality.
(or)
b) Write few points about RTGS and IMPS.
13. a) Explain in detail about Big data Analytics.
(or)
b) Where 3D printing can be used?
14. a) Explain in detail about transmission media.
(or)
b) Explain Cloud Computing.
15. a) List out and explain ICT tools.
(or)
b) Write down the functions of social media.

PART C - Answer any THREE Questions (3 * 10=30)

16. a) Explain in detail about Computer Architecture.(5 marks)
b) How to write an algorithm? Explain with suitable example (5 marks).
17. Differentiate between Wired and Wireless Media.
18. Write any one emerging technologies in Digital Analytics.
19. How to use internet banking for transaction?
20. a) Explain Internetworking.(5 marks)
b) Write in detail about Digital Signatures. (5 marks)

SEMESTER III

Year	II	Course code:	Credits	4
Semester	III	Course Title: Object Oriented Programming using ‘JAVA’	Hours	75
			Category	C
Prerequisites, if any		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: 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 multithreading	
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
MJD 3: Object Oriented Programming using JAVA
II Year/III Semester

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) Input Stream Reader b) File Reader c) Buffered Reader d) Scanner
6. What happens if you access an invalid index of an array in Java?
a) Array IndexOutOfBoundsException b) Null Pointer Exception
c) Segmentation Fault d) No Error
7. Which one of the following is correct?
a) Java applets cannot 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 notes 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 String Buffer class (6 marks)
b) Write a program to implement overriding concepts (4 marks)
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 marks)
b) Explain the JDBC Driver class with suitable example (5 marks)

Year	II	Course code:	Credits	4
Semester	III	Course Title: Data Structures	Hours	75
			Category	C
Prerequisites , if any		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
MJD 4: Data Structures
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 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 $A-B / (C * D \wedge E)$ is?
a) $-A/B * C \wedge DE$ b) $-A/BC * \wedge DE$ c) $-ABCD * \wedge DE$ d) $-/* \wedge ACBDE$
5. 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) $O(n \log n)$ d) $O(n * \log n)$
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 $O(\log n)$
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:	Credits	4
Semester	III	Course Title: Internet of Things	Hours	75
			Category	C
Prerequisites, if any	Basics of Computers			
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 Arduino, Raspberry Pi - Manage IoT server and cloud infrastructure, focusing on security			
Unit No.	Theory component			Hours
Unit I	Introduction Definition, Characteristics of IoT, IoT Devices – Physical Design of IoT – Protocols – Logical Design of IoT – IoT communication models - IoT communication APIs - IoT Enabled Technologies.			9
Unit II	Domain Specific IoT Applications: Home Automation – City – Environment – Energy – Retail – Logistics – Agriculture – Industry – Health and Lifestyle			9
Unit III	Developing IoT Systems (Basic Programming Concepts only) Introduction to Arduino Platform, Arduino Programming Basics, Integration of Sensors and Actuators, Data Acquisition from Sensors, Introduction Raspberry PI: Role of Raspberry PI in IoT System, Components and Ports — GPIO Header — Raspberry PI Interfaces (Serial, SPI, I2C). Programming using Raspberry PI.			9
Unit IV	IoT Platform Design Methodology Purpose & Requirements specification - Process Specification, Domain Model specification, Information Model Specification, Service Specification, IoT levels specification & Templates, Steps for IoT Design.			9
Unit V	Deployment and IoT System Management M2M Applications – Introduction to Cloud & Storage Models, Cloud for IoT - Webserver, Web Server for IoT. Software Defined Networks – Network Function Virtualization – Need for IoT System Management – Simple Network Management Protocol – IoT System Management with NETCOZF-YANG - Security Management in an IoT System			9
Recommended Learning Resources				
Text Books	1.Arshdeep Bahga and Vijay Madisetti, “Internet of Things – A Hands-on Approach”, First Edition, Orient Blackswan Private Limited, 2015.(Units I–V) 2.Richard Blum, “Arduino Programming in 24 Hours”, Sams Teach Yourself, Pearson Education, 2017. (Unit III)			

	3. Dr. Mahamed Rizwan, “Internet of Things”, Margham Publications, 2022.
Reference Books	1. Dr Kamlesh Lakhwani, Dr Hemant Kumar Gianey, Joseph Kofi Wireko, K. K. Hiran, “Internet of Things (IoT): Principles, Paradigms and Applications of IoT”, BPB Publications, 2020. 2. Pethuru Raj and Anupama C. Raman "The Internet 'of Things: Enabling Technologies, Platforms, and Use Cases", (CRC Press). (Unit V)

Practical Component		
Title of the Practical: Internet of Things		
Ex. No	Exercises	Hours
1	Sketch a physical design for a home automation system using IoT devices.	30
2	Set up a basic communication protocol between two IoT devices using MQTT.(Publisher–Subscriber using Python)	
3	Simulation of Home Automation System using Arduino / Python	
4	Arduino Sensor Data Acquisition and Serial Communication with Python	
5	Raspberry Pi GPIO Control using Python	
6	IoT Dashboard System using Raspberry Pi (Data Display & Alerts)	
7	Program a Raspberry Pi to collect weather data from sensors and display it on a web server	
8	Design and Implementation of IoT System (Domain, Information Model) using Python	
9	Development of IoT Service Layer using Flask (REST API)	
10	Investigate and compare M2M applications in industries such as healthcare and logistics.	
11	Simulation of IoT System Monitoring using Python (SNMP concept)	
12	Select and Develop any one case study from the list provided below using IoT platforms like Arduino or Raspberry Pi: 1. Weather Monitoring. 2. Home automation 3. Smart City.	
Tools/ Software to be used	Python, Arduino IDE	

Model Question Paper
MID 3: Internet of Things
II Year/III Semester

Time: 3 Hours

Max. Marks: 60

PART A

Answer All Questions (10 × 1 = 10 Marks)

1. Which of the following communication protocols is commonly used in IoT applications based on the Publish-Subscribe model?
a) FTP b) SMTP c) MQTT d) SNMP
2. Which component in an IoT system is responsible for converting electrical signals into physical actions?
a) Sensor b) Router c) Gateway d) Actuator
3. Smart irrigation systems are an example of IoT applications in which domain?
a) Retail b) Agriculture c) Logistics d) Healthcare
4. Which of the following is a Smart City application?
a) Crop monitoring b) Fleet management c) Smart parking d) Patient monitoring
5. Which function in an Arduino program executes repeatedly after the setup() function?
a) begin() b) init() c) main() d) loop()
6. What does GPIO stand for in Raspberry Pi?
a) General Purpose Input Output b) General Program Interface Output
c) Global Process Input Output d) General Peripheral Interface Operation
7. In IoT methodology, which specification identifies entities and their relationships within a system?
a) Service Specification b) Process Specification
c) Domain Model Specification d) Information Model Specification
8. Which IoT level typically involves a single node connected directly to a local application?
a) Level 1 b) Level 3 c) Level 5 d) Level 6
9. Which protocol is widely used for network monitoring and management?
a) MQTT b) HTTP c) SNMP d) CoAP
10. What is the primary purpose of Software Defined Networking (SDN)?
a) Increase sensor accuracy b) Separate control plane from data plane
c) Reduce cloud storage requirements d) Improve battery capacity

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

11. a) Define IoT and explain its characteristics..
or
b) Differentiate between sensors and actuators with examples.
12. a) Explain the architecture and applications of IoT in home automation.
or
b) Explain how IoT can improve logistics and industrial operations.
13. a) Explain Serial, I2C, and SPI interfaces used in IoT devices.
or
b) Explain the structure of an Arduino program with examples.
14. a) Discuss Information Model Specification in IoT systems.
or
b) Discuss IoT deployment templates with examples.
15. a) Explain M2M communication and its applications
or
b) Explain IoT system management using NETCOZF-YANG.

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

16. Explain the Physical Design and Logical Design of IoT with suitable diagrams.
17. a) Discuss IoT applications in environmental monitoring. (5 marks)
b) Explain the role of IoT in energy systems (5 marks)
18. Explain the Raspberry Pi architecture and its role in IoT systems. (5 marks)
Explain the Arduino platform, architecture. (5 marks)
19. Explain IoT methodology and the various stages involved in developing IoT systems.
20. a) Explain the role of Cloud Computing in IoT systems. (6 marks)
b) Explain Software Defined Networking (SDN). (4 marks)

Year	II	Course code:	Credits	3
Semester	III	Course Title: Data Visualization Tools	Hours	60
			Category	B
Prerequisites, if any		Basic knowledge of Computer		
Course Outcomes		• Understanding the concepts of Data visualization • Explore various option with Tabula tool for visualization • Understand the Python Libraries associated with Data Visualization • Explore various visualization options in Seaborn • Explore the options in R tool for visualization		
Ex. No	Practical Component			Hours
1	Build a simple & Advance Visualization with Source data using Tableau			30
2	Built all the Map options in Tableau			
3	Create interactive dashboard by applying calculations filters in tableau			
4	Build the scatter plot and ggplot2 with Source data using R			
5	Build a visualizing cluster with heatmaps using R			
6	Build all types of charts using Matplotlib			
7	Build histogram using Matplotlib			
8	Build a visualization with source data handling using Pandas			
9	Build all types of charts using Seaborn			
10	Visualize the Categorical data plotting with Seaborn			
Tools/Software to be used		‘R’ Studio, Python, Tableau		

Key topics and concepts covered to implement the exercises:

Tableau: Data Visualization, Charts, Maps, Dashboards, Filters, Calculated Fields, Interactive Dashboards, Data Connection.

R Programming: ggplot2, Scatter Plots, Heatmaps, Cluster Visualization, Statistical Visualization, Data Visualization.

Matplotlib: Plotting Charts, Histograms, Data Visualization, Figure Customization, Graph Formatting.

Pandas: DataFrames, Data Handling, Data Manipulation, Data Analysis, Visualization with Source Data.

Seaborn: Statistical Visualization, Categorical Plots, Heatmaps, Distribution Plots, Advanced Data Visualization.

Recommended Learning Resources	
Text Books	1. Kalilur Rahmman, "Python Data Visualization Essentials Guide", First Edition, BPB Publications, 2021. 2. Pritpal Singh, "Advance Data Visualization" First Edition, Publisher Lovely Professional University, 2021.
Reference Books	3. Margot Tollefson, "Visualizing Data in R 4: Graphics Using the base, graphics, stats, and ggplot2 Packages Paperback – Import", First Edition, APress, 2021

Year	II	Course Code:	Credits	3
Semester	III	Course Title: 3D Modelling & Animation	Hours	60
			Category	B
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, moonlight, and night-time scenarios(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 using 3D models			
9	Developing an animated story			
10	Developing an animated virtual building tool with first-person walkthrough (VR integration).			
11	Implement VR-based immersive environment navigation for the created 3D scene (virtual walkthrough system).			
12	Apply AR-based visual enhancement by overlaying 3D objects into real-world style scene simulation (marker-based or camera-based concept).			
Tools/Software to be used		Blender		

Key topics and concepts covered to implement the exercises:

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	1. Andy Beane, “3D Animation Essentials”, First Edition, Wiley & Sons, 2012. 2. Magesh Chandramouli, “3D Modeling & Animation: A Primer”, CRC Press, 2021. 3. 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
Prerequisites, if any	Basic Programming Knowledge			
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 2D game.			30
2	Understand and develop the UI design in games			
3	Creating Game Menus and Scene Navigation			
4	Implementing Collision Detection and Physics			
5	Adding Sound Effects and Background Music(including 3D spatial audio concepts)			
6	Developing a Character Controller (VR-style navigation support).			
7	Understanding and apply the role of AI in games (NPC behavior and pathfinding).			
8	Developing a Puzzle game			
9	Developing a Multiplayer game using unity (Python-based networking concepts).			
10	Developing a 3D game with immersive environment design (VR-ready extension).			
11	Develop an immersive 3D Game with VR-based interaction (first-person view, head movement simulation, VR-style navigation).			
12	Develop a VR-based Character Controller for immersive gameplay interaction.			
13	Create a VR Game Menu System with 3D world-space UI and gaze-based selection.			
14	Implement AR-based game interaction using camera-based overlay or marker-based object placement (conceptual AR integration).			
15	Select and Develop any one case study from the list provided below: 1. Create a basic virtual reality environment using a VR development platform like Unity or Unreal Engine 2. Develop a VR application where users can interact with virtual objects using hand gestures or controllers 3. Build a VR application that allows users to watch 360-degree videos in a virtual reality environment 4. Develop a VR tour experience where users can explore virtual replicas of real-world locations like museums 5. Design a VR puzzle game where players must solve challenges or riddles to progress through levels			
Tools/Software to be used		Python, C# (for Unity), C++ (for Unreal Engine), Visual Studio, Photoshop, Canva, Blender		

Key topics and concepts covered to implement the exercises: 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.

Year	II	Course Code:	Credits	3
Semester	III	Course Title: Accounting Tools	Hours	60
			Category	B
Prerequisites, if any	Nil			
Course Outcomes	• Student will be able to computerize the accounts maintained in ledger • Acquire knowledge about how to use the package for accounts application for a company • Learned about basic entries in Tally ERP(Financial Package) • To work tally Accounting Software for maintaining accounts			
Ex. No	Practical Component			Hours
1	a. Prepare Simple Income & Expense Statement in Excel b. Create Invoice Preparation System in Excel			
2	a. Prepare Ledger Account Preparation using Excel b. Prepare Simple Payroll Sheet in Excel			
2	Create a new company and configure basic settings			30
3	Create the necessary groups and ledger accounts for a trading business, including cash, bank, sales, purchases, expenses, debtors, and creditors.			
4	Record various receipt, payment, and contra transactions using the appropriate voucher types in Tally ERP 9			
5	Enter purchase and sales transactions using voucher entries and maintain accurate accounting records			
6	Create stock groups, units of measurement, and stock items for inventory management in Tally ERP 9.			
7	Record inventory-based purchase and sales transactions and verify stock balances using inventory reports.			
8	Configure GST in Tally ERP 9 and generate GST-compliant purchase and sales invoices.			
9	Generate and analyze accounting reports such as Day Book, Ledger Report, Trial Balance, Profit and Loss Account, and Balance Sheet			
10	Create and maintain multiple ledger accounts and record business transactions using appropriate vouchers.			
11	Generate and interpret financial reports including Trial Balance, Profit and Loss Account, Balance Sheet, and Stock Summary.			
12	Develop a case study on ABC Traders sells electronics items like Laptops, Keyboards, and Mice			
Tools/Software to be used		Tally ERP 9/Excel		

Key Topics covered to implement the exercises

Excel accounting and statistical packages.

Basics of Accounting-Types of accounts-Golden rules of accounting -Accounting Principles - Concepts and conventions -Double entry system of Book keeping-Mode of Accounting- Financial Accounting - Recording Transactions.

Fundamentals of Tally - Creation / Setting up of Company in Tally- Accounting masters in Tally - F11: Features - F12 Configurations -Setting up of Account Heads.

Preparation of Journal, Ledger and Trial Balance.

Voucher Entry in Tally- Accounting Vouchers –Inventory Vouchers –Invoicing.

