

*Regulations 2025*  
*Curriculum and Syllabi*  
*(As approved by the 24<sup>th</sup> Academic Council)*  
*August - 2025*

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**M.C.A.**  
**(Master of Computer Applications)**



**REGULATIONS 2025**

**CURRICULUM AND SYLLABI (I & II SEMESTERS)**

**(As approved by 24<sup>th</sup> Academic Council)**

**August – 2025**

**M.C.A.**

**MASTER OF COMPUTER APPLICATIONS**

## **VISION AND MISSION OF THE INSTITUTION**

### **VISION**

B.S. Abdur Rahman Crescent Institute of Science and Technology aspires to be a leader in Education, Training and Research in multidisciplinary areas of importance and to play a vital role in the Socio–Economic progress of the Country in a sustainable manner.

### **MISSION**

- To blossom into an internationally renowned Institute.
- To empower the youth through quality and value–based education.
- To promote professional leadership and entrepreneurship.
- To achieve excellence in all its endeavors to face global challenges.
- To provide excellent teaching and research ambience.
- To network with global Institutions of Excellence, Business, Industry and Research Organizations.
- To contribute to the knowledge base through Scientific enquiry, Applied Research and Innovation.

## **VISION AND MISSION**

### **DEPARTMENT OF COMPUTER APPLICATIONS**

#### **VISION**

Aspires to provide quality education in the field of computer applications with state-of-the-art computational facilities and undertake quality research in collaboration with industries and universities to produce committed professionals and academicians to meet the needs of the industries and society.

#### **MISSION**

The Department of Computer Applications, endeavours

- To disseminate knowledge through education and training of graduates in the field of computer applications.
- To focus on teaching – learning, research and consultancy to promote excellence in computer applications.
- To foster graduates with opportunities required to explore, create and face challenges of IT related industries.
- To equip the graduates with the necessary skills in communication, team work and leadership qualities to meet the needs of the IT related sector globally.
- To disseminate the outcome of projects and research work undertaken by the department through appropriate measures for the benefit of society and industry.

## PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

The **Programme Educational Objectives** of MCA (Master of Computer Applications) are listed below:

The Graduates of Computer Applications will

- PEO1.** Exhibit solid foundation in mathematics and computing fundamentals required to analyze and solve computing problems and to pursue research and higher studies.
- PEO2.** Demonstrate technical expertise in various programming languages and the capability to comprehend, analyze, design and create innovative computing solutions for real time problems.
- PEO3.** Possess the ability required for a promising career in IT and reflect an urge for self-learning; engage in lifelong learning to improve their personality, excellence and leadership qualities.
- PEO4.** Communicate effectively, reflect the technical and innovative skills required to meet the dynamic needs of the industry and society.

## PROGRAMME OUTCOMES (POs)

The programme outcomes of MCA describe the acquirement of students as they progress through the programme.

- PO 1.** (Foundation Knowledge): Apply knowledge of mathematics, programming logic and coding fundamentals for solution architecture and problem solving.
- PO 2.** (Problem Analysis): Identify, review, formulate and analyse problems for primarily focusing on customer requirements using critical thinking frameworks.
- PO 3.** (Development of Solutions): Design, develop and investigate problems with as an innovative approach for solutions incorporating ESG/SDG goals.
- PO 4.** (Modern Tool Usage): Select, adapt and apply modern computational tools such as development of algorithms with an understanding of the limitations including human biases.

- PO 5.** (Individual and Teamwork): Function and communicate effectively as an individual or a team leader in diverse and multidisciplinary groups. Use methodologies such as agile.
- PO 6.** (Project Management and Finance): Use the principles of project management such as scheduling, work breakdown structure and be conversant with the principles of Finance for profitable project management.
- PO 7.** (Ethics): Commit to professional ethics in managing software projects with financial aspects. Learn to use new technologies for cyber security and insulate customers from malware
- PO 8.** (Life-long learning): Change management skills and the ability to learn, keep up with contemporary technologies and ways of working.

**B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE AND  
TECHNOLOGY, CHENNAI – 600 048.**

**REGULATIONS 2025**

**M.Tech. / MCA / M.Sc. / M.Com. / M.A. DEGREE PROGRAMMES**

***(Under Choice Based Credit System)***

**1.0 PRELIMINARY DEFINITIONS AND NOMENCLATURE**

In these Regulations, unless the context otherwise requires:

- i) "**Programme**" means post graduate degree programme (M.Tech. / MCA / M.Sc. / M.Com. / M.A.)
- ii) "**Branch**" means specialization or discipline of programme like M.Tech. in Structural Engineering, Food Biotechnology etc., M.Sc. in Physics, Chemistry, Actuarial Science, Biotechnology etc.
- iii) "**Course**" means a theory / practical / laboratory integrated theory / mini project / seminar / internship / project and any other subject that is normally studied in a semester like Advanced Concrete Technology, Electro Optic Systems, Financial Reporting and Accounting, Analytical Chemistry, etc.
- iv) "**Institution**" means B.S. Abdur Rahman Crescent Institute of Science and Technology.
- v) "**Academic Council**" means the Academic Council, which is the apex body on all academic matters of this Institute.
- vi) "**Dean (Academic Affairs)**" means the Dean (Academic Affairs) of the Institution who is responsible for the implementation of relevant rules and regulations for all the academic activities.
- vii) "**Dean (Student Affairs)**" means the Dean (Students Affairs) of the Institution who is responsible for activities related to student welfare, conduct of co-curricular, extra-curricular events and discipline in the campus.
- viii) "**Controller of Examinations**" means the Controller of Examinations of the Institution who is responsible for the conduct of examinations and declaration of results.
- ix) "**Dean of the School**" means the Dean of the School of the department concerned.
- x) "**Head of the Department**" means the Head of the Department concerned.

## 2.0 ADMISSION REQUIREMENTS

2.1 Students for admission to the first semester of the Master's Degree Programme shall be required to have passed the appropriate degree examination as specified in the clause 3.2 [Eligible entry qualifications for admission to programmes] of this Institution or any other University or authority accepted by this Institution.

2.2 The other conditions for admission such as class obtained, number of attempts in the qualifying examination and physical fitness will be as prescribed by the Institution from time to time.

## 3.0 BRANCHES OF STUDY

3.1 The various programmes and their mode of study are as follows:

Degree	Mode of Study
M.Tech.	Full Time
MCA	
M.Sc.	
M.Com.	
M.A.	

## 3.2 Programmes offered

S. No.	Name of the Department	Programmes offered
1.	Aeronautical Engineering	M.Tech. (Avionics)
2.	Civil Engineering	M.Tech. (Structural Engineering)
		M. Tech. (Construction Engineering and Project Management)
3.	Mechanical Engineering	M.Tech. (CAD/CAM)
4.	Electrical and Electronics Engineering	M.Tech. (Power Systems Engineering)
5.	Electronics and Communication Engineering	M.Tech. (VLSI and Embedded Systems)

S. No.	Name of the Department	Programmes offered
6.	Computer Science and Engineering	M.Tech. (Computer Science and Engineering)
		M.Tech. (Artificial Intelligence and Data Science)
7.	Information Technology	M.Tech. (Information Technology)
8.	Computer Applications	MCA
9.	Mathematics	M.Sc. (Actuarial Science)
10.	Physics	M.Sc.(Physics)
11.	Chemistry	M.Sc.(Chemistry)
12.	Life Sciences	M.Sc. Biochemistry & Molecular Biology
		M.Sc. Biotechnology
		M.Sc. Microbiology
		M.Sc. Stem Cell Technology
		M.Sc. Clinical Embryology
		M.Tech. Biotechnology
	M.Tech. Food Biotechnology	
13.	Commerce	M.Com
14.	Arabic and Islamic Studies	M.A. Islamic Studies

### 3.3 Eligible entry qualifications for admission to programmes

Sl. No.	Programme	Eligibility for Admission in M.Tech. / MCA / M.Sc. / M.Com. / MA Programmes
1.	M.Tech. (Avionics)	B.E. / B.Tech. in Aeronautical Engineering / Aerospace Engineering / Mechanical Engineering / Mechatronics / EEE / ECE / EIE / or Equivalent degree in relevant field.
2.	M.Tech. (Structural Engineering)	B.E. / B.Tech. in Civil Engineering / Structural Engineering or Equivalent degree in relevant field.
	M. Tech. (Construction)	B.Tech. in Mechanical / Civil / Electrical and Electronics / Geo Informatics / B Plan / B. Des, and B.Arch.

Sl. No.	Programme	Eligibility for Admission in M.Tech. / MCA / M.Sc. / M.Com. / MA Programmes
	Engineering and Project Management)	
3.	M.Tech. (CAD/CAM)	B.E. / B.Tech. in Mechanical / Automobile / Manufacturing / Production / Industrial / Mechatronics / Metallurgy / Aerospace / Aeronautical / Material Science / Polymer / Plastics / Marine Engineering or Equivalent degree in relevant field.
4.	M.Tech. (Power Systems Engineering)	B.E. / B.Tech. in EEE / ECE / EIE / ICE / Electronics / Instrumentation Engineering or Equivalent degree in relevant field.
5.	M.Tech. (VLSI and Embedded Systems)	B.E. / B.Tech. in ECE / EIE / ICE / EEE / IT or Equivalent degree in relevant field.
6.	M.Tech. (Computer Science and Engineering)	B.E. / B.Tech. in CSE / IT / ECE / EEE / EIE / ICE / Electronics Engineering / MCA or Equivalent degree in relevant field.
	M.Tech. (Artificial Intelligence and Data Science)	B.E. / B.Tech. in CSE / IT / ECE / EEE / EIE / ICE / Electronics Engineering / MCA or Equivalent degree in relevant field.
7.	M.Tech. (Information Technology)	B.E. / B.Tech. in IT / CSE / ECE / EEE / EIE / ICE / Electronics Engineering / MCA or Equivalent degree in relevant field.
8.	MCA	BCA / B.Sc. Computer Science / B.E. / B.Tech. / B.Sc. Mathematics, B.Sc. Physics / Chemistry / B.Com. / BBA / B.A. with Mathematics at graduation level or at 10 + 2 level or equivalent degree in relevant field.
9.	M.Sc. (Actuarial Science)	Any under graduate degree with Mathematics / Statistics as one of the subjects of study at 10 + 2 level.
10.	M.Sc.(Physics)	B.Sc. in Physics / Applied Science / Electronics / Electronics Science / Electronics & Instrumentation or Equivalent degree in relevant field.

Sl. No.	Programme	Eligibility for Admission in M.Tech. / MCA / M.Sc. / M.Com. / MA Programmes
11.	M.Sc.(Chemistry)	B.Sc. in Chemistry / Applied Science or Equivalent degree in relevant field.
12.	M.Sc. Biochemistry & Molecular Biology	B.Sc. in Biotechnology / Biochemistry / Botany / Zoology / Microbiology / Molecular Biology / Genetics or Equivalent degree in relevant field.
	M.Sc. Biotechnology	B.Sc. in Biotechnology / Biochemistry / Botany / Zoology / Microbiology / Molecular Biology / Genetics or Equivalent degree in relevant field.
	M.Sc. Microbiology	B.Sc.in Biotechnology / Biochemistry / Botany / Zoology / Microbiology / Molecular Biology / Genetics or Equivalent degree in relevant field.
	M.Sc. Stem Cell Technology	B.Sc.in Biotechnology / Biochemistry / Botany / Zoology / Microbiology / Molecular Biology / Genetics or Equivalent degree in relevant field.
	M.Sc. Clinical Embryology	B.Sc.in Biotechnology / Biochemistry / Botany / Zoology / Microbiology / Molecular Biology / Genetics or Equivalent degree in relevant field.
	M.Tech. Biotechnology	B.Tech. / B.E. in Biotechnology or Equivalent degree in relevant field.
	M.Tech. Food Biotechnology	B.E. / B.Tech. in Biotechnology / Food Biotechnology / Chemical Engineering / Biochemical Engineering / Industrial Biotechnology or Equivalent degree in relevant field.
13. .	M.Com	B.Com. / BBA
14. .	M.A. Islamic Studies	B.A. in Islamic Studies / Arabic (or) Afzal-ul-Ulama (or) Any under graduate degree with Part 1 Arabic (or)

Sl. No.	Programme	Eligibility for Admission in M.Tech. / MCA / M.Sc. / M.Com. / MA Programmes
		Any under graduate degree with Aalim Sanad / Diploma / Certificate in Arabic or Islamic Studies.

#### 4.0. STRUCTURE OF THE PROGRAMME

4.1. The PG. programmes consist of the following components as prescribed in the respective curriculum:

- i. Core courses
- ii. Elective courses
- iii. Laboratory integrated theory courses
- iv. Project work
- v. Laboratory courses
- vi. Open elective courses
- vii. Seminar
- viii. Mini Project
- ix. Industry Internship
- x. MOOC courses (NPTEL- Swayam, Coursera etc.)
- xi. Value added courses

4.1.1. The curriculum and syllabi of all programmes shall be approved by the Academic Council of this Institution.

4.1.2. For the award of the degree, the student has to earn a minimum total credits specified in the curriculum of the respective specialization of the programme.

4.1.3. The curriculum of programmes shall be so designed that the minimum prescribed credits required for the award of the degree shall be within the limits specified below:

Programme	Range of credits
M.Tech.	80 - 86
MCA	80 - 86
M.Sc.	80 - 85
M.Com.	80 - 88
M.A.	80 - 84

4.1.4. Credits will be assigned to the courses for all programmes as given below:

- ❖ One credit for one lecture period per week or 15 periods of lecture per

semester.

- ❖ One credit for one tutorial period per week or 15 periods per semester.
- ❖ One credit each for seminar/practical session/project of two or three periods per week or 30 periods per semester.
- ❖ One credit for 160 hours of industry internship per semester for all programmes (except M.Com.)
- ❖ Four credits for 160 hours of industry internship per semester for M.Com.

**4.1.5.** The number of credits the student shall enroll in a non-project semester and project semester is as specified below to facilitate implementation of Choice Based Credit System.

<b>Programme</b>	<b>Non-project semester</b>	<b>Project semester</b>
M.Tech.	9 to 32	18 to 26
MCA	9 to 32	18 to 26
M.Sc.	9 to 32	10 to 26
M.Com.	9 to 32	16 to 28
M.A.	9 to 32	NA

**4.1.6** The student may choose a course prescribed in the curriculum from any department offering that course without affecting regular class schedule. The attendance will be maintained course wise only.

**4.1.7** The students shall choose the electives from the curriculum with the approval of the Head of the Department / Dean of School.

**4.1.8** Apart from the various elective courses listed in the curriculum for each specialization of programme, the student can choose a maximum of two electives from any other similar programmes across departments, alter to open electives, during the entire period of study, with approval of Head of the department offering the course and parent department.

**4.1.9. Online courses**

Students are permitted to undergo department approved online courses under SWAYAM up to 40% of credits of courses in a semester excluding project semester (in case of M.Tech. M.Sc. & MCA programmes) with the recommendation of the Head of the Department / Dean of School and with the prior approval of Dean Academic Affairs during his/ her period of

study. The credits earned through online courses shall be transferred following the due approval procedures. The online courses can be considered in lieu of core courses and elective courses.

