

**MASTER OF COMPUTER APPLICATIONS
(MCA)
CHOICE BASED CREDIT SYSTEM (CBCS)**

Curriculum and Syllabus

Regular (2025 – 2026)



**DEPARTMENT OF COMPUTER APPLICATIONS
FACULTY OF ARTS, SCIENCE, COMMERCE AND MANAGEMENT(FASCM)**

KARPAGAM ACADEMY OF HIGHER EDUCATION

(Deemed to be University)

(Established Under Section 3 of UGC Act, 1956)

(Accredited with A+ Grade by NAAC in the Second Cycle)

Eachanari (Post), Coimbatore – 641 021.

Tamil Nadu, India

Phone No. 0422-2980011 – 14 Fax No. 0422-2980022-23

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(Deemed to be University)
(Established Under Section 3 of UGC Act, 1956)

FACULTY OF ARTS, SCIENCE, COMMERCE AND MANAGEMENT (FASCM)
POST GRADUATE PROGRAMME (MCA)
(REGULAR PROGRAMME)

REGULATIONS
(2025)

CHOICE BASED CREDIT SYSTEM
(CBCS)

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FACULTY OF ARTS, SCIENCE, COMMERCE AND MANAGEMENT

MCA DEGREE PROGRAMME

REGULAR MODE

CHOICE BASED CREDIT SYSTEM (CBCS)

REGULATIONS - 2025

The following regulations shall apply to candidates admitted to MCA Degree Programme in the Faculty of Arts, Science, Commerce and Management, Karpagam Academy of Higher Education (KAHE) from the academic year 2025-2026 onwards.

1. PROGRAMMES OFFERED, MODE OF STUDY AND ADMISSION REQUIREMENTS

1.1. PG PROGRAMME OFFERED

MCA – MASTER OF COMPUTER APPLICATIONS

1.2. MODE OF STUDY

The Programme is offered in Full-Time Regular mode.

1.3. ADMISSION REQUIREMENTS (ELIGIBILITY)

A candidate for admission to the first semester of the MCA Degree Programme shall be required to have passed any Degree Examination of this Karpagam Academy of Higher Education or any other University accepted by the KAHE as equivalent thereto. Admission shall be offered only to the candidates who possess any undergraduate degree with a minimum of 50% marks.

2. DURATION OF THE PROGRAMMES

2.1. The minimum and maximum period for completion of the MCA Degree Programme is given below:

Programme	Min. No. of Semesters	Max. No. of Semesters
MCA	4	8

2.2. Each semester normally consists of 90 working days or 525 instructional hours for full-time mode of study. End Semester Examination shall be conducted at the end of every semester for the respective courses.

3. CHOICE BASED CREDIT SYSTEM

Credits means the weightage given to each course of study by the experts of the Board of Studies concerned. MCA Degree programme is offered under Choice Based Credit System with a minimum of 92 credits. Students admitted from Non-Computer UG programmes shall earn an additional of 4 credits in their first semester by undertaking 2 bridge courses for which only ESE theory will be conducted for 100 marks.

4. STRUCTURE OF THE PROGRAMME

Every Programme will have a curriculum and syllabus consisting of core courses, core elective courses, open elective, Internship and project work.

4.1 Core courses

Core courses consist of theory and practical and the examinations shall be conducted at the end of each semester.

4.2 Core Elective courses

Elective courses are to be chosen with the approval of the Head of Department concerned from the list of elective courses mentioned in the curriculum.

4.3 Project Work

The project work shall start at the beginning of the Fourth semester in the Department/Industry/Research Institute (National/International) and the project report has to be submitted at the end of the fourth semester. The Head of the Department concerned shall assign a project supervisor who in turn shall monitor the project work of the student.

If the student undertakes the Project work outside the Department, the faculty concerned within the Department shall be the Supervisor and the teacher/scientist of the host institute will be the Co-supervisor. The student shall bring the attendance certificate from the place where the project work was carried out.

A Project Assessing Committee (PAC) shall be constituted with HoD and two senior faculty members of the Department. The PAC shall announce the dates for the reviews and demonstration. Three reviews shall be conducted as part of internal assessment. The student shall make a presentation on the progress and demonstration of their project before the PAC in the presence of their supervisor on the scheduled dates.

4.4 Internship

The student shall undergo 15 days internship at the end of second semester. Internship report will be evaluated and marks will be awarded in the third semester. Students have to earn 2 credits for the Internship. The Internship will be assessed internally and marks will be awarded out of 100.

4.5 Open Elective

The student may select one of the open elective courses offered by other departments in the third semester (List is given below). Students have to earn 2 credits from this course (Students must select an open elective offered by a department other than their parent department)

S.No.	Name of the offering Department	Course Code	Course Name
1	English	25EGPOE301	English for Competitive Examinations
2	Commerce	25CMPOE301	Personal Finance and Planning
3	Management	25MBAPOE301	Organizational Behavior
4	Computer Applications	25CAPOE301	Robotic Process Automation
5	Computer Science	25CSPOE301	Cyber Forensics
6	Mathematics	25MMPOE301	Coding Theory
7	Physics	25PHPOE301	Electrical Appliances and Servicing
8	Chemistry	25CHPOE301	Industrial Chemistry
9	Microbiology	25MBPOE301	Fermentation Technology
10	Biotechnology	25BTPOE301	Nutrition and Dietetics

5. ADVANCED LEARNERS AND ON-DEMAND EXAMINATION

Students who secure 7.5 CGPA and maintain an attendance of 80% in every semester and clear all the courses in their first appearance itself are referred to as advanced learners. When a student fails to maintain any of these conditions at any given time, the student cannot be an advanced learner further.

These students can request for an on-demand examination for the courses in their forthcoming semester(s). These students, upon prior registration, can appear for examinations well in advance and complete the entire courses well before the prescribed period of study and can progress for a full time Research Project/Internship/Minor Project during the remaining prescribed period of study. The Internal and External examinations will be conducted for these courses as like the other courses. One or more faculty mentors shall be allocated

based on the number of students/courses enrolled for the on-demand examination. When the number of students enrolled for a particular course is less than 30, only self-learning mode is applicable and will be monitored by the mentor. Otherwise, a faculty will handle the course after regular working hours. The examination will be conducted along with the current semester courses in the same exam pattern.

Also, these advanced learners can register for online courses from NPTEL/SWAYAM/SWAYAM Plus portals on prior and proper approval from the department. The credits earned from those courses will be transferred to the mark statement of the students as in Clause 6.

6. TRANSFER OF CREDITS EARNED THROUGH ONLINE PLATFORM / INTERNATIONAL STUDIES

Students are encouraged to enroll in courses offered by NPTEL/SWAYAM/SWAYAM Plus platforms and international institutions of higher learning, either virtually or in person. The equivalent credits for these courses will be determined by a committee named Subject & Grade Equivalence Committee comprising the Dean of the Faculty as Chairman, Dean (R&D, Industrial Relations), Head of the Department (HoD), and one faculty member nominated by the Vice Chancellor as members. The committee's decision will be submitted for ratification/approval by the Board of Studies (BoS) and the Academic Council.

7. MEDIUM OF INSTRUCTION

The medium of instruction for all courses, examinations, seminar presentations, Internship and project/thesis/dissertation reports is in English.

8. SCHEME OF EXAMINATION

8.1 Evaluation: Evaluation of the course comprises two parts such as the Continuous Internal Assessment (CIA) and the End Semester Examination (ESE).

The theory and practical courses shall carry a maximum of 100 marks, out of which 40 percent of marks are awarded for Continuous Internal Assessment (CIA) and 60 percent of marks for End Semester Examinations (ESE).

8.2 Maximum Marks for Project work

S. No	Programme	Maximum Marks	CIA	ESE
1	MCA	200	80	120

9. FACULTY MENTOR

To help students in planning their courses of study and for general advice on the academic programme, the HoD shall allot a certain number of students to a faculty who will function as mentor throughout their period of study. Faculty mentors shall advise the students and monitor their behavior and academic performance. Problems if any shall be counseled by them periodically. The faculty mentor is also responsible to inform the parents of their wards' progress. Faculty mentor shall display the cumulative attendance particulars of his / her students' periodically (once in 2 weeks) on the Notice Board to enable the students to know their attendance status and satisfy the **clause 13** of this regulation.

10. ONLINE COURSE COORDINATOR

To help students for planning their online courses and for general orientation on online courses, the HoD shall nominate a coordinator for the online courses. The Online course coordinator shall identify the courses which students can select for their programme from the available online courses offered by different agencies periodically and inform the same to the students. Further, the coordinators shall orient the students regarding the online courses and monitor their participation.

11. CLASS COMMITTEE

Every class shall have a Class Committee consisting of the faculty members of various courses of the class concerned, student representatives (Minimum 2 boys and 2 girls of various capabilities and Maximum of 6 members) and the concerned HoD / senior faculty as Chairperson. The objective of the Class Committee Meeting is all about the teaching – learning process. The Class Committee shall be convened at least once in a month. The constitution and functions of the Class Committee shall include

1. The class committee shall be constituted during the first week of each semester.
2. The Class Committee of a particular class of any department is normally constituted by the HoD/Chairperson of the Class Committee. However, if the students of different departments are mixed in a class, the Class Committee shall be constituted by the respective Dean of the Faculty.
3. The HoD/Chairperson of the Class committee is authorized to convene the meeting of the class committee.
4. The respective Dean of the Faculty has the right to participate in any Class committee meeting.
5. The Chairperson is required to prepare the minutes of every meeting, and submit the same to the Dean concerned within two days after having convened the meeting. Serious issues, if any, shall be brought to the notice of the Registrar by the HoD/Chairperson immediately.
6. Analyzing and solving problems experienced by students in the classroom and in the laboratories.
7. Analyzing the performance of the students of the class after each test and finding the ways and means to improve the performance.

12. COURSE COMMITTEE FOR COMMON COURSES

Each common course offered to more than one programme or department shall have a “Course Committee” comprising all the teachers handling the common course with one of them nominated as Course Coordinator. The nomination of the course coordinator shall be made by the respective Dean depending upon whether all the teachers handling the common course belong to a single department or to various other departments. The ‘Course Committee’ shall meet in order to arrive at a common scheme of evaluation for the tests to ensure a uniform evaluation of the tests. If feasible, the course committee shall prepare a common question paper for the Internal Assessment Test(s). The Course Committee Meeting is conducted once in a semester. To indicate the common course, the Course Code should be suffixed with the letter “G”.

13. ATTENDANCE REQUIREMENTS TO APPEAR FOR THE END SEMESTER EXAMINATION

13.1 Every student is expected to attend all classes and should secure 100% attendance. However, in order to allow for certain unavoidable circumstances, the student is expected to have at least 75% of attendance and the conduct of the candidate has been satisfactory during the Programme.

13.2. A candidate who has secured attendance between 65.00% and 74.99% (both included), due to medical reasons (Hospitalization / Accident / Specific Illness) shall be given exemption from prescribed minimum attendance requirements and shall be permitted to appear for the examination on the recommendation of the Head of Department concerned and the Dean. The Head of Department has to verify and certify the genuineness of the case before recommending it to the Dean concerned. However, the candidate has to execute an undertaking and the parent along with the student should assure that this situation does not arise in the future. This permission is given only once during the entire period of study.

13.3. A candidate who has secured attendance between 55.00% and 64.99% (both included), due to medical reasons (Hospitalization / Accident / Specific Illness with all the medical records, bills and discharge summary), will not be presented to that semester examination. However, that candidate will be permitted to go to the next semester wherein he / she has to compensate for the previous semester's lack of attendance. In such a case, the candidate will be permitted to write both semester examinations at the end of the next semester. This combination of lack of attendance can be done only between subsequent semesters. That is 1 & 2 or 2 &3 or 3&4 or 4&5 or 5&6.

13.4. However, a Student who has secured less than 55% in any of the semesters due to any reasons, shall not be permitted to appear for the End Semester Examinations. But he/she will be permitted to appear for his/her arrear examinations. In order to redo the semester with lack of attendance, he/she must attend the corresponding semester of the subsequent year(s) with approval of the Dean of the Faculty, Dean - Students Affairs and the Registrar.

14. PROCEDURE FOR AWARDING MARKS FOR INTERNAL ASSESSMENT

14.1. Attendance and Assessment: Every Faculty is required to maintain an **Attendance and Assessment Record (Log book)** which consists of attendance of students marked for each lecture/practical/ project work, the CIA and Seminar marks and the record of class work completed (topic covered), separately for each course. This should be submitted to the HoD once in a week for checking the syllabus coverage, records of test marks and attendance. The HoD shall sign with the date after due verification. The same shall be submitted every fortnight to the respective Dean. After the completion of the semester the HoD should keep this record in safe custody for five years as records of attendance and assessment shall be submitted for inspection as and when required by the KAHE/any other approved body.

14.2. Continuous Internal Assessment (CIA): The performance of students in each course will be continuously assessed by the respective faculty. Retest will be conducted and considered based on the requirements and recommendations by the Head of the Department. The guidelines for the Continuous Internal Assessment (CIA) are given below:

Theory Courses

S. No.	Category	Maximum Marks
1.	Attendance	5
2.	Seminar	15
3.	Test – I (2 ½ units)	10
4.	Test – II (2 ½ units)	10
Total		40

Theory-cum-Practical

S. No.	Category	Maximum Marks
1.	Attendance	5
2.	Seminar	5
3.	Observation	5
4.	Record	5
5.	Test – I (2 ½ units)	10
6.	Test – II (2 ½ units)	10
Total		40

Practical Courses

S. No.	Category	Maximum Marks
1.	Attendance	5
2.	Observation work	5
3.	Record work	5
4.	Internal Practical Assessment practical examination	15
5.	<i>Viva – voce</i> [Comprehensive]*	10
Total		40

* *Viva - voce* conducted during model practical examination.

Every practical Exercise / Experiment shall be evaluated based on the conduct of Exercise/ Experiment and records maintained.

14.3 Pattern of Test Question Paper

Theory Courses:

Maximum Marks : 60

Duration: 2 ½ Hours

Section	Marks
Part – A	Short Answer Answer ALL Questions (6 x 2 = 12 Marks)
Part - B	Long Answer – 3 Six Mark questions ‘either – or’ type Answer ALL Questions (3 x 6 = 18 Marks)
Part - C	Essay type Answer– 3 Ten Mark questions ‘either – or ‘ type Answer ALL Questions (3 x 10 = 30 Marks)

14.4 Attendance

Marks Distribution for Attendance

S. No.	Attendance (%)	Maximum Marks
1.	91 and above	5
2.	81 - 90	4
3.	75-80	3

15. ESE EXAMINATIONS

15.1 End Semester Examination (ESE): ESE will be held at the end of each semester for each course. The question paper is for a maximum of 100 marks.

15.2 Pattern of ESE Question Paper

Theory Courses:

Maximum Marks: 100*

Duration: 3 Hours

Section	Marks
Part – A	Short Answer Answer ALL the Questions (10 x 2 = 20 Marks)
Part - B	Long Answer – 5 six mark questions ‘either – or’ type Answer ALL the Questions (5 x 6 = 30 Marks)
Part - C	Essay type Answer– 5 ten mark questions ‘either – or ‘ type Answer ALL the Questions (5 x 10 = 50 Marks)

* The 100 Marks is converted to 60 Marks.(Theory)

* The 100 Marks is converted to 45 Marks (Theory-cum-Practical)

Practical Courses: There shall be combined valuation by the Internal and External examiners. The pattern of distribution of marks shall be as given below.

S. No.	Category	Maximum Marks
1.	Experiments	40
2.	Record work	10
3.	<i>Viva – voce</i> [Comprehensive]	10
Total		60

* The 60 Marks is converted to 15 Marks (Theory-cum-Practical)

Record Notebooks for Practical Examination

Candidates taking the Practical Examination should submit a prescribed Bonafide Record Notebook for the practical examination, failing which the candidate will not be permitted to take the practical examination.

In case of failures in Practical Examination, the marks awarded for the Record at the time of first appearance of the Practical Examination shall remain the same at the subsequent appearance also by the candidate.

15.3. Evaluation of Project Work

15.3.1 The project shall carry maximum marks as per (vide clause 8.2). ESE will be a combined evaluation of Internal and External Examiners.

The distribution of marks for the Continuous Internal Assessment (CIA) are given below:

Maximum Marks: 80

S. No.	Category	Maximum Marks
1.	Problem Selection	20
2.	Progress of the work (3 reviews X 5 marks)	30
3.	Presentation of the work (3 reviews X 5 marks)	30
Total		80

The pattern of distribution of marks for the End Semester Examination are given below:

Maximum Marks: 120*

S. No.	Category	Maximum Marks
1.	Project Document	60
2.	Project Presentation	40
3.	Viva Voce	20
Total		120*

*Combined valuation of Internal and External Examiners.

15.3.2 The project report prepared according to the approved guidelines and duly signed by the supervisor(s) shall be submitted to HoD.

Guidelines to prepare the project report

- a. Cover page
- b. Bonafide Certificate
- c. Declaration
- d. Acknowledgement
- e. Table of contents
- f. Chapters
 - Introduction
 - Aim and Objectives
 - Materials and Methods (Methodology)
 - Results (Analysis of Data) and Discussion (Interpretation)
 - Summary
 - References

15.3.3 The evaluation of the project will be based on the project report submitted and *Viva-Voce* Examination by a team consisting of the supervisor, who will be the Internal Examiner and an External Examiner who shall be appointed by the COE. In case the supervisor is not available, the HoD shall act as an Internal Examiner.

15.3.4 If a student fails to submit the project report on or before the specified date given by the Examination Section, the student is deemed to have failed in the project work and shall re-enroll for the same in a subsequent semester.

If a student fails in the *viva-voce* examinations he/she has to resubmit the project report within 30 days from the date of declaration of the results. The resubmitted report shall be evaluated in the subsequent semester.

15.3.5 Copy of the approved project report after the successful completion of *viva voce* examinations shall be kept in the KAHE library.

16. PASSING REQUIREMENTS

16.1 Passing minimum: A student needs to secure a minimum of 20 marks out of 40 marks in CIA and 30 marks out of 60 marks in ESE. The overall passing minimum in each course is 50 marks out of 100 marks.

16.2 If a student fails to secure a pass in a particular course (either CIA or ESE or Both) as per clause 16.1, it is mandatory that the student has to register and reappear for the examination in that course during the subsequent semester when examination is conducted for the same until the student passes both CIA and ESE (vide Clause 2.1).

16.3 The CIA marks secured by the student in the first passed attempt shall be retained by the Office of the Controller of Examinations and considered valid for all subsequent attempts till the student secures a pass in ESE.

16.4 Students failed in internal assessment will be permitted to reappear to pass the internal assessment in the subsequent semesters by writing tests and by re-submitting Assignments/ Seminars.

The distribution of marks for this test shall be as given below.

S. No.	Category	Maximum Marks
1.	Attendance (Retained from the respective semester)	5
2.	Seminar	15
3.	Test*	20
	Total	40

* Test shall be conducted in the ESE pattern for 100 marks and converted to 20 marks.

The examination should be completed within 6 weeks after reopening of the subsequent semester.

16.5 A Student who is absent in ESE in a Course / Practical / Project Work after having enrolled for the same shall be considered to have Absent (AAA) in that examination.

17. ONLINE EXAMINATIONS

The students who are going for Project / Internship / Coursework at National level are permitted to write their CIA test through Online Mode and ESE in Offline/Online mode. When they go for an International Project / Internship / Coursework, both the CIA and ESE shall be conducted through online mode.

18. IMPROVEMENT OF MARKS IN THE COURSE ALREADY PASSED

The Students desirous to improve the marks secured in a passed course in their first attempt shall reappear once (**only in ESE**) in the subsequent semester. **The improved marks shall be considered for classification but not for ranking.** If there is no improvement, there shall be no change in the marks awarded earlier.

19. AWARD OF LETTER GRADES

All assessments of a course will be done on an absolute marks basis. However, for the purpose of reporting the performance of a student, letter grades, each carrying certain number of points, will be awarded as per the range of total marks (out of 100) obtained by the student in each course as detailed below:

Letter grade	Marks Range	Grade Point	Description
O	91-100	10	OUTSTANDING
A+	81 - 90	9	EXCELLENT
A	71 - 80	8	VERY GOOD
B+	61 - 70	7	GOOD
B	56 - 60	6	AVERAGE
C	50 - 55	5	PASS
RA	Below 50	-	REAPPEARANCE
AAA	-	-	ABSENT

20. GRADE SHEET

After the declaration of the results, Grade Sheets will be issued to each student which will contain the following details:

- i. The list of courses enrolled during the semester and the corresponding grade obtained.
- ii. The Grade Point Average (**GPA**) for the semester and
- iii. The Cumulative Grade Point Average (**CGPA**) of all courses enrolled from first semester onwards.

GPA of a Semester and CGPA of a programme will be calculated as follows.

$$\text{GPA of a Semester} = \frac{\text{Sum of the product of the GP by the corresponding credits of the courses}}{\text{Sum of the credits of the courses of that Semester}}$$

i.e. **GPA** of a Semester =
$$\frac{\sum_i C_i G P_i}{\sum_i C_i}$$

Sum of the product of the GPs by the corresponding credits of the courses offered for the entire programme

CGPA of the entire programme =
$$\frac{\sum_n \sum_i C_{ni} G P_{ni}}{\sum_n \sum_i C_{ni}}$$

Sum of the credits of the courses of the entire programme

i.e. **CGPA** of the entire programme =
$$\frac{\sum_n \sum_i C_{ni} G P_{ni}}{\sum_n \sum_i C_{ni}}$$

where,

- C_i is the credit fixed for the course 'i' in any semester
- G_{Pi} is the grade point obtained for the course 'i' in any semester
- 'n' refers to the Semester in which such courses are credited

Note: RA grade will be excluded for calculating **GPA** and **CGPA**.

21. REVALUATION

Candidates can apply for revaluation or retotaling of his / her semester examination answer script (**theory courses only**), within 2 weeks from the date of declaration of results, on payment of a prescribed fee. For the same, the prescribed application has to be sent to the Controller of Examinations through the HoD. **A candidate can apply for revaluation of answer scripts not exceeding 5 courses at a time.** The Controller of Examinations will arrange for the revaluation and results will be intimated to the candidate through the

HODs concerned. Revaluation is not permitted for supplementary theory courses.

22. TRANSPARENCY AND GRIEVANCE COMMITTEE

Revaluation and Retotaling may be requested by representation (clause 21). Students may get the Xerox copy of the answer script on payment of prescribed fee, if he / she wishes. The student may represent the grievance, if any, to the Grievance Committee, which consists of Dean of the Faculty, (if Dean is HoD, the Dean of another Faculty nominated by the KAHE), the HoD of Department concerned, the faculty of the course and Dean from other discipline nominated by the KAHE and the CoE. If the Committee feels that the grievance is genuine, the script may be sent for external valuation; the marks awarded by the External examiner will be final. The student has to pay the prescribed fee for the same.

23. ELIGIBILITY FOR THE AWARD OF THE DEGREE

A student shall be declared to be eligible for the conferment of the Degree if he / she has

- Successfully completed all the components in clause 4 and gained the required number of total credits as specified in the curriculum corresponding to his / her Programme within the stipulated period.
- No pending disciplinary enquiry/ action against him/her.
- The award of the degree must be approved by the Board of Management.

24. CLASSIFICATION OF THE DEGREE AWARDED

24.1. Students who qualify for the award of the Degree (vide clause 23) having passed the examinations in all the courses in his / her first appearance, within the specified minimum number of semesters and securing a **CGPA not less than 8.0** shall be declared to have passed the examination in **First Class with Distinction**.

24.2 Students who qualify for the award of the Degree (vide clause 23) having passed the examinations in all the courses within the specified maximum number of semesters (vide clause 2.1), securing a **CGPA not less than 6.5** shall be declared to have passed the examination in **First Class**.

24.3 All other students (not covered in clauses 24.1 and 24.2) who qualify for the award of the degree (vide Clause 23) shall be declared to have passed the examination in **Second Class**.

25. RANKING

Candidates who qualify for the PG Degree programme passing all the Examinations in the first attempt, within the minimum period prescribed for the programme of study from Semester I through Semester IV to the programme shall be eligible for ranking. Such ranking will be confined to 10% of the total number of candidates qualified in that particular programme of study subject to a maximum of 10 ranks.

26. SUPPLEMENTARY EXAMINATION

Supplementary Examination will be conducted only for the final semester students within ten days from the date of publication of results for students who have failed in one theory course only. Such students shall apply with prescribed fee to the Controller of Examinations within the stipulated time.

27. DISCIPLINE

27.1. If a student indulges in malpractice in any of the Internal/External Examinations he/she shall be liable for punitive action as prescribed by the KAHE from time to time.

27.2. Every student is required to observe discipline and decorous behavior both inside and outside the campus and not to indulge in any activity which will tend to bring down the prestige of the KAHE. The erring students will be referred to the disciplinary committee constituted by the KAHE, to enquire into acts of indiscipline and recommend the disciplinary action to be taken.

28. KAHE ENTRANCE EXAMINATION

At the end of Fourth Semester, the KAHE Entrance Examinations will be conducted for those who are aspiring for Higher Education (Ph.D).

29. REVISION OF REGULATION AND CURRICULUM

Karpagam Academy of Higher Education may from time-to-time revise, amend or change the Regulations, Scheme of Examinations and syllabi if found necessary.

Karpagam Innovation and Incubation Council (KIIC)

(A Section 8 Company)

Based on the 2019 National Innovation and Startup Policy and the 2019–2023 Tamil Nadu Startup Policy, KIIC has recommended to the KAHE students who are affiliated with the KIIC that it be incorporated in the university Program Regulations 2023-24 and implement from this academic year.