Final Accounts: Trading Account - Profit and Loss Account - Balance Sheet Preparation of Final Accounts with simple adjustments.

Tally Lab Flow: (Essential)

Introduction to Computerized Accounting ->Company Creation ->Groups and Ledgers->Voucher Entry (Contra, Payment, Receipt, Purchase, Sales)->Inventory Basics->Create Inventory and Record Stock Transactions->Create GST Purchase and Sales Invoices->Generating Reports (Trial Balance, P&L, Balance Sheet)

Recommended Learning Resources	
Text Books	1. R.L. Gupta and V.K Gupta, “Financial Accounting”, Sultan Chand and Sons Publishers, 2012. 2. Tally ERP 9 in Simple Steps, Kogent Learning Solution, Printman India, 2010. 3. S.N. Maheswari, “Advanced Accountancy Vol I”, Vikas Publishing 4. Joanne M. Flood, “Interpretation and Application of Generally Accepted Accounting Principles”, Wiley GAAP 2023.

SEMESTER - IV

Year	II	Course code:	Credits	4
Semester	IV	Course Title: Database Management Systems	Hours	75
			Category	C
Prerequisites , if any		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. 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, SQL Server, 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) Write a note on use of triggers.

(or)

b) Explain integrity constraints in SQL.

14. a) Explain how redundant attributes removed in an entity set.

(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. Define key in DBMS. Explain the types of keys with examples.

17. a) Explain SQL set operations with examples. (5 Marks)

b) List the aggregate functions with examples. (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
Prerequisites, if any		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 Implementation – File System Structure – File System Operations – Allocation methods			9
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		C / Python, Linux OS

Model Question Paper
MJD 6: Operating Systems
II Year/ IV Semester

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 marks)
(b) Explain Bankers Algorithm with an example (6 marks)
18. a) Explain about paging techniques (5 marks)
b) Elucidate about LRU page replacement algorithm with an example.(5 marks)
19. Explain various Disk Scheduling Algorithms
- 20.a) Explain about Linux File System.(5 marsk)
b) State features and benefits of NTFS in windows. (5 marks)

Year	II	Course Code:	Credits	4
Semester	IV	Course Title: Mathematical Foundations of Computer Science	Hours	75
			Category	A
Prerequisites, if any	Knowledge of functions, algebra, and pre-calculus			
Course Outcomes	• Understand logical statement structures • Apply operations in problem-solving • Analyze integer representations and congruences • Understand counting principles • Evaluate combinatorial solutions			
Unit No.	Course Content		Hours	
Theory Component				
Unit I	Logic and Proofs Propositional Logic – Predicates and Quantifiers – Rules of Inference - Proofs – Methods and Strategy		15	
Unit II	Basic Structures Sets – Functions – Sequences and Summations– Matrices Relations – properties – representation		15	
Unit III	Number Theory Divisibility and Modular Arithmetic – Integer Representations and Algorithms – Primes and Greatest Common Divisors – Congruences		15	
Unit IV	Induction and Recursion Mathematical Induction - Strong Induction and Well Ordering - Recursive Definitions and Structural Induction		15	
Unit V	Counting Basics – Pigeonhole principle – Permutations and Combinations – Binomial Coefficients		15	
Recommended Learning Resources				
Text Books	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.			

Model Question Paper
MJD 7: Mathematical Foundations of Computer Science
II Year/IV Semester

Time: 3 Hours

Max. Marks: 60

PART A

Answer All Questions ($10 \times 1 = 10$ Marks)

1. Which of the following is the negation of the statement " $p \wedge q$ "?
a) $\neg p \wedge \neg q$ b) $\neg p \vee \neg q$ c) $p \vee q$ d) $p \rightarrow q$
2. The rule of inference "If $p \rightarrow q$ 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 $A \cup B$ 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) $(a, b) \in R$ implies $(b, a) \in R$ b) $(a, a) \in R$ for every $a \in A$
c) (a, b) and (b, c) imply (a, c) d) $(a, b) \notin R$ for all $a, b \in A$
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 ($5 \times 4 = 20$ Marks)

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

(or)

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

$$\begin{aligned} &[\\ &1 + 3 + 5 + \dots + (2n-1) = n^2 \\ &] \end{aligned}$$

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:

- $({}^6P_3)$
- $({}^6C_3)$

(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 ($3 \times 10 = 30$ 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

$$\left[\begin{array}{l} 1+2+3+\cdots+n=\frac{n(n+1)}{2} \end{array} \right]$$

for all positive integers (n) using mathematical induction.

b) 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:

- $({}^8P_3)$
- $({}^8C_3)$
- $({}^{10}C_4)$ (5 Marks)

Year	II	Course Code:	Credits	4
Semester	IV	Course Title: Cloud Computing and IoT	Hours	75
			Category	C
Prerequisites, if any	Basics of IoT			
Course Outcomes	- Identify the need for the cloud in IoT deployment - Describe different Cloud provider’s architecture. - Apply IoT analytics and data visualization. (K3) - Explain the need of security measures in the Internet of Things. - Apply the knowledge of Dev-ops in IoT applications.			
Unit No.	Course Content			Hours
Theory Component				
Unit I	Cloud & Enabling Technologies Introduction to Cloud Computing: Definition, Evolution of Cloud Computing, Cloud Characteristics - Service models (IaaS, PaaS, SaaS) - Deployment models (public, private, hybrid, and community cloud) - Elasticity and On-demand Provisioning - Virtualization Concepts – Role of cloud computing in IoT systems, Applications.			9
Unit II	IOT and Cloud Four Pillars of IoT - Cloud of Things: cloud computing, Grid/SOA and Cloud Computing, Cloud Middleware, NIST’s SPI Architecture and Cloud Standards - The Cloud of Things Architecture - Defining Edge Computing and Fog Computing.			8
Unit III	Cloud Providers and Systems Introduction to Amazon AWS – AWS Components – S3 – Lambda – AWS IoT Core - MQTT Protocol – Connecting web application with AWS IoT - AWS IoT Rules Engine - Basic IoT Case Studies using AWS.			8
Unit IV	IOT Data Analytics (Basics) Defining IoT Analytics and challenges – IoT analytics for cloud: elastic analytics concepts, designing for scale, – data collection strategies and techniques: Designing data processing for analytics, applying big data technology to storage (Hadoop & Apache Basics) – data science for IoT: Machine learning representation, evaluation and optimization, use case for deep learning for IoT – Strategies to organize data for analytics: Linked analytical data sets managing data lakes.			12
Unit V	IoT Cloud Security Cloud Security – Infrastructure Security – Data security and Storage – Data privacy and security Issues – Cloud Data Security Principles in IoT - Identity & Access Management – Access Control – Authentication and Authorization in IoT, Device Security, Encryption Techniques (Data at Rest and In Transit), Legal and Privacy Issues in IoT.			8

Recommendation Learning Resources	
Text Books	1. Rajkumar Buyya, James Broberg, Andrzej Goscinski, “Cloud Computing: Principles and Paradigms”, First Edition, Wiley, 2013. (Unit I) 2. The Internet of Things in the Cloud A Middleware Perspective, Honbo Zhou – CRC Publication.(Units II, III) 3. Analytics for the Internet of Things (IoT), Andrew Minter, Packt Publication 2017(Unit III, IV, V)
References Books	1. IoT: Security and Privacy Paradigm (Internet of Everything (IoE)) [1 ed.] by Souvik Pal (editor), Vicente García Díaz (editor), Dac-Nhuong Le (editor) , CRC Press, 2020. 2. Arshdeep Bahga and Vijay Madisetti, “Internet of Things – A Hands-on Approach”, First Edition, Orient Blackswan Private Limited, 2015.

Practical Component		
Paper Title: Cloud Computing for IoT		
Ex. No	Exercises	Hours
1	Cloud Storage Simulation using Python and Google Drive	30
2	Cloud Elasticity Simulation using Python	
3	IoT Data Collection & Storage: Simulate and store sensor data (Data Simulation)	
4	IoT Data Logging into Cloud Database(Google Drive)	
5	Upload IoT Data to cloud storage(Google Drive & Cloud Integration)	
6	IoT Data Retrieval from Cloud	
7	Serverless Processing using AWS Lambda (Concept Code)	
8	IoT Data Streaming Simulation using Python (MQTT Concept Simulation)	
9	Upload IoT Data to Cloud Storage (AWS S3 Simulation)	
10	IoT Data Analytics using Pandas: Perform statistical analysis	
11	IoT Data Visualization & Dashboard: Plot graphs and display insights (Matplotlib)	
12	IoT Dashboard using Python (Matplotlib)	
13	IoT Web Server using Flask: Create server to serve IoT data	
14	Web Dashboard for IoT Data	
15	Implement security measures such as encryption and authentication in an IoT system using cloud-based services	
16	Select and Develop one case study from the list provided below: 1. IoT Cloud Analytics in Smart Healthcare System 2. IoT Cloud Analytics in Smart Traffic Management System 3. IoT Cloud Analytics in Smart Agriculture System 4. IoT Cloud Analytics in Smart Parking System	
Tools/ Software to be used		Python, MySQL/SQLite

Model Question Paper
MID 4: Cloud Computing and IoT
II Year/ IV Semester

Time: 3 Hours

Max. Marks: 60

PART A

Answer All Questions (10 × 1 = 10 Marks)

1. Which cloud service model provides virtualized computing resources such as servers, storage, and networking?
a) SaaS b) PaaS c) IaaS d) DaaS
2. Which characteristic of cloud computing allows resources to automatically scale up or down based on demand?
a) Virtualization b) Elasticity c) Portability d) Availability
3. What is the primary role of cloud computing in IoT systems?
a) Manufacturing IoT devices b) Data storage, processing, and analytics
c) Replacing sensors d) Reducing network bandwidth
4. What does NIST's SPI architecture stand for?
a) Storage, Processing, Integration b) Security, Platform, Infrastructure
c) Software, Platform, Infrastructure d) Service, Protocol, Internet
5. Which AWS service is primarily used for object storage?
a) AWS Lambda b) AWS IoT Core c) Amazon EC2 d) Amazon S3
6. Which protocol is commonly used by AWS IoT Core for device communication?
a) HTTP b) FTP c) MQTT d) SMTP
7. Which of the following is a major challenge in IoT analytics?
a) Limited data generation b) Lack of devices
c) Handling large volumes of data d) Absence of cloud services
8. A Data Lake is primarily used for:
a) Network routing b) Storing large amounts of raw data
c) Device authentication d) Software deployment
9. Which of the following is a major security concern in cloud computing?
a) Data breaches b) Increased storage capacity
c) Resource sharing d) Virtualization
10. Which security type focuses on protecting IoT devices from unauthorized access?
a) Physical Security b) Device Security
c) Cloud Storage Security d) Data Compression Security

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

- 11. a) Explain the characteristics of cloud computing.**

(or)

b) Explain virtualization and its role in cloud computing.

12. a) Explain the role of cloud computing in IoT systems.

(or)

b) Differentiate between Grid Computing, SOA, and Cloud Computing.

13. a) Explain Amazon S3 and its key features.

(or)

b) Explain AWS IoT Core and its working with MQTT protocol.

14. a) Discuss the challenges in IoT data analytics with suitable examples.

(or)

b) Write a note on Data Lakes.

15. a) Explain security concerns and risk issues in cloud computing.

(or)

b) Discuss legal and compliance issues in cloud computing security.

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

16. Explain in detail the evolution of Cloud Computing. Explain cloud service models and deployment models in detail. (IaaS, PaaS, SaaS)

17. a) Explain the role of Data storage and processing in IoT-cloud (5 marks)

b) Explain Cloud of Things (CoT) architecture in detail. (5 marks)

18. Explain Amazon AWS architecture with focus on core services.

19. a) Explain IoT analytics data collection strategies. (5 marks)

b) Explain data science methods in IoT analytics. (5 marks)

20. a) Explain the Encryption Techniques for IoT cloud computing. (6 marks)

b) Authentication and access control (4 marks)

SEMESTER V

Year	III	Course code:	Credits	4
Semester	V	Course Title: Computer System Architecture	Hours	75
			Category	C
Prerequisites, if any	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
MJD 8: 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 $R1 \leftarrow R2 + R3$ 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
Prerequisites, if any	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 9 – Computer Networks
II Year/IV Semester

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 $x^3 + 1$. 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

17. Describe the sliding window protocol for data link layer

18. Explain how routing performed using link state algorithm is. Illustrate with an example.

19. Describe the TCP congestion control approaches with necessary diagrams.

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
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 – Prim’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. 2. 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	C/Python/JAVA	

Model Question Paper
MJD 10: Design and Analysis of Algorithms
III Year/V Semester

Time: 3 Hours

Max. Marks: 60

PART A

Answer All Questions ($10 \times 1 = 10$ 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) $\Theta(n)$
 - b) $O(n)$
 - c) $\Omega(n)$
 - 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
 - b) 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
 - b) 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 ($5 \times 4 = 20$ 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 ($3 \times 10 = 30$ 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
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				
Text Books	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.			

Model Question Paper
MJD 11: Operations Research
III Year/V Semester

Time: 3 Hours

Max. Marks: 60

PART A
Answer All Questions ($10 \times 1 = 10$ Marks)

1. Operations Research is primarily used for:
a) Entertainment b) Decision Making c) Programming d) Networking
2. Which of the following is a characteristic of Operations Research?
a) Scientific Approach b) Guess Work
c) Trial and Error Only d) Random Selection
3. Which method is used to solve Linear Programming Problems graphically?
a) MODI Method b) Hungarian Method c) Graphical Method d) CPM
4. The Big-M method is used in:
a) Transportation Problems b) Assignment Problems
c) Linear Programming Problems d) PERT
5. The Assignment Problem is generally solved using:
a) MODI Method b) Hungarian Method c) Simplex Method d) CPM
6. The objective of an Assignment Problem is to:
a) Maximize distance b) Minimize cost or time
c) Increase inventory d) Increase variables
7. NWCR stands for:
a) North-West Corner Rule b) North-West Cost Rule
c) New Weight Cost Rule d) None of these
8. Which method is used to test optimality in Transportation Problems?
a) Hungarian Method b) MODI Method c) Big-M Method d) CPM
9. In CPM, the longest path in a network is called:
a) Dummy Path b) Critical Path c) Feasible Path d) Alternate Path
10. PERT uses how many time estimates?
a) One b) Two c) Three d) Four

PART B - Answer All Questions ($5 \times 4 = 20$ Marks)

11. (a) Explain the characteristics and applications of Operations Research.
(or)
(b) Discuss the components of a Linear Programming Problem and the steps involved in solving an LPP.

12. (a) Explain the mathematical formulation of a Linear Programming Problem with an example.
(or)
(b) Discuss the concept of Duality in LPP and explain the relationship between primal and dual problems.
13. (a) Explain the mathematical formulation of an Assignment Problem.
(or)
(b) Describe the steps involved in solving an Assignment Problem using the Hungarian Method.
14. (a) Explain the North-West Corner Rule (NWCR) for obtaining an initial basic feasible solution.
(or)
(b) Compare NWCR, Least Cost Method (LCM), and Vogel's Approximation Method (VAM).
15. (a) Explain the basic components of a network and the rules of network construction.
(or)
(b) Discuss the concept of Critical Path Analysis and its significance in project management.