Students shall undergo project related online course on their own with the mentoring of the project supervisor.

### **3.5 Project work**

**3.5.1** Project work shall be carried out by the student under the supervision of a faculty member in the department with similar specialization.

**3.5.2** A student may however, in certain cases, be permitted to work for the project in an Industry / Research organization, with the approval of the Head of the Department/ Dean of School. In such cases, the project work shall be jointly supervised by a faculty of the Department and an Engineer / Scientist / Competent authority from the organization and the student shall be instructed to meet the faculty periodically and to attend the review meetings for evaluating the progress.

**3.5.3** The timeline for submission of final project report / dissertation is within 30 calendar days from the last instructional day of the semester in which project is done.

**3.5.4** If a student does not comply with the submission of project report / dissertation on or before the specified timeline he / she is deemed to have not completed the project work and shall re-register in the subsequent semester.

### **5.0 DURATION OF THE PROGRAMME**

**5.1.** The minimum and maximum period for completion of the programmes are given below:

<b>Programme</b>	<b>Min. No. of Semesters</b>	<b>Max. No. of Semesters</b>
M.Tech.	4	8
MCA	4	8
M.Sc.	4	8
M.Com.	4	8
M.A.	4	8

**5.2** Each academic semester shall normally comprise of 90 working days. Semester end examinations shall follow within 10 days of the last Instructional day.

**5.3** Medium of instruction, examinations and project report shall be in English.

## **6.0 REGISTRATION AND ENROLLMENT**

**6.1** The students of first semester shall register and enroll at the time of admission by paying the prescribed fees. For the subsequent semesters registration for the courses shall be done by the student one week before the last working day of the previous semester.

### **6.2 Change of a Elective Course**

A student can change an enrolled elective course within 10 working days from the commencement of the course, with the approval of the Dean (Academic Affairs), on the recommendation of the Head of the Department of the student.

### **6.3 Withdrawal from a Course**

A student can withdraw from an enrolled course at any time before the first continuous assessment test for genuine reasons, with the approval of the Dean (Academic Affairs), on the recommendation of the Head of the Department of the student.

**6.4** A student can enroll for a maximum of 36 credits during a semester including Redo / Predo courses.

## **7.0 BREAK OF STUDY FROM PROGRAMME**

**7.1** A student may be allowed / enforced to take a break of study for two semesters from the programme with the approval of Dean (Academic Affairs) for the following reasons:

7.1.1 Medical or other valid grounds

7.1.2 Award of 'I' grade in all the courses in a semester due to lack of attendance

7.1.3 Debarred due to any act of indiscipline

**7.2** The total duration for completion of the programme shall not exceed the prescribed maximum number of semesters (vide clause 3.1).

**7.3** A student who has availed a break of study in the current semester (odd/even) can rejoin only in the subsequent corresponding (odd/even)

semester in the next academic year on approval from the Dean (Academic affairs).

- 7.4** During the break of study, the student shall not be allowed to attend any regular classes or participate in any activities of the Institution. However, he / she shall be permitted to enroll for the 'I' grade courses and appear for the arrear examinations.

## **8.0 CLASS ADVISOR AND FACULTY ADVISOR**

### **8.1 CLASS ADVISOR**

A faculty member shall be nominated by the HOD/ Dean of School as Class Advisor for the class throughout their period of study.

The class advisor shall be responsible for maintaining the academic, curricular and co-curricular records of students of the class throughout their period of study.

### **8.2 FACULTY ADVISOR**

To help the students in planning their courses of study and for general counseling, the Head of the Department / Dean of School of the students shall attach a maximum of 20 students to a faculty member of the department who shall function as faculty advisor for the students throughout their period of study. Such faculty advisor shall guide the students in taking up the elective courses for registration and enrolment in every semester and also offer advice to the students on academic and related personal matters.

## **9.0 COURSE COMMITTEE**

- 9.1** Each common theory / laboratory course offered to more than one group of students 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 Head of the Department / Dean (Academic Affairs) depending upon whether all the teachers handling the common course belong to a single department or from several departments. The Course Committee shall meet as often as possible to prepare a common question paper, scheme of evaluation and ensure uniform evaluation of the assessment tests and semester end examination.

**10.0 CLASS COMMITTEE**

**10.1** A class committee comprising faculty members handling the courses, student representatives and a senior faculty member not handling any courses for that class as chairman will be constituted in every semester:

**10.2** The composition of the class committee will be as follows:

- i) One senior faculty member preferably not handling courses for the concerned semester, appointed as chairman by the Head of the Department
- ii) Faculty members of all courses of the semester
- iii) All the students of the class
- iv) Faculty advisor and class advisor
- v) Head of the Department – Ex officio member

**10.3** The class committee shall meet at least three times during the semester. The first meeting shall be held within two weeks from the date of commencement of classes, in which the nature of continuous assessment for various courses and the weightages for each component of assessment shall be decided for the first and second assessment. The second meeting shall be held within a week after the date of first assessment report, to review the students' performance and for follow up action.

**10.4** During these two meetings the student members, shall meaningfully interact and express opinions and suggestions to improve the effectiveness of the teaching-learning process, curriculum and syllabi of courses.

**10.5** The third meeting of the class committee, excluding the student members, shall meet within 5 days from the last day of the semester end examination to analyze the performance of the students in all the components of assessments and decide their grades in each course. The grades for a common course shall be decided by the concerned course committee and shall be presented to the class committee(s) by the concerned course coordinator.

## 11.0 CREDIT REQUIREMENTS TO REGISTER FOR PROJECT WORK

11.1 A student is permitted to register for project semester, if he/she has earned the minimum number of credits specified below:

Programme	Minimum no. of credits to be earned to enroll for project semester
M.Tech.	18
MCA	22
M.Sc.	18
M.Com	NA
M.A.	NA

11.2 If the student has not earned minimum number of credits specified, he/she has to earn the required credits, at least to the extent of minimum credits specified in clause 9.1 and then register for the project semester.

## 12.0 ASSESSMENT PROCEDURE AND PERCENTAGE WEIGHTAGE OF MARKS

12.1 Every theory course shall have a total of three assessments during a semester as given below:

Assessments	Weightage of Marks
Continuous Assessment 1	25%
Continuous Assessment 2	25%
Semester End Examination	50%

### 12.2 Theory Course

Appearing for semester end theory examination for each course is mandatory and a student shall secure a minimum of 40% marks in each course in semester end examination for the successful completion of the course.

### 12.3 Laboratory Course

Every practical course shall have 75% weightage for continuous assessments and 25% for semester end examination. However, a student

shall have secured a minimum of 50% marks in the semester end practical examination for the award of pass grade.

#### 12.4 Laboratory Integrated Theory (LIT) Courses

For laboratory integrated theory courses, the theory and practical components shall be assessed separately for 100 marks each and consolidated by assigning a weightage of 75% for theory component and 25% for practical component (for a 4 credit LIT Course). Grading shall be done for this consolidated mark. Assessment of theory components shall have a total of three assessments with two continuous assessments carrying 25% weightage each and semester end examination carrying 50% weightage. The student shall secure a separate minimum of 40% in the semester end theory examination. The evaluation of practical components shall be through continuous assessment.

Component	Maximum Marks	Weightage for Final Grade	Mode of Assessment
Theory Component	100	75%	CAT1 (25%) + CAT2 (25%) + SEE (50%)
Practical Component	100	25%	Continuous assessment only
Final Grade Basis	Consolidated	100%	75% Theory + 25% Practical
Pass Requirement	-	-	Minimum 40% in Semester-End Theory Exam (SEE)

#### Note:

1. Proportionate weightage shall be assigned to LIT courses based on their credit value, whether 2 or 3 credits.
2. In Lab-Integrated Professional Elective courses, the laboratory component shall be assessed by the course faculty.

**12.5** The components of continuous assessment for theory/practical/laboratory integrated theory courses shall be finalized in the first class committee meeting.

#### 12.6 Industry Internship

In the case of industry internship, the student shall submit a report, which shall be evaluated along with an oral examination by a committee of faculty members constituted by the Head of the Department. The student shall also

submit an internship completion certificate issued by the industry / research / academic organisation. The weightage of marks for industry internship report and viva voce examination shall be 60% and 40% respectively.

## 12.7 Project Work

**Mini project work**, shall be carried out individually or as a group activity involving a maximum of three students.

Each group shall identify a suitable topic within their domain, either disciplinary or interdisciplinary, based on the students' abilities and in consultation with the faculty mentor. The topic must lead to the development of a small-scale system or application.

The progress of the mini project shall be evaluated through three periodic reviews: two interim reviews and one final review. A project report shall be submitted by the end of the semester. The reviews shall be conducted by a committee of faculty members constituted by the Head of the Department / Dean of the School.

An oral examination (viva voce) shall be conducted as the semester-end examination by an internal examiner approved by the Controller of Examinations, based on the project report.

The weightage for assessment shall be as follows:

- Periodic Reviews: 50%
  - 25% by the Project Guide
  - 25% by the Review Committee
- Project Report: 20%
- Viva Voce Examination: 30%

**The Project** shall be carried out individually or as a group activity, involving a maximum of two or three students.

A committee of faculty members, constituted by the Head of the Department / Dean of the School, shall conduct three periodic reviews during the semester to monitor and assess the progress of the project.

At the end of the semester, students shall submit a project report, based on which a semester-end oral examination (viva voce) shall be conducted by an external examiner approved by the Controller of Examinations.

The assessment weightage shall be as follows:

- Periodic Reviews – 50%
  - 25% by the Project Guide
  - 25% by the Review Committee
- Project Report – 20%
- Viva Voce Examination – 30%

**12.8** The assessment of seminar course including its component and its weightage shall be decided by a committee of faculty members constituted by the Head of the Department. This committee shall ensure the conduct of assessment of components and award marks accordingly.

**12.9** For the first attempt of the arrear theory examination, the internal assessment marks scored for a course during first appearance shall be used for grading along with the marks scored in the arrear examination. From the subsequent appearance onwards, full weightage shall be assigned to the marks scored in the semester end examination and the internal assessment marks secured during the course of study shall become invalid.

**In case of laboratory integrated theory courses**, after one regular and one arrear appearance, the internal mark of theory component is invalid and full weightage shall be assigned to the marks scored in the semester end examination for theory component. **There shall be no arrear or improvement examination for lab components.**

### **13.0 SUBSTITUTE EXAMINATIONS**

**13.1** A student who is absent, for genuine reasons, may be permitted to write a substitute examination for any one of the two continuous assessment tests of a course by paying the prescribed substitute examination fee. However, permission to take up a substitute examination will be given under exceptional circumstances, such as accidents, admission to a hospital due to illness, etc. by a committee constituted by the Head of the Department / Dean of School for that purpose. However, there is no substitute examination for semester end examination.

**13.2** A student shall apply for substitute exam in the prescribed form to the Head of the Department / Dean of School within a week from the date of assessment test. However, the substitute examination will be conducted

only after the last working day of the semester and before the semester end examination.

#### **14.0 ATTENDANCE REQUIREMENT AND SEMESTER / COURSE REPETITION**

**14.1** A student shall earn 100% attendance in the scheduled contact hours (such as lectures, tutorials, labs, etc.) for that course. However, a relaxation of up to 25% in attendance may be granted to account for valid reasons such as medical emergencies, participation in co-curricular or extracurricular activities with prior approval, or other genuine circumstances.

If a student's attendance falls below 75% in a particular course, even after considering the permissible relaxation, they will not be allowed to appear for the semester-end examination in that course. Instead, the student will be awarded an "I" grade (Incomplete) for the course

**14.2** The faculty member of each course shall cumulate the attendance details for the semester and furnish the names of the students who have not earned the required attendance in the concerned course to the class advisor. The class advisor shall consolidate and furnish the list of students who have earned less than 75% attendance, in various courses, to the Dean (Academic Affairs) through the Head of the Department / Dean of the School. Thereupon, the Dean (Academic Affairs) shall officially notify the names of such students prevented from writing the semester end examination in each course.

**14.3** If a student's attendance in any course falls between 65% and 75% due to medical reasons (e.g., hospitalization, illness) or participation in institution-approved events, they may be granted exemption from the minimum attendance requirement and allowed to appear for the semester-end exam. The student must submit valid documents to the class advisor upon rejoining, with approval from the HoD/Dean. Final approval for **condonation** will be granted by the Vice Chancellor based on the Dean (Academic Affairs)'s recommendation.

**14.4** A student who has obtained an "I" grade in all the courses in a semester is not permitted to move to the next higher semester. Such students shall **repeat** all the courses of the semester in the subsequent academic year. However, he / she is permitted to redo the courses awarded with 'I' grade /

arrear in previous semesters. They shall also be permitted to write arrear examinations by paying the prescribed fee.

**14.5** The student awarded “I” grade, shall enroll and repeat the course when it is offered next. In case of “I” grade in an elective course either the same elective course may be repeated or a new elective course may be taken with the approval of the Head of the Department / Dean of the School.

**14.6** A student who is awarded “U” grade in a course shall have the option to either write the semester end arrear examination at the end of the subsequent semesters, or to **redo** the course when the course is offered by the department. Marks scored in the continuous assessment in the redo course shall be considered for grading along with the marks scored in the semester end (redo) examination. If any student obtains “U” grade in the redo course, the marks scored in the continuous assessment test (redo) for that course shall be considered as internal mark for further appearance of arrear examination.

**14.7** If a student with “U” grade, who **prefers to redo** any particular course, fails to earn the minimum 75% attendance while doing that course, then he / she is not permitted to write the semester end examination and his / her earlier “U” grade and continuous assessment marks shall continue.

## **15.0 REDO / PRE-DO COURSES**

**15.1** A student can register for a maximum of three redo courses per semester without affecting the regular semester classes, whenever such courses are offered by the concerned department, based on the availability of faculty members and subject to a specified minimum number of students registering for each of such courses.

**15.2** The number of contact hours and the assessment procedure for any redo course shall be the same as regular courses, except there is **no provision for any substitute examination and withdrawal from a redo course.**

**15.3** A student shall be permitted to pre-do a course offered by the concerned department, provided it does not affect the regular semester class schedule. Such permission shall be granted based on the availability of faculty members, the maximum permissible credit limit of the semester,

and the student's fulfillment of the necessary prerequisites for the course. The proposal shall be recommended by the Dean of the School and the Head of the Department, and shall require final approval from the Dean (Academic Affairs).

## 16.0 PASSING AND DECLARATION OF RESULTS AND GRADE SHEET

16.1 All assessments of a course shall be made on absolute marks basis. The class committee without the student members shall meet to analyse the performance of students in all assessments of a course and award letter grades following the relative grading system. The letter grades and the corresponding grade points are as follows:

Letter Grade	Grade Points
S	10
A	9
B	8
C	7
D	6
E	5
U	0
W	-
I	-
PA	-
FA	-

**"W"**- denotes withdrawal from the course

**"I"** - denotes "Incomplete" ie. inadequate attendance in the course and prevention from appearance of semester end examination

**"U"** - denotes unsuccessful performance in the course.

**"PA"** - denotes the 'Pass' of the zero credit courses.

**"FA"** - denotes the 'Fail' of the zero credit courses.

16.2 A student who earns a minimum of five grade points ('E' grade) in a

course is declared to have successfully completed the course. Such a course cannot be **repeated by the student for improvement of grade.**

**16.3** Upon awarding grades, the results shall be endorsed by the chairman of the class committee and Head of the Department / Dean of the School. The Controller of Examinations shall further approve and declare the results.