Norms to Student Start-Ups

- a) Any (UG/PG / (Ph.D.) Research scholars, student, right from the first year of their program is allowed to set a startup (or) work part time/ full time in a startup or work as intern in a startup
- b) Any (UG/PG / (Ph.D.) Research scholars) student right from the first year of their program is allowed to earn credit for working on Innovative prototypes/business Models/ Pre incubation (case to case basis).
- c) Start Up activities will be evaluated based on the guidelines being given by the expert committee of the KIIC
- d) Student Entrepreneurs may use the address of incubation center (KIIC) to register their venture while studying in KAHE.
- e) Students engaged in startups affiliated with the KIIC or those who work for them may be exempted from KAHE's attendance requirements for academic courses under current regulations, up to a maximum of 30% attendance per semester, including claims for ODs and medical emergencies Potential Students who have been incubated at KIIC may be permitted to take their University semester exams even if their attendance is below the minimum acceptable percentage, with the proper authorization from the head of the institution. (On case-to-case basis depends upon the applicability strength, societal benefits and quality of the Innovation and Subsequent engagement of the students with the/ her business)
- f) Any Students Innovators/entrepreneurs are allowed to opt their startup in place mini project /major project, /seminar and summer training etc. (In plant training, Internship, value added Course.). The area in which the student wishes to launch a Startup may be interdisciplinary or multidisciplinary.
- g) Student's startups are to be evaluated by Expert committee, formed by KIIC and KAHE

Guide lines to award Credits/ Marks to a Student startup

Student's startup stages are divided into five phases and these startup phases can be considered equally in place of the course title as mentioned below with the same credits allotted to the course title in a University curriculum.

Sl. No.	Description/Startup phases	In place of the Subject / Course title	Grades/Credits /Marks
1	Idea stage/Problem Identification	Seminar	Same Marks/Credits can be awarded that are listed in the course title's curriculum for the respective startup phases.
2	Proof of Concept (POC) /Solution development	In-plant training /Internship	
3	Product Development (Lab scale) /Prototype Model/ Company Registered	Mini Project/ Value added Course	
4	Validation/Testing	Main Project phase I	
5	Business Model/Ready for Commercialization/Implementation	Main Project phase II,	

PROGRAMME OUTCOMES

By the end of the programme, our graduates will

1. **Disciplinary knowledge:** Possess a profound understanding of the foundational concepts, theories, methodologies, and practices within the discipline of Computer Applications.
2. **Communication Skills:** Emerge as confident communicators capable of articulating complex concepts, advocating for their viewpoints, and engaging in meaningful discourse to address contemporary issues and drive positive change.
3. **Critical thinking:** Master advanced critical thinking skills, analyzing complex issues, and solving problems through evidence-based decision-making.
4. **Problem solving:** Excel in problem-solving, applying analytical techniques and creative thinking to address complex challenges in the field of Computer Applications.
5. **Analytical reasoning:** Emerge as adept analytical thinkers, equipped to tackle challenging problems, make informed decisions, and contribute to the advancement of knowledge in the field of Computer Applications.
6. **Research-related skills:** Demonstrate proficiency in data analysis, critical appraisal, and ethical research practices, contributing original insights to the advancements in Computer Applications.
7. **Cooperation/Team work:** Develop strong cooperation and teamwork skills, collaborating effectively with diverse peers to achieve common goals.
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PROGRAMME SPECIFIC OBJECTIVES (PSOs):

PSO 1: Apply the scientific knowledge acquired to develop smart applications.

PSO 2: Ability to design and develop software with appropriate documentation.

PSO 3: Apply current tools and techniques to design and develop innovative applications for solving real life challenges.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

1. PEO 1: Design, model and develop smart applications by utilizing strong technical and domain knowledge acquired from the programme for the improvement of society.
2. PEO 2: Apply tools, technologies and critical thinking to develop applications for solving industry-oriented problems
3. PEO 3: Function as a team member and develop projects in a multi-disciplinary environment by emulating leadership skills

MAPPING of PEOs and POs

POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
PEO1	X	X	X	X	X										
PEO2		X	X	X		X		X		X	X	X	X	X	X
PEO3			X		X	X	X		X		X	X		X	X

DEPARTMENT OF COMPUTER APPLICATIONS
FACULTY OF ARTS, SCIENCE COMMERCE AND MANAGEMENT
PG PROGRAMME(CBCS) – MCA (Master of Computer Appliations)

(2025–2026 Batch and Onwards)

Course code	Name of the course	Category	Objectives and Outcomes		Instruction Hours / Week			Credit(s)	Maximum Marks			Page No.
			PSOs	POs	L	T	P		CIA	ESE	Total	
									40	60	100	
SEMESTER I												
25CAP101	Advanced Computer Networks	Major 1	1,2	1,3,9,11	4	-	-	4	40	60	100	1
25CAP102	Data Structure and Algorithms using C	Major 2	1,2	1,2,3,4	4	-	-	3	40	60	100	3
25CAP103	Database Technology	Major 3	3	1,2,5,6	4	-	-	3	40	60	100	5
25MAP102	Mathematical Foundation of Computer Applications	Major 4	1,2	1,3,5,9	5	-	-	4	40	60	100	8
25CAP141	Object Oriented Programming using Java	Major 5	1,2	1,3,4,5	4	-	4	5	40	60	100	10
25CAP111	Data Structure and Algorithms using C - Practical	Major 6	1,2	1,2,3,4	-	-	4	2	40	60	100	13
25CAP112	Database Technology - Practical	Major 7	3	1,2,5,6	-	-	4	2	40	60	100	15
25CAP113	Communication Skills Enhancement - I	Major 8	-	-	-	-	2	2	40	60	100	18
Semester Total					21	0	14	25	320	480	800	
SEMESTER II												
25CAP201	Cyber Security	Major 9	1,2	1,3,4,5,6,7	4	-	-	4	40	60	100	20
25CAP202	Communication Skills Enhancement - II	Major 10	1,2	1,5,7	2	-	-	1	100	-	100	23
25CAP241	Internet of Things	Major 11	1,2	3,5,6,8,9	4	-	4	5	40	60	100	25
25CAP242PE1	Web Development Foundations	Major 12	1,2	1,3,5,6,8,9	5	-	4	7	40	60	100	28
25CAP242PE2	Cloud Foundations With AWS, AZURE, AND GCP											31
25CAP242PE3	Data Analytics using Python											34
25CAP242PE4	Advanced Data Structures And Algorithms											37
25CAP243PE1	Frontend Development	Major 13	1,2	1,3,5,6,8,9	5	-	4	7	40	60	100	40
25CAP243PE2	Core DevOps and Microservices Principles											43
25CAP243PE3	Database Integration for Data Analytics											46
25CAP243PE4	System Design											49
25CAP291	Mini Project I	Major 14	1,2	1,3,5,6	-	-	3	2	40	60	100	52
Semester Total					20	0	15	26	300	300	600	

SEMESTER III												
25CAP301	Blockchain Technologies	Major 15	1,2	1,3,4,5,6,7	4	-	-	3	40	60	100	53
25CAP302	Machine Learning	Major 16	1,2	1,3,5,6	4	-		3	40	60	100	55
25CAP341PE1	Backend Development with Java	Major 17	1,2	1,3,5,6,8,9	5	-	5	7	40	60	100	57
25CAP341PE2	Continuous Integration / Continuous Delivery (CI/CD)											60
25CAP341PE3	Data Visualization and Communication											63
25CAP341PE4	Web Development Foundations											66
25CAP342PE1	Full Stack Development and Deployment	Major 18	1,2	1,3,5,6,8,9	5	-	5	7	40	60	100	69
25CAP342PE2	Containerization and Orchestration											72
25CAP342PE3	Tools and Techniques for Data Analytics											75
25CAP342PE4	Frontend Frameworks											78
25CAP391	Mini Project II	Major 19	1,2	1,3,4,8,9	-	-	4	2	40	60	100	81
25CAP392	Internship [#]	Major 20	1,2,3	-	-	-	-	2	100	-	100	82
25CAPOE301	Open Elective*	Major 21	1,2	1,3,5,6,9,13,14	3	-	-	2	40	60	100	83
Semester Total					21	0	14	26	340	360	700	
SEMESTER IV												
25CAP491	Project Viva Voce	Major 22	1,2	1,3,4,5,6,7	-	-	-	12	80	120	200	84
Semester Total					0	0	0	12	80	120	200	
Total					62	0	43	89	1040	1260	2300	
SEM I/II/III	MOOC				0	0	0	2	0	0	0	
Total					62	0	43	91	1040	1260	2300	
Minimum 89+2 = 91 Credits to Earn the Degree												

PROGRAM OUTCOMES

By the end of the programme, our graduates will

1. **Disciplinary knowledge:** Possess a profound understanding of the foundational concepts, theories, methodologies, and practices within the discipline of Computer Applications.
2. **Communication Skills:** Emerge as confident communicators capable of articulating complex concepts, advocating for their viewpoints, and engaging in meaningful discourse to address contemporary issues and drive positive change.
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MAPPING of PEOs and POs

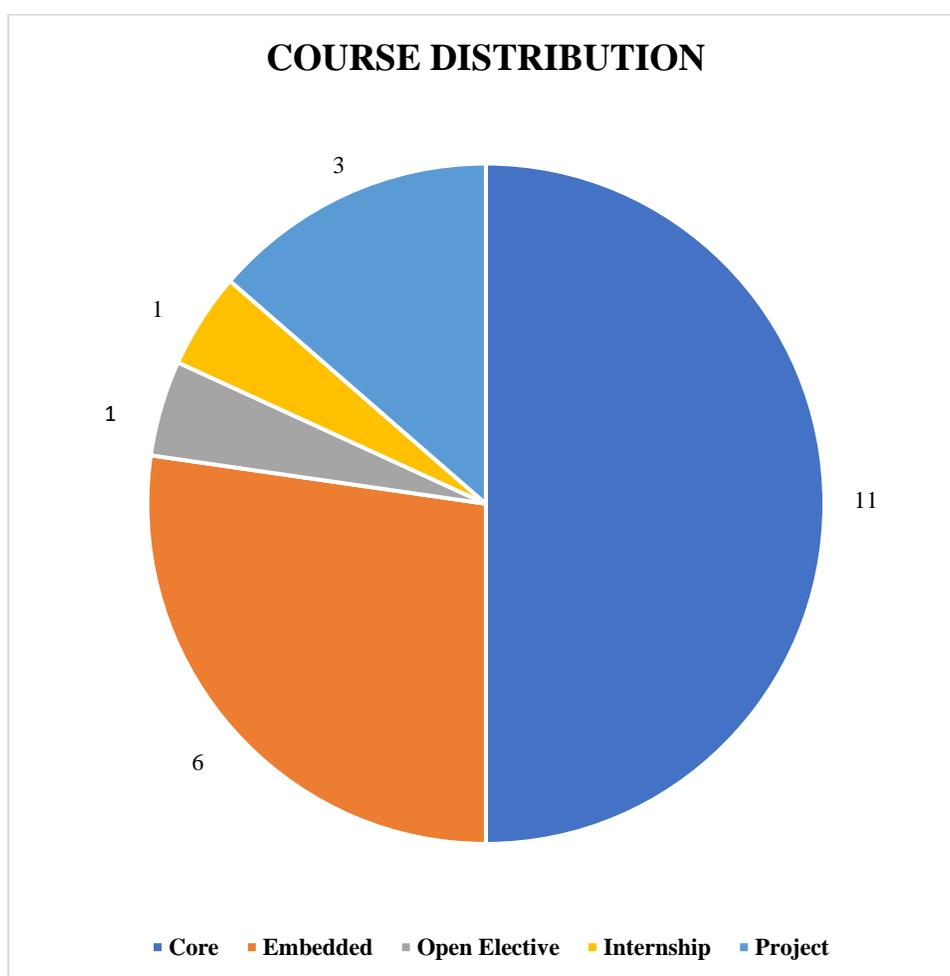
POs	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
PEO1	X	X	X	X	X										
PEO2		X	X	X		X		X		X	X	X	X	X	X
PEO3			X		X	X	X		X		X	X		X	X

Open Elective Courses

Sl.No	Department	Course Code	Course Name
1	English	24EGPOE301	English for Competitive Examination
2	Commerce	24CMPOE301	Personal Finance and Planning
3	Management	24MBAPOE301	Organizational Behavior
4	Computer Applications	24CAPOE301	Robotics Process Automation
5	Computer Science	24CSPOE301	Cyber Forensics
6	Mathematics	24MMPOE301	Coding theory
7	Physics	24PHPOE301	Electrical Appliances and Servicing
8	Chemistry	24CHPOE301	Industrial Chemistry
9	Microbiology	24MBPOE301	Fermentation Technology
10	Biotechnology	24BTPOE301	Nutrition and Dietetics

Course Distribution

Papers	Theory	Practical	Total
Core	8	3	11
Embedded	6	-	6
Allied	-	-	-
DSE	-	-	-
Open Elective	1	-	1
Internship	1	-	1
Project	-	3	3
Total	16	6	22



PREREQUISITE:

Not Required

COURSE OBJECTIVES (CO):

- To Understand fundamental networking concepts, including network hardware, software, protocols, and reference models like OSI and TCP/IP.
- To Explore network and transport layer functionalities, including IP addressing (IPv4 & IPv6), routing algorithms, and transport protocols such as TCP, UDP, and SCTP.
- To Analyze routing and forwarding mechanisms, including unicast, broadcast, and multicast routing protocols like RIP, OSPF, BGP, and IGMP.
- To Examine flow, error, and congestion control mechanisms to understand Quality of Service (QoS) and transport reliability.
- To Learn about key application layer services and protocols, including DNS, HTTP, SMTP, FTP, Telnet, and SNMP.

COURSE OUTCOMES (COs):

Upon completion of this course, the student will be able to:

COs	Course Outcomes	Blooms Level
CO1	Compare the various reference models in Network	Understand
CO2	Analyze the different routing algorithms	Analyze
CO3	Analyze the protocols used in Transport layer	Analyze
CO4	Analyze and describe the working principles of Internet.	Analyze
CO5	Identify the protocols involved at the application layer.	Understand

UNIT I: INTRODUCTION & NETWORK LAYER

10 HOURS

Network applications, network hardware, network software, reference models: OSI, TCP/IP, Internet, Connection-oriented network - X.25, frame relay, Protocol. Network layer: Network Layer Services, Packet Switching, Performance, provided transport layers, implementation connectionless services, implementation connection-oriented services, comparison of virtual –circuit and datagram subnets. IPV4 Address, Forwarding of IP Packets, Internet Protocol, ICMP v4, Mobile IP

UNIT II: ROUTING ALGORITHMS

10 HOURS

Routing Algorithms–Distance Vector routing, Link State Routing, Path Vector Routing, Unicast Routing Protocol-Internet Structure, Routing Information Protocol, Open-Source Path First, Border Gateway Protocol V4, Broadcast routing, Multicasting routing, Multicasting Basics, Intradomain Multicast Protocols, IGMP.

UNIT III: TRANSPORT LAYER**10 HOURS**

IPv6 Addressing, IPv6 Protocol, Transition from IPv4 to IPv6. Transport Layer Services, connectionless versus connection oriented protocols. Transport Layer Protocols: Simple Protocol, Stop and Wait, Go-Back-N, Selective repeat, Piggy Backing. UDP: User datagram, Services, Applications. TCP: TCP services, TCP features, segment, ATCP connection, Flow control, error control, congestion control.

UNIT IV: INTERNET LAYER**9 HOURS**

SCTP: SCTP services SCTP features, packet format, An SCTP association, flow control, error control. QUALITY OF SERVICE: flow characteristics, flow control to improve QOS: scheduling, traffic shaping, resource reservation, admission control.

UNIT V: APPLICATION LAYER**9 HOURS**

Domain name system, electronic mail, World Wide Web: architectural overview, dynamic web document and http. APPLICATION LAYER PROTOCOLS: Simple Network Management Protocol, File Transfer Protocol, Simple Mail Transfer Protocol, Telnet.

TOTAL: 48 HOURS**TEXT BOOKS:**

- 1 A. S. Tanenbaum, 2022. *Computer Networks*, 6th edition, Pearson Education/ PHI, New Delhi, India.
- 2 Stallings W, 2024. *Data and Computer Communications*, 10th edition, Pearson Education India

REFERENCE BOOKS:

- 1 Douglas E Comer, 2015. *Internet Working with TCP/IP Volume -1*, Sixth Edition, Addison-Wesley Professional
- 2 Goransson P, Black C, Culver T, 2016. *Software Defined Networks: a Comprehensive Approach*, Morgan Kaufmann.

WEBSITES:

- 1 <https://www.geeksforgeeks.org/learn-data-structures-and-algorithms-dsa-tutorial/>
- 2 <https://techdevguide.withgoogle.com/>

CO, PO, PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14	PO 15	PSO 1	PSO 2
CO1	3	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-
CO2	3	-	3	2	3	1	-	1	2	1	-	-	-	-	-	1	-
CO3	3	-	3	-	3	1	-	1	2	1	-	-	-	-	-	-	-
CO4	3	-	3	1	3	1	-	1	2	1	1	-	-	-	-	-	-
CO5	3	-	1	-	-	-	-	-	2	-	-	-	-	-	-	-	1
Average	3	0	2.5	1.5	3	1	0	1	1.8	1	1	0	0	0	0	1	1

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

PREREQUISITE:

- Basic Knowledge of C Programming
- Understanding of Mathematical and Logical Concepts
- Problem-Solving Skills

COURSE OBJECTIVES (CO):

- To provide a strong foundation in fundamental data structures and algorithms using C.
- To equip students with the ability to analyze algorithm efficiency using time and space complexity.
- To implement various linear and non-linear data structures for solving computational problems.
- To develop real-world applications using appropriate data structures.

COURSE OUTCOMES (COs):

Upon completion of this course, the student will be able to:

COs	Course Outcomes	Blooms Level
CO1	Understand the fundamentals of data structures and their classification	Understand
CO2	Analyze algorithm performance using time and space complexity	Analyze
CO3	Implement linear and non-linear data structures using C	Apply
CO4	Apply sorting, searching, and hashing techniques in data handling	Apply
CO5	Solve real-world problems using appropriate algorithmic strategies	Create

UNIT I: INTRODUCTION TO DATA STRUCTURES AND ALGORITHMS

9 HOURS

Introduction – Need for Data Structures – Classification – Abstract Data Types – Algorithm Analysis: Time Complexity and Space Complexity – Asymptotic Notation (Big O, Omega, Theta).

UNIT II: LINEAR DATA STRUCTURES

9 HOURS

Arrays – Operations (Insertion, Deletion, Searching, Sorting) – Linked List: Types (Singly, Doubly, Circular) – Stack: Operations and Applications (Infix to Postfix Conversion, Expression Evaluation) – Queue: Types (Simple Queue, Circular Queue, Deque, Priority Queue) – Applications.

UNIT III: NON-LINEAR DATA STRUCTURE: TREES

10 HOURS

Trees: Definition – Basic Terminologies - Types (Binary Tree, Binary Search Tree, AVL Tree) – Operations (Insertion, Deletion, Traversal, Searching)

UNIT IV:NON-LINEAR DATA STRUCTURE: GRAPHS**10 HOURS**

Graphs: Definition – Basic Terminologies - Representation – Graph Traversal Algorithms (BFS and DFS) – Graph Algorithms: Topological Sort - Dijkstra’s Algorithm – Minimum Spanning Tree Algorithms (Kruskal’s and Prim’s Algorithm)

UNIT V:SORTING, SEARCHING ALGORITHMS AND HASHING**10 HOURS**

Sorting Algorithms: Bubble Sort, Selection Sort, Insertion Sort, Merge Sort, Quick Sort, Heap Sort – Searching Algorithms: Linear Search, Binary Search – Hashing: Hash Tables - Hashing Techniques.

TOTAL :48 HOURS**TEXT BOOKS:**

- 1 Mark Allen Weiss, (2002). *Data Structures and Algorithm Analysis in C*, Second Edition, Pearson Education
- 2 Reema Thareja, (2014). *Data Structures Using C*, Second Edition, Oxford University Press
- 3 Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, (2008). *Fundamentals of Data Structures in C*, Second Edition, Universities Press.

REFERENCE BOOKS:

- 1 YashavantKanetkar, (2020). *Data Structures Through C*, BPB Publications.
- 2 Narasimha Karumanchi, (2016). *Data Structures and Algorithms Made Easy*, Fifth Edition, CareerMonk Publications

WEBSITES:

- 1 <https://www.geeksforgeeks.org/learn-data-structures-and-algorithms-dsa-tutorial/>
- 2 <https://techdevguide.withgoogle.com/paths/data-structures-and-algorithms/>
- 3 <https://www.programiz.com/dsa>

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CO2	3	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
CO3	3	-	-	-	2	1	-	1	2	-	-	-	-	-	-	-	1
CO4	3	-	3	2	3	2	-	2	-	-	-	-	-	-	-	-	-
CO5	3	-	3	3	3	2	-	1	3	-	-	-	-	-	-	-	-
Average	3	0	3	2.5	2.7	1.7	0	1.3	2.5	1	2	0	0	0	0	1	1

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

PREREQUISITE:

- Fundamentals of Computer Science
- Basic Knowledge of Programming
- Understanding of Data Structure and Algorithms

COURSE OBJECTIVES (CO):

- To provide a comprehensive understanding of database technologies including both relational and non-relational models.
- To enable students to design, implement, and manage databases using SQL and NoSQL technologies.
- To teach foundational principles such as database design, normalization, query languages, and transaction management.
- To develop practical skills in query optimization and ensure awareness of database security practices.
- To expose students to modern database trends, including the use of technologies like MongoDB.

COURSE OUTCOMES (COs):

Upon completion of this course, the student will be able to:

COs	Course Outcomes	Blooms Level
CO1	Understand the fundamental concepts of relational databases, database architecture, and the Entity-Relationship model.	Understand
CO2	Design and normalize relational databases to ensure data integrity and efficiency.	Apply
CO3	Develop and execute queries using SQL, including DDL, DML, DQL, and advanced SQL features like joins, views, functions, and triggers.	Apply
CO4	Implement transaction management techniques, concurrency control, and database recovery mechanisms.	Analyze
CO5	Explore NoSQL databases, particularly MongoDB, and perform data modelling, aggregation, indexing, and backup operations.	Apply

UNIT I: RELATIONAL DATABASE

10 HOURS

Introduction - Purpose of Database System — Views of data — Database Architecture — Structure of Relational Databases - Database Schema - Keys - Schema Diagrams - Entity-Relationship (ER) Model - Mapping Cardinalities and Participation Constraints - Reduction to Relational Schemas – Entity-Relationship Design Issues - Extended ER Features.

UNIT II: DATABASE DESIGN**10 HOURS**

Features of Good Relational Designs - Functional Dependencies — Non-loss Decomposition — First, Second, Third Normal Forms — Boyce/Codd Normal Form — Multi-valued Dependencies and Fourth Normal Form — Join Dependencies and Fifth Normal Form – Sixth Normal Form - Denormalization in databases - Refactoring Databases for Performance

UNIT III: STRUCTURED QUERY LANGUAGE**10 HOURS**

SQL Data Definition and Data Types – SQL Constraints – Data Definition Language (DDL) Commands - Data Manipulation Language (DML) Commands - Data Query Language (DQL) commands – Database Querying – Aggregate Functions - Set Operations - Nested Sub queries – Joins – Views and Indexes – Query Execution Plan Analysis - PL/SQL - Functions and Procedures – Triggers

UNIT IV: TRANSACTION MANAGEMENT**9 HOURS**

Transaction Concepts — ACID Properties — Schedules — Serializability — Concurrency Control — Need for Concurrency — Locking Protocols — Two Phase Locking — Deadlock — Transaction Recovery — Save Points — Transaction Control Language (TCL) commands in SQL - Isolation Levels — Database security – Access control – Data Control Language (DCL) commands in SQL - Backup and recovery.

UNIT V: NoSQL and MongoDB**9 HOURS**

Relational Vs Non-relational database - Introduction to NoSQL – Types of NoSQL Databases - CAP Theorem – Sharding. **MongoDB:** Introduction - Database, Collections and Documents in MongoDB - JavaScript Object Notation - Datatypes - Data Modelling - Basic Operations: Insert, Update, Delete, Query – Aggregation, Indexing and Joining collections - Backup and recovery.

TOTAL : 48 HOURS**TEXT BOOKS:**

- 1 Abraham Silberschatz, Henry F. Korth, S. Sudarshan, (2019). *Database System Concepts*, Seventh Edition, McGraw Hill.
- 2 RamezElmasri, Shamkant B. Navathe, (2017). *Fundamentals of Database Systems*, Seventh Edition, Pearson Education/Addison Wesley.
- 3 C. J. Date, A. Kannan, S. Swamynathan, (2006). *An Introduction to Database Systems*, Eighth Edition, Pearson Education.

REFERENCE BOOKS:

- 1 Brad Dayley, (2014). *Teach Yourself NoSQL with MongoDB in 24 Hours*, First Edition, Sams Publishing.
- 2 Manu Sharma, (2021). *MongoDB Complete Guide*, BPB Publications.

WEBSITES:

- 1 <https://www.geeksforgeeks.org>
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CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	3	3	-	-	-	-	-	2	1	2	-	-	-	-	-
Average	3	3	3	3	2	2	0	0	0	2	1	2	0	0	0	0	0

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Instruction Hours / Week: L: 5 T: - P: -

Marks: Internal: 40 External: 60 Total: 100

End Semester Exam: 3 Hours

PREREQUISITE:

- Basic knowledge of mathematics including algebra, matrix operations, probability theory, and statistics.