PART C Answer Any Three Questions ($3 \times 10 = 30$ Marks)

16. Explain in detail the definition, characteristics, techniques, and applications of Operations Research. Also discuss the role of Operations Research in decision-making.
17. Solve a Linear Programming Problem using the Simplex Method and explain the concepts of artificial variables, Big-M method, and Two-Phase method.
18. Explain the Assignment Problem in detail and solve a suitable problem using the Hungarian Method. Discuss the variants of Assignment Problems.
19. Describe the Transportation Problem and explain the methods for obtaining an initial basic feasible solution (NWCR, LCM, and VAM). Illustrate the MODI method for optimality testing.
20. Explain PERT and CPM techniques in detail. Discuss critical path analysis, activity times, floats, three-time estimates, and probability of project completion.

Year	III	Course Code:	Credits	4
Semester	V	Course Title: Machine Learning in IoT	Hours	75
			Category	C
Prerequisites, if any	Basics of IoT			
Course Outcomes	• Ability to develop small applications using IoT. • Learned the IoT Architecture. • Evaluate machine learning theory • Implement linear models • Implement and analyze clustering techniques			
Unit No.	Course Content			Hours
Theory Component				
Unit I	Introduction to IoT Getting started- Hardware requirements – Single Board-Computer - Single Board Microcontroller - IoT Sensors - Commercial uses of IoT			9
Unit II	Overview of IIoT Industrial Internet of Things – Application of IIoT - IoT and IIoT differences.			9
Unit III	Machine Learning and IoT Introduction to Machine Learning: Definition, Need, Advantages of IoT and Machine Learning Integration– implementation of ML Algorithms: Regression (Linear and Logistic) – SVM for IoT–Neural Network on case study: Agriculture and IoT– Smart Home etc.			9
Unit IV	Storing sensor data Using Python in Raspberry Pi – Handling sensor data Using Python in Arduino - Configure SQLite3 Database – create, insert data – Checking of data sanity.			9
Unit V	Machine Learning in Sensor Data Using machine learning models on sensor data – Machine learning Case studies in IoT.			9
Recommended Learning Resources				
Text Books	1. Puneeth Mathur, IoT Machine Learning Applications in Telecom, Energy, and Agriculture: With Raspberry Pi and Arduino Using Python, Apress, 2021.			
Reference Book	1. Analytics for the Internet of Things (IoT), Andrew Minter, Packt Publication 2017.			

Practical Component		
Paper Title: Machine Learning in IoT		
Ex. No	Exercises	Hours
1	Develop a Human detection system using an IR sensor and write received data from Arduino to PC through Serial.	30
2	Develop an Intelligent Traffic Light system, which gets ultrasonic sensor readings for identifying trespassers with an understanding of Arduino Read and Write commands.	
3	Simulate IoT device data generation and transfer sensor data to PC using Python and serial communication concept.	
4	Get sensor readings from any IoT device and to import and export data using Pandas library functions	
5	Develop a system to compare IoT and IIoT datasets and analyze differences using Python.	
6	Implement machine learning models such as Linear Regression, Logistic Regression, and SVM on IoT sensor data using Python.	
7	Develop a predictive system for IoT sensor data using Linear Regression for trend forecasting.	
8	Store sensor data in SQLite3 Database	
9	Perform data cleaning and sanity checking on IoT sensor data to identify missing values and outliers using Python.	
10	Develop an end-to-end Smart IoT system for agriculture or smart home using machine learning techniques.	
11	Implement an IoT anomaly detection system using machine learning models to detect abnormal sensor behavior in real-time data.	
12	Select and Develop any one case study from the list provided below: a. Smart Home Energy Management using IoT and ML. b. Smart Retail System using IoT and Cloud. c. Smart Parking System	
Tools /Software to be used	Python, SQLite3	

Model Question Paper
MID 5: Machine Learning in IoT
III Year/ VI Semester

Time: 3 Hours

Max. Marks: 60

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

1. What does IoT stand for?
a) Internet of Technology b) Internet of Things
c) Integration of Things d) Interface of Technology
2. Which device is an example of a Single Board Computer?
a) Arduino Uno b) ESP32 c) Raspberry Pi d) PIR Sensor
3. IIoT is mainly used in which sector?
a) Education a) Industrial environments c) Entertainment d) Social media
4. Which is a key difference between IoT and IIoT?
a) IIoT is cheaper b) IoT has higher precision than IIoT
c) IIoT requires higher reliability d) IoT is used only in industries
5. Which ML technique is used for predicting continuous values in IoT?
a) Classification b) Clustering c) Regression d) Association
6. SVM is mainly used for:
a) Data storage b) Classification problems c) Sensor wiring d) Database design
7. Which language is commonly used in Raspberry Pi for IoT applications?
a) Java b) Python c) C# d) PHP
8. SQLite3 is used in IoT systems for:
a) Sensor manufacturing b) Data storage c) Network routing d) Hardware control
9. What is the first step in ML workflow for IoT sensor data?
a) Model deployment b) Data collection c) Prediction d) Feature selection
10. Which application uses ML in IoT for predicting machine failure?
a) Smart home b) Predictive maintenance c) Social media d) Gaming systems

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

11. a) Describe Single Board Computers and Single Board Microcontrollers with examples and differences.

(or)

b) Discuss the commercial applications of IoT in real-world domains.
12. a) Explain the applications of IIoT in modern industries.

(or)

- b) Differentiate between IoT and IIoT with suitable examples.
13. a) Explain the advantages of integrating IoT with Machine Learning.
(or)
b) Describe Linear Regression and Logistic Regression in IoT applications.
14. a) Explain how Python is used in Raspberry Pi for IoT applications.
(or)
b) Describe how Arduino can be used to collect and process sensor data using Python.
15. a) Explain the workflow of applying Machine Learning models on IoT sensor data.
(or)
b) Discuss different machine learning models used in IoT applications with examples.

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

16. Explain IoT sensors and their role in data acquisition.
17. a) Define Industrial IoT (IIoT) and explain its architecture. (5 marks))
b) Discuss the advantages of IIoT in industrial automation (5 marks)
18. Discuss Support Vector Machine (SVM) and Neural Network applications in IoT case studies (e.g., Smart Home, Agriculture).
19. a) Describe storing IoT sensor data using SQLite3 database. (5 Marks)
b) Discuss data sanity checking and its importance in IoT systems. (5 Marks)
20. a) Explain how machine learning can be used to detect anomalies in sensor data in IoT systems. Provide an example. (5 Marks)
b) Discuss the role of predictive maintenance using machine learning on IoT sensor data. (5 Marks)

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", 1st edition, HarperCollins Publishers Ltd, 2019. 2. Roger S. Pressman, Bruce Maxim, "Software Engineering, A Practitioner's Approach", 9th edition, McGraw Hill International Edition, 2023.
Reference Books	1. Allen, "Software Security Engineering: A Guide for Project Managers", 1st 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
MJD 12: 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				
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) clearTimeout() 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
b) 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	

(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.

PART C - Answer Any Three Questions ($3 \times 10 = 30$ Marks)

16. a) Explain the evolution of Soft Computing from conventional Artificial Intelligence. Discuss the characteristics and constituents of Soft Computing. (6 marks)

b) Discuss Fuzzy Set Theory and Fuzzy Logic in detail. Explain fuzzy set operations and fuzzy relations with examples. (4 marks)

17. Explain Membership Functions, Fuzzy Rules, and Fuzzy Reasoning. Illustrate the process of fuzzy inference with an example.

18. a) Describe Fuzzy Decision Making, Fuzzy Clustering, and Fuzzy Expert Systems with suitable applications. (5 marks)

b) Explain the Genetic Algorithm in detail. (5 Marks)

19. Discuss various variants of Genetic Algorithms. Explain Multi-objective Optimization using Genetic Algorithms with examples.

20. Explain Neural Network architectures. Compare Single Layer and Multilayer Neural Networks with suitable diagrams.

Year	III	Course code:	Credits	4
Semester	VI	Course Title: Visual Programming using C#	Hours	75
			Category	C
Prerequisites, if any	Basic knowledge of computer 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 of ADO.NET and to efficiently develop, test, and deploy ASP.Net Core applications			
Theory Component				
Unit No	Content			Hours
Unit I	Introduction to .Net Framework: An Overview – 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.			9
Unit II	Overview of C#: Program structure – Literals – Variables – Constants – Data Types – Operators – Statements and Expressions – Branching – Looping and Loop Control Statements – Arrays – Strings Manipulation – Boxing and Unboxing – Pre-processors – Namespaces.			9
Unit III	Object Oriented Programming concepts in C#: Class – Objects – Encapsulation – Constructors and its types – Inheritance – Polymorphism – Interface – Abstract Class – Operator Overloading – Properties – Indexers – Delegates – Collections.			9
Unit IV	Windows Forms: Introduction to Windows Forms and various controls – SDI and MDI applications – Menu Creation, Common Dialog Boxes – Events and Event Handling.			9
Unit V	Getting started with ADO and ASP.Net: Introduction to ADO.NET basics - ADO.NET Architecture - Connection Object - Command Object - Dataset - Data Reader Object - Data Adapter Object – Data Table - Connecting to a database – Retrieving – Adding – Editing records in database. ASP.NET: Choosing a Code Editor - Creating an ASP.NET Core Project - Running the ASP.NET Core Application, Testing ASP.Net Core Applications: Creating a Unit Test Project- Writing and Running Unit Tests.			9
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.
Reference Books	1. Paul Deitel & Harvey Deitel, “C# 2010 for Programmers”, Pearson Education, 4 th edition, 2011

Practical Component		
Title of the Practical: Visual Programming using C#		
Ex. No	Exercises	Hours
1	Exploring Visual Studio components and Creation of Simple Console applications using C#.	30
2	1. Create a simple C# program for the following concepts: a) To check whether a given number is an Armstrong or not. b) To generate Fibonacci numbers. c) To check whether the alphabet is a vowel or not using switch-case. d) To check whether the given string is palindrome or not	
3	Create programs to implement: a) Array manipulation b) String Manipulation c) Demonstrate boxing and unboxing operations.	
4	Implement Classes and Objects, Constructors.	
5	Implement Inheritance & Polymorphism	
6	Implement Interfaces, Operator Overloading, Delegates and Events	
7	Create a GUI using standard controls, SDI & MDI Forms	
8	Design an application with menu options and a Common Dialog box.	
9	Implement ADO.NET with Console Application	
10	Implement ADO.NET with Windows Application	
11	Create a simple web application using ASP.Net	
12	Select and Develop any one case study from the list provided below: 1. Business Process Automation System (Workflow Designer) 2. Industrial Automation Monitoring Dashboard 3. Data Transformation Pipeline Builder (ETL Tool) 4. Healthcare Workflow Management System 5. Document Processing & Approval System 6. Web Admin Panel Generator	
Tools/Software to be used		Visual Studio 8/10

Model Question Paper
MID 6: Visual Programming using C#
III Year/V Semester

Time: 3 Hours

Max. Marks: 60

PART A

Answer All Questions (10 × 1 = 10 Marks)

1. Which of the following is responsible for managing the execution of code in the .NET Framework?
a) Common Type System (CTS) b) Common Language Runtime (CLR)
c) Microsoft Intermediate Language (MSIL) d) Common Language Specification (CLS)
2. Which component of the .NET Framework contains reusable types like collections, file I/O, and database connectivity?
a) Common Language Runtime (CLR) b) .NET Base Class Library (BCL)
c) Metadata d) JIT Compiler
3. Which of the following is a valid data type in C#?
a) integer b) int c) number d) float64
4. Which of the following data types in C# can be used to store an unboxed value type in an object?
a) Boxing b) String c) Array d) Delegates
5. What is the primary purpose of encapsulation in object-oriented programming?
a) To hide the internal implementation details of a class
b) To allow a class to inherit properties from another class
c) To overload operators in C#
d) To convert one data type to another
6. Which feature in C# allows you to pass a function as a parameter or assign it to a variable?
a) Indexers b) Delegates c) Collections d) Properties
7. Which of the following is used to create a form-based application in Windows Forms?
a) Console Application b) Windows Forms Application
c) WPF Application d) Class Library
8. Which of the following dialog boxes is commonly used to allow the user to select a directory in Windows Forms?
a) OpenFileDialog b) SaveFileDialog c) FolderBrowserDialog d) PrintDialog
9. Which of the following objects is used to establish a connection to a database in ADO.NET?
a) Command Object b) DataReader Object
c) DataLink Object d) DataSet Object
10. What is the purpose of unit tests in ASP.NET Core development?
a) To ensure the application runs correctly on all platforms
b) To test individual components or methods for correctness

- c) To check if the application meets the UI requirements
- d) To monitor the application's runtime performance

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

11. a) Explain the .NET Base Class Library (BCL).
or
b) Describe the purpose and functionality of the Just-In-Time (JIT) compiler in .NET.
12. a) What are literals, constants and variables in C#? Explain their declaration and initialization with examples.
or
b) Explain the concept of array manipulations in C# with examples.
13. a) Explain the role of constructors in C#. Describe the difference between parameterized and default constructors.
or
b) Explain the concept of polymorphism in C#. Provide an example.
14. a) Write about any ten controls used in windows forms with its uses.
or
b) Explain the concept of events and event handling in Windows Forms.
15. a) Describe how to establish a connection to a database in .NET.
or
b) What is unit testing in ASP.NET Core? How can you create and execute unit tests. Provide an example.

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

16. Explain the architecture of the .NET Framework with its components.
17. (a) Classify different data types available in C#? (5 marks)
(b) Interpret the concepts boxing and unboxing in C# with diagram and code example. (5 marks)
18. What is inheritance in C#? Explain the types of inheritance with examples.
19. (a) Differentiate between SDI and MDI? Explain how to implement MDI in Windows Forms. (5 marks)
(b) Describe the process of menu creation in Windows Forms. Demonstrate it with a program that includes handling menu items and click event (5 marks)
20. (a) What is ADO.NET? Explain its architecture and the roles of Connection, Command, and DataReader objects in data access (6 marks)
(b) Explain how to create an ASP.NET Core project. Provide a simple example. (4 marks)

SEMESTER – VII

Year	IV	Course Code:	Credits	4
Semester	VII	Course Title: Distributed Systems	Hours	75
			Category	C
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 Coulouris, Jean Dollimore 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	Select and Develop any one case study from the list provided 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
Semester	VII	Course Title: System Modelling and Simulation	Hours	75
			Category	C
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 behavior 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	Two-sample Kolmogorov-Smirnov test	
5	Test for Standard Normal Distribution	
6	Monte-Carlo Simulation.	
7	Simulation of Single Server Queuing System.	
8	Simulation of Two-Server Queuing System.	
9	Simulate and control a conveyor belt system	
10	Select and Develop any one case study from the list provided below: 1. Bank Customer Service System (Single Server Queue) 2. Hospital Emergency Room (Two Server Queue) 3. Manufacturing Conveyor Belt System (Assembly Line) 4. Monte Carlo Simulation for π / Area Estimation Problem 5. Quality Control in Manufacturing (Chi-square + KS Testing)	
Tools/Software to be used	JAVA, Python, ‘R’ Studio, SPSS, MATLAB	

Model Question Paper
MJD 17: System Modelling and Simulation
IV Year / VII Semester

Time: 3 Hours

Max. Marks: 60

PART A

Answer All Questions ($10 \times 1 = 10$ 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 ($5 \times 4 = 20$ 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
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		- Andrew S. Tanenbaum, David J. Wetherall, “Computer Networks”, Fifth Edition, Prentice Hall publisher, 2022. - 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.
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Practical Component		
Title of the Practical: Wireless Communication Networks		
Ex. No	Exercises	Hours
1	a. Study about different Wireless devices like Wi-Fi Dongler, Wireless Access Point, Antenna, Wi-Fi Router. b. Basic Verification Commands (Packet Tracer / CLI)	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.	
11	Select and Develop 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.
19. Explain Wireless Access Protocols and describe the Wireless Application Environment (WAE).
20. Explain Wireless LAN architecture and Technologies with advantages and limitations.