**16.4 Within one week** from the date of declaration of result, a student can apply for revaluation of his / her semester end theory examination answer scripts of one or more courses, on payment of prescribed fee, through proper application to the Controller of Examinations. Subsequently, the Head of the Department / Dean of the School offered the course shall constitute a revaluation committee consisting of chairman of the class committee as convener, the faculty member of the course and a senior faculty member having expertise in that course as members. The committee shall meet within a week to revalue the answer scripts and submit its report to the Controller of Examinations for consideration and decision.

**16.5** After results are declared, grade sheets shall be issued to each student, which contains the following details: a) list of courses enrolled during the semester including redo courses / arrear courses, if any; b) grades scored; c) Grade Point Average (GPA) for the semester and d) Cumulative Grade Point Average (CGPA) of all courses enrolled from the first semester onwards.

GPA is the ratio of the sum of the products of the number of credits of courses registered and the grade points corresponding to the grades scored in those courses, taken for all the courses, to the sum of the number of credits of all the courses in the semester.

If  $C_i$ , is the number of credits assigned for the  $i^{\text{th}}$  course and  $GP_i$  is the Grade Point in the  $i^{\text{th}}$  course,

$$GPA = \frac{\sum_{i=1}^n (C_i)(GP_i)}{\sum_{i=1}^n C_i}$$

Where n = number of courses

The Cumulative Grade Point Average (CGPA) is calculated in a similar manner, considering all the courses enrolled from first semester.

“I”, “W”, “PA” and “FA” grades are excluded for calculating GPA.

“U”, “I”, “W”, “PA” and “FA” grades are excluded for calculating CGPA.

The formula for the conversion of CGPA to equivalent percentage of marks shall be as follows:

Percentage equivalent of marks = CGPA X 10

**16.6** After successful completion of the programme, the degree shall be awarded to the students with the following classifications based on CGPA.

<b>Classification</b>	<b>CGPA</b>
First Class with Distinction	8.50 and above and passing all the courses in first appearance and completing the programme within the prescribed period of 8 semesters for all students (except lateral entry students) and 6 semesters for lateral entry students
First Class	6.50 and above and completing the programme within a maximum of 10 semesters for all students (except lateral entry students) and 8 semesters for lateral entry students
Second Class	Others

#### **16.6.1 Eligibility for First Class with Distinction**

- A student should not have obtained ‘U’ or ‘I’ grade in any course during his/her study
- A student should have completed the UG programme within the minimum prescribed period of study (except clause 7.1.1)

#### **16.6.2 Eligibility for First Class**

- A student should have passed the examination in all the courses not more than two semesters beyond the minimum prescribed period of study (except clause 7.1.1)

**16.6.3** The students who do not satisfy clause 16.6.1 and clause 16.6.2 shall be classified as second class.

**16.6.4** The CGPA shall be rounded to two decimal places for the purpose of classification. The CGPA shall be considered up to three decimal places for the purpose of comparison of performance of students and ranking.

## **17.0 SUPPLEMENTARY EXAMINATION**

**Final year students and passed out students** can apply for supplementary examination for a maximum of **three** courses thus providing an opportunity to complete their degree programme. Likewise, students with less credit can also apply for supplementary examination for a maximum of **three** courses to enable them to earn minimum credits to move to higher semester. The students can apply for supplementary examination within three weeks of the declaration of results in both odd and even semesters.

## **18.0 DISCIPLINE**

**18.1** Every student is expected to observe discipline and decorum both inside and outside the campus and not to indulge in any activity which tends to affect the reputation of the Institution.

**18.2** Any act of indiscipline of a student, reported to the Dean (Student Affairs), through the Head of the Department / Dean of the School concerned shall be referred to a Discipline and Welfare Committee constituted by the Registrar for taking appropriate action.

## **19.0 MULTI ENTRY AND MULTI EXIT (MEME) FRAMEWORK \***

In accordance with the provisions of the National Education Policy (NEP)

2020, the programme shall support a Multi Entry – Multi Exit (ME-ME) framework to provide flexibility in the academic pathway of students.

\* **At present (AY 2025-26), it is applicable only for all M.Tech. Programmes.**

### **19.1. Exit Option:**

#### **19.1.1 Credit Requirement for Award of M.Tech. Degree**

To qualify for the award of a M.Tech. degree from the Institute, a student must successfully complete the total credit requirements as prescribed in the approved curriculum of the respective programme. The specific credit requirements are determined by the programme curriculum.

#### **19.1.2 Provision for Multiple Exit**

In alignment with NEP 2020 guidelines, the Institute provides students enrolled in postgraduate programmes with the option of multiple exits, subject to the following conditions:

##### **a. Exit at the End of First Year**

Students may choose to exit the programme at the end of the first year, provided they have fulfilled the prescribed academic requirements.

##### **b. Application for Exit**

A student intending to exit must submit a formal written application in the prescribed format at least **eight weeks prior to the scheduled end of the academic year.**

##### **c. Departmental Recommendation**

1. Upon receipt of the application, the concerned Department shall evaluate the academic record of the student and recommend the award of a **Post Graduate Diploma**, based on the credits earned.

2. In the case of arrear courses, the post graduate diploma will be conferred only after successful clearance of all pending arrears.

##### **d. Notification of Completion**

Once a student has fulfilled the requirements for the award of post graduate diploma, the Department shall notify the same to controller of examinations for further processing and issuance.

#### **19.1.3 Award of Qualifications under Multiple Exit Scheme**

Post graduate diploma: Awarded after successful completion of the first year, subject to earning the prescribed cumulative credits as per the respective programme curriculum (e.g., 44 credits from the first year) along with 3 credits of Skill Based Courses.

#### 19.1.4 Conditions Governing Exit

1. The multiple exit facility is intended strictly for **genuine and exceptional circumstances**, such as prolonged illness, or securing an employment opportunity necessitating a temporary withdrawal from the programme.
2. Students opting for a temporary exit after the first year must obtain **prior approval from the Registrar through Dean (Academics)**, based on the recommendation of the respective Head of the Department.

#### 19.1.5 Expectation of Programme Continuity

While the option for multiple exits exists, it is generally expected that students admitted to a post graduate programme shall pursue their studies continuously until completion of the final degree requirements.

#### 19.2. Entry Option:

Students seeking re-entry into the programme (multi-entry) must submit an application through the proper channel at the beginning of the odd semester. Admission shall be subject to fulfilment of institutional guidelines, credit mapping, and availability of seats.

#### 19.3. Credits Requirement for the Certifications

Name of the Certificate Programme	Required Credits
Post graduate Diploma (Level 6.5 as per NEP 2020)	40* - 45

\* The minimum number of credits that a student must earn (as per the respective curriculum) in order to get the above certification program

### 20.0 ELIGIBILITY FOR THE AWARD OF THE MASTER'S DEGREE

**20.1** A student shall be declared to be eligible for the award of the Master's Degree, if he/she has:

- i. Successfully acquired the required credits as specified in the curriculum corresponding to his/her programme within the

maximum period of 8 semesters from the date of admission, including break of study.

- ii. No disciplinary action is pending against him/her.
- iii. Enrolled and completed at least one value added course.
- iv. Enrollment in at least one MOOC / SWAYAM course (non-credit) before the final semester (Except MCA programme since the curriculum has mandatory 1 credit MOOC in II Semester).

**20.2** The award of the degree must have been approved by the Institute.

### **21.0 POWER TO MODIFY**

Notwithstanding all that have been stated above, the Academic Council has the right to modify any of the above regulations from time to time.

**B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE AND TECHNOLOGY**

**REGULATIONS 2025**  
**CURRICULUM & SYLLABI FOR**  
**(MASTER OF COMPUTER APPLICATIONS (MCA))**

<b>SEMESTER 1</b>							
S.no	Course Category	Course Code	Course Name	L	T	P	C
1.	FC	MAE 6187	Applied Probability and Statistics for Computer Applications	3	1	0	4
2.	PCC	CAF 6101	Data Structures and Algorithms	3	0	0	3
3.	PCC	CAF 6102	Operating System and Shell Scripting	3	0	0	3
4.	PCC	CAF 6103	Object Oriented Software Engineering	3	0	0	3
5.	PCC	CAF 6104	Computer Networks	3	0	0	3
6.	PCC	CAF 6105	Advanced Java Programming	3	0	0	3
7.	PCC	CAF 6106	Data Structures and Algorithms Laboratory	0	0	2	1
8.	PCC	CAF 6107	Advanced Java Programming Laboratory	0	0	2	1
9.	PCC	CAF 6108	Programming in C and C++ Laboratory	0	0	2	1
<b>Total</b>							<b>22</b>
<b>SEMESTER 2</b>							
1.	EEC	CAF 6201	Qualitative and Quantitative Reasoning	3	0	0	3
2.	PCC	CAF 6202	Advanced Database Technology	3	0	0	3
3.	PCC	CAF 6203	Python Programming	3	0	0	3
4.	PCC	CAF 6204	Full Stack Web Development	3	0	2	4
5.	PCC	CAF 6205	Mobile Application Development	3	0	0	3
6.	PEC		Professional Elective - 1	3	0	2	4
7.	PCC	CAF 6206	Python Programming Laboratory	0	0	2	1

M.C.A.		Curriculum & Syllabi		Regulations 2025			
8.	PCC	CAF 6207	Mobile Application Development Laboratory	0	0	2	1
9.	PCC	CAF 6208	Advanced Database Technology Laboratory	0	0	2	1
10	EEC	ENF 6281	Professional Communication	0	0	2	1
11			MOOC courses	0	0	0	1
			<b>Total</b>				<b>25</b>
<b>SEMESTER 3</b>							
1	RMC	CAF 7101	Research Methodologies and IPR	2	0	0	2
2	PCC	CAF 7102	Software Testing	3	0	2	4
3			Professional Elective –2	3	0	2	4
4			Professional Elective –3	3	0	0	3
5			Professional Elective –4	3	0	0	3
6	EEC	CAF 7103	Entrepreneurship and Professional Ethics	3	0	0	3
7	EEC	CAF 7104	Mini Project	0	0	2	1
			<b>Total</b>				<b>20</b>
<b>SEMESTER 4</b>							
1	EEC	CAF 7205	Project	0	0		<b>20</b>
<b>Total Credits</b>							<b>87</b>

*FC–Foundation Course*

*PCC–Professional Core Course*

*PEC–Professional Elective Course*

*EEC–Employability Enhancement Course*

*RMC–Research Methodology Course*

Note: Enrollment and completed at least one value-added course is mandatory for completion of degree.

**Professional Elective–1**

<b>S. no</b>	<b>Course Category</b>	<b>Course Code</b>	<b>Course Name</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1.	PEC	CAFY 101	Data Science and Cloud computing	3	0	2	4
2.	PEC	CAFY 102	Cloud Technologies	3	0	2	4
3.	PEC	CAFY 103	Cyber Security	3	0	2	4
4.	PEC	CAFY 104	Artificial Intelligence and Machine Learning	3	0	2	4
5.	PEC	CAFY 105	Internet of Things	3	0	2	4
6.	PEC	CAFY 106	Artificial Intelligence and Data Science	3	0	2	4
7.	PEC	CAFY 107	Natural Language Processing	3	0	2	4

**Professional Elective –2**

1.	PEC	CAFY 201	Big Data Analytics	3	0	2	4
2.	PEC	CAFY 202	Social Media Analytics	3	0	2	4
3.	PEC	CAFY 203	Ethical Hacking	3	0	2	4
4.	PEC	CAFY 204	Cloud Security	3	0	2	4
5.	PEC	CAFY 205	Digital Forensics	3	0	2	4
6.	PEC	CAFY 206	Cryptography	3	0	2	4
7.	PEC	CAFY 207	Deep Learning Techniques	3	0	2	4
8.	PEC	CAFY 208	Generative AI	3	0	2	4
9.	PEC	CAFY 209	Data Analytics and Visualization using Power BI	3	0	2	4

**Professional Elective – 3**

1.	PEC	CAFY 301	Software Project Management	3	0	0	3
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M.C.A.	Curriculum & Syllabi			Regulations 2025			
2.	PEC	CAFY 302	Management Information Systems	3	0	0	3
3.	PEC	CAFY 303	Customer Relationship Management System	3	0	0	3
4.	PEC	CAFY 304	Agile Methodologies	3	0	0	3
5.	PEC	CAFY 305	Supply Chain Management	3	0	0	3
6.	PEC	CAFY 306	Developments and Operations	3	0	0	3
7.	PEC	CAFY 307	Software Design	3	0	0	3
8.	PEC	CAFY 308	Digital Marketing	3	0	0	3
<b>Professional Elective – 4</b>							
9.	PEC	CAFY 401	Soft Computing	3	0	0	3
10.	PEC	CAFY 402	Information Retrieval Techniques	3	0	0	3
11.	PEC	CAFY 403	Computer Vision	3	0	0	3
12.	PEC	CAFY 404	Quantum Computing	3	0	0	3
13.	PEC	CAFY 405	Blockchain Technology	3	0	0	3
14.	PEC	CAFY 406	Prompt Engineering	3	0	0	3



**MODULE V TESTING OF HYPOTHESIS****9+3**

Null and alternative hypothesis – Types of errors – Level of significance – Critical region – One tail and two-tail test – Large sample test – Test for single mean and difference of means – Small sample tests – t test for single mean, difference of means – Paired t-test – F test – Test for equality of two population variances and Chi-square test for independence of attributes and goodness of fit.

**L – 45; T – 15; TOTAL HOURS – 60****TEXT BOOKS:**

1. Robert V. Hogg and Allen T. Craig, "Introduction to Mathematical Statistics", 8<sup>th</sup> Edition, Pearson Education, 2018.
2. S.C. Gupta, "Fundamentals of Statistics", 8<sup>th</sup> Revised Edition, Himalaya Publishing House, 2024.
3. Sheldon M. Ross, "Introduction to Probability and Statistics for Engineers and Scientists", 5<sup>th</sup> Edition, Elsevier, 2016.

**REFERENCES:**

1. Mendenhall, W., Beaver, R.J., and Beaver, B.M., "Probability and Statistics", Cengage Learning India.
2. S.C. Gupta and V.K. Kapoor, "Fundamentals of Mathematical Statistics", 12<sup>th</sup> Edition, Sultan Chand & Sons, 2014.
3. Miller, I., Miller, M., and Freund, J.E., Mathematical Statistics, 7<sup>th</sup> Edition, Prentice Hall, 1999.
4. Richard A. Johnson, "Probability and Statistics for Engineers", 8<sup>th</sup> Edition, Pearson, 2017.