COURSE OBJECTIVES (CO):

- To apply matrix algebra in computer graphics, cryptography, and data analysis.
- To apply probability theory in areas like machine learning and cryptography.
- To use PERT and CPM for efficient project scheduling in software development.

COURSE OUTCOMES (COs):

Upon completion of this course, the student will be able to:

COs	Course Outcomes	Blooms Level
CO1	Apply matrix algebra techniques to solve computational problems in fields like computer graphics, cryptography, and data analysis.	Understand
CO2	Construct logical arguments and Manipulate sets and relations in various disciplines.	Analyze
CO3	Analyze uncertainty and apply probability distributions in real-world scenarios	Apply
CO4	Articulate testing of hypothesis to interpret the results.	Analyze
CO5	Proficiently schedule and manage projects using PERT and CPM techniques, ensuring efficient resource utilization.	Apply

UNIT I: MATRIX ALGEBRA

12 HOURS

Matrices – Rank of a matrix – Solving system of equation – Eigen values and Eigen vectors – Cayley – Hamilton theorem – Inverse of a matrix

UNIT II: MATHEMATICAL LOGIC

12 HOURS

Propositional Logic – Propositional Equivalences: Tautologies, Contradictions and Logical Equivalence – Predicates and Quantifiers: Universal and Existential Quantifiers – Rules of Inference – Mathematical Induction – Inclusion-Exclusion Principle – Pigeonhole Principle.

UNIT III: PROBABILITY DISTRIBUTIONS

12 HOURS

Probability – The Axioms of Probability – Conditional Probability – Baye’s Theorem. Discrete and Continuous Random Variables – Binomial, Poisson, Uniform and Normal distributions.

UNIT IV: TESTING OF HYPOTHESIS**12 HOURS**

Testing of Hypothesis: Null and Alternative Hypothesis, Type I and Type II Errors, Standard Error, Level of Significance, Acceptance and Rejection Regions and Procedure for Testing Hypothesis. Large Sample Test – Z test – Tests for Means, Variances and Proportions. Small Sample Tests based on t (Single Mean only), F and Chi- Square Distributions.

UNIT V: SCHEDULING BY PERT AND CPM**12 HOURS**

Network Construction – Critical Path Method – Floats – Project Evaluation and Review Technique – Probability Consideration in PERT, Advantages and Limitations of Network Techniques.

TOTAL HOURS:60**TEXT BOOKS:**

- 1 Bronson, R. (2011). *Matrix operations* (Schaum's outline series). Tata McGraw-Hill.
- 2 Sharma, J. K. (2011). *Discrete mathematics* (3rd ed.). Macmillan Publishers India Ltd.
- 3 Veerarajan, T. (2017). *Fundamentals of mathematical statistics*. Yesdee Publishing Pvt. Ltd.
- 4 Pillai, R. S. N., & Bagavathy. (2002). *Statistics*. S. Chand & Company Ltd.
- 5 Kantiswarup, Gupta, P. K., & Man Mohan. (2011). *Operations research* (12th rev. ed.). S. Chand & Sons Education Publications.

REFERENCE BOOKS:

- 1 Gupta, S. P., & Gupta, P. K. (2013). *Business statistics and business mathematics*. Sultan Chand & Sons.
- 2 Sharma, S. D. (2017). *Operations research: Theory, methods & applications*. Kedar Nath Ram Nath Publications.

WEBSITES:

- 1 https://www.youtube.com/watch?v=TGo0_eIEFoA
- 2 <https://youtu.be/vUMGvpsb8dc>

CO, PO, PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14	PO 15	PSO 1	PSO 2
CO1	3	-	2	3	-	-	-	-	2	-	-	-	-	-	-	-	-
CO2	3	-	2	3	-	-	-	-	2	-	-	-	-	-	-	-	2
CO3	3	-	3	3	3	1	-	1	-	-	-	-	-	-	-	-	-
CO4	3	-	2	3	2	-	-	-	1	-	-	-	-	-	-	-	-
CO5	3	-	3	3	1	1	-	-	-	-	-	-	-	-	-	2	-
Average	3	0	2.4	3	2	1	0	1	1.7	0	0	0	0	0	0	2	2

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

PREREQUISITE:

- Basic knowledge of programming concepts
- Understanding of fundamental programming logic
- Familiarity with C or any other procedural programming language

COURSE OBJECTIVES (CO):

- To introduce the principles of Object-Oriented Programming (OOP) using Java.
- To provide a solid understanding of core OOP concepts such as classes, objects, inheritance, polymorphism, abstraction, and encapsulation.
- To implement exception handling mechanisms for building robust applications.
- To develop multi-threaded applications for efficient concurrent processing.
- To perform file handling operations including reading, writing, and manipulating file content using Java.

COURSE OUTCOMES (COs):

Upon completion of this course, the student will be able to:

COs	Course Outcomes	Blooms Level
CO1	Understand the fundamental concepts of Object-Oriented Programming and how they are implemented in Java.	Understand
CO2	Develop Java programs using classes, objects, inheritance, polymorphism, and encapsulation.	Apply
CO3	Apply exception handling mechanisms and multi-threading concepts.	Apply
CO4	Implement file handling, collections framework, and database connectivity using JDBC.	Analyze
CO5	Design and develop GUI-based applications using Java Swing and event handling.	Create

UNIT I: INTRODUCTION TO JAVA PROGRAMMING

10T+10P= 20 HOURS

Introduction to Object-Oriented Programming (OOP) – OOP Concepts Realization -Overview of Java – Features of Java – Java Virtual Machine (JVM) – JDK, JRE – Environmental Setup - Compiling and executing using Command Line and IDE - Basic Syntax – Data Types – Operators – Control Flow Statements – Arrays and Strings – Functions.

PRACTICAL:

- Environmental Setup and create first Java Program

- Writing basic Java programs using variables and control flow statements
- Solve simple programs using Array, String and Function concept

UNIT II: OOP CONCEPTS IN JAVA

10T+10P= 20 HOURS

Classes and Objects – Access Modifiers - Constructors – Method Overloading – Static – Inner Classes (member, local, anonymous) – Encapsulation - Inheritance – Types of Inheritance – Method Overriding – Super and This Keyword - Abstract Classes and Interfaces – Packages.

PRACTICAL:

- Implementing Classes and Objects
- Demonstrating Method Overloading
- Implementing different types of Inheritance
- Demonstrating Method Overriding
- Working with Abstract Classes and Interfaces

UNIT III: EXCEPTION HANDLING, MULTITHREADING AND COLLECTIONS FRAMEWORK

10T+10P= 20 HOURS

Exception Handling: Try, Catch, Finally, Throw, Throws - Built-in and User-defined Exceptions- Multithreading: Thread Lifecycle – Creating and Running Threads – Synchronization – Inter-Thread Communication- Generics in Java - Collections Framework: ArrayList, LinkedList, HashSet, TreeSet, HashMap, TreeMap.

PRACTICAL:

- Implementing exception handling techniques
- Creating multithreading programs using Runnable and Thread classes
- Implementing synchronization in multithreading
- Demonstrate different Collection classes and methods

UNIT IV: FILE HANDLING AND JAVA NEW FEATURES

9 T+9 P=18 HOURS

File Handling: Reading and Writing Files – Streams (Byte and Character) – Serialization – Java New Features: Lambda Expressions – Stream API – New Date and Time API

PRACTICAL:

- Implementing file handling using FileReader and FileWriter
- Working with Serialization and Deserialization
- Demonstrate Lambda Expressions and Stream API
- Implement New Date and Time API classes and methods

UNIT V: GUI PROGRAMMING AND DATABASE CONNECTIVITY

9 T+9 P=18 HOURS

Event-Driven Programming – Java Swing Components (JFrame, JButton, JTextField, JLabel, etc.) - Event

Handling: Listeners and Adapters - Database Connectivity (JDBC): Connecting Java with MySQL – Executing Queries – Prepared Statement

PRACTICAL:

1. Creating a basic GUI application using Swing
2. Implementing event handling mechanisms
3. Connecting Java programs with MySQL using JDBC

TOTAL HOURS:96

TEXT BOOKS:

- 1 Herbert Schildt, (2018). *Java: The Complete Reference*, Eleventh Edition, McGraw Hill.
- 2 Cay S. Horstmann, (2018). *Core Java Volume I – Fundamentals*, Eleventh Edition, Pearson
- 3 E. Balagurusamy, (2019). *Programming with Java*, Sixth Edition, McGraw Hill

REFERENCE BOOKS:

- 1 Y. Daniel Liang, (2017). *Introduction to Java Programming and Data Structures*, Eleventh Edition, Pearson
- 2 Kathy Sierra, Bert Bates, (2005). *Head First Java*, Second Edition, O'Reilly

WEBSITES:

- 1 <https://www.geeksforgeeks.org/introduction-of-object-oriented-programming/>
- 2 <https://medium.com/@harshchandwani50028/object-oriented-programming-in-c>

CO, PO, PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14	PO 15	PSO 1	PSO 2
CO1	3	-	3	2	-	2	-	1	2	1	-	-	-	-	-	1	-
CO2	3	-	3	-	3	2	-	-	2	-	-	-	-	-	-	-	-
CO3	3	-	3	3	2	2	-	-	1	-	1	-	-	-	-	-	2
CO4	3	-	3	3	2	2	-	-	2	-	-	-	-	-	-	-	-
CO5	3	2	3	3	3	2	2	1	-	-	1	-	-	-	-	-	2
Average	3	2	3	2.8	2.5	2	2	1	1.8	1	1	-	-	-	-	1	2

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

Instruction Hours / Week: L: -T: -P: 4

Marks: Internal: 40 External: 60 Total: 100

End Semester Exam: 3 Hours

PREREQUISITE:

- Basic Knowledge of C Programming
- Understanding of Mathematical and Logical Concepts
- Problem-Solving Skills

COURSE OBJECTIVES (CO):

- To provide a strong foundation in fundamental data structures and algorithms using C.
- To equip students with the ability to analyze algorithm efficiency using time and space complexity.
- To implement various linear and non-linear data structures for solving computational problems.

COURSE OUTCOMES (COs):

Upon completion of this course, the student will be able to:

COs	Course Outcomes	Blooms Level
CO1	Solve the problems using linear data structures	Understand
CO2	Construct a tree and perform various operations on a tree along with implementation	Analyze
CO3	Examine the solution for solving various computing problems using graph data structure	Apply
CO4	Make use of Hashing Techniques to generate hash address and to resolve the collision on it	Apply
CO5	Design sorting, searching and merging of input elements	Create

LIST OF PROGRAMS

- 1 Implementation of singly Linked List Operations
- 2 Develop a program to perform various stack operations using an array
- 3 Implement a Program using Queue Data Structures.
- 4 Implementation of a Binary Search Tree
- 5 Implement binary tree traversal: in-order, pre-order, post-order
- 6 Construct a Minimum Spanning Tree
- 7 Sort characters by frequency Using Hash table
- 8 Write a program to implement hash table.
- 9 Sort the given List of Numbers using topological sort
- 10 Performing Linear and Binary Search
- 11 Performing Bubble Sort and Insertion Sort
- 12 Sort the given List of Numbers using Merge and Quick Sort

TEXT BOOKS:

- 1 Mark Allen Weiss, (2002). *Data Structures and Algorithm Analysis in C*, Second Edition, Pearson Education
- 2 Reema Thareja, (2014). *Data Structures Using C*, Second Edition, Oxford University Press
- 3 Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, (2008). *Fundamentals of Data Structures in C*, Second Edition, Universities Press.

REFERENCE BOOKS:

- 1 Yashavant Kanetkar, (2020). *Data Structures Through C*, BPB Publications.
- 2 Narasimha Karumanchi, (2016). *Data Structures and Algorithms Made Easy*, Fifth Edition, CareerMonk Publications

WEBSITES:

- 1 <https://www.geeksforgeeks.org/learn-data-structures-and-algorithms-dsa-tutorial/>
- 2 <https://techdevguide.withgoogle.com/paths/data-structures-and-algorithms/>
- 3 <https://www.programiz.com/dsa>

CO, PO, PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14	PO 15	PSO 1	PSO 2
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CO2	3	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-
CO3	3	-	-	-	2	1	-	1	2	-	-	-	-	-	-	-	1
CO4	3	-	3	2	3	2	-	2	-	-	-	-	-	-	-	-	-
CO5	3	-	3	3	3	2	-	1	3	-	-	-	-	-	-	-	-
Average	3	0	3	2.5	2.7	1.7	0	1.3	2.5	1	2	0	0	0	0	1	1

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

PREREQUISITE:

- Fundamentals of Computer Science
- Basic Knowledge of Programming
- Understanding of Data Structure and Algorithms

COURSE OBJECTIVES (CO):

- To teach foundational principles such as database design, normalization, query languages, and transaction management.
- To develop practical skills in query optimization and ensure awareness of database security practices.
- To expose students to modern database trends, including the use of technologies like MongoDB.

COURSE OUTCOMES (COs):

Upon completion of this course, the student will be able to:

COs	Course Outcomes	Blooms Level
CO1	Understand the fundamental concepts of relational databases, database architecture, and the Entity-Relationship model.	Understand
CO2	Design and normalize relational databases to ensure data integrity and efficiency.	Apply
CO3	Develop and execute queries using SQL, including DDL, DML, DQL, and advanced SQL features like joins, views, functions, and triggers.	Apply
CO4	Implement transaction management techniques, concurrency control, and database recovery mechanisms.	Analyze
CO5	Explore NoSQL databases, particularly MongoDB, and perform data modelling, aggregation, indexing, and backup operations.	Apply
	Apply database concepts to real-world scenarios through practical lab exercises and industry case studies.	Evaluate

LIST OF PROGRAMS

- 1 Consider a University Database and use necessary schema (Student, Department, Faculty, Courses...etc), Make use of DDL operations to perform creation of table, alter, modify, drop and truncate. Additionally apply DML transactions over the schema and use appropriate Integrity constraints like Primary Key, Unique key, Foreign Key, Check, Default, Null and Not Null.
- 2 Construct the University database and schema to perform the controlling privileges operations with TCL –Commit, Save point and Rollback the transactions. To deal with the rights, permissions, and

other controls of the database system use DCL that includes commands such as GRANT and REVOKE.

- 3 Build the essential DB objects using view, sequences ,indexes and synonyms for University Database
- 4 Make use of Employee Database and perform SQL Statements on
 - a. Single row: General functions, Case Conversion functions, Character functions, Date functions, Number functions.
 - b. Aggregate functions: AVG,COUNT,MAX,MIN,SUM.
 - c. Set operations: Union, UnionAll, Intersect, Minus.
- 5 Experiment with Employee Database and Perform various Joins & Sub queries for displaying data from multiple tables using SQL operators, GROUPBY, HAVING and ORDERBY clause
- 6 Construct a basic block to combine database language and procedural programming language using PL/SQL programs
- 7 Generate payroll process for employee tables by stored functions and stored procedures using PL/SQL programs
- 8 Iterate number of employees using Cursors in PL/SQL programs and perform Implicit, Explicit Cursor Operations for the table.
- 9 Execute the Commands of MongoDB and operations in MongoDB : Insert, Query, Update, Delete and Projection. (Note: use any collection)
- 10 Develop a MongoDB query to select certain fields and ignore some fields of the documents from any collection
- 11 Execute query selectors (comparison selectors, logical selectors) and list out the results on any collection
- 12 Execute Aggregation Pipeline and its operations (pipeline must contain \$match, \$group, \$sort, \$project, \$skip etc. students encourage to execute several queries to demonstrate various aggregation operators)

TOTAL : 48 HOURS

TEXT BOOKS:

- 1 Abraham Silberschatz, Henry F. Korth, S. Sudarshan, (2019). *Database System Concepts*, Seventh Edition, McGraw Hill.
- 2 Ramez Elmasri, Shamkant B. Navathe, (2017). *Fundamentals of Database Systems*, Seventh Edition, Pearson Education/Addison Wesley.
- 3 C. J. Date, A. Kannan, S. Swamynathan, (2006). *An Introduction to Database Systems*, Eighth Edition, Pearson Education.

REFERENCE BOOKS:

- 1 Brad Dayley, (2014). *Teach Yourself NoSQL with MongoDB in 24 Hours*, First Edition, Sams Publishing.
- 2 Manu Sharma, (2021). *MongoDB Complete Guide*, BPB Publications.

WEBSITES:

- 1 <https://www.geeksforgeeks.org>
- 2 <https://techdevguide.withgoogle.com>

CO, PO, PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14	PO 15	PSO 1	PSO 2
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CO2	3	3	-	-	2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	3	3	-	-	-	-	-	2	1	2	-	-	-	-	-
Average	3	3	3	3	2	2	0	0	0	2	1	2	0	0	0	0	0

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

PREREQUISITE:

Not Required

COURSE OBJECTIVES (CO):

- To improve clarity and conciseness in verbal and written communication.
- To enhance ability to adapt to changing circumstances and new challenges.
- To promote a respectful and supportive workplace environment.

COURSE OUTCOMES (COs):

Upon completion of this course, the student will be able to:

COs	Course Outcomes	Blooms Level
CO1	Understand and implement positive outlook, interpret the body language of team members and stakeholders, better interpersonal relationships. Develop into self-motivated professionals with confidence. Practice Responding instead of Reacting.	Understand
CO2	Create good Presentation and Present with confidence. Also, recognize and manage Stress, Prioritize and Plan.	Create
CO3	Listen to understand. To be able to ask good questions.	Understand
CO4	Understand to be a good Team player, Team Dynamics and to understand the Business Ethics	Apply
CO5	Write and speak correctly, forming grammatically correct sentences.	Apply

LIST OF PROGRAMS

1. Listening Skills: Fish Market – Value Added Game
2. Chinese Whispers- Value Added Game
3. Listening Skills Practice- Audio Exercises- 1 and 2
4. Listening to Scientific Lectures
5. Phonetics- Pronunciation of Long and Short Vowels
6. Stress and Intonation- Role Play
7. Stress and intonation and voice modulation Let’s Talk Activity Game
8. Conversation Skills-I and II
9. Conversation Skills and Rate of Speech- Common Conversation Topics
10. Clarity of Speech in Conversation-
 1. Mrs. Tongue Does Her Housework-Game and
 2. Tongue Twisters!
11. Reading and Comprehension Skills- War Minus Shooting- The Sporting Spirit-Essay

12. Reading Skills- A Dilemma- A Layman Looks at Science
13. Reading and Writing Skills- You and Your English- Spoken English and Broken English
14. Interview Skills- Mock Interview -1
15. Interview Skills- Mock Interview-2
16. Interview Preparation- Common Interview Questions
17. Group Discussion- Discuss and Evaluate Swachh Bharat Mission

TOTAL HOURS:24

TEXT BOOKS:

- 1 Kumar, S., &PushpLata. (2015). *Communication Skills* (2nd ed.). New Delhi: Oxford University Press.
- 2 Murphy, R. (2012). *Essential English Grammar: Reference and Practice for South Asian Students* (2nd ed.). Cambridge: Cambridge University Press.

REFERENCE BOOKS:

- 1 Pye, G. (2011). *Vocabulary in Practice, Parts 1 and 2* (1st ed.). Cambridge: Cambridge University Press.

WEBSITES:

- 1 <https://www.forbes.com/advisor/in/business/soft-skills-examples/>
- 2 <https://www.thebalancemoney.com/list-of-soft-skills-2063770>

CO, PO, PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14	PO 15	PSO 1	PSO 2
CO1	3	-	1	-	1	1	-	-	-	1	2	-	-	-	-	1	-
CO2	3	-	1	-	-	-	-	-	-	-	-	-	1	-	-	-	2
CO3	3	-	2	-	-	-	-	2	2	-	-	-	1	-	-	-	-
CO4	3	-	1	-	-	1	-	2	2	-	-	-	-	-	-	-	-
CO5	3	-	1	1	1	-	-	1	2	-	-	-	1	-	-	-	-
Average	3	-	1.2	1	1	1	-	1.7	2	1	2	-	1	-	-	1	2

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

PREREQUISITE:

Not Required

COURSE OBJECTIVES (CO):

- To systematically educate the necessity to understand the impact of cyber-crimes and threats with solutions in a global and societal context.
- To select suitable ethical principles and commit to professional responsibilities and human values and contribute value and wealth for the benefit of the society
- To learn about Risk assessment, plan suitable security controls, audit and compliance.

COURSE OUTCOMES (COs):

Upon completion of this course, the student will be able to:

COs	Course Outcomes	Blooms Level
CO1	Outline the principles of cyber security and to identify threats and risks	Understand
CO2	Explain how to secure physical assets and develop system security controls.	Apply
CO3	Explain how to apply security for Business applications and Network Communications.	Apply
CO4	Summarize the technical means to achieve security.	Understand
CO5	Explain monitor and audit security measures.	Analyze

UNIT I PLANNING FOR CYBER SECURITY

10 HOURS

Best Practices-Standards and a plan of Action-Security Governance Principles, components and Approach-InformationRiskManagement-Asset Identification-Threat Identification- Vulnerability Identification-Risk Assessment Approaches-Likelihood and Impact Assessment-Risk Determination, Evaluation and Treatment- Security Management Function-Security Policy-Acceptable Use Policy- Security Management Best Practices – Security Models: Bell La Padula model, Biba Integrity Model - Chinese Wall model.

UNIT II SECURITY CONTROLS

10 HOURS

People Management-Human Resource Security-Security Awareness and Education-Information Management- Information Classification and handling-Privacy-Documents and Record Management-Physical Asset Management-Office Equipment-Industrial Control Systems-Mobile Device Security- System Development-Incorporating Security into SDLC - Disaster management and Incident.

UNIT III: CYBER SECURITY FOR BUSINESS APPLICATIONS NETWORKS

10 HOURS

Business Application Management-Corporate Business Application Security-End user Developed

Applications-System Access- Authentication Mechanisms-Access Control-System Management- Virtual Servers-Network Storage Systems-Network Management Concepts-Firewall-IP Security- Electronic Communications – Case study on OWASP vulnerabilities using OWASP ZAP tool.

UNIT IV TECHNICAL SECURITY

9 HOURS

Supply Chain Management-Cloud Security-Security Architecture-Malware Protection-Intrusion Detection-Digital Rights Management-Cryptographic Techniques-Threat and Incident Management- Vulnerability Management - Security Event Management - Forensic Investigations- Local Environment Management-Business Continuity.

UNIT V SECURITY ASSESSMENT

9 HOURS

Security Monitoring and Improvement-Security Audit-Security Performance-Information Risk Reporting - Information Security Compliance Monitoring-Security Monitoring and Improvement Best Practices – Cyber laws.

TOTAL HOURS:48 HOURS

TEXT BOOKS:

- 1 William Stallings, 2019. Effective Cyber Security - A guide to using Best Practices and Standards, Addison-Wesley Professional, First Edition.
- 2 Adam Shostack, 2014. Threat Modelling - Designing for Security, Wiley Publications, First Edition.
- 3 Gregory J. Touhill and C. Joseph Touhill, 2014. Cyber Security for Executives - A Practical Guide, Wiley Publications, First Edition.
- 4 Raef Meeuwisse, 2017. Cyber Security for Beginners, Second Edition, Cyber Simplicity Ltd, 2017.

REFERENCE BOOKS:

- 1 Patrick Engebretson, 2013. The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy, 2nd Edition, Syngress.
- 2 Charles P. Pfleeger, Shari Lawrence Pfleeger, Jonathan Margulies, 2015. Security in Computing”, Fifth Edition, Prentice Hall.

WEBSITES:

- 1 <https://esu.desire2learn.com/>
- 2 <https://www.javatpoint.com/what-is-cyber-security>
- 3 <https://www.techtarget.com/searchsecurity/definition/cybersecurity>

CO, PO, PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14	PO 15	PSO 1	PSO 2
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CO3	3	-	2	-	-	-	-	2	2	-	-	-	1	-	-	-	-
CO4	3	-	1	-	-	1	-	2	2	-	-	-	-	-	-	-	-
CO5	3	-	1	1	1	-	-	1	2	-	-	-	1	-	-	-	-
Average	3	-	1.2	0.2	0.4	0.4	-	1	1.2	-	0.4	-	-	-	-	0.2	0.4

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

PREREQUISITE:

Not Required

COURSE OBJECTIVES (CO):

- Improve clarity and conciseness in verbal and written communication.
- Enhance ability to adapt to changing circumstances and new challenges.
- Promote a respectful and supportive workplace environment.

COURSE OUTCOMES (COs):

Upon completion of this course, the student will be able to:

COs	Course Outcomes	Blooms Level
CO1	Understand what is spoken without distortion and respond appropriately.	Understand
CO2	Behave professionally.	Apply
CO3	Participate productively in an official meeting keeping etiquette in mind.	Understand
CO4	Communicate effectively through writing.	Apply
CO5	Behave appropriately in an official environment.	Analyze

UNIT I ACCENT NEUTRALIZATION

5 HOURS

Identifying and dealing with Mother Tongue Influence (MTI) – Pronunciation - Vowel Sounds and Consonant Sounds – Inflection – Pausing - Reducing rate of speech - Volume and tone – Pitch – Clarity - and enunciation.

UNIT II CUSTOMER SERVICE

5 HOURS

Customer Service - Different types of customers - Difference between customer service and customer experience - Telephone Etiquette - Handling difficult customers.

UNIT III PROBLEM SOLVING AND DECISION MAKING

5 HOURS

Define a Problem - Define Decision Making- Blocks in problem solving - Stereotyping and unconscious biases - The process of Problem Solving and decision making - Problem Analysis- Decision Analysis - Potential Problem / Opportunity Analysis - Creative Thinking - Problem Solving process - Implementation of the solution.

UNIT IV BUSINESS EMAIL ETIQUETTE AND CHAT

4 HOURS

Emails Etiquette: Share format/ signature - Emails etiquette - dos and don'ts.