Year	IV	Course Code:	Credits	4
Semester	VII	Course Title: Artificial Intelligence	Hours	75
			Category	C
Prerequisites, if any	Basic Programming Skills			
Course Outcomes	• Understanding the diverse traits of a problem-solving agent • Explore methods for tackling problems amidst different constraints • Implement AI techniques in various applications • Grasp the distinct models of learning • Develop an expert system			
Unit No.	Course Content			Hours
Theory Component				
Unit I	Introduction Foundation and History of AI - Intelligent Agents - Agents and Environments - The Concept of Rationality - Nature of Environments - Structure of Agents - Problem Solving Agents - Examples			9
Unit II	Searching Searching for Solutions, Uniformed Search Strategies - Heuristics Search Strategies - Local Search Algorithms and Optimization Problems- Hill Climbing- Simulated Annealing- Local Beam Search- Genetic Algorithms - Optimal Decisions in Games - Alpha–Beta Pruning			9
Unit III	Agents Logical Agents- Knowledge-Based Agents- The Wumpus World- Logic- Propositional Logic - Propositional Theorem Proving - Effective Propositional Model Checking - Agents Based on Propositional Logic			9
Unit IV	First Order Logic Introduction- Syntax and Semantics - Inference - Propositional Vs. First-Order Inference - Unification and Lifting - Forward Chaining - Backward Chaining- Resolution.			9
Unit V	Learning Forms of Learning- Supervised Learning- Learning Decision Trees- Hypothesis- Theory of Learning - Prolog - Programs - Data Objects			9
Recommended Learning Resources				
Text Books	1. S. Russell and P. Norvig, “Artificial Intelligence – A Modern Approach”, Fourth Edition, Pearson Education, 2022. 2. Max Bramer, “Logic Programming with Prolog”, Springer, 2013.			

Practical Component		
Title of the Practical: Artificial Intelligence		
Ex. No	Exercises	Hours
1	Implement Breadth First Search	30
2	Implement Depth First Search	
3	Implement Tic-Tac-Toe game	
4	Implement 8-Puzzle problem	
5	Implement Water-Jug problem	
6	Implement Monkey Banana Problem	
7	Implement Alpha-Beta Pruning	
8	Develop an expert system using Prolog	
9	Select and Develop any one case study from the list provided below: 1. Autonomous Vacuum Cleaner / Service Robot 2. Wumpus World Exploration Agent 3. Traveling Salesman Problem (Optimization) 4. Self-Driving Car Navigation System 5. Spam Email Detection System	
Tools/Software to be used		Python

Model Question Paper
MID 7: Artificial Intelligence
IV Year/ VII Semester

Time: 3 Hours

Max. Marks: 60

PART A

Answer All Questions (10 × 1 = 10 Marks)

1. The concept of an agent doing the right thing based on what it perceives and what it knows is called:
a) Utility maximization b) Rationality c) Omniscience d) Autonomy
2. Which environment is characterized by changes that can happen without the agent's actions?
a) Static b) Deterministic c) Dynamic d) Fully Observable
3. Which uninformed search strategy is guaranteed to find the shortest path in an unweighted graph?
a) Depth-First Search b) Iterative Deepening Search
c) Breadth-First Search (BFS) d) Uniform Cost Search
4. In game theory, the process of eliminating branches that cannot possibly influence the final decision
is known as:
a) Monte Carlo Tree Search b) Pruning Heuristic
c) Game Tree Reduction d) Alpha–Beta Pruning
5. The Wumpus World is typically used to illustrate the reasoning capabilities of which type of agent?
a) Simple Reflex Agent b) Knowledge-Based Agent
c) Utility-Based Agent d) Problem Solving Agent
6. In propositional logic, a sentence that is true under all possible interpretations is called a:
a) Contingency b) Contradiction c) Literal d) Tautology
7. The process that substitutes variables with terms so that two logical expressions become identical is called:
a) Resolution b) Unification c) Inference d) Instantiation
8. Inference in which one starts with the known facts and applies rules to derive new conclusions until the goal is reached is called:
a) Backward Chaining b) Forward Chaining
c) Resolution d) Abduction

9. Learning that involves classifying data into categories based on labeled examples is known as: a) Unsupervised Learning b) Reinforcement Learning
c) Supervised Learning d) Passive Learning

10. In Prolog, what is the term used for a collection of clauses (rules and facts)?
a) Data Objects b) Query c) Predicate d) Program

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

11. a). Distinguish between a Rational Agent and an Omniscient Agent.

or

b). Describe the four main types of Structure of Agents .

12. a) Compare and contrast Uniformed Search Strategies and Heuristics Search Strategies.

or

b) Briefly explain the working principle of Simulated Annealing as a local search algorithm.

13. a) Explain the five components of a Knowledge-Based Agent (KBA).

or

b) State and explain the common inference rules used in Propositional Theorem Proving.

14. a) List and briefly explain the advantages of First-Order Logic (FOL) over Propositional Logic.

or

b) Explain the significance of the Resolution principle in automated inference for First-Order Logic.

15. a) Describe the concept of Hypothesis in the context of machine learning and the Theory of Learning.

or

b) Explain the fundamental difference between Supervised and Unsupervised Learning.

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

16. Explain the Nature of Environments by classifying them based on the properties: Fully Observable vs. Partially Observable, Single Agent vs. Multi-agent, Deterministic vs. Stochastic, Episodic vs. Sequential.

17. (a) Describe the process of Alpha-Beta Pruning in game search and illustrate how it improves search efficiency. (5 marks)

(b) Differentiate between Hill Climbing and Local Beam Search. (5 marks)

18. Explain the structure and operation of a Knowledge-Based Agent (KBA) in the Wumpus World scenario, detailing how the agent reasons to reach its goal.

19. (a) Explain the steps involved in the Unification and Lifting process in First-Order Logic. (4 marks)

(b) Compare and contrast Forward Chaining and Backward Chaining as inference mechanisms. (5 marks)

20. (a) Explain the algorithm for Learning Decision Trees from a set of examples. (6 marks)

(b) Briefly describe the purpose of Prolog Data Objects. (4 marks)

Year	IV	Course Code:	Credits	4
Semester	VII	Course Title: UI / UX Design	Hours	75
			Category	C
Prerequisites, if any	Knowledge of Computer Application, Graphics Design			
Course Outcomes	- Understand the Concepts in UI/UX design - Develop proficiency in conducting user research techniques - Create wireframes and interactive prototypes using industry-standard tools - Learn to organize and structure information effectively - Design accessible interfaces for users with disabilities			
Unit No.	Course Content			Hours
Theory Component				
Unit I	UI / UX Design Principles UI/UX design concepts - Importance’s of UI/UX design - User centered design (UCD) Principles - Basics of Visual Design - layout, typography, color theory, imagery			9
Unit II	User Research and Analysis User research methods - Conducting user interviews and creating user - Gathering and analyzing user feedback - Introduction to information architecture (IA) - Utilizing user data and analytics to inform design decisions.			9
Unit III	UI / UX Design Tools Popular UI / UX design tools - Sketch, Adobe XD, Figma, and InVision - Basics of wireframing and prototyping - Principles of responsive, interaction and collaborative design			9
Unit IV	Visual Design UI components Advanced principles of visual design – designing UI components - applying design patterns and frameworks - motion design and animation principles - designing for different platforms			9
Unit V	UI / UX evaluation and iteration Usability testing methods and techniques conducting usability studies and heuristic evaluations - analyzing user feedback-strategies for effective communication and presentation			9
Recommended Learning Resources				
Text Books	- Jason Beaird, James George, “The Principles of Beautiful Web Design”, Third Edition, O’Reilly, 2014. - Tom Mulligan, “UX/UI Design 2021-2022 Tutorial the Complete step by step guide to UX/UI Design and Best Practices for designers with no experience”, 2022.			

Practical Component		
Title of the Practical: UI / UX Design		
Ex. No	Exercises	Hours
1	Design wireframes for a simple web or mobile application & its use case	30
2	Develop an interactive prototype for a specific user flow within an application & its use case	
3	Conduct usability testing on an existing website or application & its use case	
4	Design a mobile version of a website or application to ensure responsiveness across different screen sizes & its use case	
5	Create user personas based on research and analysis of target Users & its use case	
6	Select and Develop any one case study from the list provided below: 1. Spotify – Music Personalization System 2. Amazon – E-commerce Checkout Optimization 3. Airbnb – Booking Experience Redesign 4. Uber – Ride Booking & Real-Time Tracking 5. Google Maps – Navigation & Interaction Design	
Tools/Software to be used		Adobe, Canva, Figma

Model Question Paper
MID 7: UI / UX Design
IV Year/ VII Semester

Time: 3 Hours

Max. Marks: 60

PART A

Answer All Questions (10 × 1 = 10 Marks)

1. UI design mainly focuses on:
a) Backend development b) Database management
c) Visual and interactive elements d) Software testing
2. Which principle emphasizes designing based on user needs?
a) Agile design b) User-Centered Design
c) Visual hierarchy d) Responsive layout
3. Which of the following is a qualitative user research method?
a) Web analytics b) A/B testing c) User interviews d) Heat maps
4. Information Architecture (IA) mainly deals with:
a) Visual styling b) Content organization c) Color selection d) Animation effects
5. Which tool is widely used for collaborative UI design?
a) Photoshop b) Figma c) MS Paint d) Blender
6. A wireframe is best described as:
a) A final visual design b) A backend structure
c) A low-fidelity layout of a design d) A marketing document
7. Which of the following is a UI component?
a) User persona b) Navigation bar c) User journey map d) Use case diagram
8. Motion design in UI primarily helps to:
a) Reduce development cost b) Improve user engagement
c) Store user data d) Increase server speed
9. Usability testing is conducted to:
a) Improve code efficiency b) Identify user experience issues
c) Increase system security d) Reduce storage usage
10. Heuristic evaluation is performed using:
a) Real users b) Automated tools c) Design guidelines d) Marketing surveys

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

11. a) Explain the importance of UI/UX design in digital products.

or

b) Describe the principles of User-Centered Design (UCD).

12. a) Discuss different user research methods.

or

b) Explain the process of gathering and analyzing user feedback.

13. a) Describe the features of popular UI/UX design tools.

or

b) Explain wireframing and prototyping with examples.

14. a) Explain the principles of designing UI components.

or

b) Discuss the role of motion design and animation in UI/UX.

15. a) Explain usability testing methods and techniques.

or

b) Describe strategies for effective communication and presentation of UX designs.

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

16. Explain UI/UX design concepts and discuss the basics of visual design including layout, typography, color theory, and imagery.

17. (a) Explain user interviews and persona creation. (5 marks)

(b) Discuss the importance of information architecture in UX design. (5 marks)

18. Describe popular UI/UX design tools such as Sketch, Adobe XD, Figma, and InVision. Explain their role in collaborative design.

19. (a) Explain advanced principles of visual design in UI components. (5 marks)

(b) Discuss designing interfaces for different platforms. (5 marks)

20. (a) Explain usability testing and heuristic evaluation in detail. (6 marks)

(b) Describe the process of analyzing user feedback for design improvement. (4 marks)

Year	IV	Course Code:	Credits	4
Semester	VII	Course Title: E-Commerce Application Development	Hours	75
			Category	C
Prerequisites, if any	Basic Programming Knowledge			
Course Outcomes	- Understand the basic concepts of E– commerce and Business Model - Understand the web development basics for E-Commerce - Understand the backend and database for E-Commerce - Explore the integration of payment gateway and user management - Deployment, testing and analysing the performance of E-Commerce application			
Unit No.	Course Content			Hours
Theory Component				
Unit I	Introduction to E-Commerce Development E-commerce v/s Traditional Commerce - E-Business – EDI – Importance, Features & Benefits – Business Models – Architectural Framework of E-Commerce & Development Life Cycle – Platforms and Technologies			9
Unit II	Web Development for E-Commerce PHP/JavaScript - Control Structures - The elements of e-commerce – Responsive design principle – Frontend framework – building user interface-browse, search, cart, checkout - A web site Evaluation Model			9
Unit III	Backend and Database Management Server-Side Languages – Backend Framework – DBMS for E-Commerce Application – SQL, NO SQL – Designing and Implementing – Catalog, User Accounts Orders			9
Unit IV	Security, Payment Integration, and User Management Authentication and authorization for user accounts – Implementing Secure Payment Gateway – Compliance with PCI DSS – Managing user profile, address and order history			9
Unit V	Deployment, Testing and Performance Implementing search and recommendation system – Performance optimization and scalability – Testing – Deploying to Cloud Platform			9
Recommended Learning Resources				
Text Books	1. Turban, Rainer, and Potter, “Introduction to E-Commerce”, Second Edition, 2003. 2. H. M. Deitel, P. J. Deitel and T. R. Nieto, “E-Business and E-Commerce: How to Program”, Prentice Hall, 2001. 3. Developers from DevZone, “Building eCommerce Applications”, O'Reilly Media, Inc., 2011.			