**COURSE OUTCOMES:** At the end of the course students will be able to

**CO1:** solve basic probability problems using axiomatic and conditional approaches

**CO2:** use appropriate probability distributions in real-world applications.

**CO3:** analyze and interpret data using descriptive statistical tools.

**CO4:** apply sampling methods and construct confidence intervals using estimation techniques.

**CO5:** perform hypothesis testing using standard parametric and non-parametric tests.

**Board of Studies (BOS):**

17<sup>th</sup> BOS of Department of Mathematics and Actuarial Science held on 23.06.2025.

**Academic Council:**

24<sup>th</sup> AC held on 26.08.2025

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	H							
CO2	H							
CO3		H	M	M				
CO4	H					M		
CO5						H		

**SDG 4 – Quality Education:** Ensure inclusive and equitable quality education and promote lifelong opportunities for all.

Learning probability and statistical concepts will help in computer applications.

<b>CAF 6101</b>	<b>DATA STRUCTURES AND ALGORITHMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>SDG: 9</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**COURSE OBJECTIVES:**

- COB1:** Understand fundamental data structures and their memory representations.
- COB2:** Explore abstract data types and their implementations in stacks and queues.
- COB3:** Analyze and implement sorting and searching algorithms.
- COB4:** Familiarize with tree and graph data structures and related algorithms.
- COB5:** Examine algorithm efficiency using asymptotic notations and solve problems using algorithmic strategies.

**MODULE I INTRODUCTION 9**

Data Structure: Introduction – Classifications – Memory Allocation Functions. Basic Data Structures: List ADT – Singly Linked Lists – Doubly Linked Lists – Circular Linked Lists.

**MODULE II STACK AND QUEUE 9**

Stack: Stack ADT – Implementation of Stacks and Applications. Queue: Queue ADT – Implementation of Queue – Applications. Notations: Infix – Prefix – Postfix Notations – Conversion from Infix to Postfix – Conversion from Infix to Prefix – Evaluation of Prefix and Postfix Expressions.

**MODULE III SORTING AND SEARCHING ALGORITHMS 9**

Sorting: Bubble Sort – Selection Sort – Insertion Sort – Quick Sort – Merge Sort – Heap Sort. Linear time sorting: Bucket Sort–Radix Sort. Searching: Linear Search – Binary Search – Jump Search and Hash Table.

**MODULE IV TREES AND GRAPH ALGORITHMS 9**

Trees: Tree Traversals; AVL Tree – Splay Tree – B Tree – B+ Tree – Red Black Tree. Traversal of Binary Tree: Preorder – Inorder – Postorder. Graphs: The Graph ADT – Representation of Adjacency List and Matrix. Search Algorithms: Breadth–First Search – Depth–First Search. Shortest Path Algorithms: Shortest Path – Weighted Graphs –

Dijkstra's Algorithm – Minimum Spanning Tree – Prim's and Kruskal's Algorithm.

**MODULE V APPLICATIONS AND CASE STUDIES 9**

Introduction to Design and Analysis of Algorithms. Analysis: Asymptotic Analysis – Asymptotic Notations and their properties – Apriori Analysis. Design Technique: Greedy Algorithms – Divide and Conquer – Brute Force – Backtracking – Branch and Bound – Closest Point Problem – Selection Problem. Case Studies: Sentinel Technique – Time Complexity – Design Choice in Data Pipeline – Hash Table Design.

**L –45 ; TOTAL HOURS –45**

**TEXT BOOKS:**

1. Adam Drozdek, Data Structures and Algorithms in C++, Cengage India, 4th Edition, 2024
2. Yashavant Kanetkar, Data Structures Through C++, BPB Publications, 5th Edition, 2023.

**REFERENCES:**

1. R.S. Salaria, Data Structures & Algorithms Using C++ – Theory, Design and Object Oriented Implementation, Khanna Publishers, 3rd Edition, 2021.
2. Wisnu Anggoro, C++ Data Structures and Algorithms, 2nd Edition, Packt Publishing, 2020.

**COURSE OUTCOMES:**

- CO1:** Analyze fundamental data structures such as lists, stacks, and queues, along with their applications and memory management techniques.
- CO2:** Apply stack-based and queue-based algorithms to convert and evaluate arithmetic expressions in infix, prefix, and postfix notations.
- CO3:** Implement various sorting and searching algorithms for a suitable environment.
- CO4:** Develop and apply tree and graph data structures to solve problems using traversal, shortest path, and minimum spanning tree algorithms.
- CO5:** Evaluate algorithm performance using asymptotic notations and design efficient solutions using standard algorithmic design strategies

**Board of Studies (BoS):**

21<sup>st</sup> BoS of Computer Applications held on  
13.06.2025

**Academic Council:**

24<sup>th</sup> AC held on 26.08.2025

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	H	M	L	H	L	L	L	M
CO2	H	H	L	M	L	L	L	L
CO3	H	H	M	H	L	L	L	L
CO4	H	H	H	H	M	L	L	M
CO5	H	H	H	H	L	L	L	M

**Note:** L – Low Correlation    M – Medium Correlation    H – High Correlation

SDG 9: Industry, Innovation and Infrastructure – Build resilient Infrastructure, promote inclusive and sustainable industrialization, and foster innovation.

Statement:

Design and development skills taught in this course for the learners with respect to the course outcomes are measurable. The learner can able to emphasize the importance of data structures in developing and implementing efficient algorithms.

<b>CAF 6102</b>	<b>OPERATING SYSTEM AND SHELL</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>SDG: 9</b>	<b>SCRIPTING</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**COURSE OBJECTIVES:**

**COB1:** To understand the fundamental concepts of operating systems:

**COB2:** To develop knowledge of process management techniques:

**COB3:** To gain proficiency in memory management techniques:.

**COB4:** To study the file and disk management in operating systems:

**COB5:** To acquire hands-on experience with shell programming and system administration:

**MODULE I INTRODUCTION 9**

Basics of Operating System Concepts– Computer system overview –Goals & Structures of operating system–Types of Operating Systems–OS Service –System Calls –Multitasking – Multiprogramming – Timesharing – Buffering–Concept of Virtual Machine. Process Concept, Process states, Process control–Process Control Block.

**MODULE II PROCESS MANAGEMENT 9**

Threads, Types of scheduling and algorithms: FCFS, SJF, RR –Inter Process Communication: Race Conditions, Critical Section, Peterson’s Solution, Semaphores–Mutual Exclusion–Dining Philosopher’s Problem– Reader’s & Writer Problem –Deadlock: Principles of Deadlock, Starvation, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection.

**MODULE III MEMORY MANAGEMENT 9**

Memory Management–Basics– Memory allocation: Contiguous Memory and Non–Contiguous allocation– Virtual memory – Paging–Handling Page Fault – Demand paging – segmentation–Page Replacement Algorithms: Optimal (OPT), First in First Out (FIFO), Second Chance– Least Recently used (LRU).

**MODULE IV FILE AND DISK MANAGEMENT 9**

File concept, Access methods– File types, File operations, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free–Space management (bit vector, linked list, grouping), directory implementation (linear list, hash table),efficiency & performance– Disks: Disk Formatting– Disk Scheduling algorithms: FCFS,SSTF,LOOK, CLOOK,SCAN,CSCAN–Error Handling

**MODULE V SHELL SCRIPTS AND OS TOOLS**

9

Unix/Linux – Role & Function of Kernel–Basic Linux commands :File and Directory commands– Shell Programming: Names, Types, Accessing files, variables, arguments and functions– Directory Structure, System Administration: Add new user, Managing Users, groups, Removing users, Disabling Logins, files and file permissions and security aspects of operating systems using the concepts of firewall– Security: Authentication– Insider Attacks – Malware – Defenses–Utilities.

**L – 45 ; TOTAL HOURS –45****TEXT BOOKS:**

1. Silberschatz Abraham, Greg Gagne, Peter B. Galvin. “Operating System Concepts”, Tenth Edition, Wiley, 2018.
2. Andrew S. Tanenbaum, Herbert Bos, “Modern Operating Systems”, 4th Edition, Pearson, 2014

**REFERENCES:**

1. William Stallings, “Operating Systems: Internals and Design Principles”, Ninth Edition, Prentice Hall, 2017.
2. H M Deital, P J Deital and D R Choffnes, “Operating Systems”, Third edition, Pearson Education, 2011.
3. Beginning Ubuntu Linux, Keir Thomas, Andy Channelle and Jaime Sicam, 4<sup>th</sup> edition, 2009.
4. D M Dhamdhere, “Operating Systems: A Concept–based Approach”, Second Edition, Tata McGraw–Hill Education, 2007.

**COURSE OUTCOMES:****CO1:** Describe the basic concepts of operating systems**CO2:** Analyze process management and apply scheduling algorithms**CO3:** Implement memory management techniques**CO4:** Manage files and disks in an operating system**CO5:** Write and debug shell scripts and handle OS tools for system administration**Board of Studies (BoS):**

21<sup>st</sup> BoS of Computer Applications held on  
13.06.2025

**Academic Council:**

24<sup>th</sup> AC held on 26.08.2025

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	H	M	M	M	L	L	L	M
CO2	M	H	M	M	L	L	L	M
CO3	M	H	H	M	L	L	L	M
CO4	M	M	M	H	L	L	L	M
CO5	M	M	H	H	M	L	M	H

**Note:** L– Low Correlation    M –Medium Correlation    H –High Correlation

SDG 9 : Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

Statement: Understanding OS leads to the development of efficient, secure, and innovative systems that form the backbone of IT infrastructure.

<b>CAF 6103</b>	<b>OBJECT ORIENTED SOFTWARE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>SDG: 9</b>	<b>ENGINEERING</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**COURSE OBJECTIVES:**

**COB1:** Understand the basic concepts of software engineering and software life cycle models.

**COB2:** Explore the techniques for requirement gathering design and specification.

**COB3:** Give an insight into the concepts of modeling and notations of the different UML Diagrams.

**COB4:** Explain the strategies behind designing a project and track progress.

**COB5:** Provide knowledge on software configuration management.

**MODULE I INTRODUCTION 9**

Nature of Software –Defining Software –Software Application Domains– Software Engineering Process– Process Framework – Umbrella Activities – Software Engineering Practice–Process Models– Agility and Process–Agility principles– Agile Development –Agile Framework

**MODULE II REQUIREMENT SPECIFICATIONS, PLANNING AND SCHEDULING 9**

Introduction – Overview of requirements elicitation – Requirement elicitation concepts – Requirement elicitation activities – Software Requirements Specification – Software project planning –Software Estimation – Empirical Estimation Models – Software Project Scheduling

**MODULE III ANALYSIS AND DESIGN 9**

UML: UML Diagrams–Object Oriented Analysis Process–Use Case Driven Object Oriented Analysis– Use Case Models–Object Oriented Analysis Classification–Noun Phrase Approach–Classes, Responsibilities and Collaborators– Identifying Object Relationships, Attributes and Methods– Associations –Object Oriented Design Process and Design Axioms–Design classes –Design using Tools.

**MODULE IV INTERFACE DESIGN AND SOFTWARE TESTING 9**

Overview of interface design – Principles – Activities– Overview of mapping– Mapping models to Code – Software Testing concepts– Testing Activities–Unit

Testing –Black box testing –White Box Testing–Integration Testing and Regression Testing.

**MODULE V SOFTWARE PROJECT MANAGEMENT 9**

Software Project Management –Project Management Concepts– Project Activities: Planning – Agile Project Management Activities Software Configuration Management –Configuration Management Activities– Risk Management –Case studies.

**L – 45; TOTAL HOURS – 45**

**TEXT BOOKS:**

1. Roger. S. Pressman and Bruce R. Maxim, "Software Engineering – A Practitioner's Approach", McGraw Hill, 9<sup>th</sup> Edition, 2023
2. Ali Bahrami, "Object Oriented Systems Development" McGraw Hill, 2020 .
3. Ian Sommerville, "Software Engineering", Pearson Education, 10<sup>th</sup> edition, New Delhi, 2016.

**REFERENCES:**

1. S.K. Kataria, Rajiv Chopra, "Object Oriented Software Engineering", 3rd Edition, 2013.
2. Stephan R. Schach, "Object Oriented and Classical software engineering", Tata McGraw Hill, 8th Edition, 2010.
3. Bernd Bruegge, "Object oriented software engineering", 3rd Edition, Pearson Education, 2009.

**COURSE OUTCOMES:**

**After completion of the course ,students will be able to ,**

**COB1:** Compare the different software life cycle models and select the appropriate model for a real time project .

**COB2:** Identify the software requirement specifications and formulate project planning in real time scenario.

**COB3:** Analyze different UML concepts and illustrate the UML design for real–time project.

**COB4:** Execute the object–oriented and software reusability concepts.

**COB5:** Implement and test software configuration management techniques in software engineering environment.

**Board of Studies (BoS):**

21<sup>st</sup> BoS of Computer Applications held on  
13.06.2025

**Academic Council:**

24<sup>th</sup> AC held on 26.08.2025

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	H							H
CO2			M					M
CO3				M				
CO4					H			
CO5							M	

**Note:** L– Low Correlation    M –Medium Correlation    H –High Correlation

**SDG 9 :** Industry, Innovation and Infrastructure – Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

**Statement:** By understanding the object oriented features, the students will be able to apply the knowledge to derive solutions to real world problems. The students will be able to analyze complex problems in the domain of software development with better effectiveness. Object oriented software can help optimize industrial processes and improve resource efficiency, contributing to sustainable industrialization. software engineering education and training can equip individuals with the skills needed for the digital economy, contributing to a more skilled workforce.

<b>CAF 6104</b>	<b>COMPUTER NETWORKS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>SDG: 9</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**COURSE OBJECTIVES:**

COB1: Understand the enough knowledge in networking, various types of networks and its applications

COB2: Explore the various functions of Network layer and its functions.

COB3: Explore the various functions of transport layer and its functions.

COB4: Explain the various functions of network management and application layer.

COB5: Familiarize the essential knowledge about wireless networks and mobile network.

**MODULE I INTRODUCTION 9**

Data Communications – Data Communications Networking – Layered Architecture – OSI Model – Internet Architecture (TCP/IP) – Data Transmission media – Concepts and Terminology – Networking Devices: Bridges, Switches, Routers, and Gateways.

**MODULE II NETWORK LAYER 9**

Network Layer: Internet Protocol – IPV4 Packet Format – Drawback of IPv4 – Internet Protocol version 6 (IPv6) – Benefits of IPv6 – IPv6 addressing – IPv6 Security – IPv6 Packet Structure– IP Addressing – Sub netting – Address Resolution Protocol (ARP) – Reverse Address Resolution Protocol (RARP) – Internet Control Message Protocol (ICMP) – Concept of SDN – Circuit switching: Circuit switching networks switching concepts – Routing in circuit switched networks – Packet switching principles – Routing in packet switching

**MODULE III TRANSPORT LAYER 9**

Transport Layer functions – Multiplexing and De – multiplexing – User Datagram Protocol – Applications – Transmission Control Protocol – Error control –Types –Flow Control – Retransmission Strategies – Congestion Control.