UNIT V BASICS OF FINANCE**5 HOURS**

Accounting systems and how transactions are recorded - Financial statements: Profit & Loss account - balance sheet - cash flow statement - Fixed assets - depreciation and the capitalization of software development expense - Working capital and cash management - Using ratio analysis to assess corporate health and performance - Funding the business: equity - debt and other aspects - Budgeting & Forecasting – capex – apex - Designing a flexible budget - Capital expenditure appraisal and approval

TOTAL: 24 HOURS**TEXT BOOKS:**

- 1 Dauer, R. M. (1993). *Accurate English: A Complete Course in Pronunciation*. Prentice Hall.
- 2 Timm, P. R. (2011). *Customer Service: Career Success through Customer Loyalty* (5th ed.). Prentice Hall.
- 3 Kepner, C. H., & Tregoe, B. B. (1997). *The New Rational Manager: An Updated Edition for a New World*. Princeton Research Press.
- 4 Flynn, N. P., & Flynn, T. P. (2003). *Writing Effective E-Mail: Improving Your Electronic Communication* (2nd ed.). Cengage Learning.
- 5 Brigham, E. F., & Houston, J. F. (2019). *Fundamentals of Financial Management* (15th ed.). Cengage Learning.

WEBSITES:

- 1 <https://www.speechactive.com/>
- 2 <https://www.thebalancemoney.com/career-planning-6265513>

CO, PO, PSO Mapping

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CO3	3	-	3	2	3	2	2	1	2	-	1	-	-	-	-	2	-
CO4	3	-	1	1	1	1	1	-	1	-	-	-	-	-	-	-	1
CO5	3	-	-	1	-	-	-	-	-	1	-	-	-	-	-	-	-
Average	3	-	2	1.3	2	1.5	1.5	1	1.5	1	1	-	-	-	-	2	1

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

PREREQUISITE:

Not Required

COURSE OBJECTIVES (CO):

- To understand the Introduction to IoT and Architectural Overview of IoT
- To understand the various IoT Protocols (Datalink, Network, Transport, Session, Service)
- To understand the communication technologies in IoT Know the IoT protocols and web of things

COURSE OUTCOMES (COs):

Upon completion of this course, the student will be able to:

COs	Course Outcomes	Blooms Level
CO1	Explain the fundamental concepts of Internet of Things.	Understand
CO2	Analyze the protocols, standardization efforts, and security.	Analyze
CO3	Analyze the Web of Things with the Internet of Things.	Analyze
CO4	Demonstrate the integration of Internet of Things.	Understand
CO5	Summarize the role of IoT in enhancing autonomy and agility.	Understand

UNIT I INTRODUCTION

10 HOURS

Internet Layers - Protocols - Packets - Services - Performance parameters - Peer-to-peer networks Sensor networks - Multimedia - IOT Definitions and Functional Requirements - Motivation - Architecture - Web 3.0 View of IoT - Ubiquitous IoT Applications - Four Pillars of IoT - DNA of IoT - The Toolkit Approach for End-user Participation in the Internet of Things. Middleware for IoT: Overview - Communication middleware for IoT - IoT Information Security.

UNIT II IOT PROTOCOLS

10 HOURS

Protocol Standardization for IoT - Efforts - M2M and WSN Protocols - SCADA and RFID Protocols - Issues with IoT Standardization - Unified Data Standards - Protocols - IEEE 802.15.4 - BACNet Protocol - point-to-point protocols - Ethernet Protocols - cellular Internet access protocol - Machine-to-machine protocol - Modbus - KNX - Zigbee Architecture - Network layer - APS layer - Security.

UNIT III WEB OF THINGS

9 HOURS

Web of Things versus Internet of Things - Two Pillars of the Web - Architecture Standardization for WoT - Platform Middleware for WoT - Unified Multitier WoT Architecture - WoT Portals and Business Intelligence. Cloud of Things: Grid/SOA and Cloud Computing - Cloud Middleware - Cloud Standards - Cloud Providers and Systems - Mobile Cloud Computing - The Cloud of Things Architecture.

UNIT IV INTEGRATING IOT

9 HOURS

Integrated Billing Solutions in the Internet of Things Business Models for the Internet of Things Network Dynamics: Population Models–Information Cascades -Network Effects - Network Dynamics: Structural Models - Cascading Behavior in Networks - The Small- World Phenomenon.

UNITV APPLICATIONS

10 HOURS

The Role of the Internet of Things for Increased Autonomy and Agility in Collaborative Production Environments - Resource Management in the Internet of Things: Clustering, Synchronization and Software Agents. Applications - Smart Grid – Electrical Vehicle Charging Domain Specific IoT: Home Automation- Agriculture-Health and Lifestyle monitoring system-Cities-Smart Parking-Smart Roads-Surveillance. Industry: Machine Diagnosis-Indoor Air Quality Monitoring System.

TOTAL: 48 HOURS

LIST OF EXPERIMENTS

Experiments using ESP32/Arduino

Serial Monitor, LED, Servo Motor–Controlling:

- 1 Controlling actuator through Serial Monitor. Creating different led patterns and controlling them using push buttons witches. Controlling servo motor with the help of joystick.

Distance Measurement of an object:

- 2 Calculate the distance to an object with the help of an ultrasonic sensor and display it on an LCD

LDR Sensor, Alarm and temperature, humidity measurement:

- 3 (a) Controlling relay state based on ambient light levels using LDR sensor.
(b) Basic Burglar alarm security system with the help of PIR sensor and buzzer.
(c) Displaying humidity and temperature values on LCD

Experiments using Raspberry Pi/Arduino

- 4 (a) Controlling relay state based on input from IR sensors
(b) Interfacing stepper motor with R-Pi
(c) Advanced burglar alarm security system with the help of PIR sensor, buzzer and keypad. (Alarm gets disabled if correct keypad password is entered)
(d) Automated LED light control based on input from PIR (to detect if people are present) and LDR (ambient light level)

IOT Framework:

- 5 Upload humidity & temperature data to ThingSpeak, periodically logging ambient light level to ThingSpeak
- 6 Controlling LEDs, relay & buzzer using Blynk app

HTTP Based:

- 7 Introduction to HTTP. Hosting a basic server from the ESP32 to control various digital based actuators (led, buzzer, relay) from a simple web page.
- 8 Displaying various sensor readings on a simple web page hosted on the ESP32

MQTT Based:

- 9 Controlling LEDs/ Motors from an Android/ Webapp, Controlling AC Appliances from an android/web app with the help of relay.
- 10 Displaying humidity and temperature data on a web-based application

UAV/Drone:

- 11 (a) Demonstration of UAV elements, Flight Controller
(b) Mission Planner flight planning design
- 12 Python program to read GPS coordinates from Flight Controller

TOTAL: 48 HOURS**TEXT BOOKS:**

- 1 Olivier Hersent, Omar Elloumi and David Boswarthick, (2012). The Internet of Things: Applications to the Smart Grid and Building Automation. Wiley.
- 2 Olivier Hersent, David Boswarthick, Omar Elloumi, (2012). The Internet of Things – Key applications and Protocols, Wiley.

REFERENCE BOOKS:

- 1 Dieter Uckelmann; Mark Harrison; Florian Michahelles- (Eds.), (2011). Architecting the Internet of Things, Springer.

WEBSITES:

- 1 <https://www.ibm.com/blogs/internet-of-things/what-is-the-iot>

CO, PO, PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14	PO 15	PSO 1	PSO 2
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CO2	3	-	3	2	2	1	-	2	-	-	-	-	-	-	-	3	3
CO3	3	-	-	2	2	1	-	2	-	-	-	-	-	-	-	-	2
CO4	3	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
CO5	3	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	1
Average	3	-	3	2	2	1	-	1.7	3	3	1.5	-	-	-	-	3	2

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

PREREQUISITE:

- Familiarity with fundamental programming concepts
- Understanding of basic networking concepts is an advantage

COURSE OBJECTIVES (CO):

- This course introduces the basics of web development and internet technologies.
- Students will learn to use HTML5 for structuring web pages and CSS3 for styling.
- They will implement interactive features with JavaScript and create responsive designs using Bootstrap.
- The course also covers basic jQuery for manipulating web page elements and introduces Git and GitHub for version control and collaboration.

COURSE OUTCOMES (COs):

Upon completion of this course, the student will be able to:

COs	Course Outcomes	Blooms Level
CO1	Structure content using semantic HTML5 elements.	Understand
CO2	Style web pages using CSS3 properties and frameworks like Bootstrap.	Analyze
CO3	Write interactive web pages using JavaScript and jQuery.	Analyze
CO4	Build simple responsive websites.	Apply
CO5	Use Git for version control and GitHub for project hosting.	Analyze

UNIT I: FUNDAMENTALS OF WEB DEVELOPMENT

12 HOURS

Basics of Computer Networks – Introduction to Internet and Its History –Web Terminologies – Web System Architectures –Introduction to Web Servers –Web Communication Protocols –Ports and DNS Concepts – Introduction to Client –Side and Server –Side Scripting.

UNIT II: HTML5

12 HOURS

HTML Basics – Attributes in HTML – Hyperlinks and Bookmarks – Working with Images – Lists and Tables – Form Elements – Layouts in HTML – Other Important HTML5 Elements – HTML Multimedia

UNIT III: CSS3

12 HOURS

Basics of CSS – CSS Selectors – Pseudo –classes and Pseudo –elements – Core CSS3 Properties –CSS3 Features –Responsive Design and Media Queries – CSS Preprocessors (SASS / SCSS).

UNIT IV: JAVASCRIPT

12 HOURS

Introduction to JavaScript –JavaScript Syntax and Basics –JavaScript Building Blocks – Control Flow Statements – Functions in JavaScript – Event Listeners –Object –Oriented JavaScript Concepts –Built –in JavaScript Objects –Working with Events –Document Object Model (DOM) Manipulation – Form Validation using JavaScript.

UNIT V: INTRODUCTION TO GIT AND GITHUB

12 HOURS

Introduction to Version Control- Installing Git- Basic Git Commands: clone, add, commit, push- Creating and Managing GitHub Repositories Hosting Static Websites on GitHub Pages

TOTAL: 60 HOURS

LIST OF PROGRAMS

1. Explore various types of websites (static vs dynamic)
2. Inspect HTTP Request/Response headers using developer tools
3. Simulate DNS lookups and observe port behavior.
4. Create a personal profile page using HTML5 elements
5. Build a webpage with navigation (hyperlinks and bookmarks)
6. Design a registration form using HTML forms
7. Embed an audio and a video into a sample webpage.
8. Style a multi –page website using external CSS
9. Create responsive layouts using Flexbox and media queries
10. Write basic SASS/SCSS code and compile it
11. Write and run basic JavaScript programs
12. Implement simple event –driven actions
13. Manipulate DOM elements dynamically
14. Perform client –side form validations
15. Host a sample project using GitHub Pages

TOTAL: 48 HOURS

TEXT BOOKS:

- 1 Terry Felke –Morris, "Web Development and Design Foundations with HTML5", 9th Edition, Pearson, 2018.
- 2 Jon Duckett, "HTML & CSS: Design and Build Websites", Wiley, 2014.
- 3 Jon Duckett, "JavaScript & jQuery: Interactive Front –End Web Development", Wiley, 2014.
- 4 Achyut Godbole and Atul Kahate, "Web Technologies: TCP/IP to Internet Application Architectures", 2nd Edition, McGraw Hill Education, 2012.
- 5 Kogent Learning Solutions Inc., "HTML5 Black Book", Dream tech Press, 2011.

REFERENCE BOOKS:

- 1 Mozilla Developer Network (MDN), "HTML, CSS, JavaScript Documentation", Mozilla Foundation, Accessed 2024, <https://developer.mozilla.org/>
- 2 Bootstrap Team, "Bootstrap 5 Documentation", Accessed 2024, <https://getbootstrap.com/>
- 3 jQuery Foundation, "jQuery API Documentation", Accessed 2024, <https://api.jquery.com/>
- 4 GitHub, "Git and GitHub Learning Resources", Accessed 2024, <https://docs.github.com/>
- 5 Mozilla Developer Network (MDN), "HTML, CSS, JavaScript Documentation", Mozilla Foundation, Accessed 2024, <https://developer.mozilla.org/>

CO, PO, PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14	PO 15	PSO 1	PSO 2
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CO2	3	-	2	3	-	-	-	-	2	-	-	-	-	-	-	-	2
CO3	3	-	3	3	3	1	-	1	-	-	-	-	-	-	-	-	-
CO4	3	-	2	3	2	-	-	-	1	-	-	-	-	-	-	-	-
CO5	3	-	3	3	1	1	-	-	-	-	-	-	-	-	-	2	-
Average	3	0	2.4	3	2	1	0	1	1.7	0	0	0	0	0	0	2	2

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

PREREQUISITE:

- Basic understanding of networking and operating systems
- Familiarity with virtualization concepts
- Prior exposure to Linux CLI (preferred)

COURSE OBJECTIVES (CO):

- This course introduces learners to the fundamentals of cloud computing and provides practical exposure to the three major cloud platforms: AWS, Microsoft Azure, and Google Cloud Platform (GCP).
- Students will gain essential skills to create, configure, and manage core services like compute, storage, networking, and identity on each platform.

COURSE OUTCOMES (COs):

Upon completion of this course, the student will be able to:

COs	Course Outcomes	Blooms Level
CO1	Understand the core principles, models, and deployment strategies of cloud computing.	Understand
CO2	Use web consoles and CLI tools to manage cloud resources across AWS, Azure, and GCP.	Analyze
CO3	Compare and contrast major cloud services across providers.	Analyze
CO4	Build foundational cloud-based infrastructure and manage access control.	Apply
CO5	Analyze the core Microsoft Azzure Essential and deployment strategies of cloud computing.	Analyze

UNIT I: CLOUD COMPUTING BASICS

12 HOURS

What is Cloud Computing? – Benefits and Evolution - Cloud Service Models: IaaS, PaaS, SaaS - Cloud Deployment Models: Public, Private, Hybrid, Multi-Cloud - Concepts of Elasticity, Scalability, On-Demand Resource Provisioning

UNIT II: CLOUD INFRASTRUCTURE FUNDAMENTALS

12 HOURS

Core Components: Compute, Storage, Networking, Identity - Understanding Data Centres, Regions, and Availability Zones - Virtualization vs Containerization -Introduction to Cloud Pricing Models and Free Tier Limitations

UNIT III: AWS Essentials**12 HOURS**

AWS Architecture and Global Infrastructure -Core Services: EC2 (Compute), S3 (Storage), VPC (Networking), IAM (Identity) - Introduction to AWS CLI and IAM Policies - Overview of AWS Billing and Resource Management

UNIT IV: MICROSOFT AZURE Essentials**12 HOURS**

Azure Architecture: Subscriptions, Management Groups, Resource Groups -Core Services: Azure VMs, Azure Blob Storage, Virtual Networks, Azure AD - Introduction to Azure Portal, Cloud Shell, and Azure CLI - Overview of Azure Resource Manager (ARM)

UNIT V: Google Cloud Essentials**12 HOURS**

GCP Structure: Projects, Billing Accounts, Folders, Organization - Core Services: Compute Engine, Cloud Storage, VPC, IAM - GCP Console and gcloud CLI Basics - Overview of APIs & Services and GCP Marketplace

TOTAL HOURS:60 HOURS**LIST OF PROGRAMS**

1. Demonstration: Understanding Web-based Cloud Console Interfaces
2. Setup and sign in to AWS, Azure, and GCP free-tier accounts
3. Explore and compare global regions in AWS, Azure, and GCP
4. Perform cost estimation using cloud pricing calculators
5. Launch and connect to an EC2 instance
6. Create and configure S3 buckets with permissions
7. Setup a basic VPC and IAM roles/policies
8. Create a VM and configure network settings
9. Set up Blob storage and apply access tiers
10. Use Azure AD to assign user roles
11. Deploy a virtual machine using Compute Engine
12. Set up Cloud Storage with lifecycle rules
13. Create and assign IAM roles using gcloud CLI

TOTAL: 48 HOURS**TEXT BOOKS:**

- 1 Erl, T. (2013). Cloud Computing: Concepts, Technology & Architecture. Prentice Hall.
- 2 Jackson, K. L., & Goessling, S. (2018). Architecting Cloud Computing Solutions. Packt Publishing.

WEBSITES:

- 1 Amazon Web Services. (n.d.). AWS Documentation. Retrieved from <https://docs.aws.amazon.com>
- 2 Microsoft. (n.d.). Azure Documentation. Retrieved from <https://learn.microsoft.com/en-us/azure>
- 3 Google Cloud. (n.d.). Google Cloud Documentation. Retrieved from <https://cloud.google.com/docs>

CO, PO, PSO Mapping

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CO2	3	-	2	3	-	-	-	-	2	-	-	-	-	-	-	-	2
CO3	3	-	3	3	3	1	-	1	-	-	-	-	-	-	-	-	-
CO4	3	-	2	3	2	-	-	-	1	-	-	-	-	-	-	-	-
CO5	3	-	3	3	1	1	-	-	-	-	-	-	-	-	-	2	-
Average	3	0	2.4	3	2	1	0	1	1.7	0	0	0	0	0	0	2	2

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

PREREQUISITE:

- Basic programming knowledge
- Familiarity with basic data structures and algorithms
- Basic understanding of databases and data handling concepts

COURSE OBJECTIVES (CO):

- Understand the fundamental concepts of data analytics and their role in supporting data-driven decision-making.
- Use Python and essential libraries (NumPy, Pandas, Matplotlib) to perform data manipulation, cleaning, and analysis.
- Apply data cleaning techniques to prepare raw datasets for meaningful analysis.
- Create effective visualizations to explore, summarize, and communicate patterns in data.
- Analyze real-world datasets to extract insights and present data-based conclusions.

COURSE OUTCOMES (COs):

Upon completion of this course, the student will be able to:

COs	Course Outcomes	Blooms Level
CO1	Understand key concepts in data analytics and the role of Python in the analytics pipeline.	Understand
CO2	Perform data manipulation and analysis using NumPy and Pandas.	Analyze
CO3	Clean and prepare data for analysis, handling common issues like missing data and outliers.	Analyze
CO4	Use Python libraries for exploratory data analysis and visualization.	Apply
CO5	Develop data-driven insights using statistical techniques and visualizations.	Analyze

UNIT I: INTRODUCTION TO DATA ANALYTICS AND PYTHON

12 HOURS

What is Data Analytics? - Types of Analytics: Descriptive, Diagnostic, Predictive, Prescriptive - Real-world Applications of Data Analytics - Data Lifecycle and Pipeline Overview - Role of Python in Data Analytics - Introduction to Python: Tokens, Basic Elements, Data Types, Type Conversion, I/O, Control Flow Statements (Sequence, Selection, Looping), Functions, Data Structures (String, List, Tuple, Dictionary, Set), Exception Handling, Files, Modules and Packages, Regular Expression Operation

UNIT II: NUMPY**12 HOURS**

Introduction to NumPy - Arrays vs Lists - Array Creation, Indexing, and Slicing - Array Operations and Broadcasting - Mathematical Functions and Aggregations - Random Number Generation - Basic Statistics with NumPy

UNIT III: PANDAS FOR DATA ANALYSIS**12 HOURS**

Introduction to Pandas - Series and DataFrames - Reading Data from CSV/Excel - Indexing, Filtering, and Slicing - GroupBy and Aggregation - Handling Missing Data - Data Transformation: Sorting, Renaming, Type Casting - Merging and Joining DataFrames.

UNIT IV: DATA CLEANING AND PREPARATION**12 HOURS**

Common Data Issues - Dealing with Missing, Duplicate, and Outlier Data - String Operations - Feature Engineering Basics - Data Type Conversion - Handling Dates and Times - Encoding Categorical Variables – Introduction to Data Normalization and Scaling

UNIT V: EXPLORATORY DATA ANALYSIS AND VISUALIZATION**12 HOURS**

Introduction to Data Visualization - Matplotlib Basics - Line, Bar, Pie, and Scatter Plots - Seaborn for Statistical Visuals - Histograms, Boxplots, Heatmaps - Pair Plots and Correlation Matrices - Basic EDA Flow: Ask, Analyze, Visualize.

TOTAL: 60 HOURS**LIST OF PROGRAMS**

1. Implement Python concepts like loops, functions, and exception handling
2. Work with data structures (lists, tuples, dictionaries, sets)
3. Handle file I/O and basic regular expressions
4. Create and manipulate NumPy arrays
5. Perform operations such as reshaping and broadcasting
6. Calculate basic statistics on synthetic data
7. Load and explore datasets using Pandas
8. Clean and manipulate data (filter, sort, rename, etc.)
9. Perform aggregation and group-wise analysis
10. Clean a messy dataset (missing values, duplicates)
11. Format date/time columns and extract features
12. Encode categorical data for machine learning
13. Plot different types of charts using Matplotlib and Seaborn
14. Visualize dataset distributions and identify outliers
15. Perform basic exploratory data analysis (EDA) on a new dataset

TOTAL: 48 HOURS

TEXT BOOKS

- 1 McKinney, W. (2017). *Python for data analysis: Data wrangling with pandas, NumPy, and IPython*. O'Reilly Media.
- 2 VanderPlas, J. (2016). *Python data science handbook: Essential tools for working with data*. O'Reilly Media.
- 3 Müller, A. C., & Guido, S. (2016). *Introduction to machine learning with Python: A guide for data scientists*. O'Reilly Media.
- 4 Grus, J. (2015). *Data science from scratch: First principles with Python*. O'Reilly Media.

REFERENCE BOOKS

- 1 Cormen, T. H., Leiserson, C. E., Rivest, R. L., & Stein, C. (2009). *Introduction to algorithms* (3rd ed.). MIT Press.
- 2 Sedgewick, R. (2011). *Algorithms* (4th ed.). Addison-Wesley.
- 3 Skiena, S. S. (2020). *The algorithm design manual* (3rd ed.). Springer.

CO, PO, PSO Mapping

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CO3	3	-	3	2	3	2	2	1	2	-	1	-	-	-	-	2	-
CO4	3	-	1	1	1	1	1	-	1	-	-	-	-	-	-	-	1
CO5	3	-	-	1	-	-	-	-	-	1	-	-	-	-	-	-	-
Average	3	-	2	1.3	2	1.5	1.5	1	1.5	1	1	-	-	-	-	2	1

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

PREREQUISITE:

- Good knowledge of Basic Data Structures and Algorithms
- Strong C/C++/Java/Python programming skills
- Familiarity with Complexity Analysis

COURSE OBJECTIVES (CO):

- Provides a comprehensive understanding of advanced data structures and algorithms.
- Emphasizes both theoretical concepts and practical implementation.
- Focuses on algorithm analysis to enhance problem-solving skills.
- Teaches students how to efficiently handle various data structures.
- Helps students understand the real-world applications of data structures and algorithms

COURSE OUTCOMES (COs):

Upon completion of this course, the student will be able to:

COs	Course Outcomes	Blooms Level
CO1	Design and implement advanced data structures like Red-Black Trees, B-Trees, Tries, Segment Trees, and more.	Understand
CO2	Analyze and evaluate algorithm performance using time complexity and space complexity, including asymptotic notations.	Analyze
CO3	Implement advanced algorithms for sorting, searching, graph traversal, dynamic programming, and more.	Analyze
CO4	Apply appropriate data structures to solve complex computational problems.	Apply
CO5	Develop efficient algorithmic solutions for real-world scenarios, optimizing for both time and space.	Analyze

UNIT I: ADVANCED SORTING AND SEARCHING ALGORITHMS

12 HOURS

Radix Sort – Bucket Sort – Counting Sort – Cyclic Sort -Modified Binary Search – Exponential Search – Ternary Search

UNIT II: ADVANCED TREE-BASED DATA STRUCTURES

12 HOURS

Red-Black Trees: Properties – Insertion – Deletion - B-Trees: Introduction – Insertion – Deletion –

Search – Applications in Database Indexing- Heaps: Binary Heap – Heap Operations (Insert, Extract, Heapify) – Heap Sort – Priority Queue Applications - Tries: Insertion – Search – Deletion – Applications

UNIT III: ADVANCED GRAPH-BASED DATA STRUCTURES **12 HOURS**

Graph Traversal Revisit: BFS – DFS - Topological Sort – Floyd-Warshall Algorithm – Union-Find (DSU) - Cycle Detection in Directed Graphs – Cycle Detection in Undirected Graphs

UNIT IV: ALGORITHMIC STRATEGIC OVERVIEW **12 HOURS**

Brute Force: Knapsack Problem – Subset Sum – Permutations and Combinations - Divide and Conquer: Knapsack Problem – Matrix Multiplication (Strassen's Algorithm)-Backtracking: State Space Search – Subset Sum – Knapsack – N-Queens Problem

UNIT V: GREEDY ALGORITHMS AND DYNAMIC PROGRAMMING **12 HOURS**

GCP Structure: Projects, Billing Accounts, Folders, Organization - Core Services: Compute Engine, Cloud Storage, VPC, IAM - GCP Console and gcloud CLI Basics - Overview of APIs & Services and GCP Marketplace

TOTAL: 60 HOURS

LIST OF PROGRAMS

1. Implement Radix Sort – Bucket Sort – Counting Sort – Cyclic Sort
2. Solve searching problems using Modified Binary Search – Exponential Search – Ternary Search
3. Implement Red-Black Tree operations – B-Tree insertion and search
4. Implement Heap Sort – Simulate Priority Queue operations
5. Implement Trie for prefix-based searching
6. Implement BFS – DFS – Topological Sort
7. Solve shortest path problems using Floyd-Warshall Algorithm
8. Detect cycles using Union-Find (Directed and Undirected Graphs)
9. Implement Brute Force – Divide and Conquer – Backtracking Algorithms
10. Solve Knapsack – Subset Sum – Matrix Multiplication – N-Queens Problem
11. Solve Greedy Problems: Activity Selection – Kruskal's – Prim's – Huffman Encoding
12. Solve Dynamic Programming Problems: Knapsack – Fibonacci – Travelling Salesman Problem

TOTAL: 48 HOURS

TEXT BOOKS

- 1 Weiss, M. A. (2002). Data structures and algorithm analysis in C (2nd ed.). Pearson Education.
- 2 Karumanchi, N. (2016). Data structures and algorithms made easy (5th ed.). CareerMonk Publications.