Practical Component		
Title of the Practical: E-Commerce Application Development		
Ex. No	Exercises	Hours
1	Home page design of web site	30
2	Validation using PHP	
3	Implement Catalogue design	
4	Implement Access control mechanism (eg: username and password)	
5	Select and Develop any one case study from the list provided below: 1. Investigate how Zomato uses search optimization, location-based services, and backend APIs to provide restaurant discovery and ordering features. 2. Study how Myntra implements responsive design and mobile-first UI to improve user experience across different devices. 3. Examine how Alibaba operates a B2B marketplace by connecting global suppliers and buyers through a structured e-commerce platform. 4. Study how eBay supports a C2C model by allowing users to buy and sell products through auction and fixed-price systems. 5. Analyze how Netflix uses backend databases and recommendation algorithms to personalize content for users based on viewing history. 6. Examine how Shopify provides a complete e-commerce platform with frontend templates, backend management, and cloud deployment tools for small businesses.	
Tools/Software to be used		Java Script, HTML, PHP, Node.js, MySQL

Model Question Paper
MID 8: E-Commerce Application Development
IV Year/ VII Semester

Time: 3 Hours

Max. Marks: 60

PART A

Answer All Questions (10 × 1 = 10 Marks)

1. E-commerce mainly differs from traditional commerce in terms of:
a) Physical presence b) Digital transactions
c) Manual billing d) Face-to-face interaction

2. EDI in e-commerce refers to:
a) Electronic Data Interchange b) Enterprise Digital Interface
c) Electronic Design Integration d) Enterprise Data Internet

3. Which language is commonly used for client-side scripting in e-commerce websites?
a) PHP b) JavaScript c) SQL d) Python

4. Responsive web design primarily ensures:
a) Faster servers b) Device-independent user interface
c) Strong security d) Better database performance

5. SQL databases are mainly used for:
a) Unstructured data b) Structured data c) Image processing d) Network security

6. Which component manages product listings and pricing?
a) User authentication b) Catalog management
c) Payment gateway d) Order tracking

7. Authentication in e-commerce systems is used to:
a) Encrypt data b) Verify user identity c) Process payments d) Store orders

8. PCI DSS standards are related to:
a) Website design b) Payment card security
c) Database optimization d) Cloud deployment

9. Performance optimization in e-commerce aims to:
a) Increase page load time b) Improve scalability and speed
c) Reduce security d) Eliminate testing

10. Deploying an e-commerce application to the cloud provides:
a) Manual scalability b) High availability and flexibility
c) Local storage only d) Reduced accessibility

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

11. a) Explain e-commerce and e-business.

or

b) Discuss the importance, features, and benefits of e-commerce.

12. a) Explain the elements of an e-commerce website.

or

b) Describe responsive design principles and their role in e-commerce.

13. a) Explain the role of DBMS in e-commerce applications.

or

b) Differentiate between SQL and NoSQL databases for e-commerce.

14. a) Explain authentication and authorization mechanisms in e-commerce.

or

b) Describe the implementation of a secure payment gateway.

15. a) Explain performance optimization techniques for e-commerce systems.

or

b) Discuss the importance of testing in e-commerce applications.

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

16. Explain the architectural framework of e-commerce and the e-commerce development life cycle.

17. (a) Explain frontend frameworks used in e-commerce websites. (5 marks)

(b) Describe browse, search, cart, and checkout functionalities. (5 marks)

18. Explain backend frameworks and database design for managing user accounts and orders in e-commerce applications.

19. (a) Explain PCI DSS compliance in e-commerce systems. (5 marks)

(b) Discuss managing user profiles, addresses, and order history. (5 marks)

20. (a) Explain implementing search and recommendation systems in e-commerce. (6 marks)

(b) Discuss deploying an e-commerce application to a cloud platform. (4 marks)

Year	IV	Course Code:	Credits	4
Semester	VII	Course Title: Mobile Application Development	Hours	75
			Category	C
Prerequisites, if any	Basic knowledge of programming			
Course Outcomes	• Understanding of Mobile Development Concepts • Proficiency in Mobile App Design and Development • Skill in Data Storage and Retrieval • Ability to Build and Deploy Mobile Apps • Design and build a responsive UI using various features			
Unit No.	Course Content		Hours	
Theory Component				
Unit I	Introduction Overview of Android Platform and its Architecture – Android Studio IDE – Setting up Development Environment – Basic Android Components		9	
Unit II	User Interface Design and Development Design Principles for Android UI/UX - Layouts and Views - Handling User Input - Styling and Theming Android Applications		9	
Unit III	Data Storage and Retrieval Working with SQLite database - Preferences and Settings - Room Persistence Library - Working with content providers and loaders		9	
Unit IV	Networking and Data Persistence Making Network Requests with Retrofit or Volley - Parsing JSON and XML Responses - AsyncTask and AsyncTaskLoader for Background Tasks - Working with RESTful APIs		9	
Unit V	Advanced Topics in Android Development Fragments and FragmentManager – Responsive UI with ConstraintLayout and ViewPager – Services and Background Processing – Material Design Components and Animations		9	
Recommended Learning Resources				
Text Books		1. Google Developer Training, "Android Developer Fundamentals Course – Concept Reference”, Google Developer Training Team, 2017.		

Practical Component		
Title of the Practical: Mobile Application Development		
Ex. No	Exercises	Hours
1	Create a simple Android application with one activity displaying text	30
2	Implement Multiple Activities and Navigation with buttons	
3	Design and Implement a Sign-Up form	
4	Implement a To-Do List App with SQLite Database	
5	Implement setting screen using Shared Preferences	
6	Fetch data from a RESTful API	
7	Implement AsyncTask for Background Task	
8	Implement communication between Fragments	
9	Implement ViewPager with TabLayout	
10	Select and Develop any one case study from the list provided below Personal Expense Tracker App – Manage income and expenses with local storage (SQLite/Room). Weather Forecast App – Fetch and display weather data from an online API. Notes & Reminders App – Create, edit, and schedule notes with notifications. Food Delivery / Restaurant Menu App – Browse menus, place orders, and store cart data. Fitness Tracker App – Track exercises, calories, and daily goals with charts and background processing.	
Tools/Software to be used		Android Studio, Android SDK, SQLite

Model Question Paper
MID 8: Mobile Application Development
IV Year/ VII Semester

Time: 3 Hours

Max. Marks: 60

PART A

Answer All Questions (10 × 1 = 10 Marks)

1. Which layer of Android architecture contains the Activity Manager?
a) Linux Kernel b) Libraries c) Application Framework d) Applications
2. Android Studio is officially based on which IDE?
a) Eclipse b) NetBeans c) IntelliJ IDEA d) Visual Studio
3. Which layout is best suited for designing flexible and responsive UI?
a) LinearLayout b) RelativeLayout c) FrameLayout d) ConstraintLayout
4. Which view is used to display scrollable text in Android?
a) TextView b) EditText c) ScrollView d) Button
5. Which database is natively supported by Android for local storage?
a) MySQL b) Firebase c) SQLite d) PostgreSQL
6. Which Android library provides an abstraction layer over SQLite?
a) Volley b) Retrofit c) Room d) Picasso
7. Which library is commonly used for making REST API calls in Android?
a) Glide b) Retrofit c) Room d) Gson
8. Which format is most commonly used for data exchange in RESTful APIs?
a) CSV b) YAML c) XML d) JSON
9. Which component allows reuse of UI in multiple activities?
a) Service b) Fragment c) Intent d) Content Provider
10. Which Android component is used to perform long-running operations in the background?
a) Activity b) Broadcast Receiver c) Service d) Fragment

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

11. a) Explain the architecture of the Android platform.

or

b) Describe the steps involved in setting up the Android development environment.

12. a) Discuss different types of layouts used in Android UI design.

or

b) Explain handling user input events in Android applications.

13. a) Explain Shared Preferences with a suitable example.

or

b) Describe the advantages of using the Room Persistence Library.

14. a) Explain how JSON data is parsed in Android applications.

or

b) Describe the role of AsyncTask in background processing.

15. a) Explain the concept of Fragments and their lifecycle..

or

b) Describe Material Design components used in Android applications.

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

16. Explain Android Studio IDE in detail and discuss its major tools and features.

17. (a) Explain Android UI design principles and UI/UX guidelines. (5 marks)

(b) Describe different Android views and their uses. (5 marks)

18. Explain SQLite database operations in Android with suitable examples.

19. (a) Explain making network requests using Retrofit.. (5 marks)

(b) Describe RESTful APIs and their significance in mobile applications. (5 marks)

20. (a) Explain Services and background processing in Android. (6 marks)

(b) Describe ViewPager and its role in creating responsive UI. (4 marks)

SEMESTER – VIII (Honors and Honors with Research)

Year	IV	Course Code:	Credits	4
Semester	VIII	Course Title: Data Warehousing and Mining	Hours	75
			Category	C
Prerequisites, if any	Basic Computer Knowledge			
Course Outcomes	- Understand the fundamental concepts in Data Warehousing - Learn the architecture of Data Warehouse - Understand the concepts in Data mining - Learn the Data Preprocessing concepts like Data Cleaning, Data Integration and Data Reduction - Learn to use Data Visualization techniques with advance charts			
Unit No.	Course Content			Hours
Theory Component				
Unit I	Introduction to Data Warehousing Purpose and benefits - Modern Data Warehouse concepts, roles and Structure - Types: Enterprise Data Warehouse, Operational Data Store, Data Marts - Stores vs. Warehouses vs. Marts - Metadata: Types, management, importance - Data Warehouse Schema Design: Star Schema, Snowflake Schema , Fact Constellation - Data Quality and Governance.			9
Unit II	Data Warehouse Architecture Three-Tier Architecture: Bottom Tier, Middle Tier, Top Tier - Steps in designing and constructing a Data Warehouse - ETL Processes: Extraction, Transformation, Loading - Backend tools and Data Marts - Metadata Repository and its role - OLAP Operations: Roll-up, Drill-down Slice, Dice, Pivot. Performance considerations: Indexing, Partitioning, Materialized Views.			9
Unit III	Data Mining & Preprocessing Introduction – Applications - Data Mining Tasks: Classification, Regression, Clustering, Association – Data Preprocessing: Need of Data Preprocessing – Methods – Data Cleaning – Data Integration – Data Transformation - Data Reduction			9
Unit IV	Data Mining Techniques(Introduction only) Classification Algorithms: Decision Trees, Naïve Bayes, K-Nearest Neighbor - Clustering Algorithms: K-Means, Hierarchical, DBSCAN- Association Rule Mining: Market Basket Analysis, Apriori, FP-Growth - Evaluation Metrics: Accuracy, Precision, Recall, F-Measure, ROC Curve – Limitations – challenges and ethical issues in Data Mining.			11
Unit V	Data Visualization Purpose – Techniques: Pixel-Oriented Visualization Techniques - Geometric Projection Visualization Techniques - Icon-Based Visualization Techniques - Hierarchical Visualization Techniques - Visualizing Complex Data and Relations.			7

Recommended Learning Resources	
Text Books	1. George M. Marakas, “Modern Data Warehousing, Mining and Visualization: Core Concepts”, Pearson Education, 2012. 2. Dr. Jugnesh Kumar. “Data Warehouse and Data Mining: Concepts, techniques and real-life applications”, BPB Publication, 2024. 3. Parteek Bhatia, “Data mining and data warehousing”, Cambridge University Press, 2019.
Reference Books	4. Ralph Kimball, Margy Ross, The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling, 3rd Edition, Wiley 5. Jiawei Han, Micheline Kamber, Jian Pe, Data Mining: Concepts and Techniques, Morgan Kaufmann (Elsevier), 4th Edition, 2022

Practical Component		
Title of the Practical: Data Warehousing & Mining		
Ex. No	Exercises	Hours
1	Setting up a data warehouse environment using a relational database management system (e.g., MySQL)	30
2	Data cleaning and preprocessing techniques for handling missing values, outliers, and inconsistencies	
3	To design and implement a star schema for a given application in a data warehouse system.	
4	To perform OLAP operations such as roll-up, drill-down, slice, dice, and pivot using SQL queries	
5	To apply classification algorithms(such as Decision Tree, Naïve Bayes, or K-Nearest Neighbor) on a given dataset.	
6	To implement clustering algorithms (such as K-Means, Hierarchical clustering, or DBSCAN) on a dataset and analyze the results	
7	To apply association rule mining using Apriori or FP-Growth algorithm for market basket analysis.	
8	To extract meaningful patterns and insights from a dataset using data mining techniques.	
9	To evaluate the performance of data mining models using metrics such as accuracy, precision, recall, F-measure, and ROC curve.	
10	To visualize the results of data mining using appropriate graphical techniques such as bar charts, scatter plots, and heatmaps.	
11	Select and Develop any one case study from the list provided below: 1. Retail Sales (Market Basket Analysis) 2. Healthcare Disease Prediction System 3. Student Performance Analysis 4. E-Commerce Recommendation System 5. Stock Market / Time-Series Analysis 6. Current trends: Text Mining, Web Mining, Temporal Mining.	
Tools/Software to be used		Python, Oracle, SQL, ‘R’ Studio, Weka,

Model Question Paper
MJD 19: Data Warehousing and Mining
IV Year/ VIII Semester

Time: 3 Hours

Max. Marks: 60

PART A

Answer All Questions (10 × 1 = 10 Marks)

1. A Data Warehouse is primarily used for:
a) Transaction processing b) Analytical processing and decision making
c) File storage d) Real-time control systems
2. Which schema consists of a central fact table connected to dimension tables?
a) Snowflake Schema b) Star Schema c) Network Schema d) Hierarchical Schema
3. Which layer in three-tier architecture interacts directly with users?
a) Bottom tier b) Middle tier c) Top tier d) ETL layer
4. Which OLAP operation allows viewing data in multiple dimensions?
a) Roll-up b) Slice c) Dice d) Pivot
5. Which of the following is a data mining task?
a) Compilation b) Clustering c) Linking d) Formatting
6. Data preprocessing includes:
a) Classification b) Data Cleaning c) Prediction d) Clustering
7. Which algorithm is used for classification?
a) K-Means b) Decision Tree c) Apriori d) DBSCAN
8. Which algorithm is used for association rule mining?
a) Naïve Bayes b) KNN c) FP-Growth d) K-Means
9. Which visualization technique uses pixel representation of data?
a) Icon-Based b) Pixel-Oriented c) Hierarchical d) Geometric Projection
10. Which visualization is best for hierarchical data?
a) Scatter plot b) Tree map c) Line chart d) Bar chart

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

- 11. a) Explain the roles and structure of a modern data warehouse.**

(or)

- b) Differentiate between data warehouse, data mart, and operational database.
12. a) Describe the three-tier data warehouse architecture with a neat diagram.
(or)
b) Explain OLAP operations such as roll-up, drill-down, slice, and dice.
13. a). Explain the need for data preprocessing in data mining
(or)
b) Describe data integration and data transformation methods
14. a). Discuss the techniques used in data mining.
(or)
b). Describe Association rule based mining.
15. a) Explain geometric projection visualization techniques.
(or)
b) Describe hierarchical visualization techniques with examples.