**MODULE IV NETWORK MANAGEMENT AND APPLICATION LAYER 9**

Network Management, The Internet–Standard Management Framework, SMI– MIB, SNMP Protocol Operations and Transport Mappings, Security and Administration. Application Layer protocols – HTTP – FTP – SMTP – SNMP – DNS –ping and traceroute commands–case study–Cisco Packet tracer–OMNeT++, NS–3.

**MODULE V WIRELESS NETWORKS AND MOBILE NETWORK 9**

Introduction– Wireless Links and Network Characteristics: 802.11 Wireless LANs– 802.11 Architecture–802.11 MAC Protocol– Features of 802.11, Personal Area Networks: Bluetooth and Zigbee–MANET– Cellular Internet Access– CDMA–FDMA– TDMA–GSM architecture Mobile IP–handoff method–DTN

**L – ; TOTAL HOURS –45**

**TEXT BOOKS:**

1. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Fifth Edition, Morgan Kaufmann Publishers Inc., 2011.
2. William Stallings, “Data and Computer Communications”, Tenth Edition/e, Pearson Education, 2017.

**REFERENCES:**

1. Behrouz A. Forouzan, Data Communication & Networking, Mc. Graw Hill Publishers, 4th edition 2017.
2. Mischa Schwartz, “Mobile wireless communication,” Cambridge press 2004, ISBN–13 978–0–511–26423–8.

**COURSE OUTCOMES:**

**CO1:** Identify the key functions of different network devices.

**CO2:** Analyze and compare network layer protocols.

**CO3:** Analyze and compare transport layer protocols.

**CO4:** Design Network architecture using Network simulation tools.

**CO5:** To demonstrate the scholarship of knowledge through performing in a group to identify, formulate and solve a problem related to wireless Computer Networks and Mobile networks.

**Board of Studies (BoS):**

21<sup>st</sup> BoS of Computer Applications held on 13.06.2025

**Academic Council:**

24<sup>th</sup> AC held on 26.08.2025

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	H	L	H	M	M	H	H	H
CO2	H	L	L	L	H	H	L	L
CO3	H	H	H	L	L	M	M	H
CO4	H	H	H	L	L	M	H	H
CO5	H	H	H	H	L	M	H	H

**SDG 9:** Quality Education.

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

**STATEMENT:**

The course promotes inclusive and equitable quality education and fosters lifelong learning opportunities by equipping students with essential knowledge in computer networks resources and various types of communication. computer networks support and strengthening digital infrastructure, enabling innovation, and improving industrial productivity through better connectivity

<b>CAF 6105</b>	<b>ADVANCED JAVA PROGRAMMING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>SDG: 4</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**COURSE OBJECTIVES:**

**COB1:** Understand the concept of packages, interface.

**COB2:** Explore the concept of Inheritance and Exception handling in java.

**COB3:** Learn the database connectivity and know the differences of AWT and Swing

**COB4:** Understand and create web applications using Java Servlet and Java Server Page technology.

**COB5:** Study the concept of Java beans

**MODULE I            FUNDAMENTALS , INHERITANCE AND INTERFACE            9**

Introduction – Java features – Java Platform – Java Fundamentals – Expressions, Operators, and Control Structures–Constructor–The Java Class– Inheritance, Derived Classes, Method Overriding, Method Overloading, Abstract Class and Method, Interfaces, Packages.

**MODULE II            THREAD, EXCEPTION HANDLING,APPLET AND AWT            9**

Threads: Introduction, Creating Threads in Applications–Thread Priority –Exception Handling. Applet: Create an Applet, Applets Life Cycle. AWT: AWT package – Layouts – Containers – Event Package – Event Model – Painting– Language Packages.

**MODULE III            JAVA SWING AND JDBC            9**

Java collection framework. –Swing: Components hierarchy, Panes, Swing components.JDBC: Introduction, JDBC Architecture, Types of Drivers, Statement, ResultSet, Read Only ResultSet, Updatable ResultSet, Forward Only ResultSet, Scrollable ResultSet, PreparedStatement, Connection Modes, SavePoint, Batch Updatations, CallableStatement.

**MODULE IV            SERVLET AND JSP            9**

Servlets: Introduction, Web application Architecture, Http Protocol & Http Methods, Web Server & Web Container, Servlet Interface, GenericServlet, HttpServlet, Servlet Life Cycle, ServletConfig, ServletContext, Servlet Communication, Session Tracking Mechanisms JSP: Introduction, JSP LifeCycle, JSP Implicit Objects & Scopes, JSP Directives, JSP Scripting Elements, JSP Actions: Standard actions and customized actions.

**MODULE V          JAVA BEANS****9**

Java Beans: Introduction, JavaBeans Properties, Struts2: Basic MVC Architecture, framework features, MVC pattern, Request life cycle, Configuration Files, Actions, Interceptors, Results & Result Types, Value Stack/OGNL.

**L – 45 ; TOTAL HOURS –45****TEXT BOOKS:**

1. Cay S. Horstmann, Gary Cornell, Core Java™ 2: Volume II–Advanced Features Prentice Hall PTR,9th Edition,2023.
2. Herbert Schildt, Java 2 Complete Reference, 5th Edition, Tata McGraw Hill, New Delhi,2021
3. James McGovern, Rahim,Adatia, Yakor Fain, J2EE 1.4 Bible, Wiley–dreamtech India Pvt. Ltd, New Delhi , 2020.

**REFERENCES:**

1. D. R.Callaway,Inside Servlets, Addison Wesley, Boston, 2021.
2. K. Moss, Java Servlets, Second edition, Tata McGraw Hill, New Delhi. 2020,
3. Joseph O’Neil, Java Beans from the Ground Up, Tata McGraw Hill, New Delhi.,2020.

**COURSE OUTCOMES:**

**CO1:** Write programs in core java programming.

**CO2:** Design GUI in Java usingApplet & AWT along with response to events.

**CO3:** Implement frontend and backend connectivity.

**CO4:** Apply Servlets and JSP for creating Web based applications using JDBC.

**CO5:** Develop JavaBeans using tools like the JavaBeans API, Application Builder, and JAR files.

**Board of Studies (BoS):**

21<sup>st</sup> BoS of Computer Applications held on  
13.06.2025

**Academic Council:**

24<sup>th</sup> AC held on 26.08.2025

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	H							H
CO2	H		M		L		L	H
CO3	H	M	H		L		L	H
CO4	H	H	H	H	H	H	H	H
CO5	H	H	H	H	H	H	M	H

**SDG: 4 Quality Education.**

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

**STATEMENT:**

The course promotes inclusive and equitable quality education and fosters lifelong learning opportunities by equipping students with essential digital and data literacy skills. Through hands-on programming, Servlets, JSP, Java bean, learners are empowered to engage in real-world problem-solving, thus enhancing their readiness for both academic research and industry demands.

<b>CAF 6106</b>	<b>DATA STRUCTURES AND</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>SDG: 9</b>	<b>ALGORITHMS LABORATORY</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**COURSE OBJECTIVES:**

- CO1:** Understand and implement various linear and non-linear data structures.
- CO2:** Explore stack and queue data structures for expression conversion and evaluation.
- CO3:** Familiarize sorting and searching techniques for efficient data access and organization.
- CO4:** Develop programs using advanced tree data structures such as AVL, Splay, and B+ Tree.
- CO5:** Examine computational problems using appropriate data structures and algorithms.

**PRACTICALS**

## List of Experiments:

1. Write a C program for matrix multiplication using arrays.
2. Write a C program to implement a singly linked list with operations: insert at the beginning, end, and specific position; delete by value.
3. Write a C program to implement a doubly linked list with forward and backward traversal.
4. Write a C program to implement a stack using linked lists. Include push, pop, and display operations.
5. Write a C program to implement a queue using linked lists. Include enqueue, dequeue, and display functions.
6. Write a C++ program to implement a circular queue using an array.
7. Write a C++ program to convert an infix expression to postfix using a stack.
8. Write a C++ program to evaluate a postfix expression using a stack.
9. Write a C++ program to apply bucket sorting algorithm for non-negative integers.
10. Write a C++ program that implements the radix sort algorithm.
11. Write a C++ program that implements the jump search algorithm.
12. Write a program for an AVL Tree implementation in C++ with insertion and rotations.

13. Write a program for a Splay Tree implementation in C++ with its splaying operation.
14. Write a C++ program to implement B+ Tree with insertions and display the structure.
15. Write a C++ program to implement brute force pattern matching algorithm.

**P-30; TOTAL HOURS -30**

**TEXT BOOKS:**

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C (2nd Edition), Pearson Publication (India), May 2025.
2. Adam Drozdek, Data Structures and Algorithms in C++, Cengage India, 4th Edition, 2024.

**REFERENCES:**

1. Yashavant Kanetkar, Data Structures Through C++, BPB Publications, 5th Edition, 2023.
2. R.S. Salaria, Data Structures & Algorithms Using C++ – Theory, Design and Object Oriented Implementation, Khanna Publishers, 3rd Edition, 2021.

**COURSE OUTCOMES:**

- CO1:** Implement and manipulate linked lists (singly, doubly, circular) using dynamic memory allocation.
- CO2:** Apply stack and queue data structures to solve expression conversion and evaluation problems.
- CO3:** Demonstrate the implementation of sorting (bucket, radix) and searching (jump search) techniques.
- CO4:** Construct and perform operations on self-balancing and multi-way trees like AVL, Splay, B Tree, and B+ Tree.
- CO5:** Develop algorithmic approaches like quickselect to solve selection and optimization problems.

**Board of Studies (BoS):**

21<sup>st</sup> BoS of Computer Applications held on  
13.06.2025

**Academic Council:**

24<sup>th</sup> AC held on 26.08.2025

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	H	M	M	H	L	L	L	M
CO2	H	H	M	H	L	L	L	M
CO3	H	H	H	H	L	M	L	M
CO4	H	H	H	H	M	M	L	M
CO5	H	H	H	H	M	M	L	H

**Note:** L– Low Correlation    M –Medium Correlation    H –High Correlation

SDG 9: Build resilient Infrastructure, promote inclusive and sustainable industrialization, and foster innovation

Statement: Design and development skills taught in this course for the learners, concerning the course outcomes, are measurable. The learner can able to emphasize the importance of data structures in developing and implementing efficient algorithms.

<b>CAF 6107</b>	<b>ADVANCED JAVA</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>SDG: 4</b>	<b>PROGRAMMING LABORATORY</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

### **COURSE OBJECTIVES:**

**COB1:** Understand the fundamentals of object oriented programming in Java.

**COB2:** Learn the exception handling, Threads and AWT

**COB3:** Learn the database connectivity and know the differences of AWT and Swing

**COB4:** Understand and create web application using Java Servlet and Java Server Page technology.

**COB5:** Explore the concept of Java beans

### **PRACTICALS**

List of Experiments:

1. Write a program to accept a number and check if it is prime using control structures.
2. Write a Java program that prompts the user for an integer and then prints out all prime numbers up to that integer. (use Scanner class to read input)
3. Write a Java program to create a Student class with following fields
  - i. Hall ticket number
  - ii. Student Name
  - iii. Department Create 'n' number of Student objects where 'n' value is passed as input to constructor.
4. Program to illustrate the use of overloading and overriding.
5. Program to implement the concept of Interfaces and packages.
6. Write a program to demonstrate single inheritance with extended functionality.
7. Write a Java program that creates three threads. First thread displays "Good Morning" everyone second, the second thread displays "Hello" every two seconds and the third thread displays "Welcome" every three seconds.
8. Generate the program using exceptions handling mechanism.

9. Write a Java program for handling mouse events and key events using Adapter classes
10. Develop simple calculator using Java Swings.
11. Write a program that connects to a database using JDBC and does add, delete, modify and retrieve operation in java.
12. Write a simple servlet that displays a message.
13. Write a servlet for session tracking.
14. Write a JSP that reads parameters from user login page
15. Write a java program to create a bean that performs conversion of American dollar to Indian rupee.

#### Case Studies

1. Create Student Registration System using Java Swing for the GUI and JDBC for database operations. The application should allow students to register for a course by entering their personal and academic information.
2. Develop an Online Book Store web application using Java Servlets and JSP. The application should allow users to browse books, add them to a cart, and place orders. Administrators should be able to add and manage books in the catalog.
3. Develop an Online Job Portal using JavaBeans and the Struts 2 framework. The application allows users to register, log in, create a profile, and apply for jobs. Administrators can post job openings and manage applicants.

**P – 30; TOTAL HOURS – 30**

#### TEXT BOOKS:

1. Cay S. Horstmann, Gary Cornell, Core Java™ 2: Volume II–Advanced Features Prentice Hall PTR,9th Edition,2023.
2. Herbert Schildt, Java 2 Complete Reference, 5th Edition, Tata McGraw Hill, New Delhi,2021.
3. James McGovern, Rahim,Adatia, Yakor Fain, J2EE 1.4 Bible, Wiley–dreamtech India Pvt. Ltd, New Delhi , 2020.

#### REFERENCES:

1. D. R.Callaway,Inside Servlets, Addison Wesley, Boston, 2021.
2. K. Moss, Java Servlets, Second edition, Tata McGraw Hill, New Delhi. 2020,
3. Joseph O'Neil, Java Beans from the Ground Up, Tata McGraw Hill, New Delhi.,2020.

**COURSE OUTCOMES:**

**CO1:** Apply Object oriented features using Java.

**CO2:** Design GUI in Java using Applet & AWT along with response to events.

**CO3:** Implement the database connectivity using JDBC

**CO4:** Develop web application using Java Servlet and Java Server Page technology

**CO5:** Create JavaBeans using tools like the JavaBeans API, Application Builder, and JAR files.

**Board of Studies (BoS):**

21<sup>st</sup> BoS of Computer Applications held on  
13.06.2025

**Academic Council:**

24<sup>th</sup> AC held on 26.08.2025

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO1	H	L		L	H		L	
CO2	H	H	H	M	H	H	L	H
CO3	H	H	H	H	H	H	M	H
CO4	H	H	H	H	H	H	M	H
CO5	H	H	H	H	H	H	M	H

**Note:** L– Low Correlation    M –Medium Correlation    H –High Correlation

SDG 4 : Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Statement: This Sustainable Development Goal (SDG 4: Quality Education) it promotes access to quality learning materials and innovative teaching methods. It emphasizes the development of essential skills that prepare students for employment, entrepreneurship, and active participation in sustainable development.

<b>CAF 6108</b>	<b>PROGRAMMING IN C AND C++</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>SDG: 9</b>	<b>LABORATORY</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

### **COURSE OBJECTIVES:**

**COB1:** Introduce students to structured programming concepts using the C language, focusing on data types, control statements, loops, and arrays

**COB2:** Develop the ability to write modular programs using functions, recursion, and pointers to solve computational problems

**COB3:** Familiarize students with user-defined data types such as structures and unions, and apply them in data handling and manipulation.

**COB4:** Enable students to write efficient and reusable code by using advanced features in C++, including constructors, destructors, and operator overloading.

**COB5:** Prepare students for real-world software development by applying both procedural and object-oriented programming approaches to solve basic to intermediate-level problems.