REFERENCE BOOKS

- 1 Cormen, T. H., Leiserson, C. E., Rivest, R. L., & Stein, C. (2009). Introduction to algorithms (3rd ed.). MIT Press.
- 2 Sedgewick, R. (2011). Algorithms (4th ed.). Addison-Wesley.
- 3 Skiena, S. S. (2020). The algorithm design manual (3rd ed.). Springer.

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CO3	3	-	2	1	3	2	-	2	3	-	2	-	-	-	-	-	3
CO4	3	-	-	-	-	1	-	-	2	-	-	-	-	-	-	-	-
CO5	3	-	-	-	-	1	-	-	2	-	-	-	-	-	-	-	-
Average	3	-	2	1	3	1.4	-	2	2.4	1	2	-	-	-	-	2	2.5

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

PREREQUISITE:

- Good understanding of HTML5, CSS3, and JavaScript
- Basic knowledge of web development concepts (DOM, Events, Forms)
- Familiarity with browser debugging tools

COURSE OBJECTIVES (CO):

- Demonstrate proficiency in modern JavaScript and apply advanced concepts to build dynamic and interactive web applications.
- Develop scalable frontend applications using ReactJS and state-management tools such as Redux.
- Build high-performance, production-ready web interfaces using Next.js and modern web workflows.
- Apply UI/UX design principles to create intuitive, accessible, and user-centered interfaces.
- Design, develop, and deploy complete frontend projects, demonstrating practical skills in real-world development environments.

COURSE OUTCOMES (COs):

Upon completion of this course, the student will be able to:

COs	Course Outcomes	Blooms Level
CO1	Apply advanced JavaScript concepts including asynchronous programming, module design, and API handling.	Understand
CO2	Integrate UI/UX design principles to create user-centered, visually appealing interfaces using Figma.	Analyze
CO3	Develop dynamic, component-based frontend applications using ReactJS.	Analyze
CO4	Manage complex application state effectively using Redux and asynchronous actions.	Apply
CO5	Build and deploy full-stack capable frontend applications using Next.js with server-side rendering (SSR) and static site generation (SSG).	Analyze

UNIT I: ADVANCED JAVASCRIPT

12 HOURS

Overview of Core JavaScript Features, ES6+: Let and const scope, Arrow functions, Template literals, Destructuring, Spread and Rest operators, Default parameters. Functions and Callbacks: Higher-order functions, Callback functions, Closures, Anonymous and named functions, Function scope vs block scope. Advanced Array Methods: map, filter, reduce. Asynchronous JavaScript: setTimeout(), setInterval(), Event loop and call stack basics, Callbacks vs Promises, Creating and chaining Promises, async / await, Error handling in Promises. Working with APIs: fetch() API, Handling JSON responses. Introduction to JavaScript Frameworks and Libraries.

UNIT II: UI/UX DESIGN**12 HOURS**

Overview of Design Thinking, Introduction to UI/UX: Importance of User Interface and User Experience, UI vs UX: Key Differences, Fundamental Principles of Good Design, Figma Tool Overview: Introduction to Figma and Interface Walkthrough, Creating Mindmaps, Designing Wireframes: Low-Fidelity, Mid-Fidelity, High-Fidelity, Building Mockups and Interactive Prototypes

UNIT III: REACT JS**12 HOURS**

Introduction to React, Virtual DOM, Setting up the React Development Environment, Functional Components, Class Components, Props, State Management, Conditional Rendering, Event Handling in JSX, Controlled vs Uncontrolled Components, Form Submission, useState Hook, useEffect Hook, useContext Hook, Lifecycle simulation with Hooks, Rules of Hooks, Fetch API, Axios, Handling loading and error states, React Router Basics, Route, Link, Navigation, Dynamic Routing.

UNIT IV: REDUX**12 HOURS**

Introduction to Redux, Need for State Management, Store, Actions, Reducers, Setting up Redux in React App, Redux Flow, Provider Component, useSelector Hook, useDispatch Hook, Connecting Redux to Components, Redux Middleware, Redux Thunk, Async Actions, Handling API Calls with Redux.

UNIT V: INTRODUCTION TO NEXT.JS AND PROJECT DEVELOPMENT**12 HOURS**

What is Next.js, Differences from React, File-based Routing, Pages and Navigation, Static and Server-side Rendering, API Routes, Data Fetching (getStaticProps, getServerSideProps), Styling in Next.js, SEO with Head component, Image Optimization, Final Mini Project using React, Redux, and Next.js, Deploy project on Vercel.

TOTAL : 60 HOURS**LIST OF PROGRAMS**

1. Build modular JavaScript programs using ES6 features.
2. Fetch and display dynamic data from APIs.
3. Create a simple Canvas-based animation using JavaScript.
4. Create Mindmaps, Wireframes, and High-Fidelity Designs using Figma.
5. Build reusable React components with props and state.
6. Implement React Hooks for managing component state and side effects.
7. Fetch and display data using APIs and handle navigation using React Router.
8. Configure Redux Store and integrate it with a React application.
9. Manage global state and asynchronous API calls using Redux Thunk.
10. Build and deploy a full-stack capable frontend application using React, Redux, and Next.js.

TOTAL: 48 HOURS

TEXT BOOKS:

- 1 Bass, L., Weber, I., & Zhu, L. (2015). DevOps: A Software Architect's Perspective. Addison-Wesley.
- 2 Sharma, S. (2017). The DevOps Adoption Playbook. Wiley.
- 3 Burns, B., & Oppenheimer, D. (2018). Designing Distributed Systems. O'Reilly.

WEBSITES:

- 1 Amazon Web Services. (n.d.). What is DevOps? AWS. Retrieved April 30, 2025, from <https://aws.amazon.com/devops/what-is-devops/>
- 2 Microsoft. (n.d.). What is DevOps? Microsoft Learn. Retrieved April 30, 2025, from <https://learn.microsoft.com/en-us/devops/plan/what-is-devops>
- 3 Atlassian. (n.d.). DevOps: A culture, movement & practice. Retrieved April 30, 2025, from <https://www.atlassian.com/devops>
- 4 GitHub. (n.d.). GitHub Learning Lab. Retrieved April 30, 2025, from <https://lab.github.com/>
- 5 HashiCorp. (n.d.). Terraform documentation. Retrieved April 30, 2025, from <https://developer.hashicorp.com/terraform/docs>
- 6 Microsoft. (n.d.). Architecting cloud-native .NET apps for Azure: Microservices architecture. Microsoft Learn. Retrieved April 30, 2025, from <https://learn.microsoft.com/en-us/dotnet/architecture/microservices/>

CO, PO, PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14	PO 15	PSO 1	PSO 2
CO1	3	-	1	-	1	1	-	-	-	1	2	-	-	-	-	1	-
CO2	3	-	1	-	-	-	-	-	-	-	-	-	1	-	-	-	2
CO3	3	-	2	-	-	-	-	2	2	-	-	-	1	-	-	-	-
CO4	3	-	1	-	-	1	-	2	2	-	-	-	-	-	-	-	-
CO5	3	-	1	1	1	-	-	1	2	-	-	-	1	-	-	-	-
Average	3	-	1.2	0.2	0.4	0.4	-	1	1.2	-	0.4	-	-	-	-	0.2	0.4

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

PREREQUISITE:

- Basic understanding of cloud foundations (AWS, Azure, GCP)
- Familiarity with Git and Linux commands
- Awareness of cloud infrastructure and deployment basics

COURSE OBJECTIVES (CO):

- This course provides foundational knowledge of DevOps and microservices architecture.
- It focuses on the cultural shift, infrastructure automation, and service decomposition required in modern software delivery.
- Learners will explore Infrastructure as Code (IaC), version control, and the principles that guide microservices adoption.
- This course prepares students for advanced DevOps topics like CI/CD and container orchestration.

COURSE OUTCOMES (COs):

Upon completion of this course, the student will be able to:

COs	Course Outcomes	Blooms Level
CO1	Understand the DevOps mindset and its benefits in software development	Understand
CO2	Apply Git-based version control and workflow practices	Analyze
CO3	Use Infrastructure as Code tools to automate cloud provisioning	Analyze
CO4	Understand the key principles and benefits of microservices	Apply
CO5	Design service-oriented architecture using real-world patterns	Analyze

UNIT I: INTRODUCTION TO DEVOPS

12 HOURS

What is DevOps? - DevOps Lifecycle – Dev vs Ops gap - Core DevOps Principles: Collaboration, Automation, Feedback, Measurement - DevOps Tools Ecosystem Overview

UNIT II: GIT AND VERSION CONTROL BASICS

12 HOURS

Git Basics – Branching – Merging – Pull Requests - GitHub for collaboration and code reviews - Git Flow vs Trunk-Based Development

UNIT III: INFRASTRUCTURE AS CODE (IAC)

12 HOURS

Introduction– Benefits and Use Cases - Declarative vs Imperative Approaches- Tools: Terraform – CloudFormation – ARM Templates - Modular IaC – Secrets Management – Remote State Management

UNIT IV: Microservices Architecture Principles**12 HOURS**

Monolith vs Microservices – Service Decomposition - Stateless Services – API Gateway – Service Discovery - Inter-service Communication: REST – gRPC – Message Brokers - Best Practices for Microservices Security and Scaling

UNIT V: DevOps in Practice (Use Cases and Toolchains)**12 HOURS**

DevOps Use Cases: SaaS Application – Internal Tools – APIs - DevOps Toolchains: Git, Terraform, Monitoring, IaC - Team Collaboration: DevOps roles, handoffs, and feedback loops

TOTAL : 60 HOURS**LIST OF PROGRAMS**

11. Analyze DevOps workflows for a sample app
12. Identify lifecycle stages and pain points in traditional SDLC
13. Create and manage GitHub repositories
14. Perform branching and merging workflows
15. Provision cloud resources using Terraform
16. Compare IaC templates for AWS and Azure
17. Create a service blueprint for a sample microservices system
18. Plan service communication and fault tolerance mechanisms
19. Map a DevOps toolchain to a real-world system
20. Prepare a DevOps readiness checklist for a sample project

TOTAL: 48 HOURS**TEXT BOOKS:**

- 1 Bass, L., Weber, I., & Zhu, L. (2015). DevOps: A Software Architect's Perspective. Addison-Wesley.
- 2 Sharma, S. (2017). The DevOps Adoption Playbook. Wiley.
- 3 Burns, B., & Oppenheimer, D. (2018). Designing Distributed Systems. O'Reilly.

WEBSITES:

- 1 Amazon Web Services. (n.d.). What is DevOps? AWS. Retrieved April 30, 2025, from <https://aws.amazon.com/devops/what-is-devops/>
- 2 Microsoft. (n.d.). What is DevOps? Microsoft Learn. Retrieved April 30, 2025, from <https://learn.microsoft.com/en-us/devops/plan/what-is-devops>
- 3 Atlassian. (n.d.). DevOps: A culture, movement & practice. Retrieved April 30, 2025, from <https://www.atlassian.com/devops>
- 4 GitHub. (n.d.). GitHub Learning Lab. Retrieved April 30, 2025, from <https://lab.github.com/>
- 5 HashiCorp. (n.d.). Terraform documentation. Retrieved April 30, 2025, from <https://developer.hashicorp.com/terraform/docs>
- 6 Microsoft. (n.d.). Architecting cloud-native .NET apps for Azure: Microservices architecture. Microsoft Learn. Retrieved April 30, 2025, from <https://learn.microsoft.com/en-us/dotnet/architecture/microservices/>

CO, PO, PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14	PO 15	PSO 1	PSO 2
CO1	3	-	-	3	1	1	-	1	1	-	1	-	-	-	-	-	-
CO2	3	-	2	2	2	2	-	2	2	-	-	-	-	-	-	3	-
CO3	3	-	2	2	2	2	-	2	3	-	-	-	-	-	-	-	2
CO4	3	-	3	3	3	3	-	3	3	-	-	-	-	-	-	-	2
CO5	3	-	2	2	2	2	-	2	2	-	-	-	-	-	-	-	-
Average	3	-	2.3	2.4	2	2	-	2	2.2	-	1	-	-	-	-	3	2

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

PREREQUISITE:

- Basic programming knowledge in Python
- Understanding of relational and NoSQL databases
- Familiarity with SQL queries and MongoDB basics

COURSE OBJECTIVES (CO):

- Integrate SQL and NoSQL databases into data analytics workflows using Python for efficient data access and management.
- Automate ETL (Extract, Transform, Load) processes to streamline data collection, cleaning, and preparation for analysis.
- Clean, preprocess, and transform raw datasets to ensure accuracy, consistency, and readiness for analytical tasks.
- Perform exploratory data analysis (EDA) using Python-based tools to uncover patterns, trends, and insights.
- Design and build automated, repeatable data pipelines that support real-world analytics and data engineering scenarios.

COURSE OUTCOMES (COs):

Upon completion of this course, the student will be able to:

COs	Course Outcomes	Blooms Level
CO1	Perform data extraction and manipulation from SQL and MongoDB using Python.	Understand
CO2	Build ETL workflows using standard Python libraries.	Analyze
CO3	Clean and preprocess raw data for downstream analytics tasks.	Analyze
CO4	Conduct exploratory data analysis (EDA) and visualize insights using Python.	Apply
CO5	Automate data workflows and schedule regular data tasks.	Analyze

UNIT I: PYTHON INTEGRATION WITH SQL AND MONGODB

12 HOURS

Connecting to MySQL using pymysql or psycopg2 - Query execution and result fetching - Using pymongo for MongoDB operations - Converting results to Pandas DataFrames - Error handling and connection management

UNIT II: ETL WORKFLOWS WITH PYTHON

12 HOURS

Introduction to ETL and its importance in analytics - Data extraction from SQL, MongoDB, and flat files (CSV, Excel) - Transformation using Pandas: cleaning, type conversion, formatting - Loading data to target databases - Writing reusable and modular ETL scripts

UNIT III: DATA CLEANING AND PREPROCESSING FOR ANALYTICS **12 HOURS**

Handling missing data, duplicates, and outliers - String manipulation and date/time formatting - Data normalization and scaling - Encoding categorical variables - Data type corrections and conversions

UNIT IV: EXPLORATORY DATA ANALYSIS (EDA) FROM DATABASES **12 HOURS**

Descriptive statistics from database-driven datasets - Using Pandas, Matplotlib, and Seaborn for visualization - Trend analysis, correlation analysis - Outlier detection using visual methods - EDA workflow for structured data

UNIT V: WORKFLOW AUTOMATION AND SCHEDULING WITH PYTHON **12 HOURS**

Overview of automation in analytics pipelines - Using schedule, time, and os libraries - Writing Python scripts for recurring data fetch and cleaning - Introduction to cron (Linux) and Task Scheduler (Windows) - Logging and error notification basics

TOTAL: 60 HOURS

LIST OF PROGRAMS

1. Write Python scripts to connect to MySQL and MongoDB
2. Execute queries and retrieve data as DataFrames
3. Insert, update, and delete records via Python
4. Design a simple ETL process to load cleaned data
5. Extract from a source and load into another database
6. Apply transformations such as column renaming, type casting, etc.
7. Clean real-world messy data from databases
8. Normalize and encode fields for further analysis
9. Create a preprocessed dataset ready for EDA
10. Perform EDA on data pulled from SQL and/or MongoDB
11. Visualize data distributions, trends, and relationships
12. Summarize insights from EDA using Python notebooks
13. Schedule an ETL job to run daily or weekly
14. Automate cleaning and EDA steps using scripts
15. Generate logs and reports from automated pipelines

TOTAL: 48 HOURS

TEXT BOOKS

- 1 McKinney, W. (2017). *Python for data analysis: Data wrangling with pandas, NumPy, and IPython* (2nd ed.). O'Reilly Media.
- 2 Beazley, D. (2013). *Python cookbook* (3rd ed.). O'Reilly Media.
- 3 Joshi, P. (2017). *Artificial intelligence with Python*. Packt Publishing.
- 4 Chodorow, K. (2013). *MongoDB: The definitive guide* (2nd ed.). O'Reilly Media.
- 5 Karwin, B. (2010). *SQL antipatterns: Avoiding the pitfalls of database programming*. Pragmatic Bookshelf.

WEB REFERENCES

- 1 Python documentation. <https://docs.python.org/>
- 2 NumPy documentation. <https://numpy.org/doc/>
- 3 Pandas documentation. <https://pandas.pydata.org/docs/>
- 4 Python Package Index. mysql-connector-python. <https://pypi.org/project/mysql-connector-python/>
- 5 MongoDB documentation. <https://www.mongodb.com/docs/>
- 6 Advanced Python Scheduler (APScheduler). <https://apscheduler.readthedocs.io/>
- 7 Schedule: Job scheduling for humans. <https://schedule.readthedocs.io/>

CO, PO, PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14	PO 15	PSO 1	PSO 2
CO1	3	-	3	3	1	1	-	-	2	-	1	-	-	-	-	3	2
CO2	3	-	3	3	2	2	-	2	2	-	-	-	-	-	-	2	1
CO3	3	-	3	2	2	2	-	1	3	-	-	-	-	-	-	3	3
CO4	3	-	3	3	3	3	-	1	2	-	-	-	-	-	-	-	-
CO5	3	-	3	3	1	1	-	1	2	-	1	-	-	-	-	3	3
Average	3	-	3	2.8	1.8	1.8	-	1.3	2.2	-	1	-	-	-	-	2.8	2.3

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

PREREQUISITE:

- Basic programming knowledge (Java, Python, C++, etc.)
- Familiarity with data structures and algorithms
- Basic understanding of databases and web architecture

COURSE OBJECTIVES (CO):

- Understand the fundamental concepts and practices of system design.
- Learn to plan and design scalable, reliable software systems.
- Explore both high-level and low-level design principles and system components.
- Analyze design decisions used in real-world software applications.
- Develop the ability to think like a software engineer and prepare for system design interviews and project development.

COURSE OUTCOMES (COs):

Upon completion of this course, the student will be able to:

Cos5	Course Outcomes	Blooms Level
CO1	Understand the key concepts of system design and the difference between high-level and low-level design.	Understand
CO2	Identify system requirements and estimate storage, traffic, and performance needs.	Analyze
CO3	Design system architectures using databases, caches, load balancers, and queues.	Analyze
CO4	Create design diagrams such as architecture layouts, data flows, and API structures.	Apply
CO5	Explain design choices and apply system design principles to build scalable and reliable systems.	Analyze

UNIT I: FUNDAMENTALS OF SYSTEM DESIGN

12 HOURS

Introduction – Importance in SDE roles – LLD vs HLD - Functional vs Non-Functional Requirements – Throughput – Latency – Availability – Scalability - Estimation Techniques: QPS, storage, bandwidth, latency

UNIT II: CORE COMPONENTS AND INFRASTRUCTURE

12 HOURS

Web Architecture: Client-Server Model – Web Server – App Server -Databases: SQL vs NoSQL – Indexing – Replication – Sharding – Partitioning - Load Balancers – Caching (LRU, Redis) – Content Delivery Networks (CDN) - DNS, Reverse Proxy, API Gateway Basics

UNIT III: COMMUNICATION, MESSAGING, AND STORAGE **12 HOURS**

Synchronous vs Asynchronous Communication – REST vs gRPC - Messaging Queues: Kafka – RabbitMQ – Pub/Sub Model - Storage Systems: Blob Storage – Distributed File Systems – CAP Theorem – Consistency Models - Data Modeling for large-scale applications

UNIT IV: SYSTEM DESIGN CASE STUDIES **12 HOURS**

URL Shortener – Rate Limiter – Notification System – Chat App – E-commerce Checkout System -Real-time Feed System – Collaborative Document Editor – Scalable File Upload System - Stateless vs Stateful Systems – Horizontal vs Vertical Scaling – Microservices vs Monolith

UNIT V: SYSTEM DESIGN FOR SDE INTERVIEWS **12 HOURS**

System Design Interview Format – Requirement Gathering – Clarifying Constraints - Approaching Design Interviews: Step-by-Step Strategy - Presenting HLD and LLD – Trade-off Discussions – Mock Interview Sessions

TOTAL: 60 HOURS

LIST OF PROGRAMS

1. Identify and break down requirements
2. Perform estimation and scaling calculations for sample systems
3. Compare relational vs non-relational designs for given scenarios
4. Simulate caching layer and load balancing logic
5. Design message queue-based architecture for real-time communication
6. Create storage and database design for a scalable file-sharing system
7. Present system design solutions with architecture diagrams
8. Analyze bottlenecks and recommend improvements for given systems
9. Participate in peer-to-peer system design interviews
10. Build and present a complete system design portfolio project

TOTAL: 48 HOURS

TEXT BOOKS

- 1 Martin, R. C. (2008). *Clean architecture: A craftsman's guide to software structure and design*. Prentice Hall.
- 2 Malhotra, A. (2020). *Grokking the system design interview*. Design Gurus.

REFERENCE BOOKS

- 1 Tang, A., & Han, J. (2017). *Software architecture design: Methodology and styles*. Springer.
- 2 Narkhede, N., Shapira, G., & Palino, T. (2017). *Kafka: The definitive guide*. O'Reilly Media.
- 3 Amazon Web Services. (n.d.). *AWS Well-Architected Framework*. Retrieved from <https://docs.aws.amazon.com>

CO, PO, PSO Mapping

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CO2	3	2	-	-	3	-	2	1	-	2	-	-	-	-	-	-	1
CO3	3	-	2	3	-	2	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	2	-	-	2	-	1	-	3	-	-	-	-	2	-	1
CO5	3	-	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	3	2.5	2	2	3	2	2	1	-	2.5	-	-	-	-	2	-	1

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

PREREQUISITE:

- Not Required

COURSE OBJECTIVES (CO):

- To introduce students to the concepts and techniques of Blockchain Technology.
- To understand a conceptual elements for Blockchain.
- To summarize the major developments related to blockchain and cryptocurrencies.

COURSE OUTCOMES (COs):

Upon completion of this course, the student will be able to:

COs	Course Outcomes	Blooms Level
CO1	Understand the security and performance perspective of blockchain technology	Understand
CO2	Learn and apply security analysis and performance-enhancing techniques related to blockchain.	Apply
CO3	Understand the real-life applications of blockchain technology and apply it to provide solutions to some real-life problems.	Understand
CO4	Categorize the various types of blockchains	Apply
CO5	Evaluate alternative Blockchains and their applicability.	Evaluate

UNIT I INTRODUCTION TO BLOCKCHAIN

10 HOURS

Introduction to Blockchain history: Digital Money to Distributed Ledgers Design Primitives: Protocols, Security, Consensus, Permissions, Privacy. aBlockchain Architecture and Design. Basic crypto primitives: Hash, Signature, Hashchain to Blockchain, Basic consensus mechanisms

UNIT II NETWORK SECURITY MODELS

9 HOURS

Network Security, Different type of network attack, Warm hole attack, byzantine attack, network based attack etc, Trust based Secure routing schemes.

UNIT III BITCOIN & BLOCKCHAIN

9 HOURS

Bitcoin & Blockchain: Blockchain Structure, Basic Operations, Beyond Bitcoin, Gas, minor's role in

blockchain. Ethereum Blockchain: Smart Contracts, Ethereum Structure, Ethereum Operations, Incentive Model in blockchain.

UNIT IV CRYPTOGRAPHY AND CRYPTOCURRENCY 10 HOURS

Cryptography and cryptocurrency: Algorithms & Techniques Public-Key Cryptography, Public key and private key combinations in Blockchain security, Hashing, Transaction Integrity, Securing Blockchain. Blockchain in Financial Software and Systems (FSS): Settlements, KYC, Capital markets, Insurance Use case II: Blockchain in trade supply chain: Provenance of goods, visibility, tradesupply chain finance, invoice management discounting, etc

UNIT V PRIVACY AND SECURITY ON BLOCKCHAIN 10 HOURS

Blockchain Cryptography Privacy and Security on Blockchain, Blockchain consensus protocols, Various recent works on scalability Secure cryptographic protocols on Blockchain Secured, Multi-party Computation, Blockchain, for science: making better use of the data-mining network, Case Studies: Comparing Ecosystems - Bitcoin, Hyperledger, Ethereum and more

TOTAL: 48 HOURS

TEXT BOOKS

- 1 Swan, M. (2015). *Blockchain: Blueprint for a new economy* (1st ed.). O'Reilly Media.
- 2 Drescher, D. (2017). *Blockchain basics* (1st ed.). Apress.
- 3 Kaushik, A. (n.d.). *Blockchain and cryptocurrencies*. Khanna Publishing House.

Websites

- 1 <https://ai.google/education/>
- 2 <https://docs.docker.com/get-started/https://console.ng.bluemix.net/docs/services/block%2520chain/index.html>
- 3 [https://developer.ibm.com/patterns/create-and-deploy-block chain-network-usingfabric-sdk-java/](https://developer.ibm.com/patterns/create-and-deploy-block-chain-network-usingfabric-sdk-java/)

CO, PO, PSO Mapping

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CO2	3	-	2	3	-	-	-	-	2	-	-	-	-	-	-	-	2
CO3	3	-	3	3	3	1	-	1	-	-	-	-	-	-	-	-	-
CO4	3	-	2	3	2	-	-	-	1	-	-	-	-	-	-	-	-
CO5	3	-	3	3	1	1	-	-	-	-	-	-	-	-	-	2	-
Average	3	0	2.4	3	2	1	0	1	1.7	0	0	0	0	0	0	2	2

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

PREREQUISITE:

Not Required

COURSE OBJECTIVES (CO):

- To define the types and theory of machine learning.
- To describe the classification models of machine learning.
- To explain the techniques of distance-based models of machine learning.