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

16. Explain data warehouse architecture in detail. Discuss metadata and its importance in data warehousing.
17. a) Explain the components of the three-tier data warehouse architecture. (5 Marks)
b) Discuss the role of metadata repositories in data warehouse systems. (5 Marks)
18. a) Explain data cleaning techniques with suitable examples. (5 Marks)
b) Describe data reduction techniques used in preprocessing. (5 Marks).
19. Explain Market Basket Analysis in detail. Discuss the current limitations and challenges of data mining
20. a) Explain pixel-oriented and icon-based visualization techniques. (6 Marks)
b) Discuss challenges in visualizing complex data and relationships. (4 Marks)

Year	IV	Course Code:	Credits	4
Semester	VIII	Course Title: Data Science	Hours	75
			Category	C
Prerequisites, if any	Basic Computer Knowledge			
Course Outcomes	• Understand Fundamental of Data Science Concepts • Learn about Data Exploration and Visualization techniques • Understand the basics of Data warehousing and Mining • Understand core of data science techniques like Classification and Regression Techniques, Learn the basic concepts of Association Rule and Clustering • Learned the supportive tool big data.			
Unit No.	Course Content			Hours
Theory Component				
Unit I	Introduction to Data Science Data Science: Definition, benefits, uses, Data Science lifecycle - Types of Data(overview): structured, semi-structured, unstructured, Characteristics of Data - Data Science vs Business Intelligence vs Big Data – Data Science Process: defining goal, data collection, data preparation, data analysis, modelling, deployment. Applications.			9
Unit II	Data Warehouse and Data Mining (Basics) Data warehouse: Definition, architecture(basic) - OLTP vs OLAP systems -ETL process (Extract, Transform, Load) - Basic data models (star and snowflake schema – concept only), role of DW in DS. Data mining: Definition, data collection, data cleaning, dealing with missing values and outliers, Patterns discovery. DM vs Data Science			9
Unit III	Statistical Foundations for Data Science (Introductory Theory level) Role of mathematics in Data Science, Importance of probability and statistics in DS, important types of statistical measures in DS: Descriptive, Predictive, introduction to statistical inference, applications of statistical techniques in DS, Basics of statistics in DS: Types of data, scales of measurement - Measures of central tendency (mean, median, mode) - Measures of dispersion (range, variance, standard deviation) - Basics of probability - Correlation and covariance - Data distributions (normal distribution – concept only) - Sampling methods (simple idea).			9
Unit IV	Data Exploration and Visualization Types of data - Descriptive Statistics - exploratory data analysis and visualization techniques, difference between exploratory and descriptive statistics, EDA and visualization as key component of Data Science - Univariate Visualization - Multivariate Visualization - High - Dimensional Data.			9
Unit V	Big Data, Data Analytics & Machine Learning (Basics) Introduction to Big Data - 3Vs and characteristics of Big Data - Data Warehouse vs Big Data – Big data storage and management(overview)-HDFS(Basics) – MapReduce Fundamentals. Introduction to Data Analytics: definition, Types of DA, role of DA in DS, DA vs DS. Machine Learning in DS: definition, need, applications of ML in DS, Types of ML & algorithms(overview), AI vs ML vs DL vs DS vs DA, Applications of Data Science in industries.			9

Recommended Learning Resources		
Text Books	1. Vijay Kotu, Bala Deshpande, “Data Science Concepts and Practice”, Second Edition, Morgan Kaufmann Publishers, 2018.(Unit I,II,III,IV,V) 2. David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big data Analytics”, EMC 2013(II,V) 3. Sanjeev Wagh, Manisha Bhende, Anuradha Thakare, Fundamentals of Data Science , CRC Press, 1st Edition, 2022.	
Reference Books	4. Joel Grus Data Science from Scratch: First Principles with Python 1st Edition 5. Thomas Nield, Essential Math for Data Science , O'Reilly Media Inc., 2022. 6. James, Witten, Hastie, Tibshirani – An Introduction to Statistical Learning	
Practical Component		
Title of the Practical: Data Science		
Ex. No	Exercises	Hours
1	Write a program to load a dataset and display its first 10 rows along with dataset information such as shape, columns, and data types. (using Pandas)	30
2	Write a program to filter a dataset based on a given condition and perform sorting and column selection operations. (Python)	
3	Write a program to implement the ETL process by loading a dataset, handling missing values, and saving the cleaned dataset into a new file. (Python)	
4	To perform data preprocessing by handling missing values, outliers, and noisy data in a dataset	
5	To compute descriptive statistics such as mean, median, mode, variance, and standard deviation for a dataset.	
6	Write a Python program to compute the correlation matrix of a dataset and visualize it using a heatmap	
7	Write a Python program to perform exploratory data analysis on a dataset by generating summary statistics, grouping data, and handling missing values.	
8	To visualize data using univariate and multivariate plots and interpret the results.(using Matplotlib/Seaborn.)	
9	To perform K-Means clustering and analyze grouping patterns in a dataset.	
10	Write a Python program to simulate Big Data processing by implementing a MapReduce-style word count program.	
11	Write a Python program to implement a classification model using K-Nearest Neighbors or Decision Tree algorithm and evaluate its accuracy.	
12	Write a Python program to perform linear regression on a dataset and predict output values using the trained model.	
13	Select and Develop a Case Study from the list provided below: 1. Healthcare Disease Prediction (Basic Analysis) 2. Taxi Demand or Ride Analysis (Uber / Ola Ride/Urban Data) 3. Social Media Engagement Analysis (Instagram / YouTube) 4. E-Commerce Customer Behavior Analysis (Amazon / Flipkart) 5. UPI / Digital Payment Trend Analysis (India-focused)	
Tools/Software to be used		Python/Jupyter NoteBook, MySQL

Model Question Paper
MJD 19: Data Science
IV Year/ VIII Semester

Time: 3 Hours

Max. Marks: 60

PART A

Answer All Questions (10 × 1 = 10 Marks)

1. Data Science primarily focuses on:-
a) Hardware design b) Extracting insights from data
c) Network communication d) Operating systems
2. Which of the following is NOT a type of data?
a) Structured data b) Semi-structured data c) Unstructured data d) Static data
3. Which technique is used to handle missing values in data?
a) Sorting b) Imputation c) Encryption d) Clustering
4. OLAP is mainly used for:
a) Transaction processing b) Analytical processing
c) File storage d) Data encryption
5. The measure of central tendency that occurs most frequently is:
a) Mean b) Median c) Mode d) Variance
6. Correlation measures:
a) Data storage size b) Relationship between variables
c) Data encryption level d) Number of clusters
7. Which visualization is best for showing relationship between two variables?
a) Histogram b) Bar chart c) Scatter plot d) Pie chart
8. Which library is commonly used for data visualization in Python?
a) NumPy b) Pandas c) Matplotlib d) TensorFlow
9. HDFS stands for:
a) High Data File System b) Hadoop Distributed File System
c) Hybrid Data Flow System d) High Dynamic File Storage
10. Which algorithm is used for market basket analysis?
a) K-Means b) Apriori c) Linear Regression d) SVM

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

11. a) Explain the Data Science lifecycle in detail with a neat diagram. Discuss each stage and its importance in real-world applications

(or)

b) Differentiate between Data Science, Business Intelligence, and Big Data.

12. Explain data warehouse architecture and its components. **(or)**

b) Explain the ETL process in detail.

13. a) Explain measures of central tendency with examples.

(or)

b) Describe measures of dispersion in Data Science

14. a) Explain univariate and multivariate visualization with examples.

(or)

b) Explain the steps involved in Exploratory Data Analysis (EDA)..

15. a) Explain the 3Vs and characteristics of Big Data **(or)**

b) Explain MapReduce programming model with its components

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

16. Explain the Data Science process in detail with a diagram.

17. Describe OLTP vs OLAP systems with examples.

18. a) Explain data preprocessing in Data Science. (5 Marks)

b) Discuss data cleaning techniques including handling missing values, outliers, and noisy data with examples. (5 Marks)

19. a) Explain basics of probability and its role in Data Science (5 Marks)

b) Discuss correlation and covariance with examples.. (5 Marks)

20. a) Describe HDFS and its architecture. (5 Marks)

b) Discuss the types of Machine Learning with suitable examples (5 Marks)

Year	IV	Course Code:	Credits	4
Semester	VIII	Course Title: Data Analytics and Business Intelligence	Hours	75
			Category	C
Prerequisites, if any	Basic Computer Knowledge			
Course Outcomes	- Understand the basic concepts of data Analytics - Working with machine learning and statistical methods for data analytics - Evaluation and performance measure for business analytics - Text enhancement using advance techniques - Analysing case studies to inform strategic decision-making			
Unit No.	Course Content			Hours
Theory Component				
Unit I	Data Analytic Thinking Introduction to Data Analytics: definition, data types, types of analytics, Ubiquity of Data Opportunities - Data Science, Engineering, and Data - Driven Decision Making - Data Processing and “Big Data” – Data Mining – Process – Statistics - Database Querying - Data Warehousing - Regression Analysis			9
Unit II	Predictive Modeling Models Induction and Prediction - Supervised Segmentation - Visualizing Segmentation - Probability Estimation – Classification – Regression			9
Unit III	Decision Analytical Thinking Evaluating Classifiers - Generalizing Beyond Classification - Evaluation and Performance for Investments in Data – Ranking - Profit Curves - ROC Graphs and Curves			9
Unit IV	Representing and Mining Text Representation - Beyond BOW - Link Prediction and Social Recommendation - Data Reduction – Bias – Variance - Ensemble Methods			9
Unit V	Data Science and Business Strategy Achieving and Sustaining Competitive Advantage - Nurturing Data Scientists - Examine Data Science Case Studies.			9
Recommended Learning Resources				
Text Books	- Foster Provost, Tom Fawcett, “Data Science for Business”, First Edition, O'Reilly Medi, 2013. - Sanjeev Wagh, Manisha Bhende, Anuradha Thakare, Fundamentals of Data Science , CRC Press, 1st Edition, 2022. - Thomas Nield, Essential Math for Data Science , O'Reilly Media Inc., 2022. - Analytics for the Internet of Things (IoT), Andrew Minter, Packt Publication 2017.			

Practical Component		
Title of the Practical: Data Analytics and Business Intelligence		
Ex. No	Exercises	Hours
1	Provide specific steps and techniques you would use to clean and prepare the data for analysis	30
2	Identify key variables to analyze, and describe the visualizations and statistical techniques for Customer Dataset.	
3	Discuss the choice of features, model selection, evaluation metrics, and potential challenges in the predictive analytics.	
4	Apply clustering techniques such as K-means to segment data into groups..	
5	Visualize the clusters using scatter plots or pair plots	
6	Perform text mining and sentiment analysis on a collection of text data.	
7	Visualize the sentiment distribution (positive, negative, neutral).	
8	What ethical considerations should you keep in mind when handling sensitive customer information?	
Tools/Software to be used		Python/ R Studio, SQL

Model Question Paper
MJD 20: Data Analytics and Business Intelligence
IV Year/ VIII Semester

Time: 3 Hours

Max. Marks: 60

PART A

Answer All Questions (10 × 1 = 10 Marks)

1. a) Which of the following is the primary goal of **Data Science** in business analytics?
a) Data collection b) Data storage
c) Extracting insights from data to make data-driven decisions
d) Developing hardware infrastructure
2. Big Data is typically characterized by all of the following except:
a) Volume b) Velocity c) Variety d) Viscosity
3. Supervised Segmentation in predictive modeling refers to:
a) Categorizing data into segments based on user input
b) Grouping data based on algorithms without labeled data
c) Dividing data based on labeled features
d) Segmenting data into clusters using unsupervised learning
4. Probability estimation is most commonly used in which of the following?
a) Classification b) Clustering c) Regression d) Reinforcement learning
5. a) ROC Curve is used to evaluate the performance of:
a) Clustering algorithms b) Regression models
c) Classification models d) Neural networks
6. b) Profit Curves are primarily used to:
a) Visualize market trends
b) Evaluate the profitability of investments based on model predictions
c) Calculate the cost of errors in regression models
d) Show how profits increase with more data
7. a) The Bag of Words (BOW) model is most commonly used in:
a) Regression analysis b) Text mining and natural language processing
c) Clustering algorithms d) Data normalization
8. Link Prediction in data mining is used for:
a) Predicting relationships between data points b) Classifying data into labels
c) Identifying missing values d) Reducing the dimensionality of the dataset
9. Competitive Advantage in business analytics refers to:
a) Gaining insights from data that are not accessible to competitors

- b) Developing unique business strategies based on data insights
 - c) Both (a) and (b)
 - d) None of the above
10. Nurturing Data Scientists in an organization requires:
- a) Providing access to data and tools
 - b) Encouraging collaboration across teams
 - c) Continuous learning opportunities
 - d) All of the above

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

11. a) Discuss the key steps involved in the Data Mining Process and their relevance to data-driven decisions.
- (or)*
- b) Discuss the impact of Big Data on modern business intelligence practices.
- 12 a) Explain the steps involved in Predictive Modeling.
- (or)*
- b) What are the key differences between Classification **and** Regression models in predictive modeling?
- 13 a) How do ROC Curves help in evaluating the performance of classification models?
- (or)*
- b) Explain the concept of Profit Curves and their relevance in business decision-making.
- 14 a) Explain the concept of Data Reduction and its advantages in large-scale data analytics.
- (or)*
- b) Discuss the significance of Ensemble Methods in improving the accuracy of predictive models.
- 15 a) What are advantages of Data Science in achieving a sustainable competitive business?
- (or)*
- b) How do organizations nurture Data Scientists for long-term success in the field of business intelligence?

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

16. Define Data Science and discuss its key components. How do businesses use Data Science for data-driven decision-making?

17. a) Describe the methodology of Supervised Segmentation with examples. (5 marks)
b) Describe Visualizing Segmentation and Probability Estimation (5 marks)
18. a) Discuss the importance of evaluating Classifiers using different metrics (Accuracy, Precision, Recall).
19. a) Describe the Bag of Words (BOW) model. What are its advantages and limitations in text mining (5 marks)
b) How can Link Prediction improve recommendation systems in e-commerce?(5 marks)
20. a) How can businesses achieve and sustain a competitive advantage through Data Science?
b) Explain the key strategies for nurturing data scientists in an organization.

Year	IV	Course Code:	Credits	4
Semester	VIII	Course Title: Machine Learning	Hours	75
Prerequisites, if any	Probability and Statistics			
Course Outcomes	- 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			
Unit No.	Course Content			Hours
Theory Component				
Unit I	Introduction to Machine Learning Human Learning – Machine Learning – Types of Machine Learning – Supervised Learning –Unsupervised Learning – Reinforcement Learning – Applications – Preparing to Model – Types of Data – Structure – quality and Remediation – Pre-Processing.			9
Unit II	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			9
Unit III	Supervised Learning – Classification Introduction – Example – Model – Learning Steps – Algorithms – k–Nearest Neighbor – Decision tree – Random Forest Model – Support Vector Machines.			9
Unit IV	Supervised Learning – Regression Introduction – Example – Model – Algorithms – Simple and Multiple linear regression – Assumptions – Main problems in regression analysis – Logistic regression – Maximum Likelihood estimation.			9
Unit V	Unsupervised Learning Introduction – Applications – Clustering – Types – Partitioning Methods – Hierarchical Clustering – Density-based Methods – DBSCAN – Apriori algorithm for Association Rule Learning.			9
Recommended Learning References				
Text Books	1. Saikat Dutt, Chandramouli.S, Amit Kumar Das., “Machine Learning”, Pearson, 2018. 2. Alpaydin, E., “Introduction to Machine Learning”, Fourth Edition, MIT Press, 2020.			