### **PRACTICALS**

#### **List of Experiments**

##### **C Programming:**

1. **Basic I/O and Data Types** – Program to demonstrate input/output and use of different data types.
2. **Control Statements** – Programs using if-else, switch, loops (for, while, do-while).
3. **Functions** – Program using User-defined functions, recursion (e.g., Factorial, Fibonacci).
4. **Arrays** – Program to implement One-dimensional and two-dimensional arrays (e.g., sorting, searching and matrix operations).
5. **Strings** – String manipulation functions (e.g., reverse, palindrome, compare and concatenation ).
6. **Pointers** –Program using Pointer operations, pointer and arrays, pointer to functions.
7. **Structures and Unions** – Creating and accessing structure members, arrays of structures.
8. **File Handling in C** – Read/write files, file pointer operations (fopen, fread, fwrite, etc.).

9. **Mini Project** – Student information system, Simple calculator, File encryption/decryption.

### **C++ Programming:**

1. Basic C++ Program – Creation of class and object with scope resolution operator.
2. Constructors and Destructors –Programs using parameterized constructors, copy constructors, destructor behaviour.
3. Function Overloading and Operator Overloading – Overload binary/unary operator and relational operators.
4. Inheritance– – Programs using various types of inheritance (Single, multiple, multilevel, hierarchical inheritance).
5. Polymorphism – Programs to implement virtual functions, runtime polymorphism, abstract classes and pure virtual function.
6. Templates – Programs using function and class templates.
7. Exception Handling – – Program to demonstrate try, catch, multiple catches, throw mechanism.
8. File Handling in C++ – Streams (ifstream, ofstream), file read/write operations.
9. Mini Project – Inventory system, Ticket booking system, Bank management system, Library management.

**P – 30 ; TOTAL HOURS – 30**

### **TEXT BOOKS:**

1. Yashavant P. Kanetkar, "Let Us C", BPB Publications; 20<sup>th</sup> edition, August 2024.
2. G. Balagurusamy, "Object–Oriented Programming with C++, 8<sup>th</sup> Edition", McGraw Hill; Eighth edition (24 September 2020); McGraw Hill Education (India) Private Limited, September 2020.

### **REFERENCES:**

1. Kunal Pimparkhede, "Computer Programming with C++", Cambridge University Press; First edition, January 2017.
2. Yashavant Kanetkar, "Let Us C++", BPB Publications, 16 September 2020.
3. Herbert Schildt, "C++: The Complete Reference, 4th Edition", McGraw Hill Education; 4th edition, July 2017.

4. Stanley Lippman, "C++ Primer", Addison–Wesley; 5th edition, August 2012

### COURSE OUTCOMES:

**CO1:** Develop simple programs using basic concepts of C like data types, operators, control structures, and arrays.

**CO2:** Apply modular programming concepts using functions and recursion in C.

**CO3:** Implement data structures such as pointers, strings, and structures in C.

**CO4:** Design object–oriented programs using classes and objects in C++.

**CO5:** Demonstrate the use of constructors, destructors, function overloading, and operator overloading in C++.

### Board of Studies (BoS):

21<sup>st</sup> BoS of Computer Applications held on  
13.06.2025

### Academic Council:

24<sup>th</sup> AC held on 26.08.2025

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	L	M			L			
CO2	H			L		L		
CO3	M	H	L	M				M
CO4	H					M		H
CO5		M		H	M	H		M

**Note:** L– Low Correlation    M –Medium Correlation    H –High Correlation

**SDG 9 :** Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

**STATEMENT** C and C++ are foundational languages for system–level programming, embedded systems, and performance–critical applications. Projects can involve innovative software solutions in areas such as robotics, automation, IoT, and real–time systems to all critical to industrial innovation. Hands–on programming builds technical capacity for sustainable industrialization.

<b>CAF 6201</b>	<b>QUALITATIVE AND QUANTITATIVE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>SDG: 4</b>	<b>REASONING</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**COURSE OBJECTIVES:**

**COB1:** Understand different types of reasoning and identify logical structures, fallacies, and biases in arguments.

**COB2:** Apply logical rules and solve analytical problems like puzzles, syllogisms, and data sufficiency questions.

**COB3:** Calculate and solve real-life problems using arithmetic, algebra, and basic statistics.

**COB4:** Interpret data from graphs and tables and evaluate scientific arguments using probability and statistics.

**COB5:** Develop and present reasoned solutions to real-world problems using critical and ethical thinking.

**MODULE I      FUNDAMENTALS OF REASONING      9**

Introduction to reasoning: Qualitative and Quantitative approaches, Deductive and inductive reasoning, Structure of arguments, Propositional and predicate logic, Validity and soundness, Common fallacies, Argument mapping, Cognitive biases in reasoning.

**MODULE II      ANALYTICAL AND LOGICAL THINKING      9**

Syllogisms, Logical deductions, Analytical puzzles, Assumptions and conclusions, Inference evaluation, Ranking and ordering, Blood relations and direction sense, Binary logic, Decision tables, Data sufficiency problems.

**MODULE III      QUANTITATIVE REASONING      9**

Arithmetic reasoning: ratios, percentages, time and work, profit and loss, Algebraic applications: linear and quadratic equations, inequalities, Financial mathematics: simple and compound interest, Net Present Value (NPV), Internal Rate of Return (IRR), Statistical tools: mean, median, mode, variance, correlation, Regression basics, Mathematical modeling for real-life problem solving.

**MODULE IV      SCIENTIFIC REASONING      9**

Data representation and analysis: tables, bar graphs, pie charts, line graphs, Probability and combinatorics, Hypothesis testing: types, errors, and interpretation, Sampling techniques and biases, Evaluation of scientific data and arguments, Interpreting research findings.

**MODULE V      INTEGRATIVE REASONING AND APPLICATION      9**

Case-based reasoning, Real-world application across disciplines: business, health, policy, education, Ethical reasoning and qualitative evaluation, Critical thinking using mixed-methods data, Capstone problem-solving project or simulation, Structured argument development and presentation.

**L – 45; TOTAL HOURS –45**

**TEXT BOOKS:**

1. M. N. Bandyopadhyay, Critical Thinking, Logic, and Reasoning, 2nd ed., New Delhi, India: Pearson Education, 2022.
2. N. K. Sinha and R. K. Meena, Quantitative Aptitude and Reasoning for Competitive Examinations, 3rd ed., New Delhi, India: McGraw Hill, 2021.

**REFERENCES:**

1. G. Bell, Data Interpretation and Logical Analysis: For Graduate Aptitude Learners, 2nd ed., London, UK: Cambridge Academic, 2023.
2. D. Facione and C. Gittens, Think Critically, 4th ed., Boston, USA: Pearson, 2023.
3. R. S. Aggarwal, A Modern Approach to Logical Reasoning, New Delhi, India: S. Chand Publishing, 2022.
4. A. T. Chambers, Applied Quantitative Reasoning in the Social Sciences, 1st ed., New York, USA: Sage Publications, 2021.

**COURSE OUTCOMES:**

**CO1:** Analyze and distinguish between qualitative and quantitative reasoning approaches in real-world contexts.

**CO2:** Apply logical and analytical thinking techniques to solve structured reasoning problems.

**CO3:** Use mathematical and statistical tools to interpret quantitative data and solve practical problems.

**CO4:** Evaluate data sources, interpret research findings, and make reasoned conclusions using scientific and statistical reasoning.

**CO5:** Integrate logical, ethical, and interdisciplinary reasoning in professional or academic problem-solving scenarios.

**Board of Studies (BoS):**

21<sup>st</sup> BoS of Computer Applications held on  
13.06.2025

**Academic Council:**

24<sup>th</sup> AC held on 26.08.2025

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO1	H	M				M		
CO2	H	H	M	H	M			
CO3	H	H	M	H	H			
CO4	H	H		H	H	M		M
CO5	H	H	M	M	M	H	M	H

**Note:** L– Low Correlation    M –Medium Correlation    H –High Correlation

**SDG 4:** Quality Education.

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

**STATEMENT:**

This course supports Quality Education by enhancing students' critical thinking, logical reasoning, and problem-solving abilities across disciplines. Through modules on analytical, quantitative, scientific, and ethical reasoning, learners develop essential skills for informed decision-making and lifelong learning, which are foundational for personal development, responsible citizenship, and professional success.

<b>CAF 6202</b>	<b>ADVANCED DATABASE TECHNOLOGY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>SDG: 9</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**COURSE OBJECTIVES:**

**COB1:** Learn the views of the database, concepts of data storage, discuss the normalization techniques and query evaluations and optimization techniques

**COB2:** Illustrate the use of views and index. cursors, triggers, procedure and functions .

**COB3:** Explore the concepts the concepts of transaction processing, concurrency control techniques and recovery procedures.

**COB4:** Introduce the fundamentals of NoSQL databases with a focus on MongoDB, its operations, architecture, and real-world application scenarios

**COB5 :** Provide an in-depth understanding of advanced database concepts including parallelism, distribution, object orientation, special-purpose databases, and cloud-native architectures.

**MODULE I INTRODUCTION TO DATABASE DESIGN 9**

Database Systems vs. File Systems – View of Data – Data Models–Database Languages – Database Systems Structure –Database Systems Applications – Keys Entity Relationship model (E–R model)– ER Diagrams – –Normalization – Non loss decomposition and functional dependencies – First – Second and third normal forms –Boyce – Codd normal form–Query Processing – Evaluation of Expressions–Query Optimization.

**MODULE II RELATIONAL DATABASE 9**

Relational Model– Relational Algebra– Fundamental operations using MYSQL – (Create, Insert, Update, Delete, Join Select,Union,Update,Where Clause, Order by, Group by,) – Join Operation –Data Constraints– Advanced Operations –Views PL/SQL based– Functions–Procedures–Trigger.

**MODULE III DATA STORAGE , INDEXING AND TRANSACTION MANAGEMENT 9**

Storage & File Structure–RAID–File Organization–Organization of Records in Files– Indexing and Hashing – Ordered Indices – B+ tree Index Files – Btree Index Files – Static Hashing – Dynamic Hashing – Transaction Concepts – Transaction Recovery – ACID Properties – System Recovery – Two Phase Commit – Save Points – Concurrency – Locking Protocols – Two Phase Locking– Deadlock– Serializability .

**MODULE IV                      NoSQL DATABASE                      9**

NOSQL database – Basics of NoSQL– Overview of NoSQL– Characteristics of NoSQL Databases– NoSQL Database Categories–Database Deployment Options– Choosing an Appropriate Data Layer– An Open–Source NoSQL Database – Overview of MongoDB– Advantages of MongoDB– Mapping Relational Databases to MongoDB– Create Database in MongoDB– MongoDB CRUD Operations– Aggregate operations

**MODULE V                      DATABASE FOR ADVANCED APPLICATIONS                      9**

Parallel Databases–: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism– Distributed Database Concepts – Architectural Models for Distributed DBMS, Distribution Design issues, Fragmentation, Allocation Distributed Data Storage – Distributed Transactions –Concepts for Object Databases: ODMG Model – ODL – OQL – Web Databases –Mobile Databases– Spatial and Temporal Data– Multimedia and Deductive Databases– Database Options in the Cloud– Cloud Native Databases.

**L – 45 ; TOTAL HOURS –45**

**TEXT BOOKS:**

1. Henry F Korth, Abraham Silberschatz and S. Sudharshan, “Database System Concepts”, McGraw Hill, Seventh Edition, Tata McGraw Hill, 2019.
2. Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Pearson, 7th Edition, 2016.
3. K. Chodorow, MongoDB: The Definitive Guide, 3rd ed. Sebastopol, CA, USA: O'Reilly Media, 2019.

**REFERENCES:**

1. Alan Beaulieu, “Learning SQL – Generate, Manipulate, and Retrieve Data”, O'Reilly, 3rd Edition, 2020.
2. Steven Feuerstein, Bill Pribyl & Chip Dawes, “Oracle PL/SQL Language Pocket Reference”, O'Reilly, 5th Edition, 2015.
3. N. P. Singh, C.S. Gupta, "Relational Database Management Systems", Abhishek Publications, 2014.
4. M. Tamer OZSU and Patuck Valduriez: Principles of Distributed Database Systems, Pearson Edn. Asia, 2011

**COURSE OUTCOMES:**

Students who complete this course will be able to

**CO1:** Implement the concepts of data storage, query evaluations and optimization techniques

**CO2:** Create and manipulate databases using SQL queries, retrieve data using Join Queries, manipulate database using PL/SQL functions and procedures.

**CO3:** Demonstrate the understanding of key notions of transaction processing and concurrency control.

**CO4:** Apply NoSQL concepts using MongoDB, including CRUD and aggregation operations

**CO5:** Analyze, design, and implement advanced database solutions including parallel, distributed, object-oriented, specialized, and cloud-native databases.

**Board of Studies (BoS):**

21<sup>st</sup> BoS of Computer Applications held on 13.06.2025

**Academic Council:**

24<sup>th</sup> AC held on 26.08.2025

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1		H	H	M				
CO2	H			M	M			
CO3			H				M	M
CO4			H	M	M	M		
CO5		H			M	M		M

**SDG 9:** Industry, Innovation and Infrastructure – Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

**Statement:** The knowledge gained by the learner in this course will help them significantly improve their understanding and enable them to implement the concepts learned in real world applications. The student will be able to store, retrieve and manage data effectively using advanced databases. The knowledge attained through advanced database management system will improve the skill set of the student to meet the industrial standard.

<b>CAF 6203</b>	<b>PYTHON PROGRAMMING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>SDG: 4</b>		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**COURSE OBJECTIVES:**

**COB1:** Understand the fundamental concepts of Python programming.

**COB2:** Understand OOPs concepts and use NumPy to access data through indexing and slicing.

**COB3:** Manipulate and preprocess the data using Pandas and visualization using and Matplotlib.

**COB4:** Explore file operations and integrate Python with Power BI for data-driven insights.

**COB5:** Facilitate the basic image and video processing techniques using OpenCV

**MODULE I      FUNDAMENTALS OF PYTHON      9**

Features of Python – Data types: Numbers, Strings & its operations, Boolean – Operators – List & its operations, Tuples & its operations, Dictionaries & its operations – Arrays – Input and Output – Conditions statements: if, if-else, if-elif – Looping statements: while Loop, For loop – Functions

**MODULE II      OOPS CONCEPTS AND NUMPY      9**

Classes – Objects – Inheritance – Encapsulation – Abstraction – Polymorphism – Exception Handling – NumPy array attributes – Array indexing – Array slicing – Computation on Numpy Arrays – Aggregations – Sorting arrays.

**MODULE III      DATA PROCESSING USING PANDAS & VISUALIZATION      9  
USING MATPLOTLIB**

Introduction to Jupyter – Pandas Basics (DataFrame), Pandas Series and Index Objects – Position / Label based data indexing (iloc, loc) – Data Work Flow & Importing Data – Data Cleaning: Handling of inconsistent data – Detection of missing values – Removing & Replacing missing values – Duplicate Data Handling – Detection of Outliers. General Matplotlib Tips – Customization of Plots – Line Plots – Histogram – Barcharts and Pie Charts – Scatter Plots

**MODULE IV      FILE HANDLING & POWER BI INTEGRATION WITH      9  
PYTHON**

**FILE HANDLING:** Files I/O – Printing to the Screen – Reading Keyboard Input – Opening and Closing Files – Reading and Writing Files – Renaming and Deleting Files – Directories in Python – Exceptions Handling using try-except.