COURSE OUTCOMES (COs):

Upon completion of this course, the student will be able to:

COs	Course Outcomes (COs)	Blooms Level
CO1	Summarize the Machine Learning Fundamentals	Understand
CO2	Analyze the concepts of Proficiency in Data Preparation and Preprocessing	Analyze
CO3	Develop the Skilful Model Evaluation and Feature Engineering of machine learning.	Create
CO4	Analyze the Classification and Regression Techniques	Analyze
CO5	Develop the program using python libraries for implementing machine learning techniques.	Create

UNIT I: MACHINE LEARNING FUNDAMENTALS

10 HOURS

Machine Learning Landscape: Introduction- Types of Machine Learning Systems- Main Challenges of Machine Learning- Testing and Validating-End to End Machine Learning Project: Working with Real Data- Discover and visualize the data to gain insights Prepare the data for Machine Learning algorithms-Select and Train a model-Fine-Tune the model

UNIT II: FEATURE ENGINEERING

9 HOURS

Motivation towards Feature Engineering - Basic Feature engineering processes- Feature Selection- Dimensionality Reduction: The Curse of Dimensionality - Main Approaches for Dimensionality Reduction- PCA-Kernel PCA-LLE- Other Dimensionality Reduction Techniques.

UNIT III: CONCEPTS OF CLASSIFICATION AND REGRESSION

9 HOURS

Classification: Training a Binary Classifier – Performance Measures - Multiclass Classification- Error Analysis- Multilabel Classification and Multioutput Classification-Training Models: Linear Regression- Gradient Descent- Polynomial Regression Learning Curves.

UNIT IV: SUPERVISED LEARNING**10 HOURS**

Classification: Introduction-Example-Classification Model-Learning Steps- Common classification algorithms- K-Nearest Neighbor Decision Tree-Random Forest Model - Support Vector Machines.
 Regression: Introduction-Example-Multiple linear regression Assumptions and problems in Regression Analysis- Improving the accuracy.

UNIT V: UNSUPERVISED LEARNING AND ARTIFICIAL NEURAL NETWORK**10 HOURS**

Introduction - Unsupervised Learning Vs Supervised Learning – Applications – Clustering - Introduction- Biological neuron - Artificial Neuron- Types of activation function-Architectures of NN – Learning process in ANN – Backpropagation

TOTAL: 48 HOURS**TEXT BOOKS:**

1. AurelienGeron, (2019). *Hands – On Machine Learning with SciKit-Learn, Keras& Tensor Flow – Concepts, Tools and Techniques to Build Intelligent Systems*, 2nd Edition, O’Reilly Media.
2. SaikatDutt, Subramanian Chandramouli and Amit Kumar Das, (2019). *Machine Learning*, 1st Edition, Pearson Education, India.

REFERENCE BOOKS:

1. Henrik Brink, Joseph W Richards, Mark Fetherolf, (2018). *Real World Machine Learning*, 1st Edition Reprint, Dreamtech Press, New Delhi.

WEBSITE LINKS:

1. <https://www.geeksforgeeks.org/machine-learning/>
2. <https://www.linkedin.com/pulse/artificial-intelligenceai-its-case-study-aachal-choudhary>

CO, PO, PSO Mapping

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CO3	3	-	3	3	2	3	-	3	-	-	-	-	-	-	-	-	1
CO4	3	-	2	2	3	2	-	2	3	-	-	-	-	-	-	-	-
CO5	3	-	3	3	2	3	-	3	-	-	-	-	-	-	-	-	-
Average	3	-	2.5	2.5	2.5	2.5	-	2.5	3	1	1	-	-	-	-	3	1.5

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

PREREQUISITE:

- Strong understanding of Core Java concepts
- Basic knowledge of Web Development
- Familiarity with Frontend Frameworks

COURSE OBJECTIVES (CO):

- To understand the core concepts of Java backend development using Servlets, JSP, and Spring MVC.
- To develop and integrate backend applications with databases using JPA and Hibernate.
- To design, build, and deploy RESTful APIs with Spring Boot and implement cloud-based deployment solutions.

COURSE OUTCOMES (COs):

Upon completion of this course, the student will be able to:

COs	Course Outcomes	Blooms Level
CO1	Build Java web applications using Servlets and JSP.	Understand
CO2	Persist data into databases using JPA and Hibernate.	Apply
CO3	Design modular applications using Spring Core and MVC architecture.	Analyze
CO4	Create RESTful APIs using Spring Boot.	Create
CO5	Secure and test Java backend applications.	Understand

UNIT I SERVLET AND JSP

12 HOURS

Introduction to Web Applications and Java EE – HTTP Protocol and Request/Response Model – Servlet Lifecycle: init(), service (), destroy () – Handling Form Data (GET, POST methods) – Introduction to JSP (Java Server Pages) – JSP Directives, Scripting Elements, Action Tags – MVC Architecture using Servlet and JSP – Session Management: Cookies and HttpSession

UNIT II JPA WITH HIBERNATE

12 HOURS

Introduction to ORM (Object Relational Mapping) – Hibernate Configuration and Architectur– Entity Classes and Hibernate Annotations – Performing CRUD Operations with Hibernate– Relationships: One-to-One, One-to-Many– Introduction to JPA and JPQL

UNIT III SPRING CORE AND SPRING MVC **12 HOURS**

Introduction to Spring Framework – Dependency Injection and Inversion of Control (IoC) – Bean Configuration and Lifecycle – Spring MVC Architecture – Request Mappings and Controllers – Introduction to Thymeleaf Template Engine– Setting up Thymeleaf with Spring MVC – Data Binding and Dynamic HTML Rendering using Thymeleaf – Form Handling and Validation using Spring MVC

UNIT IV SPRING BOOT **12 HOURS**

Overview of Spring Boot vs Traditional Spring– Spring Initializr Setup– Auto Configuration and Starter Dependencies – Spring Boot DevTools for Fast Development – Profiles and Property Management– Packaging and Running Spring Boot Applications – Spring Boot Database Connection (JPA Integration)

UNIT V REST API DEVELOPMENT USING SPRING BOOT **12 HOURS**

REST Architecture and Principles – Building REST APIs (GET, POST, PUT, DELETE) – Request Handling and Response Entities – Exception Handling in REST Services –Introduction to API Authentication (JWT Overview) – Testing APIs using Postman

TOTAL 60 HOURS

LIST OF PROGRAMS

1. Servlet Application and JSP-based Login System
2. Spring MVC Application with Thymeleaf Form Handling
3. Hibernate ORM with JPA and MySQL CRUD Operations
4. CRUD Application using Spring Boot
5. RESTful API Development and Testing with Postman
6. User Authentication and Authorization using Spring Security
7. Frontend–Backend Integration using REST APIs
8. File Upload and Download Module
9. Exception Handling and Logging in Spring Boot
10. Email Notification System using Spring Boot Mail
11. Cloud Deployment of Java Web Application
12. Docker Containerization of Spring Boot Application

TOTAL: 60 HOURS

TEXT BOOKS

- 1 K. Somasundaram, P. Suresh Kumar, Java Programming and Web Development, Tata McGraw-Hill, 2019.
- 2 Herbert Schildt, Java: The Complete Reference, 12th Edition, McGraw-Hill, 2022.
- 3 Ramesh Fadatare, Spring 5 Design Patterns, Packt Publishing, 2018.

REFERENCE BOOKS

- 1 Craig Walls, Spring in Action, 6th Edition, Manning Publications, 2022.
- 2 Christian Bauer, Gavin King, Gary Gregory, Java Persistence with Hibernate, 2nd Edition, Manning Publications, 2015.
- 3 Rod Johnson, Juergen Hoeller, Alef Arendsen, Thomas Risberg, Colin Sampaleanu, Professional Java Development with the Spring Framework, Wrox, 2009.

CO, PO, PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14	PO 15	PSO 1	PSO 2
CO1	3	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-
CO2	3	-	3	2	3	1	-	1	2	1	-	-	-	-	-	1	-
CO3	3	-	3	-	3	1	-	1	2	1	-	-	-	-	-	-	-
CO4	3	-	3	1	3	1	-	1	2	1	1	-	-	-	-	-	-
CO5	3	-	1	-	-	-	-	-	2	-	-	-	-	-	-	-	1
Average	3	0	2.5	1.5	3	1	0	1	1.8	1	1	0	0	0	0	1	1

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

25CAP341PE2 CONTINUOUS INTEGRATION / CONTINUOUS DELIVERY (CI/CD)

Instruction Hours / Week: L: 5 T: - P: 5

Marks: Internal: 40 External: 60 Total: 100

End Semester Exam: 3 Hours

PREREQUISITE:

- Completion of *Core DevOps and Microservices Principles* course
- Basic Git commands and repository management
- Familiarity with cloud foundations (AWS, Azure, or GCP) concepts

COURSE OBJECTIVES (CO):

- Understand the principles and practices of Continuous Integration and Continuous Delivery (CI/CD) and their role in modern software development.
- Gain hands-on experience with CI/CD tools and automation techniques to build, test, and deploy software efficiently.
- Design and implement basic CI/CD pipelines suitable for academic projects and entry-level real-world applications.

COURSE OUTCOMES (COs):

Upon completion of this course, the student will be able to:

COs	Course Outcomes	Blooms Level
CO1	Explain CI/CD concepts and their role in the DevOps lifecycle.	Understand
CO2	Build simple CI/CD pipelines for small-scale applications.	Apply
CO3	Integrate automated testing into the CI/CD process.	Create
CO4	Manage software artifacts and implement basic deployment strategies.	Apply
CO5	Apply CI/CD in a beginner-level microservices setup.	Apply

UNIT I INTRODUCTION TO CI/CD

12 HOURS

Introduction to Automation in Software Delivery – Continuous Integration Concepts – Continuous Delivery vs Continuous Deployment – Benefits and Challenges – CI/CD in the DevOps Lifecycle – Overview of Popular Tools: Jenkins, GitHub Actions, GitLab CI

UNIT II PIPELINE FUNDAMENTALS**12 HOURS**

Pipeline Stages: Build – Test – Deploy – Pipeline Triggers (Push, Pull Request, Scheduled) – Declarative vs Scripted Pipelines – YAML Configuration Basics – Understanding Build Logs and Results

UNIT III CI/CD IMPLEMENTATION**12 HOURS**

Jenkins Setup and Basic Pipelines – GitHub Actions Workflow Basics – GitLab CI .gitlab-ci.yml Configuration – Integrating Automated Testing – Introduction to Static Code Analysis Tools – Security Scanning

UNIT IV ARTIFACT MANAGEMENT & BASIC DEPLOYMENT**12 HOURS**

Artifacts and Artifact Repositories (Nexus, JFrog Artifactory) – Versioning Basics (Semantic Versioning) – Deployment Environments: Dev, QA, Production – Basic Deployment Strategies: Rolling, Blue-Green – Rollback Mechanisms

UNIT V CI/CD FOR MICROSERVICES**12 HOURS**

Challenges of CI/CD in Microservices – Independent vs Combined Service Pipelines – Simple Orchestration for Multi-Service Deployments – Connecting Pipelines to Cloud Services – Monitoring and Troubleshooting Pipelines

TOTAL: 60 HOURS**LIST OF PROGRAMS**

1. Study and interpret a sample CI/CD workflow diagram
2. Identify CI/CD stages for a sample web application
3. Write a basic pipeline for a “Hello World” application
4. Add a testing stage to an existing pipeline
5. Configure and run a Jenkins pipeline locally
6. Create a GitHub Actions workflow for a sample app
7. Build a GitLab CI pipeline for a simple project
8. Store and retrieve build artifacts from a repository
9. Perform a Blue-Green deployment for a static application
10. Create independent pipelines for two microservices
11. Deploy microservices to a test environment using CI/CD

TOTAL: 60 HOURS

TEXT BOOKS

- 1 Sharma, S. (2017). *The DevOps Adoption Playbook*. Wiley.
- 2 Farcic, V. (2022). *The DevOps 2.3 Toolkit: Kubernetes Continuous Deployment*. LeanPub.

REFERENCE BOOKS

- 1 Humble, J., & Farley, D. (2010). *Continuous Delivery*. Addison-Wesley.

CO, PO, PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14	PO 15	PSO 1	PSO 2
CO1	2	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1
CO2	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
CO3	2	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1
CO4	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
CO5	3	2	1	-	-	-	1	-	-	-	-	-	-	-	-	-	1
Average	2.4	1.4	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

PREREQUISITE:

- Basic knowledge of Python programming
- Familiarity with data manipulation libraries like Pandas and NumPy
- Understanding of fundamental data analytics concepts

COURSE OBJECTIVES (CO):

- Apply Python visualization libraries such as Matplotlib, Seaborn, and Plotly to create clear and effective data visualizations.
- Demonstrate understanding of visual communication principles to enhance the clarity and impact of data presentations.
- Select appropriate chart types and design interactive dashboards that effectively represent different kinds of data.

COURSE OUTCOMES (COs):

Upon completion of this course, the student will be able to:

COs	Course Outcomes	Blooms Level
CO1	Understand fundamental principles of data visualization and communication.	Understand
CO2	Use Matplotlib, Seaborn, and Plotly to create a variety of static and interactive visualizations.	Apply
CO3	Design dashboards and reports using tools like Dash and Streamlit.	Analyze
CO4	Apply best practices in chart selection and visual encoding to represent data accurately and effectively.	Apply
CO5	Communicate data insights clearly through storytelling and presentation techniques.	Create

UNIT I INTRODUCTION TO DATA VISUALIZATION

12 HOURS

Importance of data visualization – Principles of effective visualization – Types of charts: categorical, numerical, time-series, geospatial – Choosing the right visualization – Overview of libraries: Matplotlib, Seaborn, Plotly.

UNIT II ADVANCED VISUALIZATION TECHNIQUES

12 HOURS

Customizing plots with Matplotlib – Styling and themes in Seaborn – Interactive plots with Plotly – Multi-panel and layered plots – Introduction to geospatial visualization with Folium and Plotly

UNIT III DATA STORYTELLING AND COMMUNICATION **12 HOURS**

Principles of data storytelling – Crafting narratives with data – Annotating and highlighting insights – Designing reports and presentations – Avoiding misleading graphics

UNIT IV EXPLORATORY DATA ANALYSIS **12 HOURS**

Descriptive statistics from databases – Visualization using Pandas, Matplotlib, Seaborn – Trend and correlation analysis – Outlier detection visually – EDA workflow for structured data.

UNIT V DASHBOARD CREATION AND PRESENTATION **12 HOURS**

Introduction to Dash and Streamlit – Building interactive dashboards – Adding filters and controls – Exporting/sharing dashboards – Best practices for effective presentations

TOTAL: 60 HOURS

LIST OF PROGRAMS

1. Create various charts using Matplotlib and Seaborn
2. Practice chart selection based on data type
3. Customize basic plots with colors and labels
4. Build complex multi-panel visualizations
5. Create interactive charts with Plotly
6. Map geospatial data using Folium
7. Annotate and highlight plots effectively
8. Create story-driven visual reports
9. Evaluate good vs. poor visualization examples
10. Perform EDA on data from SQL/MongoDB
11. Visualize distributions, trends, correlations
12. Document insights using Python notebooks
13. Develop dashboards with Streamlit or Dash
14. Implement interactivity (filters, sliders)
15. Present dashboards clearly to audiences

TOTAL: 60 HOURS

TEXT BOOKS

- 1 Kirk, Andy. *Data Visualization: A Handbook for Data Driven Design*. SAGE Publications, 2016.
- 2 Cairo, Alberto. *The Truthful Art: Data, Charts, and Maps for Communication*. New Riders, 2016.
- 3 Few, Stephen. *Show Me the Numbers: Designing Tables and Graphs to Enlighten*. Analytics Press, 2012.

REFERENCE BOOKS

- 1 McKinney, Wes. *Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython*. O'Reilly Media, 2022.
- 2 Wexler, Steve, Shaffer, Jeffrey, and Cotgreave, Andy. *The Big Book of Dashboards: Visualizing Your Data Using Real-World Business Scenarios*. Wiley, 2017.

CO, PO, PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14	PO 15	PSO 1	PSO 2
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CO2	3	-	3	3	2	2	-	2	2	-	-	-	-	-	-	2	1
CO3	3	-	3	2	2	2	-	1	3	-	-	-	-	-	-	3	3
CO4	3	-	3	3	3	3	-	1	2	-	-	-	-	-	-	-	-
CO5	3	-	3	3	1	1	-	1	2	-	1	-	-	-	-	3	3
Average	3	-	3	2.8	1.8	1.8	-	1.3	2.2	-	1	-	-	-	-	2.8	2.3

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

PREREQUISITE:

- Familiarity with fundamental programming concepts
- Understanding of basic networking concepts is an advantage

COURSE OBJECTIVES (CO):

- This course introduces the basics of web development and internet technologies.
- Students will learn to use HTML5 for structuring web pages and CSS3 for styling.
- They will implement interactive features with JavaScript and create responsive designs using Bootstrap.
- The course also covers basic jQuery for manipulating web page elements and introduces Git and GitHub for version control and collaboration.

COURSE OUTCOMES (COs):

Upon completion of this course, the student will be able to:

COs	Course Outcomes	Blooms Level
CO1	Structure content using semantic HTML5 elements.	Understand
CO2	Style web pages using CSS3 properties and frameworks like Bootstrap.	Analyze
CO3	Write interactive web pages using JavaScript and jQuery.	Analyze
CO4	Build simple responsive websites.	Apply
CO5	Use Git for version control and GitHub for project hosting.	Analyze

UNIT I: FUNDAMENTALS OF WEB DEVELOPMENT

12 HOURS

Basics of Computer Networks – Introduction to Internet and Its History – Web Terminologies – Web System Architectures – Introduction to Web Servers – Web Communication Protocols – Ports and DNS Concepts – Introduction to Client – Side and Server – Side Scripting.

UNIT II: HTML5

12 HOURS

HTML Basics – Attributes in HTML – Hyperlinks and Bookmarks – Working with Images – Lists and Tables – Form Elements – Layouts in HTML – Other Important HTML5 Elements – HTML Multimedia

UNIT III: CSS3

12 HOURS

Basics of CSS – CSS Selectors – Pseudo –classes and Pseudo –elements – Core CSS3 Properties – CSS3 Features – Responsive Design and Media Queries – CSS Preprocessors (SASS / SCSS).

UNIT IV: JAVASCRIPT

12 HOURS

Introduction to JavaScript – JavaScript Syntax and Basics – JavaScript Building Blocks – Control Flow

Statements – Functions in JavaScript – Event Listeners –Object –Oriented JavaScript Concepts –Built –in JavaScript Objects –Working with Events –Document Object Model (DOM) Manipulation – Form Validation using JavaScript.

UNIT V: INTRODUCTION TO GIT AND GITHUB

12 HOURSS

Introduction to Version Control- Installing Git- Basic Git Commands: clone, add, commit, push- Creating and Managing GitHub Repositories Hosting Static Websites on GitHub Pages

TOTAL: 60 HOURS

LIST OF PROGRAMS

1. Explore various types of websites (static vs dynamic)
2. Inspect HTTP Request/Response headers using developer tools
3. Simulate DNS lookups and observe port behavior.
4. Create a personal profile page using HTML5 elements
5. Build a webpage with navigation (hyperlinks and bookmarks)
6. Design a registration form using HTML forms
7. Embed an audio and a video into a sample webpage.
8. Style a multi –page website using external CSS
9. Create responsive layouts using Flexbox and media queries
10. Write basic SASS/SCSS code and compile it
11. Write and run basic JavaScript programs
12. Implement simple event –driven actions
13. Manipulate DOM elements dynamically
14. Perform client –side form validations
15. Host a sample project using GitHub Pages

TOTAL: 60 HOURS

TEXT BOOKS:

- 1 Terry Felke –Morris, "Web Development and Design Foundations with HTML5", 9th Edition, Pearson, 2018.
- 2 Jon Duckett, "HTML & CSS: Design and Build Websites", Wiley, 2014.
- 3 Jon Duckett, "JavaScript & jQuery: Interactive Front –End Web Development", Wiley, 2014.
- 4 Achyut Godbole and Atul Kahate, "Web Technologies: TCP/IP to Internet Application Architectures", 2nd Edition, McGraw Hill Education, 2012.
- 5 Kogent Learning Solutions Inc., "HTML5 Black Book", Dream tech Press, 2011.

REFERENCE BOOKS:

- 1 Mozilla Developer Network (MDN), "HTML, CSS, JavaScript Documentation", Mozilla Foundation, Accessed 2024, <https://developer.mozilla.org/>
- 2 Bootstrap Team, "Bootstrap 5 Documentation", Accessed 2024, <https://getbootstrap.com/>
- 3 jQuery Foundation, "jQuery API Documentation", Accessed 2024, <https://api.jquery.com/>
- 4 GitHub, "Git and GitHub Learning Resources", Accessed 2024, <https://docs.github.com/>
- 5 Mozilla Developer Network (MDN), "HTML, CSS, JavaScript Documentation", Mozilla Foundation, Accessed 2024, <https://developer.mozilla.org/>

CO, PO, PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14	PO 15	PSO 1	PSO 2
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CO2	3	-	2	3	-	2	-	2	2	-	-	-	-	-	-	1	-
CO3	3	-	2	3	-	1	-	1	1	-	-	-	-	-	-	-	2
CO4	3	-	-	-	-	2	-	1	-	-	1	-	-	-	-	-	-
CO5	3	-	-	1	-	-	-	-	-	-	1	-	-	-	-	-	-
Average	3	-	2	2	-	1.5	-	1.3	1.3	1	1	-	-	-	-	2	2

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

PREREQUISITE:

- Web Development Foundations (HTML, CSS, JavaScript, Bootstrap, Git)
- Frontend Frameworks (ReactJS / Next.js / Angular)
- Backend Development with Java (Servlet, JSP, Hibernate, Spring MVC, Spring Boot)

COURSE OBJECTIVES (CO):

- To understand and implement frontend–backend integration using RESTful APIs for dynamic web applications.
- To develop secure user authentication and API communication using JWT and related security mechanisms.
- To deploy full stack applications on cloud platforms with basic knowledge of containerization and CI/CD practices

COURSE OUTCOMES (COs):

Upon completion of this course, the student will be able to:

COs	Course Outcomes	Blooms Level
CO1	Integrate React/Angular/Next.js frontend apps with Spring Boot REST APIs.	Understand
CO2	Handle user authentication and authorization in full stack applications.	Apply
CO3	Deploy full stack applications with separated frontend and backend hosting.	Apply
CO4	Solve common deployment issues (CORS, environment variables, API proxying).	Analyze
CO5	Gain awareness of Docker, GitHub Actions, and basic CI/CD practices.	Evaluate

UNIT I: FRONTEND–BACKEND COMMUNICATION BASICS

12 HOURS

Introduction to REST API Integration - HTTP Requests from Frontend (fetch, axios) - Understanding CORS (Cross-Origin Resource Sharing) and Solutions - API Authentication Tokens (Introduction to JWT) - Environment Variable Management (Frontend side)

UNIT II : USER AUTHENTICATION AND AUTHORIZATION **12 HOURS**

Authentication Flows (Sign up, Login, Token Handling) - Authorization Flows (Role-based access control basics) - Building a Secure Login System (Frontend + Backend) - Handling Protected Routes on Frontend - Token Expiry and Auto-Logout Handling

UNIT III: FULL STACK APPLICATION DEVELOPMENT **12 HOURS**

Full Stack Project Planning (ERD + Frontend and Backend Sync) - Folder Structure for Full Stack Applications - Connecting Frontend Forms to Backend CRUD APIs - Error Handling and User Feedback (Frontend) - Optimizing API Calls and Code Refactoring

UNIT IV: DEPLOYMENT OF FRONTEND AND BACKEND **12 HOURS**

Deployment of Frontend Apps - Deployment of Spring Boot Backend Apps - Managing Environment Variables securely - Handling Domain Linking and API URLs - Best Practices for Production Deployment

UNIT V: INTRODUCTION TO DEVOPS BASICS **12 HOURS**

Introduction to Docker Concepts -Building Simple Docker Containers (Spring Boot Backend) - Awareness of CI/CD Pipelines (GitHub Actions overview) - Version Controlling Deployment

TOTAL: 60 HOURS

LIST OF PROGRAMS

1. Create a frontend app fetching data from backend API.
2. Handle API token storage (localStorage/sessionStorage).
3. Build a login + protected dashboard full stack mini app.
4. Build a small full stack CRUD application.
5. Integrate API error handling and toast notifications.
6. Deploy full stack app live.
7. Solve CORS, domain issues, secure API keys.
8. Create a basic Dockerfile for Spring Boot app.
9. Setup auto-deploy from GitHub to Vercel for frontend.
10. Create any simple application

TOTAL: 60 HOURS

TEXT BOOKS

- 1 Robin Wieruch, The Road to React, Self-Published, 2020.
- 2 Craig Walls, Spring in Action, 5th Edition, Manning Publications, 2018.
- 3 Adam Freeman, Pro Spring Boot, 2nd Edition, Apress, 2017.

REFERENCE BOOKS

- 1 K. Somasundaram, P. Suresh Kumar, Java Programming and Web Development, Tata McGraw-Hill, 2019.
- 2 Ramesh Fadatare, Spring 5 Design Patterns, Packt Publishing, 2018.
- 3 David Clinton, Tracy Wallace, Practical GitHub Actions, O'Reilly Media, 2022.