Practical Component		
Title of the Practical: Machine Learning		
Ex. No	Exercises	Hours
1	Develop a Python script that uses a decision tree classifier for prediction	30
2	Develop a ML model that runs a random forest for classification	
3	Create a Python program that uses SVM to classify images from the MNIST dataset.	
4	Implement K–Means clustering to segment customers into groups based on their shopping data such as purchase history and customer demographics.	
5	Implement a linear regression model.	
6	Develop a program to perform multiple linear regression to predict house prices Implement logistic regression to classify emails as spam or not spam	
7	A case study on machine learning applications on real-world applications.	
Tools/Software to be used		Python

Model Question Paper
MJD 20: Machine Learning
IV Year/ VIII 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 ($5 \times 4 = 20$ 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 ($3 \times 10 = 30$ 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)

Year	IV	Course Code:	Credits	4
Semester	VIII	Course Title: Robotic Process Automation	Hours	75
			Category	C
Prerequisites, if any	Knowledge of programming, AI and ML			
Course Outcomes	- Understand RPA, its benefit and role in business process automation - Understand the RPA tools and their features, functionalities, and user interfaces - Analyze business processes, potential automation opportunities, and design RPA - Developing an automation workflow using RPA tools - Integrating RPA with other technologies			
Unit No.	Course Content			Hours
Theory Component				
Unit I	Foundation RPA - Benefits – Downsides - RPA vs BPO, BPM & BPA - Consumer Willingness for Automation - RPA Skills - Web Technology - Programming Languages and Low Code - OCR Databases - APIs, Artificial Intelligence - Cognitive Automation - DevOps			9
Unit II	Process Methodologies Lean - Six Sigma - Roles and Levels - Applying Lean and Six Sigma to RPA - Planning-Preliminaries - RPA Consulting - Case Studies – What to Automate - ROI for RPA - Use Cases			9
Unit III	Center of Excellence (CoE) CoE - Forming the Team - Business Analyst – Developer - RPA Solution Architect - RPA Supervisor – Communication - Change Management			9
Unit IV	Bot Development Installation of UiPath - Flowcharts and Sequences - Log Message – Variables - Loops and Conditionals - For each Loop - Do Loop – While Loop - If Statements - Exception Handling in RPA: Try Catch, Throw, Rethrow, Business Exceptions, System Exceptions, Retry Mechanism.			9
Unit V	Deployment and Monitoring Testing – Production – Monitoring – Security – Scaling - Data Preparation - Types of Data - Big Data - Data Process - Types of Algorithms: Classification, Regression, Clustering, Association, Decision Trees, K-Means, Clustering, Anomaly Detection.			9
Recommended Learning Resources				
Text Books	1. Tom Taulli, “The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems”, First Edition, Apress, 2020.			

Practical Component

Title of the Practical: Robotic Process Automation		
Ex. No	Exercises	Hours
1	Develop an RPA bot to automate data entry tasks(report generation by extracting data from Excel or a dataset and generating formatted reports.)	30
2	Create an RPA bot to automate email processing tasks(reading emails, categorizing them, and saving attachments.)	
3	Implement an RPA solution for automating invoice processing(by extracting invoice data, validating it, and storing it in a database or Excel sheet.)	
4	Develop an RPA bot for employee onboarding automation using process workflow optimization techniques such as Lean and Six Sigma principles	
5	Prepare a CoE documentation exercise by defining roles such as Business Analyst, Developer, Solution Architect, and Supervisor, and designing a simple RPA governance workflow.	
6	Create a change management simulation for an RPA implementation project, including communication plan, stakeholder roles, and automation adoption strategy.	
7	Develop an RPA bot for data entry automation using UiPath by reading data from Excel and entering it into a web application.	
8	Create an RPA bot for file management automation to organize, rename, move, and delete files based on rules.	
9	Develop an RPA bot for login automation with exception handling (Try-Catch and retry mechanism).	
10	Develop an RPA bot to scrape data from websites.	
11	Develop an RPA bot for data migration between two systems or databases using structured data transfer techniques.	
12	Create an RPA solution for data cleaning and basic analytics by removing duplicates, validating data, and applying simple classification or clustering logic.	
13	Select and Develop any one case study from the list provided below: 1. Select and Develop any one case study from the list provided below 2.Employee Onboarding Automation (HR Domain) 3. Bank Customer Data Migration (Banking Domain) 4. Email Query Handling Automation (Customer Service) 5.Web Data Scraping for Market Analysis (Retail/Analytics)	
Tools/Software to be used		Python, UiPath Studio

Model Question Paper
MJD 21: Robotic Process Automation
IV Year/ VIII Semester

Time: 3 Hours

Max. Marks: 60

PART A

Answer All Questions (10 × 1 = 10 Marks)

1. What is the primary benefit of Robotic Process Automation?
a) Cost reduction b) Increased employee workload
c) Higher manual errors d) Increased downtime
2. Which of the following is a downside of RPA?
a) High upfront costs b) Increased human error
c) Requires no maintenance d) Faster implementation
3. Which of the following best describes the application of Lean methodology in RPA?
a) Removing unnecessary tasks and reducing costs in processes
b) Increasing complexity in processes
c) Using artificial intelligence for process execution
d) Focusing on marketing strategies
4. What does ROI (Return on Investment) indicate in the context of RPA?
a) The time saved through automation
b) The financial benefits compared to the implementation costs
c) The quality of the RPA tools used
d) The efficiency of employees post-RPA
5. What does "CoE" stand for in the context of RPA?
a) Center of Excellence b) Cost of Execution
c) Code of Ethics d) Control of Enterprise
6. Which of the following roles is responsible for designing the overall architecture of an RPA solution?
a) RPA Developer b) RPA Solution Architect
c) RPA Supervisor d) Business Analyst
7. Which of the following tools is most commonly used for developing RPA bots?
a) UiPath b) Power BI c) Visual Studio d) Oracle
8. What is the role of sequences in RPA development?
a) To define the order of execution in the automation process
b) To store data c) To handle exceptions d) To create user interfaces
9. What does the term "scaling" refer to in the context of RPA?
a) Making the RPA solution available across multiple departments or geographies
b) Increasing the number of employees needed to manage bots

- c) Reducing the bot's performance for smaller tasks
 - d) Updating the software version
10. Big Data in the context of RPA refers to:
- a) Data sets that are too small for the bot to handle
 - b) Data sets that are extremely large, complex, or high-velocity
 - c) Data that is irrelevant to RPA bots
 - d) Data that only contains textual information

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

11. a) Explain the core benefits and downsides of Robotic Process Automation..
(or)
b) Compare and contrast RPA with Business Process Outsourcing (BPO)
12. a) Discuss the role of Lean methodology in RPA.
(or)
b) How can Six Sigma principles be applied to improve the performance of RPA?
13. a) What is a Center of Excellence (CoE) in the context of RPA, and what are its key functions?
(or)
c) Explain the different roles within an RPA CoE and their importance.
14. a) Describe the process of developing an RPA bot using UiPath.
(or)
c) What are the essential concepts involved in bot development
15. a) How do data processing techniques in RPA contribute to the overall success of automation?
(or)
b) What are some common types of algorithms used in RPA to process and handle data?

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 big data and discuss the challenges RPA faces when dealing with large volumes of data. (5 marks)
- (b) What is the importance of testing in RPA deployment? Explain the different types of testing. (5 marks)

Year	IV	Course Code:	Credits	4
Semester	VIII	Course Title: Blockchain Application Development	Hours	75
			Category	C
Prerequisites, if any	Computer Science Fundamentals, Data Structures, Programming language			
Course Outcomes	- Understand Blockchain Technology, its principles, components, and architecture - Able to design and develop Blockchain-based applications - Comprehend the Security and Privacy challenges associated with Blockchain Technology - Explore methods to integrate Blockchain Solutions with existing systems and platforms - Examine governance models and regulatory frameworks to Blockchain Technology			
Unit No.	Course Content			Hours
Theory Component				
Unit I	Blockchain Introduction Growth and History of Blockchain- Definition - Generic Elements - Benefits and Limitations - Features and Types of Blockchain			9
Unit II	Decentralization Definition – Methods – Routes - Platforms and Organizations of Decentralization			9
Unit III	Cryptography Definition – Confidentiality – Integrity – Authentication - Non-Repudiation - Accountability - DES – AES - Public Key Cryptography - Asymmetric Cryptography - Public and Private Keys – Encryption – Decryption - Hash Functions - Digital Signatures			9
Unit IV	Bitcoin Definition - Digital Keys and Address - Transactions and its types - Bitcoin Network – Wallets - Bitcoin Payments - Innovation in Bitcoins			9
Unit V	Ethereum Introduction - Ethereum Network – Components – EVM - Test Networks - Setting up Private Network			9
Recommended Learning Resources				
Text Books	1. Imran Bashir, “Mastering Blockchain”, Fourth Edition, Packt, 2023.			

Practical Component		
Title of the Practical: Blockchain Application Development		
Ex. No	Exercises	Hours
1	Develop a decentralized application (DApp) that utilizes blockchain technology	30
2	Build a blockchain explorer application that allows users to view transaction history, block details, and network statistics	
3	Implement a Blockchain-Based Supply Chain Tracking System	
4	Set up a private blockchain network using a blockchain platform	
5	Integrate a blockchain network with external systems or applications	
6	Perform a security audit of smart contracts deployed on a blockchain network	
7	Design a Cryptocurrency Wallet Application (Basic Prototype)	
8	Build a blockchain explorer application (Bitcoin-style transaction tracking concept)	
9	Develop a Decentralized File Storage System Prototype	
10	Set up a private Ethereum blockchain network	
11	Create a custom token on a blockchain platform of your choice	
12	Implement a Smart Contract for Voting System	
13	Select and Develop any one case study from the list provided below: 1. Bitcoin – Digital Currency Case Study 2. Ethereum Smart Contracts Case Study 3. Hyperledger Fabric – Enterprise Blockchain 4. Supply Chain Transparency – Walmart Food Tracking 5. Digital Identity on Blockchain	
Tools/Software to be used		Python

Model Question Paper
MJD 22: Blockchain Application Development
IV Year/ VIII Semester

Time: 3 Hours

Max. Marks: 60

PART A

Answer All Questions (10 × 1 = 10 Marks)

1. Which of the following best defines a blockchain?
a) A centralized database
b) A distributed ledger maintained by a network of nodes
c) A traditional file system d) A cloud storage platform
2. Which of the following is a limitation of blockchain technology?
a) Transparency b) Immutability
c) Scalability issues d) Decentralization
3. Decentralization primarily aims to eliminate:
a) Encryption b) Central authority
c) Network latency d) Digital signatures
4. Which platform is widely known for supporting decentralized applications (DApps)?
a) Google Cloud b) Ethereum c) Oracle d) MySQL
5. Which cryptographic property ensures that data cannot be altered without detection?
a) Confidentiality b) Authentication c) Integrity d) Non-repudiation: c
6. Which algorithm is an example of asymmetric key cryptography?
a) DES b) AES c) RSA d) SHA-256
7. What is the primary purpose of a Bitcoin wallet?
a) To store bitcoins physically b) To store public and private keys
c) To mine bitcoins d) To validate transactions
8. Which of the following is NOT a type of Bitcoin transaction?
a) Coinbase transaction b) Pay-to-Public-Key-Hash
c) Multi-signature transaction d) Smart contract transaction
9. The Ethereum Virtual Machine (EVM) is used to:
a) Store cryptocurrency b) Execute smart contracts
c) Mine bitcoins d) Encrypt transactions
10. Which of the following is a commonly used Ethereum test network?
a) Mainnet b) Ropsten c) Hyperledger d) Lightning

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

11. a) Define Blockchain and explain its key features

or

- b) Describe the different types of Blockchain and their benefits
12. a) Explain the concept of decentralization in the context of Blockchain.

or

- b) Discuss the advantages and disadvantages of decentralization.
13. a) Explain the concept of cryptography and how it ensures confidentiality and integrity in Blockchain transactions.

or

- b) What is asymmetric cryptography? Discuss its role in Blockchain security..
14. a) Explain the concept of Bitcoin and how its network operates.

or

- b) Discuss the role of Bitcoin wallets in the Bitcoin network
15. a) How does the Ethereum platform differ from Bitcoin in terms of functionality and use cases?

or

- b) How does a test network in Ethereum help developers

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

16. Discuss the growth and history of Blockchain. Highlight its evolution and key milestones.
17. a) What are the primary methods of decentralization in Blockchain technology. (5 marks)
b) How does decentralization impact the scalability and security of Blockchain systems? (5 marks)
18. Describe the process of encryption and decryption in Blockchain using public key cryptography.
19. a) Describe how Bitcoin transactions work, including the use of digital keys and addresses. (6 marks)
b) Describe the process of Bitcoin transactions and how they are validated (5 marks)
20. a) Discuss the Ethereum network and its main components, including the Ethereum Virtual Machine (EVM) (5 marks)
b) How does setting up a private Ethereum network differ from using public Ethereum networks? (5 marks)

Multi-Disciplinary Courses offering to other Departments
SEMESTER I

Year	I	Course Code:	Credits	3
Semester	I	Course Title: Basics of Networking	Hours	60
			Category	A
Prerequisites, if any		Basics of Computers		
Course Outcomes		- Explain what computer networks are and how they are used in everyday life. - Identify common network components and their purposes. - Understand how the Internet functions in simple terms. - Practice safe and responsible internet usage. - Troubleshoot basic network connection issues.		
Unit No.	Course Content			Hours
Theory Component				
Unit I	Introduction to Networking: Definition and purpose of computer networks - Daily life examples of networks - Types of networks: LAN, MAN, WAN - Difference between the Internet, Intranet and Extranet – WWW.			12
Unit II	Network Components and Devices: Network Topologies: Bus, ring, star, mesh, hybrid, tree. Hubs, Routers, Modems, Switches, Bridges, Gateways, Repeaters, Multiplexers, Access Points, Firewall, NIC, Network cables. Socket, ports.			12
Unit III	Transmission media: Cable (guided) and wireless media. Analog and Digital Data Transmission, Clients, servers, peers, Network services: File, print, message, database application. Centralized vs. distributed network architecture. Multiplexing, circuit switching, message switching, packet switching.			12
Unit IV	Internet and IP Basics: WWW, URL, Web Browser & Search Engines -Internet, Intranet and Extranet, Internet Services - IP addressing: Basics, address classes, subnetting. Static vs. Dynamic IP, Public vs. Private Ips - Website access - Domain names and DNS - Protocols and Services. Network Security: Authentication, authorization, confidentiality			12
Unit V	Wireless Networking: Wi-FiWi-Fi, Bluetooth, etc. Wireless security, Mobile device connectivity. Threats and vulnerabilities: Malware, phishing, DoS attacks. Security measures. Troubleshooting: Connecting devices - basic connectivity issues-Understanding mobile hotspot and airplane mode - Checking and improving internet speed - IP lookup tools.			12
Recommended Learning Resources				
Text Books	1. Behrouz A. Forouzan, “Data Communications and Networking”, McGraw Hill, Fourth Edition, 2007.			
Reference Books	1. P.K. Sinha, Priti Sinha, Computer Fundamentals and Networking, BPB Publications 2. Computer Networks and Internet – Dougulus E. Coumer 3. Cryptography and Network security – William Stallings			

Model Question Paper
MLD 1: Basics of Networking
I Year/ I Semester

Time: 3 Hours

Max. Marks: 60

PART A

Answer all the Questions (10 x 1 =10 marks)

1. What is the main purpose of a computer network?
 - a) To build standalone computers
 - b) To reduce electricity usage
 - c) To allow sharing of resources and communication
 - d) To improve gaming performance
2. Which of the following is an example of a LAN?
 - a) Internet
 - b) School computer lab network
 - c) Mobile 4G network
 - d) Nationwide banking network
3. Which network topology connects all devices to a central hub?
 - a) Ring
 - b) Mesh
 - c) Star
 - d) Bus
4. Which device is used to connect two different networks and determine the best path for data?
 - a) Switch
 - b) Router
 - c) Hub
 - d) Modem
5. Which of the following is a *guided* transmission medium?
 - a) Radio waves
 - b) Microwaves
 - c) Optical fiber
 - d) Infrared
6. Which switching method breaks data into small packets?
 - a) Circuit switching
 - b) Packet switching
 - c) Message switching
 - d) Manual switching
7. Which class of IP addresses is used for multicasting?
 - a) Class A
 - b) Class B
 - c) Class C
 - d) Class D
8. Which of the following provides secure access control?
 - a) Authentication
 - b) Bandwidth
 - c) DNS
 - d) Router
9. Which mode disables all wireless communications on a device?
 - a) Wi-Fi mode
 - b) Secure mode
 - c) Hotspot mode
 - d) Airplane mode
10. Which of the following is a common wireless security protocol?
 - a) WEP
 - b) IPX
 - c) POP
 - d) FTP

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

11. a) Explain the purpose of computer networks. Describe WWW.

or

b) Differentiate between Internet, Intranet, and Extranet each with examples.