**POWER BI INTEGRATION:** Python Installation – Power BI Connection – Transform Data – Python Script – Python Visuals in Power BI – Violin Plots using Seaborn for Data Analysis – Case Study: Perform Sentiment Analysis on online clothing store reviews.

**MODULE V      COMPUTER VISION USING OPEN CV      9**

Setting up OpenCV and Basic Image Handling – Reading, Displaying, and Saving Images – Basic Image Properties – Color Mapping – Blending and Pasting Images – Blurring and Smoothing – Morphological Operators – Gradient – Histogram – Introduction to Video Basics – Camera Connection – Video Files – Drawing on Live Camera – Object Detection.

**L – 45; TOTAL HOURS – 45**

**TEXT BOOKS:**

1. Matthes, Eric. *Python Crash Course*. No Starch Press, 2nd Edition, San Francisco, 2019.
2. VanderPlas, Jake. *Python Data Science Handbook*. O'Reilly Media, 1st Edition, Sebastopol, 2016.
3. McKinney, Wes. *Python for Data Analysis*. O'Reilly Media, 2nd Edition, Sebastopol, 2018.
4. Luca Zavarella. *Extending Power BI with Python and R – Second Edition: Perform advanced analysis using the power of analytical languages*, 2024.
5. Kaehler, Adrian, and Gary Bradski. *Learning OpenCV 4: Computer Vision with Python*. O'Reilly Media, 1st Edition, 2019.

**REFERENCES:**

1. Downey, Allen B. *Think Python: How to Think Like a Computer Scientist*. O'Reilly Media, 2nd Edition, Sebastopol, 2015.
2. Phillips, Dusty. *Python Object-Oriented Programming*. Packt Publishing, 2nd Edition, Birmingham, 2015.
3. Grus, Joel. *Data Science from Scratch: First Principles with Python*. O'Reilly Media, 2nd Edition, Sebastopol, 2019.
4. Sweigart, Al. *Automate the Boring Stuff with Python*. No Starch Press, 2nd Edition, San Francisco, 2019.
5. Rosebrock, Adrian. *Practical Python and OpenCV: An Introductory, Example-Driven Guide to Image Processing and Computer Vision*. PyImageSearch.

**COURSE OUTCOMES:**

**CO1:** Write Python programs using data types, operators, control structures, and recursion.

**CO2:** Apply object-oriented concepts and perform efficient numerical operations using NumPy.

**CO3:** Preprocess, clean, and visualize data using Pandas and Matplotlib

**CO4:** Perform file handling and create Python-powered visuals in Power BI for analysis.

**CO5:** Implement basic computer vision techniques for images and videos using OpenCV.

**Board of Studies (BoS):**

21<sup>st</sup> BoS of Computer Applications held  
on 13.06.2025

**Academic Council:**

24<sup>th</sup> AC held on 26.08.2025

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO1	H	M	M	L	L	L	L	M
CO2	H	M	M	H	M	L	L	M
CO3	H	H	H	H	M	L	L	M
CO4	M	H	H	H	M	M	L	H
CO5	M	H	H	H	M	M	L	H

**SDG 4:** Quality Education.

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

**STATEMENT:**

The course promotes inclusive and equitable quality education and fosters lifelong learning opportunities by equipping students with essential digital and data literacy skills. Through hands-on programming, data analysis, and integration with industry tools like Power BI and OpenCV, learners are empowered to engage in real-world problem-solving, thus enhancing their readiness for both academic research and industry demands.

<b>CAF 6204</b>	<b>FULL STACK WEB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>SDG: 9</b>	<b>DEVELOPMENT</b>	<b>3</b>	<b>0</b>	<b>2</b>	<b>4</b>

**COURSE OBJECTIVES:**

**COB1:** Introduce the fundamentals of HTML with CSS, including tags, attributes, and elements, for effective webpage development.

**COB2:** Provide a comprehensive understanding of JavaScript programming techniques.

**COB3:** Understand the key features and capabilities of the AngularJS framework for building single–page web applications.

**COB4:** Equip students with the skills to build dynamic and scalable React applications

**COB5:** Examine proficiency in Node.js and MongoDB concepts to manage events and databases.

**MODULE I                      HTML5 and CSS                      9**

Semantic HTML5 – ARIA Accessibility – Forms and Validation – Multimedia Integration – Responsive Images – Interactive Elements – SEO Basics – Web Storage API – Custom Data Attributes – Progressive Enhancement – CSS Syntax and Selectors – CSS Variables and Theming – Box Model – Flexbox – CSS Grid – Media Queries – Typography – Transitions and Animations – Scoped CSS – Dark Mode – Utility CSS Frameworks – CSS Preprocessors – Accessibility Styling – CSS Modules.

**MODULE II                      JavaScript                      9**

JavaScript Basics – Script Inclusion Methods – Syntax and Scope – DOM and BOM Access – Data Types and Conversion – Objects and Arrays – Date Handling – Control Flow – Functions and Arrow Functions – Event Handling – Form Validation – ES6+ Features – Async Programming – Modules – Error Handling – Closures – Prototypes – JSON – Fetch API – Web APIs.

**MODULE III                      AngularJS                      9**

AngularJS Introduction – SPA Concepts – MVC Pattern – Component Structure – Two–Way Binding – Custom Directives – Dependency Injection – Template Expressions – Controllers and Scope – Data Models – Pipes and Filters – Validation Techniques – Routing and Navigation – Injectable Services – Handling HTTP with \$http.

**MODULE IV                      REACTJS                      9**

ReactJS Overview – Component Architecture – JSX Fundamentals – Props for Data Transfer – Functional Component State – Event Handling Techniques – Core Hooks: useState, useEffect – Dynamic Rendering – Rendering Lists with Keys – Form

Management Basics – Context API for State Sharing – Custom Hooks Creation – React Router for Navigation – Performance Optimization – Error Boundaries – Higher-Order Components – React Memo and useCallback – Managing Side Effects – Testing with React Testing Library.

## **MODULE V                      NODEJS AND MONGODB                      9**

Node.js Basics – Environment Setup – Express Framework Essentials – RESTful API Development – Middleware and Routing – Async Programming (Promises, Async/Await) – Error Handling – Event Loop Overview – Security Practices – MongoDB Basics – CRUD Operations – Aggregation Framework – Indexing – Transactions – Mongoose ODM – Schema Design and Validation.

### **PRACTICALS**

1. Develop a simple webpage using HTML and CSS.
2. Create a simple JavaScript program to display a message on the browser console.
3. Develop a registration form and validate the username and password using JavaScript.
4. Create a simple calculator using AngularJS.
5. Develop a single page applications using AngularJS.
6. Develop a login form using ReactJS.
7. Create a Node.js program to handle basic routing
8. Develop a Node.js program to connect with MongoDB and fetch all documents from a collection.

### **Use Case**

1. Design a simple personal portfolio webpage showcasing your profile and skills using HTML, CSS, and JavaScript.
2. Build a Single Page Application (SPA) that displays a list of products with filtering options using AngularJS.
3. Create a ReactJS application with a login form and a counter feature, demonstrating event handling and state management.
4. Develop a user registration and login system that validates input on the client side using JavaScript and stores user data in MongoDB using Node.js.
5. Develop a Node.js server using Express that connects to a MongoDB database to perform CRUD operations for a simple blog application.

**L-45,P-30, TOTAL HOURS-75**

**TEXT BOOKS:**

1. Gajjar R. Mastering Angular 16: Building Scalable and Performant Web Applications. Packt Publishing. 2024.
2. Osmani A. Learning Full-Stack JavaScript Development: HTML5, CSS3, and ES6+. Packt Publishing. 2023.
3. Ihrig C.J. Pro Node.js for Developers. Apress. 2023.
4. Herron D. Modern Full-Stack Development with Node.js and MongoDB. Packt Publishing. 2023.

**REFERENCES:**

1. Banks C. React 18 – The Complete Guide: Hooks, Concurrent Mode, Suspense. Packt Publishing. 2024.
2. Bradshaw B. Angular Projects: Build Modern Web Apps with Angular 16. Apress. 2023.
3. Murray K. Advanced React: Design Patterns and State Management. O'Reilly Media. 2023.
4. Stewart J. Practical Angular: Build and Deploy Real-World Web Apps. Manning Publications. 2023.
5. Hughes S. React Design Patterns and Best Practices. Packt Publishing. 2023.

**COURSE OUTCOMES:**

**CO1:** Gain the knowledge of basic HTML tags, attributes, and elements.

**CO2:** Construct a strong foundation in JavaScript, covering syntax, variables, functions, and validation.

**CO3:** Implement key features of AngularJS to build single-page applications with MVC architecture.

**CO4:** Demonstrate the fundamentals of ReactJS, including components, state management, and event handling.

**CO5:** Discover the essentials of NodeJS, ExpressJS, and MongoDB for building scalable applications.

**Board of Studies (BoS):**

21<sup>st</sup> BoS of Computer Applications held on  
13.06.2025

**Academic Council:**

24<sup>th</sup> AC held on 26.08.2025

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO1	H		M	M	H	M	M	L
CO2	L	L	M	L	M	M	M	M
CO3	M		L				L	H
CO4	H	M			L	L		
CO5	L	L		M			M	

**Note:** L – Low Correlation    M – Medium Correlation    H – High Correlation

**SDG 9** : Industry, Innovation and Infrastructure – Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

**Statement:** Designing and developing skills taught in this course with respect to the course outcomes improve the unique capabilities of the learner. It would create a variety of ways for the learner to progress and can help significantly improve the quality of the learner.

<b>CAF 6205</b>	<b>MOBILE APPLICATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>SDG: 9</b>	<b>DEVELOPMENT</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**COURSE OBJECTIVES:**

**COB1:** Understanding different mobile development environment.

**COB2:** Understanding the basics of Android application development.

**COB3:** Impart knowledge on how to build an Android application.

**COB4:** Understand the IOS development environment.

**COB5:** Provide knowledge on how to build an iOS application.

**MODULE I OVERVIEW OF MOBILE APPLICATION DEVELOPMENT 9**

Introduction to mobile applications– Platforms–Differences between mobile applications and desktop applications–App store, Google Play, Windows Store–Hybrid Mobile App Development–Phone GAP–Ionic Framework.

**MODULE II ANDROID FRAMEWORK 9**

Introduction to Android–Brief history–Features of Android–The Android Platform – Android SDK – Anatomy of an Android Application–Creating Android Virtual Devices–Manifest file – Activity – Services–Content Provider Broadcast Receiver–Intents – SQLite Databases

**MODULE III USER INTERFACE DESIGN 9**

Android User Interface Design Elements–Views: Button, Text Field, Radio Button, Toggle Button, Checkbox, Spinner –View Groups–Android Layout Managers— List View– Grid View–Table View– Web View– Adapters–Menus, Action Bars, Notifications: Status, Toasts and Dialogs, Styles Themes Drawing and Working with Animation Android Media API: Playing audio/video, Media recording. Sensors – Maps & Location.

**MODULE IV IOS DEVELOPMENT FUNDAMENTALS 9**

iOS Basics – iOS Architecture – Integrated Development Tools – Introduction to XCode, Swift – Frame work and Libraries – Project templates – Resource & Application Settings – Views & Controls – Debugging & Running – Building Block Approach – Application Life cycle – MVC – Pattern – View.

**MODULE V ADVANCED CONCEPTS IN IOS 9**

Data Management – Core Data – Application Storage – External Storage – Memory Management – Leaks and Allocations – UI Design – Design Tools – Interface Builders – Story board – View Controllers – Drawing model – Windows – Event Handling – View

data Source and delegates – Location Services – Google Maps – Apple Push and Local Notifications – Accelerometer.

**L –45 TOTAL HOURS –45**

**TEXT BOOKS:**

1. Dawn Griffiths & David Griffiths, Head First Android Development, O'Reilly Publication, Second Edition, 2017.
2. Ahmad Sahar, Programming for Beginners, IOS 13, Packt Publishing, Fourth Edition, 2020.

**REFERENCES:**

1. Reto Meier, Professional Android 4 Application Development, Wrox Publications, Third Edition, 2012.
2. David Mark, Jack Nutting, Jeff Lamarche and Frederic Olsson Beginning iOS 6 Development: Exploring the iOS SDK, Apress, 2013.

**COURSE OUTCOMES:**

**CO1:** Understanding the requirements for mobile applications

**CO2:** Understanding the architecture and building blocks of Android.

**CO3:** Knowing how to design mobile applications using Android for specific requirements

**CO4:** Explain the architecture and building blocks of iOS.

**CO5:** Knowing how to develop mobile applications using iOS for specific requirements.

**Board of Studies (BoS):**

21<sup>st</sup> BoS of Computer Applications held on 13.06.2025

**Academic Council:**

24<sup>th</sup> AC held on 26.08.2025

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	M	H	M	M	M	M	L	M
CO2	H	M	M	H	L	L	M	H
CO3	H	H	H	H	H	H	M	M
CO4	H	M	M	H	L	L	M	H
CO5	H	H	H	H	H	H	M	M

Note: L– Low Correlation M –Medium Correlation H –High Correlation

SDG 9: Industry, Innovation and Infrastructure – Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation

<b>CAF 6206</b>	<b>PYTHON PROGRAMMING LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>SDG: 4</b>		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**COURSE OBJECTIVES:**

**COB1:** Understand and implement basic Python programming concepts like conditional statements, loops, and functions.

**COB2:** Develop practical Python skills by applying recursion, random module, file handling, and data manipulation using libraries like Pandas.

**COB3:** Build interactive Python programs and games, such as the Monte Hall game and crowd computing scenarios.

**COB4:** Analyse and process real-world data through Python, performing tasks like sentiment analysis, speech-to-text, and object detection.

**COB5:** Gain hands-on experience with Python libraries for data visualization & computer vision such as Pandas, Matplotlib, and OpenCV.

**PRACTICALS**

List of Experiments:

1. Write a python program to implement the conditional statement for the following:
  - ❖ Fibonacci number series.
  - ❖ Incorporate FIZZ for any number divisible by 3 and Buzz for any number divisible for 5 and FIZZBUZZ for any number divisible by 3 and 5 as well.
2. Write a python program to implement the crowd computing using the array concept for the following scenario.
  - ❖ To collect approximate cost for a material or object and store the same in the array. Remove first and last 10 % of the listed cost from the array and compute the mean value of the array items
3. Write a python program to implement looping concept, conditional statement and function to build a game called jumbled word.
4. Write a python program to implement random module to randomly generate 50 birth dates and find how many of them have same day of the year.
5. Write a Python program using a recursive function to calculate the factorial of a given number.