CO, PO, PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14	PO 15	PSO 1	PSO 2
CO1	3	-	3	1	2	2	-	1	2	1	2	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-
CO3	3	-	2	2	3	2	-	2	3	-	-	-	-	-	-	2	3
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	-	-	-	1	2	-	-	-	-	-	-	-	-	-	-	-
Average	3	-	2.5	1.5	2	2	-	1.5	2	1	1.5	-	-	-	-	2	3

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

PREREQUISITE:

- Completion of Core DevOps and Microservices Principles and CI/CD courses
- Basic understanding of Linux commands and networking concepts
- Familiarity with Git and basic cloud foundations (AWS, Azure, or GCP)

COURSE OBJECTIVES (CO):

- To understand the basic concepts and architecture of containerization using Docker.
- To develop, deploy, and manage containerized applications in standalone environments.
- To apply Kubernetes for orchestrating, scaling, and maintaining containers in clustered environments.

COURSE OUTCOMES (COs):

Upon completion of this course, the student will be able to:

COs	Course Outcomes	Blooms Level
CO1	Explain containerization concepts and benefits over traditional virtualization.	Understand
CO2	Create and manage Docker containers for various applications.	Create
CO3	Build and optimize Docker images.	Apply
CO4	Implement orchestration for scaling and managing containers using Kubernetes.	Apply
CO5	Deploy multi-container and microservices-based applications	Create

UNIT I INTRODUCTION TO CONTAINERIZATION

12 HOURS

Containers vs Virtual Machines – Benefits and Use Cases of Containers – Overview of Docker – Container Lifecycle – Images vs Containers – Container Registries (Docker Hub, Private Registries)

UNIT II DOCKER BASICS AND IMAGE MANAGEMENT

12 HOURS

Docker Architecture – Common Docker Commands – Building Docker Images with Dockerfile – Image Layers and Caching – Tagging and Versioning Images – Managing Volumes and Bind Mounts – Networking in Docker

UNIT III MULTI-CONTAINER APPLICATIONS WITH DOCKER COMPOSE 12 HOURS

Introduction to Docker Compose – Compose File Structure (YAML) – Defining Services, Networks, and Volumes – Environment Variables in Compose – Scaling Services – Managing Multi-Container Lifecycles

UNIT IV INTRODUCTION TO ORCHESTRATION AND KUBERNETES BASICS 12 HOURS

Why Orchestration? – Kubernetes Architecture (Master, Nodes, Pods, Services) – Deployments, Replica Sets, and Stateful Sets – Namespaces – Config Maps and Secrets – Basic Networking in Kubernetes.

UNIT V KUBERNETES ADVANCED CONCEPTS AND MICROSERVICES 12 HOURS

DEPLOYMENT

Kubernetes Volumes and Persistent Volumes – Horizontal Pod Autoscaling – Rolling Updates and Rollbacks – Health Checks (Liveness and Readiness Probes) – Introduction to Helm Charts – Basic Monitoring and Troubleshooting in Kubernetes

TOTAL: 60 HOURS

LIST OF PROGRAMS

1. Install Docker and run the first container
2. Explore and pull images from Docker Hub
3. Build a Docker image for a simple web app
4. Create and manage named volumes
5. Connect multiple containers using a custom network
6. Create a Docker Compose setup for a frontend–backend application
7. Scale a service using Docker Compose
8. Install Minikube or Kind for local Kubernetes setup
9. Deploy and scale a simple application on Kubernetes
10. Expose a service using NodePort
11. Deploy a multi-service (microservices) application on Kubernetes
12. Perform a rolling update and rollback
13. Use Helm to deploy a packaged application

TOTAL: 60 HOURS

TEXT BOOKS

- 1 Merkel, D. (2014). Docker: Lightweight Linux Containers for Consistent Development and Deployment.
- 2 Hightower, K., Burns, B., & Beda, J. (2017). Kubernetes: Up and Running. O'Reilly Media.

REFERENCE BOOKS

- 1 Mouat, A. (2015). *Using Docker*. O'Reilly Media.

CO, PO, PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14	PO 15	PSO 1	PSO 2
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CO2	3	-	-	-	-	-	-	1	1	-	1	-	-	-	-	-	2
CO3	3	-	-	-	-	1	-	2	-	-	1	-	-	-	-	-	-
CO4	3	-	1	-	-	-	-	-	2	-	-	-	-	-	-	-	-
CO5	3	-	1	-	-	3	-	-	-	-	-	-	-	-	-	1	-
Average	3	-	1	1	-	2	-	1.5	1.3	-	1	-	-	-	-	1	2

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

PREREQUISITE:

- Basic knowledge of Python programming
- Familiarity with data manipulation libraries such as Pandas and NumPy
- Understanding of fundamental data analytics concepts

COURSE OBJECTIVES (CO):

- Develop proficiency in data analytics tools and techniques using advanced spreadsheet functions, BI platforms (Power BI, Tableau), and statistical software.
- Apply data management, analysis, and visualization skills to derive actionable insights and support data-driven decision-making.
- Implement automation and reproducible workflows using Python and R to enhance efficiency and scalability in data analytics processes.

COURSE OUTCOMES (COs):

Upon completion of this course, the student will be able to:

COs	Course Outcomes	Blooms Level
CO1	Identify and select appropriate data analytics tools based on project requirements.	Understand
CO2	Perform advanced data manipulation and transformation using Excel and BI tools.	Apply
CO3	Create interactive dashboards and reports in Power BI and Tableau.	Analyze
CO4	Apply statistical and analytical techniques using data analytics software.	Apply
CO5	Automate data analysis workflows using Python, R, and tool integrations.	Create

UNIT I INTRODUCTION TO DATA ANALYTICS TOOLS

12 HOURS

Overview of analytics tools landscape - Importance of open-source and commercial tools - Introduction to Excel, Power BI, Tableau - Basics of tool selection based on problem type - Data import/export across tools

UNIT II ADVANCED SPREADSHEET TECHNIQUES FOR ANALYTICS 12 HOURS

Advanced Excel features: Pivot tables, Power Query, Power Pivot - Formulas and functions for data transformation -Data validation and error checking -Excel automation with macros and VBA basics

UNIT III DATA VISUALIZATION TOOLS 12 HOURS

Deep dive into Power BI and Tableau - Connecting to multiple data sources - Building interactive dashboards and reports - Visualization best practices in BI tools - Sharing and collaboration features

UNIT IV STATISTICAL AND ANALYTICAL TECHNIQUES USING TOOLS 12 HOURS

Descriptive and inferential statistics in Excel and Power BI - Data modeling basics - Forecasting and trend analysis - Using DAX in Power BI - Basic regression and correlation analysis

UNIT V INTRODUCTION TO AUTOMATION AND SCRIPTING FOR ANALYTICS 12 HOURS

Introduction to automation in analytics workflows - Using Python and R for automation - Integration with BI tools via APIs - Scheduling data refresh and reports - Introduction to Jupyter Notebooks and RStudio for analytics

TOTAL: 60 HOURS

LIST OF PROGRAMS

1. Import and explore datasets in Excel and Power BI
2. Perform basic data cleaning and transformation
3. Create simple charts and reports in Power BI
4. Build pivot tables and use Power Query for ETL
5. Write formulas for complex calculations
6. Create and run simple macros for automation
7. Create dashboards in Power BI and Tableau
8. Add slicers, filters, and interactive elements
9. Publish and share reports securely
10. Conduct statistical analysis with Excel and Power BI
11. Build simple predictive models and trend charts
12. Interpret and communicate statistical results
13. Automate data imports and refresh in Power BI
14. Write simple Python scripts to manipulate data
15. Use Jupyter Notebooks to combine code, visuals, and narrative

TOTAL: 60 HOURS

TEXT BOOKS

- 1 Provost, Foster, and Tom Fawcett. *Data Science for Business*. O'Reilly Media.
- 2 Shroff, Gautam. *The Intelligent Web: Search, Smart Algorithms, and Big Data*. Oxford University Press.
- 3 Winston, Wayne L. *Microsoft Excel Data Analysis and Business Modeling*. Microsoft Press.

REFERENCE BOOKS

- 1 Jones, Matt. *Learning Tableau*. Packt Publishing.
- 2 Collie, Rob, and Avichal Singh. *Power Pivot and Power BI*. Holy Macro! Books.

CO, PO, PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14	PO 15	PSO 1	PSO 2
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CO3	3	-	-	1	-	-	-	-	1	-	-	-	-	-	-	1	-
CO4	3	-	-	-	2	-	-	-	-	-	1	-	-	-	-	-	-
CO5	3	-	3	2	3	2	-	2	3	-	-	-	-	-	-	-	-
Average	3	-	3	1.7	2.7	1.7	-	2	2	1	1	-	-	-	-	1	2

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

PREREQUISITE:

- Good understanding of HTML5, CSS3, and JavaScript
- Basic knowledge of web development concepts (DOM, Events, Forms)
- Familiarity with browser debugging tools

COURSE OBJECTIVES (CO):

- This course introduces students to advanced frontend technologies and modern development workflows.
- Students will learn how to architect scalable frontend applications using JavaScript, ReactJS, Redux, Next.js, TypeScript, and Angular.
- Special emphasis is given to User Interface (UI) and User Experience (UX) principles, client – side API handling, component – based design, and modern tooling.

COURSE OUTCOMES (COs):

Upon completion of this course, the student will be able to:

COs	Course Outcomes	Blooms Level
CO1	Apply advanced JavaScript concepts including asynchronous programming, Canvas API, and module patterns.	Understand
CO2	Understand and apply UI/UX design principles to create user – centered applications.	Analyze
CO3	Build dynamic, scalable frontend applications using ReactJS and manage state efficiently with Redux.	Analyze
CO4	Create full – stack capable applications using Next.js with server – side rendering (SSR) and static generation (SSG).	Apply
CO5	Write robust, scalable frontend codebases with TypeScript and Develop modular, maintainable frontend applications using Angular framework.	Analyze

UNIT I: ADVANCED JAVASCRIPT

12 HOURS

ES6+ Features: let, const, arrow functions, destructuring, spread/rest – Advanced Functions: Closures, callbacks, promises, async/await – JavaScript Modules: import/export – Error Handling: try – catch – finally,

custom errors – Advanced Array Methods: map, filter, reduce, etc. – Event Loop and Asynchronous JavaScript – Fetch API and Basics of AJAX – Canvas API: Drawing shapes, simple animations using JavaScript

UNIT II: UI/UX DESIGN PRINCIPLES

12 HOURS

Introduction to UI and UX – Design Thinking Process – UX Research Methods: Personas, Journey Mapping – Visual Design Principles: CRAP model, Gestalt, Typography, Color Theory – Mind Mapping for UX – Wireframing with Figma – UI Designing with Figma

UNIT III: REACT JS AND REDUX

12 HOURS

Introduction to React and Virtual DOM – Setting up React Environment – • Components: Functional, Class, Props, State – Handling Events and Forms – React Hooks: useState, useEffect, useContext – Fetch API in React: Fetching and displaying data – React Router: Basic Routing Concepts – Introduction to Redux: Actions, Reducers, Store – React – Redux Integration.

UNIT IV: INTRODUCTION TO NEXT.JS

12 HOURS

What is Next.js? SSR, SSG, Static Export – Setting up Next.js Project – Pages and Routing (file – based, dynamic routes) – Data Fetching: getStaticProps, getServerSideProps, Client – side fetching – API Routes in Next.js – Deployment to Vercel

UNIT V: TYPESCRIPT AND ANGULAR BASICS

12 HOURS

Introduction to TypeScript – TypeScript Core Concepts: Types, Interfaces, Classes, Generics – Introduction to Angular: Architecture and Setup – Components and Templates – Data Binding Techniques – Directives and Services (Basics) – Routing in Angular Applications

TOTAL: 60 HOURS

LIST OF PROGRAMS

1. Create modules, Fetch data dynamically, Build a Canvas – based animation.
2. Program to fetch and display user data using Fetch API and async/await
3. Program to draw and animate a moving ball using Canvas API
4. Create Mind Maps, Wireframes, and High – Fidelity Screens using Figma
5. Create a User Persona and Journey Map in Figma for a sample app
6. Design a Login and Dashboard Wireframe/UI using Figma
7. Build React components, Fetch and display data, Navigate between routes, State Management with Redux
8. Create a Counter App using React Hooks (useState, useEffect)
9. Implement Redux for Counter State Management in React
10. Build a dynamic blog, Fetch posts, Create API routes, Deploy to Vercel
11. Create a Static Blog Page using getStaticProps in Next.js

12. Develop a Simple API Route in Next.js that returns JSON data
13. Write TypeScript code, Create Angular components, Implement basic routing
14. Implement a TypeScript Class and Interface for Employee Details
15. Create an Angular Component demonstrating Property and Event Binding

TOTAL: 60 HOURS

TEXT BOOKS:

- 1 Osmani, A. (2012). Learning JavaScript Design Patterns. O'Reilly Media.
- 2 Schwarzmüller, M. (n.d.). React – The Complete Guide [Course materials]. Udemy.
- 3 Russ, D. (2022). *Fullstack Next.js: Build Scalable Web Apps with React, TypeScript, and Tailwind*. Independently published.
- 4 Gothelf, J., & Seiden, J. (2013). *Lean UX: Applying Lean Principles to Improve User Experience*. O'Reilly Media.
- 5 Cherny, B. (2020). Programming TypeScript: Making Your JavaScript Applications Scale. O'Reilly Media.
- 6 Freeman, A., & Sanderson, P. (2022). Pro Angular: Build Powerful and Dynamic Web Apps with Angular. Apress.

WEBSITES:

- 1 MDN Web Docs.JavaScript, Fetch API, Canvas API. Mozilla. Retrieved from <https://developer.mozilla.org>
- 2 Figma Documentation. Retrieved from <https://www.figma.com>
- 3 Next.js Documentation. Retrieved from <https://nextjs.org>
- 4 Angular Official Guide. Retrieved from <https://angular.io>
- 5 TypeScript Documentation. Retrieved from <https://www.typescriptlang.org>

CO, PO, PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14	PO 15	PSO 1	PSO 2
CO1	3	-	1	-	1	-	-	-	1	1	1	-	-	-	-	-	-
CO2	3	-	-	1	-	-	-	-	-	-	1	-	-	-	-	2	-
CO3	3	-	1	-	-	1	-	1	1	-	-	-	-	-	-	-	3
CO4	3	-	1	1	-	-	-	2	2	-	-	-	-	-	-	-	-
CO5	3	-	3	2	3	2	-	3	3	-	-	-	-	-	-	-	-
Average	3	-	1.5	1.3	2	1.5	-	2	1.8	1	1	-	-	-	-	2	3

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

PREREQUISITE:

Not required

Course Objectives (CO):

- To train learners to crack competitive exams
- To enhance their ability to speak in English and face an interview.
- To make the student apply, prepare and clear the competitive exams.
- To prepare the student to concentrate, stay positive and confident.
- To take even failure at ease and continue the target of clearing competitive exams.

Course Outcomes (COs):

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

COs	Course Outcomes	Blooms Level
CO1	execute the grammatical elements in competitive exams	Apply
CO2	identify the various skills to build a strong outer relationship	Understand
CO3	analyse logical reasoning questions	Analyse
CO4	execute the process of sharing the general knowledge with use of proper communication	Apply
CO5	translate the correct structure of sentence from one language to other	Understand

UNIT I Grammar**8 HOURS**

Number-Subject, Verb and Agreement-Articles-Sequences of Tenses-Common Errors

UNIT II Word Power**7 HOURS**

Idioms and Phrases-One word substitution-Synonyms-Antonyms-Words often confused

UNIT III Paragraph**7 HOURS**

Expansion of an idea

UNIT IV Writing**7 HOURS**

Essay- Letters-Memos-Agenda-Resume writing

UNIT V Speaking**7 HOURS**

Public Speaking-Group Discussion-Interview-Spoken English

TOTAL:36 HOURS**TEXT BOOK**

1. Saraswathi,V. and Maya K. Mudbhatkal (2014). *English for Competitive Examinations*,Emerald: Chennai.

WEBSITES

1. <https://www.ef.com/wwen/english-resources/english-idioms/>
2. <https://www.talkenglish.com/speaking/listbasics.aspx>

CO, PO, PSO Mapping

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14	PO 15	PSO 1	PSO 2
CO1	-	-	3	-	-	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-
CO3	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Average		2.5	3	3	3	3	-	3	-	-	-	-	-	-	-	-	-

3-Strong; 2-Medium; 1-Low ‘-’ – No Corrections

PREREQUISITE:

Basic understanding of financial management principles.

COURSE OBJECTIVES(CO):

- To familiarize students with the concept of Investment Planning and its methods.
- To examine the scope and methods of Personal Tax Planning.
- To analyze Insurance Planning and its relevance.

COURSE OUTCOMES(COs):

Learners should be able to

COs	Course Outcomes	Blooms Level
CO1	Familiarize with regard to the concept of Investment Planning and its methods	Understand
CO2	Examine the scope and ways of Personal Tax Planning;	Analyze
CO3	Analyze Insurance Planning and its relevance	Analyze
CO4	Develop an insight in to retirement planning and its relevance.	Create
CO5	Construct an optimal portfolio in real life situations	Create

UNIT I INTRODUCTION TO FINANCIAL PLANNING**7 HOURS**

Financial goals, Time value of money, steps in financial planning, personal finance/loans, education loan, car loan & home loan schemes. Introduction to savings, benefits of savings, management of spending & financial discipline, Net banking and UPI, digital wallets, security and precautions against Ponzi schemes and online frauds such as phishing, credit card cloning, skimming.

UNIT II INVESTMENT PLANNING**7 HOURS**

Process and objectives of investment, Concept and measurement of return & risk for various assets class, Measurement of portfolio risk and return, Diversification & Portfolio formation. Gold Bond; Real estate; Investment in Greenfield and brownfield Projects; Investment in fixed income instruments- financial derivatives & Commodity market in India. Mutual fund schemes including SIP; International investment avenues.

UNIT III PERSONAL TAX PLANNING**7 HOURS**

Tax Structure in India for personal taxation, Scope of Personal tax planning, Exemptions and deductions available to individuals under different heads of income and gross total income, Special provision u/s 115BAC vis-à-vis General provisions of the Income-tax Act, 1961. Tax avoidance versus tax evasion.

UNIT IV INSURANCE PLANNING**7 HOURS**

Need for Protection planning. Risk of mortality, health, disability and property. Importance of Insurance: life and non-life insurance schemes. Deductions available under the Income-tax Act for premium paid for different policies.

UNIT V RETIREMENT BENEFITS PLANNING**8 HOURS**

Retirement Planning Goals, Process of retirement planning, Pension plans available in India, Reverse mortgage, New Pension Scheme. Exemption available under the Income-tax Act, 1961 for retirement benefits.

TOTAL: 36 HOURS**TEXT BOOKS:**

1. Indian Institute of Banking & Finance. (2017). *Introduction to Financial Planning*, Taxmann Publication., New Delhi.
2. Pandit, A. (2014). *The Only Financial Planning Book that You Will Ever Need*, Network Publications Ltd., Mumbai.

REFERENCE BOOKS:

1. Sinha, M. (2008). *Financial Planning: A Ready Reckoner*, McGraw Hill Education, New York.
2. Halan, M. (2018). *Let's Talk Money: You've Worked Hard for It, Now Make It Work for You*, Harper Collins Publishers, New York.
3. Tripathi, V. (2017). *Fundamentals of Investment*, Taxmann Publication, New Delhi.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	3	-	-	-	3	-	-	-	-	-	3	-	-	-	3	3	3
CO2	3	-	-	-	3	-	-	-	-	-	3	-	-	-	3	-	-
CO3	3	-	-	-	3	-	-	-	2	-	3	-	-	-	3	3	3
CO4	3	-	-	-	3	-	-	-	2	-	3	-	-	-	3	3	3
CO5	3	-	1	-		-	-	-	2	-	3	-	-	-	3	-	-
Average	3	-	1	-	3	-	-	-	2	-	3	-	-	-	3	3	3

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

PREREQUISITE:

Not Required

COURSE OBJECTIVES (CO):

- To understand the basic concepts of organizational behavior.
- To analyze the individual behavior traits required for performing as an individual or group.
- To obtain the perceiving skills to judge the situation and communicate the thoughts and ideas.
- To evaluate how to perform in group and team and how to manage the power, politics and conflict.
- To recognize the importance of organizational culture and organizational change, group and team work to managing the conflict between members of the organization

COURSE OUTCOMES (COs):

At the end of this course, students will be able to

COs	Course Outcomes	Blooms Level
CO1	Connect organizational behavior issues in the context of the organizational behavior theories and concepts.	Understand
CO2	Assess the behavior of the individuals and groups in organization and manage the stress.	Apply
CO3	Categorize team, power, politics and conflict arising between the members.	Analyze
CO4	Explain how organizational change and culture affect the working relationship within organizations.	Evaluate
CO5	Plan and exhibit the communications skills to convey the thoughts and ideas of case analysis to the individuals and group.	Analyze

UNIT I ORGANIZATION BEHAVIOR : INTRODUCTION**7 HOURS**

Organization Behavior: Meaning and definition - Fundamental concepts of Organization Behavior - Contributing disciplines to the Organization Behavior field – Organization Behavior Model - Significance of Organization Behavior in the organization success - Challenges and Opportunities for Organization Behavior.

UNIT II BEHAVIOUR AND PERSONALITY**7 HOURS**

Attitudes – Sources - Types - Functions of Attitudes – Attitude and Job satisfaction, Emotions and Moods – Emotional Intelligence – Organization Behavior Applications of Emotions and Moods, Learning – Theories of Learning. Personality – Determinants of personality- Theories of Personality - psycho-analytical, social learning, job-fit, and trait theories.

UNIT III PERCEPTION**7 HOURS**

Perception – factors influencing perception - Person Perception – Attribution Theory – Frequently Used Shortcuts in Judging Others- Perceptual Process- Perceptual Selectivity - Organization Errors of perception – Linkage between perception and Decision making.

UNIT IV GROUP AND STRESS MANAGEMENT**7 HOURS**

Foundation of Group Behavior - Concept of Group - Types of Groups - Stages of Group Development - Group Norms - Group Cohesiveness – Stress- Causes of Stress- Effects of Occupational stress- Coping strategies for stress.

UNIT V ORGANIZATION CULTURE AND CHANGE AND STRESS MANAGEMENT**8****HOURS**

Organizational culture- Definitions and Characteristics of Culture- Types of Culture – Creating and Maintaining an Organizational Culture. Organizational change –Meaning- Forces for Change- Managing Planned Change - Factors in Organizational Change - Resistance to change- Overcoming resistance to change.

TOTAL: 36 HOURS**TEXT BOOKS:**

1. Fred Luthans. (2017). *Organizational Behavior: An Evidence - Based Approach*, 12th Edition, Mcgraw Hill Education, New Delhi.
2. Steven Mcshane and Mary Ann Von Glinow (2017), *Organizational Behavior*, 6th Edition, McGraw Hill Education, New Delhi
3. Robbins,S. P, and Judge,T.A.(2016). *Organizational Behaviour*, 16th edition, Prentice Hall of India, New Delhi

REFERENCE BOOKS:

1. Laurie J. Mullins (2016). *Management and Organisational behaviour*, 10th Edition, Pearson Education, New Delhi
2. Robbins,S. P, and Judge,T.A.(2016). *Essentials of Organizational Behavior*,13th Edition, Pearson Education

WEB SITES:

<https://nptel.ac.in/courses/110/105/110105033/>

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	2	-
Average	-	-	2	3	2		3	-	-	-	-	-	-	-	-	2.5	-

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

PREREQUISITE:

Not Required

COURSE OBJECTIVES (CO):

- To enable the understanding of RPA and the types of variables.
- To create expertism in handling the User Events and various types of Exceptions and strategies.
- To demonstrate the Deployment of the Robot and to maintain the connection.

COURSE OUTCOMES (COs):

Upon completion of this course, the student will be able to:

COs	Course Outcomes	Blooms Level
CO1	Explain the RPA and the ability to differentiate it from other types of automation.	Understand
CO2	Analyze the different types of variables, Control Flow and data manipulation techniques.	Analyze
CO3	Summarize Image, Text and Data Tables Automation.	Understand
CO4	Evaluate the User Events and its types of Exceptions and strategies.	Evaluate
CO5	Illustrate the deployment of the robot and to maintain the connection.	Apply

UNIT I INTRODUCTION TO ROBOTIC PROCESS AUTOMATION**8 HOURS**

Scope and techniques of automation, Robotic process automation - What can RPA do?, Benefits of RPA, Components of RPA, RPA platforms, The future of automation. RPA Basics: History of Automation - What is RPA - RPA vs Automation - Processes & Flowcharts - Programming Constructs in RPA - What Processes can be Automated - Types of Bots - Workloads which can be automated - RPA Advanced Concepts - Standardization of processes - RPA Development methodologies - Difference from SDLC - Robotic control flow architecture - RPA business case - RPA Team - Process Design Document/Solution Design Document – Industries best suited for RPA - Risks & Challenges with RPA - RPA and emerging ecosystem.