12. a) Compare the functions of Access Points, Firewall, NIC, Network cables.

or

b) Write a note on the uses of socket and ports.

13. a) Differentiate between guided and unguided transmission media with examples.

or

b) Explain the centralized and distributed network architectures with diagrams. Discuss how clients, servers, and peers operate in each model.

14. a) Explain the structure of an IP address. What is the difference between static and dynamic IP addresses?

or

b) Give a brief explanation of how sub-netting works and why it is used in real networks.?

15. a) Discuss the use and range of Wi-Fi and Bluetooth.

or

b) Describe three common internet threats and suggest basic security measures to prevent them.

PART C - Answer any THREE Questions (3 x 10 = 30 marks)

16. Discuss different types of networks with diagrams and examples.

17. a) Describe the various types of network topologies with diagrams. (5 marks)

b) Write about the uses of Router, Switches, Gateways, Bridges and Modem. (5 marks)

18. Explain the various types of switching with suitable examples and diagrams.

19. Describe the complete process that occurs when a user enters a URL in a web browser:

a) Domain Name System (DNS) (2.5 marks)

b) IP addressing and routing (2.5 marks)

c) Role of protocols (HTTP, TCP/IP) (2.5 marks)

d) Browser-server communication (2.5 marks)

20. a) What are the common wireless networking technologies? (5 marks)

b) Explain how wireless security protocols (WPA2/WPA3) are implemented and why they are important. (5 marks)

SEMESTER – II

Year	II	Course code:	Credits	3
Semester	IV	Course Title: IT Enabled Services	Hours	60
			Category	A
Prerequisites , if any		Basic knowledge on IT and applications		
Course Outcomes		Define and explain the concept of IT-enabled services Evaluate business processes to identify potential areas for outsourcing Utilize information technology tools and platforms in the delivery of services Implement and demonstrate the use of ITES applications in various industries (e.g., healthcare, finance, e-commerce) Identify potential risks associated with IT-enabled services and applications		
Theory Component				
Unit No		Content	Hours	
Unit I		Introduction to IT Enabled Services (ITES) Definition and Overview of ITES - Evolution and Growth of ITES Industry - Key Components: People, Process, Technology – Global Outsourcing Trends	9	
Unit II		Business Process Outsourcing (BPO) Introduction to Business Process Outsourcing - Types of BPO: Voice and Non-Voice Processes – BPO Services: Customer Support, Technical Support, Data Entry, etc. - Case Studies on Successful BPO Implementations	9	
Unit III		Knowledge Process Outsourcing (KPO) Understanding Knowledge Process Outsourcing – Scope and Characteristics of KPO – KPO Domains: Research and Analysis, Legal Process Outsourcing, etc. - Intellectual Property and Innovation in KPO	9	
Unit IV		ITES Applications Overview of ITES Applications in Various Industries – ITES in Healthcare: Medical Transcription, Billing, and Coding – ITES in Finance and Accounting: Outsourced Bookkeeping, Payroll Services – ITES in E-commerce: Customer Support, Order Processing	9	
Unit V		Emerging Technologies in ITES Artificial Intelligence (AI) and Machine Learning (ML) in ITES – Robotic Process Automation (RPA) in Outsourcing – Cloud Computing and ITES – Cybersecurity in ITES: Challenges and Solutions	9	
Recommended Learning Resources				
Text Books		1. Sanjiva Shankar Dubey, “IT Strategy and Management”, PHI Learning, 2018. 2. Shiro Uesugi, “IT Enabled Services”, Springer, 2013. 3. Sanjiva Shankar Dubey, “IT Services Business Management: Concepts, Processes and Practices”, PHI Learning, 2012.		

Develop a Case Study listed below:		
1	Research and create a timeline of key milestones in the evolution of the ITES industry.	30
2	Identify and list three technological advancements that have significantly impacted ITES.	
3	Develop a simple customer support scenario involving a common query or issue.	
4	Select a simple BPO process (e.g., data entry) and map out its workflow.	
5	Research and present an overview of one specific KPO domain (e.g., legal process outsourcing).	
6	Develop scenarios to illustrate the scope and characteristics of KPO.	
7	Simulate a basic healthcare ITES scenario (e.g., medical transcription).	
8	Design a simplified scenario for outsourcing finance and accounting tasks.	
9	Develop a hands-on simulation of order processing in an e-commerce environment.	
10	Explore the integration of ITES processes with cloud computing services.	
11	Create cybersecurity scenarios related to ITES processes.	

Model Question Paper
MLD 2: IT Enabled Services & Applications
I Year/II Semester

Time: 3 Hours

Max. Marks: 60

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

1. Which of the following is the primary driver behind the global growth of the ITES industry?
 - a) technological innovation
 - b) Increased demand for specialized skills
 - c) Global outsourcing of business processes
 - d) Expansion of e-commerce
18. ITES typically supports business operations through:
 - a) Hardware manufacturing
 - b) Outsourcing of non-core activities
 - c) Direct customer sales
 - d) Research and Development
19. Which of the following is considered a major benefit of outsourcing in BPO?
 - a) Higher operational costs
 - b) Decreased workforce productivity
 - c) Focus on core business functions
 - d) Reduced service delivery speed
20. What is the primary function of a Non-voice BPO service?
 - a) Handling inbound calls for customer support
 - b) Managing back-office operations like data entry
 - c) Sales promotions via phone calls
 - d) Providing on-site technical support
21. Which domain is associated with KPO?
 - a) Software Testing
 - b) Legal Process Outsourcing
 - c) Data Entry Services
 - d) Call Center Operations
2. Knowledge Process Outsourcing (KPO) differs from Business Process Outsourcing (BPO) in that KPO primarily involves:
 - a) Routine tasks
 - b) Low-skilled work
 - c) High-level expertise and specialized task
 - d) Customer service and call handling
3. What is the role of ITES in the e-commerce industry?
 - a) Product manufacturing
 - b) Customer support, order processing, and inventory management
 - c) Software development
 - d) Sales promotion and advertising
4. ITES in the healthcare industry is often used for:
 - a) Creating medical devices
 - b) Customer care services
 - c) Medical transcription, billing, and coding
 - d) Manufacturing pharmaceuticals
5. Which technology is widely used in ITES to automate repetitive tasks and improve process efficiency?

- a) Blockchain b) Robotic Process Automation (RPA)
- c) Internet of Things (IoT) d) Virtual Reality

6. In ITES, Artificial Intelligence (AI) is used primarily to:
- a) Automate customer interactions and enhance decision-making
 - b) Replace all human workers in IT-related tasks
 - c) Perform basic administrative tasks only
 - d) Create digital products and software

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

11. a) Explain the key components of ITES and how they contribute to its effectiveness.
or
b) Discuss the evolution and global growth trends of the ITES industry.
12. a) Compare Voice and Non-voice BPO processes with examples.
or
b) Discuss the benefits and challenges of implementing BPO services in a large organization
13. a) How does KPO provide value compared to traditional BPO?
or
b) What are the main domains in KPO, and how do they contribute to organizational growth?
14. a) Explain how ITES applications in healthcare contribute to improved service delivery and reduced operational costs.
or
b) Discuss the role of ITES in finance, particularly in managing payroll services and bookkeeping.
15. a) How is Robotic Process Automation (RPA) transforming the ITES industry? Provide examples.
or
b) Explain the impact of Artificial Intelligence (AI) in improving decision-making and customer service in ITES.

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

16. Describe the evolution and growth of ITES in industries provide examples from different sectors.
17. a) Elaborate on BPO and its types of BPO processes with examples. (5 marks)
b) List and explain the different services offered by BPO firms. (5 marks)
18. Analyze the impact Knowledge Process Outsourcing (KPO) on high-end industries with relevant examples.
19. a) How do ITES applications in the e-commerce industry help improve customer experience and operational efficiency? (5 marks)
b) Discuss the role of ITES in billing and coding. (5 marks)
20. a) Discuss the benefits and challenges of using Cloud Computing in ITES. (6 marks)
b) Discuss the impact of cybersecurity challenges on the growth of ITES.

SEMESTER III

Year	II	Course Code:	Credits	3
Semester	III	Course Title: Business Analytics	Hours	60
			Category	A
Prerequisites, if any		Nil		
Course Outcomes		• Understand and describe data and its distributions • Understand the Role of Big Data Technologies. • Make decisions by optimizing business problems. • Understand the various features of tools and techniques and use them for business analysis • Describe and analyse the levels of Social networks and network measures.		
Unit No.	Course Content		Hours	
Theory Component				
Unit I	Introduction to Business Analytics Business Analytics: Meaning & Scope, Importance of Analytics Analytics Process, Goals & Benefits, Applications in Business Key Terms & KPIs, Career Opportunities, Ethics in Analytics		9	
Unit II	Fundamentals of Analytics Concept of Analytics, Types of Analytics: Descriptive, Diagnostic, Predictive, Prescriptive, Analytics Lifecycle, Data, Information & Knowledge, Analytics Frameworks, Role in Decision-Making Ethical Issues in Analytics		9	
Unit III	Big Data & Business Intelligence Big Data: Concept & Definition, Evolution of Big Data, Types of Data, 3Vs: Volume, Variety, Velocity, Challenges in Big Data, BI Concepts, BI vs Big Data Analytics, Role in Strategic Decision-Making, Data Privacy & Security issues		9	
Unit IV	Analytics Tools & Technologies (Basics) Classification of Analytics Tools, Open-source vs Proprietary Tools. Data Handling & Analysis Tools: MS Excel (Pivot tables, charts, basic analysis), SQL (basic querying for analytics), R (statistical analysis & visualization), Python (NumPy, Pandas, Matplotlib). Visualization & BI Tools: Tableau, Power BI. Big Data & ML Platforms: Hadoop, Spark (conceptual), Cloud analytics platforms (AWS, Azure)		9	
Unit V	Web, Social Media & Advanced Analytics(Basics) Web Analytics: Traffic & Engagement, Social Media Data & Networks, Levels of Network Analysis, Applications in Marketing & Branding, Machine Learning(overview): Concept & Relevance, AI vs ML vs Deep Learning, Responsible & Fair Analytics.		9	

Recommended Learning Resources	
Text Books	1. Sharda, R., Delen, D., & Turban, E. Business Analytics: The Science of Data Driven Decision Making. Pearson Education Limited. 2. Albright, S. Christian, and Winston, Wayne L. <i>Business Analytics: Data Analysis & Decision Making</i>, 8th Edition. Cengage Publications, 2024. 3. U. Dinesh Kumar, Business Analytics: The Science of Data-Driven Decision Making, Wiley, 2nd Edition, 2021. (Unit I & V)
Reference Books	1. Maheshwari, Anil K. <i>Data Analytics Made Accessible</i>. 1st Edition. McGraw Hill Education (India) Private Limited, July 1, 2017. 2. Flach, P. Machine Learning: <i>Data Science for Business</i>. O'Reilly Media..

Model Question Paper
MLD 3: Business Analytics
II Year/ III Semester
Common for All

Time: 3 Hours

Max. Marks: 60

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

1. Business Analytics mainly focuses on:
a) Data storage b) Data-driven decision making
c) Software development d) Hardware maintenance
2. Which of the following is a Key Performance Indicator (KPI)?
a) Database b) Profit margin c) Programming language d) Network protocol
3. Which type of analytics answers the question “*Why did it happen?*”?
a) Descriptive b) Diagnostic c) Predictive d) Prescriptive
4. In the analytics lifecycle, which step comes immediately after problem definition?
a) Decision implementation b) Data collection
c) Model deployment d) Reporting
5. Which of the following represents the **Volume** aspect of Big Data?
a) Speed of data generation b) Size of data
c) Type of data d) Data accuracy
6. Business Intelligence (BI) primarily supports:
a) Operational coding b) Strategic and managerial decisions
c) Network security d) Hardware optimization
7. Which of the following is an open-source analytics tool?
a) Tableau b) Power BI c) Python d) MS Excel
8. Which tool is mainly used for interactive dashboards and data visualization?
a) SQL b) R c) Tableau d) Hadoop
9. Website bounce rate is a metric used in:
a) Financial analytics b) Web analytics
c) Manufacturing analytics d) HR analytics
10. Which of the following best differentiates Machine Learning from traditional programming?
a) Uses fixed rules b) Learns patterns from data
c) Does not require data d) Eliminates decision-making

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

11. a) Explain the meaning and scope of Business Analytics.
or
b) Discuss the goals, benefits, and applications of Business Analytics.
12. a) Explain the different types of analytics with suitable examples
or
1. Describe the role of analytics in decision-making
13. a) Explain the evolution of Big Data and the 3Vs model.
or
2. Differentiate between Business Intelligence and Big Data Analytics.
14. a) Explain the classification of analytics tools with examples.
or
b) Discuss the role of visualization and BI tools such as Tableau and Power BI
15. a) Explain web analytics metrics related to traffic and engagement
or
b) Discuss the concept and relevance of Machine Learning in business

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

16. Explain the analytics process. Discuss ethical issues in Business Analytics
17. a) Differentiate between data, information, and knowledge. (5 marks)
b) Explain analytics frameworks used in organizations. (5 marks)
18. Explain the challenges involved in Big Data management. Discuss data privacy and security issues in analytics.
19. a) Explain the role of MS Excel and SQL in analytics. (5 marks)
b) Discuss ethical considerations in selecting and using analytics tools. (5 marks)
20. a) Explain levels of network analysis in social media analytics. (5 marks)
b) Discuss responsible and fair use of analytics and AI. (5 marks)