UNIT II RPA TOOL INTRODUCTION AND BASICS

7 HOURS

Introduction -The User Interface - Variables - Managing Variables - Naming Best Practices - The Variables Panel - Generic Value Variables - Text Variables True or False Variables - Number Variables - Array Variables - Date and Time Variables Data Table Variables - Managing Arguments - Naming Best Practices - The Arguments Panel - Using Arguments - About Imported Namespaces - Importing New Namespaces- Control Flow - Control Flow Introduction - If Else Statements - Loops - Advanced Control Flow - Sequences - Flowcharts - About Control Flow - Control Flow Activities - The Assign Activity - The Delay Activity - The Do While Activity - The If Activity - The Switch Activity - The While Activity - The For Each Activity - The Break Activity - Data Manipulation- Data Manipulation Introduction - Scalar variables, collections and Tables -Text Manipulation - Data Manipulation - Gathering and Assembling Data

UNIT III ADVANCED AUTOMATION CONCEPTS & TECHNIQUES

7 HOURS

Recording Introduction - Basic and Desktop Recording - Web Recording - Input/Output Methods - Screen Scraping - Data Scraping - Scraping advanced techniques - Selectors - Defining and Assessing Selectors - Customization - Debugging - Dynamic Selectors - Partial Selectors - RPA Challenge - Image, Text & Advanced Citrix Automation - Introduction to Image & Text Automation - Image based automation - Keyboard based automation - Information Retrieval - Advanced Citrix Automation challenges - Best Practices - Using tab for Images - Starting Apps - Excel DataTables & PDF - Data Tables in RPA - Excel and Data Table basics - Data Manipulation in excel – Extracting Data from PDF - Extracting a single piece of data - Anchors - Using anchors in PDF.

UNIT IV HANDLING USER EVENTS & ASSISTANT BOTS, EXCEPTION HANDLING

7 HOURS

What are assistant bots? - Monitoring system event triggers - Hotkey trigger - Mouse trigger - System trigger - Monitoring image and element triggers - An example of monitoring email - Example of monitoring a copying event and blocking it - Launching an assistant bot on a keyboard event.

Exception Handling -Debugging and Exception Handling - Debugging Tools - Strategies for solving issues - Catching errors.

UNIT V - DEPLOYING AND MAINTAINING THE BOT

7 HOURS

Publishing using publish utility - Creation of Server - Using Server to control the bots - Creating a provision Robotfrom the Server - Connecting a Robot to Server - Deploy the Robot to Server - Publishing and managing updates - Managing packages - Uploading packages - Deleting packages.

TOTAL: 36 HOURS

TEXT BOOKS:

1. Alok Mani Tripathi. (2018). *Learning Robotic Process Automation*, Packt Publishing.
2. Frank Casale , Rebecca Dilla, Heidi Jaynes , Lauren Livingston.(2015). *Introduction to Robotic Process Automation:a Primer*, Institute of Robotic Process Automation,1st Edition.
3. Richard Murdoch. (2018). *Robotic Process Automation: Guide to Building Software Robots, Automate Repetitive Tasks & Become an RPA Consultant*, Independently Published, 1st Edition.

REFERENCE BOOKS:

1. Srikanth Merinda. (2018). *Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation*, Consulting Opportunity Holdings LLC, 1st Edition.
2. Lim Mei Ying. (2018). *Robotic Process Automation with Blue Prism Quick Start Guide: Create software robots and automate business processes*, Packt Publishing, 1st Edition.

WEBSITE LINKS:

1. <https://www.uipath.com/rpa/robotic-process-automation>
2. <https://www.academy.uipath.com>

CO, PO, PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14	PO 15	PSO 1	PSO 2
CO1	3	-	-	-		2	-	-	2	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	3	-	-	3	-	-	-	-	-	-	-	-
CO3	-	-	-	3	-	-	2	-	3	-	-	-	-	-	-	-	-
CO4	2	2	-	-	-	-	2	1	2	-	-	-	-	-	-	-	-
CO5	-	2	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Average	2.5	2	1	2.5	-	2.5	2	1	2.5	-							

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

PREREQUISITE:

- Basics of Cyber Security.

COURSE OBJECTIVES (CO):

- To understand about computer forensics and investigations.
- To know about digital evidence, e-mail investigation, and Mobile device forensics.
- To analyse and validate forensics data.

COURSE OUTCOMES (COs):

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

COs	Course Outcomes	Blooms Level
CO1	Explain various investigation procedures and summarize duplication of digital evidence.	Evaluate
CO2	Apply the knowledge of digital evidences.	Apply
CO3	Design and develop various forensics tools and analyse the network forensics.	Analyze
CO4	Determine the systematic study of high-tech forensics	Evaluate
CO5	Analyze and validate digital evidence data	Analyze

UNIT I COMPUTER FORENSICS AND INVESTIGATIONS**7 HOURS**

Computer forensics and investigations as a profession – Preparing for computer investigations – Taking a systematic approach–Procedures for corporate high-tech investigations–Data recovery work stations and software– Conducting an investigation.

UNIT II DATA ACQUISITION**7 HOURS**

Data acquisition – Storage formats for digital evidence – Validating data acquisitions – Processing crime and incident scenes–Identifying digital evidence–Collecting evidence in private sector incident scenes – Preparing for search-seizing digital evidence at the scene-storing digital evidence –Reviewing a case.

UNIT III COMPUTER FORENSICS TOOLS**7 HOURS**

Current computer forensics tools–Software tools–Hardware tools–The Macintosh file structure and boot process – Computer forensics analysis and validation – Addressing data –Hiding techniques.

UNIT IV NETWORK FORENSICS**7 HOURS**

Virtual machines – Network forensics – Developing standard procedures – Live acquisitions – email investigations – Investigating e-mail crimes and violations – Understanding e-mail servers – Cell phone and mobile device forensics.

UNIT V MOBILE DEVICE FORENSICS**8 HOURS**

Understanding mobile device forensics – Acquisition procedures –Report writing for high-tech investigations – Importance of reports – Guidelines for writing reports –Expert testimony in high-tech investigations.

TOTAL:36 HOURS**TEXT BOOKS:**

1. Bill Nelson, Amelia Phillips and Christopher Steuart,(2018). *Computer Forensics and Investigations*, Cengage Learning, 5th Edition.
2. Eoghan Casey. (2017). *Handbook of Digital Forensics and Investigation*, 1st Edition, Academic Press.
3. John R Vacca, (2016). *Computer Forensics*, 2nd Edition, Cengage Learning.

REFERENCE BOOKS:

1. John R. Vacca, (2005), *Computer Forensics: Computer Crime Scene Investigation*, 2nd Edition Cengage Learning.
2. Marjie T Britz, (2008), *Computer Forensics and Cyber Crime: An Introduction*, 2nd Edition, Pearson Education.
3. Mari E-Helen Maras, (2014). *Computer Forensics: Cybercriminals, Laws, and Evidence*, 2nd Edition Jones & Bartlett Learning.

WEBSITES:

1. www.cps.brockport.edu/~shen/cps301/figures/figure1.pdf
2. www.forensicsguru.com/devicedataextractionsimcell.php
3. www.nptel.ac.in/courses/106101060
4. www.samsclass.info/121/ppt/ch11.ppt
5. www.garykessler.net/library/role_of_computer_forensics.html

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	-	-	3	-	-	-	-	-	-	-	2	-	-	-	-	2	-
CO2	-	-	3	-	1	-	-	-	-	-	-	-	-	-	-	-	2
CO3	3	-	-	-	-	1	2	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-
CO5	3	-	3	-	-	-	-	-	-	-	2	-	-	-	-	-	-
Average	3	-	3	-	1	1	2	-	-	-	2	-	-	-	-	2	2

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

PREREQUISITE:

- Algebra, Probability and Statistics, Digital Communication, Programming Skills.

COURSE OBJECTIVES (CO):

- To understand the communication channels and the importance of error correction.
- To explore the linear codes, self-orthogonal codes, and self-dual codes.
- To learn about the cyclic codes, their properties, and decoding methods.

COURSE OUTCOMES (COs):

Upon completion of this course, the student will be able to:

COs	Course Outcomes	Blooms Level
CO1	Understand the fundamental concepts of error detection, correction, and decoding in communication channels.	Understand
CO2	Apply the concepts of generator matrix and parity check matrix in encoding and decoding linear codes.	Apply
CO3	Analyze different types of codes, including Binary and q-ary Hamming codes, Golay codes, and MDS codes, for their error-correcting capabilities.	Analyze
CO4	Understand the definitions and properties of cyclic codes.	Understand
CO5	Apply BCH codes and Reed Solomon codes to various coding problems.	Apply

UNIT I ERROR DETECTION, CORRECTION AND DECODING**7 HOURS**

Communication channels – Maximum likelihood decoding – Hamming distance – Nearest neighbourhood minimum distance decoding – Distance of a code.

UNIT II LINEAR CODES**7 HOURS**

Linear codes – Self orthogonal codes – Self dual codes – Bases for linear codes – Generator matrix and parity check matrix – Encoding with a linear code – Decoding of linear codes – Syndrome decoding.

UNIT III BOUNDS IN CODING THEORY**8 HOURS**

The main coding theory problem – lower bounds - Sphere covering bound – Gilbert Varshamov bound – Binary Hamming codes – q-ary Hamming codes – Golay codes – Singleton bound and MDS codes – Plotkin bound.

UNIT IV CYCLIC CODES**7 HOURS**

Definitions – Generator polynomials – Generator matrix and parity check matrix – Decoding of Cyclic codes.

UNIT V SPECIAL CYCLIC CODES**7 HOURS**

BCH codes – Parameters of BCH codes – Decoding of BCH codes – Reed Solomon codes.

TOTAL: 36 HOURS**TEXT BOOKS:**

1. Hill, H. (1986). *A first course in Coding theory*, OUP.
2. San Ling and Chaping Xing, (2004). *Coding Theory: A first course*, Cambridge University Press.

REFERENCE BOOKS:

1. Berlekamp, E.R. (1968). *Algebraic Coding Theory*, Mc Graw – Hill.
2. Lin, S. and Costello, D. J. (1983). *Error control Coding: Fundamentals and Applications*, Prentice – Hall, Inc., New Jersey.
3. Vera Pless, (1982). *Introduction to the Theory of Error Correcting Codes*, Wiley, New York.

WEBSITES:

1. <https://nptel.ac.in/courses/108104092>
2. <https://nptel.ac.in/courses/117106031>

CO, PO, PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PO 13	PO 14	PO 15	PSO 1	PSO 2
CO1	2	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1
CO2	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1
CO3	2	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1
CO4	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
CO5	3	2	1	-	-	-	1	-	-	-	-	-	-	-	-	-	1
Average	2.4	1.4	1	-	-	-	1	-	-	-	-	-	-	-	-	-	1

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

PREREQUISITE:

Not Required

COURSE OBJECTIVES (CO):

- To create awareness about types and handling of domestic appliances
- To acquire knowledge about principle of operation, working and application of various domestic appliances.
- To gain the skills in assembly, repair, installation, testing and maintenance of domestic appliances.
- To acquire skills in entrepreneurship

COURSE OUTCOMES (COs):

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

COs	Course Outcomes	Blooms Level
CO1	Repair maintenance of the basic electrical and electronics appliances	Apply
CO2	Identification to protective devices	Understand
CO3	Repair and maintenance of the split Vacuum Cleaner and washing machine	Analysis
CO4	Repair and maintenance of the electric fan & hair drier	Apply
CO5	Acquire knowledge about tools, equipment and Instruments	Understand

UNIT I INSTRUMENTS AND TESTING**8 HOURS**

Introduction – voltage tester screwdriver – continuing test – insulation test – measurement of power for dc & ac circuits. **Electrical Cooking Appliances** introduction – types – construction – electric toaster – types – automatic and non-automatic. **Electric Iron Box** types – non-automatic – automatic – construction and working – comparison – trouble shooting – Steam iron box.

UNIT II WATER HEATERS & COFFEE MAKERS**7 HOURS**

Water heater – function – types – electric kettle – immersion water heater – construction and working – storage water heaters – non pressure type – pressure type – construction and working – repairs & remedies – coffee maker – types – construction and working of percolator type.

UNIT III ELECTRIC MIXER & EGG BEATERS**7 HOURS**

Electric maker – function and its construction – general operating instruction – caution – cleaning – repairs and remedies – egg beaters – hand operated crank type – electric type and its construction.

UNIT IV VACUUM CLEANER AND WASHING MACHINE**7 HOURS**

Vacuum cleaner – function – principle – main components – features – types - working – accessories - filters – repairing. washing machine – function – types – semi and fully automatic – top and front loading – washing technique – working cycle – construction and working of washing machine – comparison of top and front-loading machines – problems and remedies.

UNIT V ELECTRIC FAN & HAIR DRIER**7 HOURS**

Fan – function – terminology – construction and working of ceiling & table fans –exhaust fan – general fault and remedy. hair drier – function – types – construction and working – safety features – repairs & remedies.

TOTAL:36 HOURS**TEXT BOOKS:**

1. *Electrical Practical, Directorate General of employment & training (DGET),(2018)* .Arihant Publisher.
2. *Handbook of Repair and Maintenance of Domestic Electronics Appliances handbook* By Shashi Bhushan Sinha, BPB Publications.

REFERENCE BOOKS:

1. Dixon and Graham, *Electrical Appliance Manual–Hardcover*, ISBN 13: 9781859608005.
2. Graham and Dixon, (1995). *Electrical Appliances: The Complete Guide to the Maintenance and Repair of Domestic Electrical Appliances* (Haynes for Home DIY S.).
3. Shashi Bhushan Sinha, *Handbook of Repair and Maintenance of Domestic Electronics Appliances*.

WEBSITES:

1. <https://alison.com/courses?query=Electrical%20Appliance%20and%20Servicings#>.
2. <https://www.scribd.com/document/269725441/Electrical-Appliances-PDF>.
3. <https://www.unitec.ac.nz/career-and-study-options/electrical-and-electronics-engineering/electrical-appliance-serviceperson-eas>.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	-	-	3	-	-	-	-	-	1	-	2	-	2	-	-	2	-
CO2	-	-	3	-	1	-	-	-	1	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	1	2	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-		2	-	-	-	-	-	2	-	-	-	2
CO5	3	-	3	-	-	-	-	-	-	-	2	-	-	-	-	-	-
Average	3	-	3	-	1	1	2	-	1	-	2	-	2	-	-	2	2

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

25CHPOE301

INDUSTRIAL CHEMISTRY

Instruction Hours/week: L: 3 T: 0 P: 0

Marks: Internal: 40 External: 60 Total: 100

External Semester Exam: 3 Hours

PREREQUISITE:

Not Required

COURSE OBJECTIVES:

- To gain the comprehensive process of cane sugar and paint production.
- To understand the physical and chemical properties, characteristics, and the manufacturing processes of glass and cement.
- To acquire the knowledge of rubber fabrication.

COURSE OUTCOMES (CO's):

Upon completion of this course, the student will be able to:

COs	Course Outcomes	Blooms Level
CO1	Illustrate comprehensive process of cane sugar production.	Understand
CO2	Apply the knowledge of paint classification, constituents and diverse applications.	Apply
CO3	Examine the physical and chemical properties of glass.	Analyze
CO4	Analyze the manufacturing processes of cement, including the wet and dry processes,	Analyze
CO5	Explain the rubber fabrication, including refining processes, fabrication methods, and vulcanization techniques.	Evaluate

UNIT I SUGAR**8 HOURS**

Introduction, Manufacture of Cane Sugar - Extraction of juice, Purification of Juice, Defecation, Sulphitation, Carbonation, Concentration or Evaporation. Crystallization -Separation of crystals, drying, refining, recovery of sugar from Molasses, Bagasse. Manufacture of sucrose from beet root. Estimation of sugar, double sulphitation process, double carbonation.

UNIT II PAINTS**8 HOURS**

Classification, constituents, setting of paints, requirements of a good paint. Emulsion, Latex, Luminescent, Fire retardant and Heat resistant paints. Methods of applying paints. Special applications and failures of paint. Varnishes - Introduction – Raw materials – Manufacture of varnishes.

UNIT III GLASS**8 HOURS**

Introduction, Physical/Chemical properties, Characteristics of glass. Raw materials, methods of manufacture - formation of batch material, melting, shaping, annealing and finishing of glass.

UNIT IV CEMENT**6 HOURS**

Introduction, raw materials, manufacture – Wet process, Dry process, reactions in kiln, setting of cement, properties and uses of cement. Plaster of Paris, Gypsum, Lime.

UNIT V RUBBER**6 HOURS**

Introduction, Importance, types and properties of rubber. Refining of crude rubber, drawbacks of raw rubber. Rubber fabrication, vulcanization techniques.

TOTAL: 36 HOURS**TEXT BOOKS:**

1. Sharma, B.K. (2014). *Industrial Chemistry*, 14th Edition, Meerut: Goel Publishing House.
2. Vermani, O.P and Narula, A.K. (2016). *Industrial Chemistry*. Delhi:Galgotia Publications Pvt Ltd.

REFERENCE BOOK:

1. Jain, P.C. and Monika Jain. (2016). *Engineering Chemistry*, 16th Edition, New Delhi: Dhanpat Rai Publishing Co. (Pvt) Ltd.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	3	-	-	2	-	-	-	-	2	-	1	-	-	2	-	2	-
CO2	3	-	-	2	-	-	-	-	2	-	1	-	-	-	-	2	-
CO3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO4	-	-	-	2	-	-	-	-	2	-	1	-	-	1	-	3	-
CO5	2	-	-	2	-	-	-	-	2	-	1	-	-	1	-	2	-
Average	2.5	-	-	2	-	-	-	-	2	-	1	-	-	1.3	-	2.4	-

1-Low, 2-Medium, 3-High, '-' - No Correlation

PREREQUISITE:

Not required

COURSE OBJECTIVES (CO):

- To study the use of microorganisms in the manufacture of food or industrial products on the basis of employment.
- To gain knowledge on design of bioreactors, factors affecting growth and production, heat transfer and oxygen transfer
- To understand the rationale in medium formulation; design for microbial fermentation, and sterilization of medium and air.

COURSE OUTCOMES (COs):

Upon completion of this course students will be able to

COs	Course Outcomes	Blooms Level
CO1	Acquire knowledge in the production of industrial product, and gain knowledge in fermentation components and types	Understand
CO2	Isolate, preserve the microbes for fermentation upstream processes	Apply
CO3	Apply techniques for microbial production of various enzymes	Apply
CO4	Experiment with production of organic acids and beverages	Apply
CO5	Practice the techniques for the production of amino acids, vitamins and single cell proteins	Apply

UNIT I BASICS OF FERMENTATION PROCESSES**7 HOURS**

Definition, scope, history, and chronological development of the fermentation industry. Component parts of the fermentation process. Component parts of fermentation process. Microbial growth kinetics, batch and continuous, direct, dual or multiple fermentations; scale up of fermentation, comparison of batch and continuous culture as investigative tools, examples of the use of fed batch culture.

UNIT II ISOLATION AND PRESERVATION**7 HOURS**

Isolation, preservation, and strain improvement of industrially important microorganisms. Use of recombination system (Parasexual cycle, protoplast fusion techniques), application of recombinant strains, and the development of new fermentation products.

UNIT III SCREENING AND INOCULUM DEVELOPMENT**7 HOURS**

Screening (primary and secondary screening); detection and assay of fermentation products (Physico-chemical assay, biological assays). Inoculum development, criteria for transfer of inoculum, development of inoculum: Bacteria, Fungi and Yeast.

UNIT IV MICROBIAL PRODUCTION**7 HOURS**

Fermentation type reactions (Alcoholic, bacterial, mixed acid, propionic acid, butanediol and acetone-butanol). Microbial production of enzymes (amylases, Proteases, cellulases) primary screening for producers, large scale production. Immobilization methods.

UNIT V ALCOHOLS AND BEVERAGES**8 HOURS**

Fermentative production of industrial alcohol, production of beverages. Production of organic acids: citric acid, amino acids: glutamic acid, production of vitamins. fungal enzymes and Single cell protein.

TOTAL: 36 HOURS**TEXT BOOKS:**

1. Sridhar, S. (2010). *Industrial Microbiology*, Dominant Publishers, New Delhi.
2. Tanuja. S and Purohit, S.S. (2008). *Fermentation Technology*, Agrobios Publication, Jodhpur, India.
3. Harider, S.I. and Ashok, A. (2009). *Biotechnology, A Comprehensive Training Guide for the Biotechnology Industry*, CRC Press, New York.

REFERENCE BOOKS:

1. Casida, L.E. (2007). *Industrial microbiology*, New age international (P) Ltd., New Delhi.
2. Clark, D.P and Pazdernik, N.J. (2009). *Biotechnology applying the genetic revolution*, Elsevier Academic Press, UK.
3. Glazer, A and Nikaido. (1995). *Microbial biotechnology fundamentals of applied microbiology*, W. H. Freeman and company, USA.
4. Glick, B.R and Pasternak, J.J. (2003). *Molecular Biotechnology Principles and Applications of Recombinant DNA*, 3rd edition, ASM Press, USA.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
CO3	2	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	3
CO4	-	-	-	2	-	2	-	3	-	-	2	-	-	-	-	-	3
CO5	-	-	-	2	-	2	-	3	-	-	2	-	-	-	2	-	3
Average	2.7	-	-	2	-	2	-	3	-	-	2	-	-	-	2	-	3

1 - Low, 2 - Medium, 3 - High, '-' - No Correlation

PREREQUISITE:

Student should know about basics of food, its nutrients and their relationship to health

COURSE OBJECTIVES (CO)

The main objectives of the course are

- To understand the fundamentals of food, nutrients and their relationship to health
- To respect to deriving maximum benefit from available food resources
- To understand of the consequences of vitamin and mineral deficiency/excess of vitamin
- To learn about the nutrition in adult age
- To develop knowledge on nutrition deficiency diseases and their consequences
- To know about food adulteration and prevention of food adulteration

COURSE OUTCOMES (COs)

On completion of the course, students are able to

COs	Course Outcomes	Blooms Level
CO1	Name the fundamentals of nutrition and their relationship to health	Remember
CO2	Learn to derive maximum benefits from available food resources	Understand
CO3	Identify the consequences of vitamin and mineral deficiency/excess of vitamin	Apply
CO4	Analyze the importance of nutrition in adult age	Analyze
CO5	Assess about nutrition deficiency diseases and their consequences	Evaluate

UNIT I BASIC CONCEPTS IN FOOD AND NUTRITION**5 HOURS**

Understanding relationship between food, nutrition and health, Functions of food-Physiological, psychological and social. Dietary guidelines for Indians and food pyramid

UNIT II NUTRIENTS**5 HOURS**

Functions, dietary sources and clinical manifestations of deficiency/ excess of the following nutrients: Carbohydrates, lipids and proteins, Fat soluble vitamins-A, D, E and K, Water soluble vitamins – thiamin, riboflavin, niacin, pyridoxine, folate, vitamin B12 and vitamin C, Minerals – calcium, iron and iodine

UNIT III NUTRITION DURING THE ADULT YEARS**10 HOURS**

Physiological changes, RDA, nutritional guidelines, nutritional concerns and healthy food choices - Adult, Pregnant woman, Lactating mother, Elderly. Nutrition during childhood -Growth and development, nutritional guidelines, nutritional concerns and healthy food choices -Infants, Preschool children, School children, Adolescents. Nutritional needs of nursing mothers and infants, determinants of birth weight and consequences of low birth weight, Breast feeding, Assessment and management of moderate and severe malnutrition among children, Child health and morbidity, neonatal, infant and child mortality

UNIT IV INTRODUCTION TO NUTRITIONAL DEFICIENCY DISEASES**6 HOURS**

Causes, symptoms, treatment, prevention of the following: Protein Energy Malnutrition (PEM), Vitamin A Deficiency (VAD), Iron Deficiency Anemia (IDA), Iodine Deficiency Disorders (IDD), Zinc Deficiency, Flurosis Nutritional needs during pregnancy, common disorders of pregnancy (Anemia, HIV infection, Pregnancy induced hypertension), relationship between maternal diet and birth. Maternal health and nutritional status, maternal mortality and issues relating to maternal health.

UNIT V DIETETICS**10 HOURS**

Dietary and stress management. Dietary recommendations of WHO. Diet for diabetes mellitus-Nutrition recommendations for patient with diabetes, Meal planning, Diet for Cardiovascular Diseases -Dietary management and general guidelines for coronary heart disease, Diet for cancers at various sites in the human body, diet therapy, managing eating problems during treatment. Hormonal imbalance - Poly cystic ovarian syndrome, causes of hormonal imbalance. Diet management.

TOTAL : 36 HOURS**TEXT BOOKS:**

1. Srilakshmi.B. (2015) Food Science:. New Age International (P) Ltd. Publishers. 6nd Edition., New Delhi
2. Swaminathan.M. (2008). Essential of Food and Nutrition Vol II The Bangalore Printing and Publishing Co. Ltd., Bangalore.

REFERENCE BOOKS:

1. Garrow,J.S., and James, W.P.T.,(2000). *Human Nutrition & Dietetics*, Longman Group, UK.
2. Gordon M, Wardlaw and Paul M. (2012). *Perspectives in Nutrition*: U.S.A. McGraw Hill Publishers. 9rd Edition. New Delhi
3. Sharma, R (2004). *Diet Management*,3rdEdition, Reed Elsevier India Private Limited, Chennai.
4. Srilakshmi.B. (2014). Nutrition Science, 4th Edition, New Age International (P) Ltd. Publishers. New Delhi.

CO, PO, PSO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PO14	PO15	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	2	2	-	2	2	2	-	2	2	-	2
CO2	3	-	-	-	-	-	-	2	2	-	2	2	2	-	2	2	-	2
CO3	3	-	-	-	-	-	-	2	2	-	2	2	2	-	2	2	-	2
CO4	3	-	-	-	-	-	-	2	2	-	2	2	2	-	2	2	-	2
CO5	3	-	-	-	-	-	-	2	2	-	2	2	2	-	2	2	-	2
Avg	3	-	-	-	-	-	-	2	2	-	2	2	2	-	2	2	-	2

1-Low; 2-Medium; 3-Strong; '-' No correlation