6. Write a Python program to display all List / Tuple / Dictionary operations.
7. Write a program to convert speech to text.
8. Write a python program using pandas' library to perform the following operation.  
· Create DataFrame · Manipulate the values in DataFrame · Barcharts · Pie Charts · Scatter Plots
9. Write a python program to create a game "MONTE HALL \_ 3 – DOORS AND A TWIST". This comprises of three doors. In which two doors contain GOAT and one door contain BMW. User has to pick his/her choice of door. If the choice of door contains BMW, then user WINS otherwise LOST.
10. Write a Python program to Create a file, Read the content in a file, Write the content in a file, Delete the content in a file.
11. Write a Python code in Power BI to analyze customer reviews from an online clothing store, categorizing sentiments as positive, negative, or neutral to enhance product insight and decision-making.
12. Develop a Python script to perform real-time face detection using a webcam.

**P – 30; TOTAL HOURS – 30**

#### **TEXT BOOKS:**

1. Python: The Complete Reference by Martin C Brown – 20 March 2018.
2. "Python for Data Science for Dummies" by John Paul Mueller & Luca Massaron, 2<sup>nd</sup> Edition, 2019.

#### **REFERENCES:**

1. Matthes, Eric. *Python Crash Course*. No Starch Press, 2nd Edition, San Francisco, 2019.
2. VanderPlas, Jake. *Python Data Science Handbook*. O'Reilly Media, 1st Edition, Sebastopol, 2016.
3. McKinney, Wes. *Python for Data Analysis*. O'Reilly Media, 2nd Edition, Sebastopol, 2018.
4. Luca Zavarella. *Extending Power BI with Python and R – Second Edition: Perform advanced analysis using the power of analytical languages*, 2024.
5. Kaehler, Adrian, and Gary Bradski. *Learning OpenCV 4: Computer Vision with Python*. O'Reilly Media, 1st Edition, 2019.

#### **COURSE OUTCOMES:**

- CO1:** Apply conditional statements, loops, and functions in solving basic programming tasks.

- CO2:** Use Python data structures like lists, tuples, dictionaries, and arrays effectively
- CO3:** Utilize Python libraries like Pandas and Matplotlib to analyze, manipulate, and visualize data effectively.
- CO4:** Perform file operations, speech-to-text conversion, and sentiment analysis in real-world scenarios.
- CO5:** Develop real-time applications using Python modules like OpenCV and Random.

**Board of Studies (BoS):**

21<sup>st</sup> BoS of Computer Applications held  
on 13.06.2025

**Academic Council:**

24<sup>th</sup> AC held on 26.08.2025

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	H	M	M	M	L	L	L	M
CO2	H	M	M	M	L	L	L	M
CO3	H	H	H	H	M	L	L	M
CO4	M	H	H	H	M	M	L	H
CO5	M	H	H	H	M	M	L	H

**Note:** L– Low Correlation    M –Medium Correlation    H –High Correlation

**SDG 4:** Quality Education.

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

**STATEMENT:**

This course imparts core programming concepts, planning strategies, and key Python features aligned with clearly defined course outcomes that are measurable and skill-enhancing. Designed to strengthen both programming and logical reasoning, the course prepares learners to meet the growing demands of the software industry. It provides exposure to a wide range of technologies including Python programming, NumPy, Pandas, Matplotlib, Power BI integration, and OpenCV. With a strong emphasis on hands-on practice, learners are equipped to solve real-world problems, boosting their readiness for academic research as well as industry roles.

<b>CAF 6207</b>	<b>MOBILE APPLICATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
	<b>DEVELOPMENT LABORATORY</b>				
<b>SDG: 9</b>		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**COURSE OBJECTIVES:**

**COB1:** Understand how to develop, build, and deploy Android applications.

**COB2:** understanding key concepts like intents and layouts.

**COB3:** Impart knowledge on how to build an Android application.

**COB4:** understanding key concepts like intents and layouts.

**COB5:** learn how to create user interfaces, handle databases, and deploy applications.

**List of Experiments**

1. Develop an application that uses GUI components, Font and Colours.
2. Develop an application that uses Layout Managers and event listeners.
3. Write an application that draws basic graphical primitives on the screen.
4. Develop an application that makes use of databases.
5. Develop an application that makes use of Notification Manager.
6. Develop a native calculator application.
7. Develop an application that creates an alarm clock.
8. Develop a native application that uses GPS location information
9. Implement an application that writes data to the SD card.
10. Develop a Mobile application for simple needs. (Mini Project)

**P –30 ; TOTAL HOURS –30**

**TEXT BOOKS:**

1. Dawn Griffiths & David Griffiths, Head First Android Development, O'Reilly Publication, Second Edition, 2017.
2. Ahmad Sahar, Programming for Beginners, IOS 13, Packt Publishing, Fourth Edition, 2020.

**REFERENCES:**

1. Reto Meier, Professional Android 4 Application Development, Wrox Publications, Third Edition, 2012.

2. David Mark, Jack Nutting, Jeff Lamarche and Frederic Olsson Beginning iOS 6 Development: Exploring the iOS SDK, Apress, 2013.

### **COURSE OUTCOMES:**

**CO1:** Setting up and Understanding the Android Development Environment.

**CO2:** Learn to design and implement layouts, widgets, and views for mobile apps.

**CO3:** To implement basic and advanced app features, such as event handling, networking, and media playback.\_

**CO4:** Knowing to connect Android apps to databases like SQLite or MySQL

**CO5:** Knowing how to develop mobile applications for specific user requirements.

### **Board of Studies (BoS):**

21<sup>st</sup> BoS of Computer Applications held on  
13.06.2025

### **Academic Council:**

24<sup>th</sup> AC held on 26.08.2025

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	H	L	M	H	L	L	L	H
CO2	M	M	H	H	M	L	L	M
CO3	H	H	H	H	M	M	M	M
CO4	H	M	M	M	M	L	M	M
CO5	M	H	H	M	H	H	M	M

Note: L – Low Correlation M –Medium Correlation H – High Correlation

SDG 9: Industry, Innovation and Infrastructure – Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

Students will learn to work with user interfaces, databases, and other core functionalities, while also developing an understanding of the unique aspects of mobile programming. Ultimately, the lab aims to equip students with practical skills for creating and managing mobile applications.

<b>CAF 6208</b>	<b>ADVANCED DATABASE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>SDG: 9</b>	<b>TECHNOLOGY LABORATORY</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**COURSE OBJECTIVES:**

**COB1:** Understand and apply the principles of the relational model to design, implement, and query relational databases.

**COB2:** Develop proficiency in advanced SQL querying techniques, including joins, aggregation

**COB3:** Enhance skills in utilizing advanced database functionalities SQL operations and procedural programming techniques to automate tasks and maintain high-performance, scalable database systems.

**COB4:** Equip students with a comprehensive understanding of MongoDB installation, configuration, and basic CRUD operations in NoSQL environments.

**COB5:** Develop skills in advanced data modeling and aggregation techniques using MongoDB

**PRACTICALS**

List of Experiments:

1. **Creating a Database and Table**
  - Create a database called School.
  - Create tables for students (Students), courses (Courses), and enrollments (Enrollments).
  - Define primary and foreign keys.
2. **Inserting Data into Tables**
  - Insert sample data into the Students, Courses, and Enrollments tables.
3. **Selecting Data**
  - Retrieve all columns from the Students table.
  - Retrieve only the names and IDs of students from the Students table.
  - Use WHERE clause to filter data (e.g., all students with a GPA greater than 3.5).
4. **Updating Records**

- Update a student's GPA in the Students table.
- Update the course name in the Courses table.

#### 5. Deleting Records

- Delete a student record from the Students table where the student ID matches a specified value.

### Joins and Advanced Queries

#### 6. Using INNER JOIN

- Retrieve a list of students along with the courses they are enrolled in, using an INNER JOIN between Students and Enrollments tables.

#### 7. Using LEFT JOIN

- Retrieve all students and the courses they are enrolled in, including students who are not enrolled in any courses (use LEFT JOIN).

#### 8. Using UNION

- Combine results from two tables using the UNION operator (e.g., list all student names and course names from two different tables).

#### 9. GROUP BY and Aggregation

- Use GROUP BY to count the number of students in each course.
- Use HAVING to filter out courses with fewer than 5 students.

#### 10. Using ORDER BY

- List students ordered by their GPA in descending order.
- Order courses by the number of students enrolled (based on a JOIN query with COUNT).

### Data Integrity and Constraints

#### 11. Adding Constraints to a Table

- Alter the Students table to add a UNIQUE constraint on the email column.
- Add a NOT NULL constraint on the GPA column in the Students table.

#### 12. Implementing Foreign Keys

- Create a foreign key between the Enrollments table and the Students table to ensure referential integrity.

### Views and Stored Procedures

#### 13. Creating a View

- Create a view called StudentCourses that combines data from the Students and Courses tables using a JOIN.
- Retrieve data from the StudentCourses view to see the enrolled courses for each student.

#### 14. Stored Procedures

- Create a stored procedure add\_student that takes student details (ID, name, GPA) and inserts them into the Students table.

#### 15. Using Functions

- Create a function to calculate the average GPA for students enrolled in a specific course.

#### 16. Creating Triggers

- Create a trigger that updates a Last\_Updated timestamp column in the Students table whenever a student's record is updated.

17. Consider following database and draw ER diagram and convert entities and relationships to relation table for a given scenario.

COLLEGE DATABASE:

STUDENT (USN, SName, Address, Phone, Gender)

SEMSEC (SSID, Sem, Sec) CLASS (USN, SSID)

SUBJECT (Subcode, Title, Sem, Credits)

IAMARKS (USN, Subcode, SSID, Test1, Test2, Test3, FinalIA)

18. Explore different types of NoSQL databases (Document, Key–Value, Column–family, Graph). (CRUD) operations.

**Tasks:**

- Create a database and collections.
  - Insert documents into collections.
  - Query documents using various operators.
- Update and delete documents using update and delete methods
19. Design a MongoDB schema to store data for a sample application.  
Perform aggregation operations in MongoDB.

**Tasks:**

- Use the aggregate () function for complex queries.
- Implement \$group, \$match, \$project, and \$sort stages in aggregation pipelines.
- Analyze and summarize data (e.g., average, count, sum) using aggregation.

**P –30 ; TOTAL HOURS –30****TEXT BOOKS:**

1. Henry F Korth, Abraham Silberschatz and S. Sudharshan, "Database System Concepts", McGraw Hill, Seventh Edition, Tata McGraw Hill, 2019.
2. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Pearson, 7th Edition, 2016.
3. K. Chodorow, MongoDB: The Definitive Guide, 3rd ed. Sebastopol, CA, USA: O'Reilly Media, 2019.

**REFERENCES:**

1. E. Redmond and J. R. Wilson, Seven Databases in Seven Weeks: A Guide to Modern Databases and the NoSQL Movement, 2nd ed. Beijing, China: Pragmatic Bookshelf, 2015.
2. C. J. Date, SQL and Relational Theory: How to Write Accurate SQL Code, 2nd ed. Sebastopol, CA, USA: O'Reilly Media, 2012.
3. P. J. Sadalage and M. Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence. Boston, MA, USA: Addison–Wesley, 2012.

**COURSE OUTCOMES:**

**CO1:** Design database schemas, define appropriate keys and constraints, and perform fundamental SQL operations

**CO2:** Construct and optimize complex SQL queries and use these skills to extract meaningful insights from large datasets.

**CO3:** Design and implement views for data abstraction, creating stored procedures and functions to encapsulate business logic, and deploying triggers, thereby ensuring efficient and robust database operations in real–world applications.

**CO4:** Install and set up MongoDB on local or cloud instances, create databases and collections, and perform basic Create, Read, Update, and Delete operations

**CO5:** Design MongoDB schemas for sample applications, implementing aggregation thereby enabling to build scalable, data–driven applications.

**Board of Studies (BoS):**

21<sup>st</sup> BoS of Computer Applications held on  
13.06.2025

**Academic Council:**

24<sup>th</sup> AC held on 26.08.2025

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1		H	H	M				
CO2	H			M	M			
CO3			H				M	M
CO4			H	M	M	M		
CO5		H			M	M		M

**Note:** L– Low Correlation    M –Medium Correlation    H –High Correlation

**SDG 9:** Industry, Innovation and Infrastructure – Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

**Statement:** The knowledge gained by the learner in this course will help them significantly improve their understanding and enable them to implement the concepts learned in real world applications. The student will be able to store, retrieve and manage data effectively using advanced databases. The knowledge attained through advanced database management system will improve the skill set of the student to meet the industrial standard

<b>ENF 6281</b>	<b>PROFESSIONAL COMMUNICATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>SDG: 4 &amp; 8</b>		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**COURSE OBJECTIVES:**

- COB1:** To introduce the fundamentals of professional communication in workplace contexts.
- COB2:** To develop structured presentation and public speaking skills.
- COB3:** To develop students' proficiency in written correspondence, including emails, and reports.
- COB4:** To enhance awareness and use of body language in professional settings
- COB5:** To instill appropriate workplace etiquette and digital professionalism.

**MODULE I COMMUNICATION AT THE WORKPLACE P: 6**

Language and communication fundamentals, Types of workplace communication, Formal and informal Communication, Direction and flow of Communication-Organizational communication and interpersonal dynamics, 7 Cs of Communication - Ethical use of AI assisted communication tools

**MODULE II PRESENTATION & PUBLIC SPEAKING SKILLS P: 6**

Importance of presentation skills, Managing public speaking anxiety, Structured planning and delivery of presentations, Use of visual aids and technology - Interactive tools

**MODULE III CORRESPONDENCE AT WORK P: 9**

Digital correspondence - Email Writing and Etiquette, Report Writing: Incident Reports, Feasibility Reports, and Executive Summaries

**MODULE IV BODY LANGUAGE P: 5**

Fundamentals of body language in professional communication, Types of non-verbal cues, posture -Interpreting and responding to non-verbal signals in interpersonal and group contexts, Cultural variations in body language and their implications in global communication

**MODULE V WORKPLACE ETIQUETTE P: 4**

Workplace etiquette, Cultural sensitivity in globalized work environments, Gender sensitivity and inclusivity, DEI, Netiquette and digital professionalism - video conferencing,

Professional networking (Social media, LinkedIn, etc.), Virtual team dynamics

**P – 30; Total Hours:30**

**TEXT BOOKS:**

1. Course material by the Department of English

**REFERENCES:**

1. Bovee, C. L., & Thill, J. V. *Business Communication Today* (14<sup>th</sup> ed.). Pearson, 2021.
2. Cardon, P. W., & Marshall, B. The hype and reality of social media use for work collaboration and team communication. *International Journal of Business Communication*, 52(3), 2015, 273–293.
3. Guffey, M. E., & Loewy, D. *Essentials of Business Communication* (11<sup>th</sup> ed.). Cengage Learning, 2020.
4. Jones, D. A., & Pittman, M. The digital professionalism paradox: Workplace norms and expectations in the era of online communication. *Journal of Applied Communication Research*, 49(3), 2021, 283–301.
5. Keyton, J., & Smith, F. L. M. Communication practices of work teams: Task, social, and identity functions. *Journal of Business Communication*, 46(4), 2009, 402–426.
6. Krizan, A. C., Merrier, P., Logan, J., & Williams, K. *Business Communication* (9<sup>th</sup> ed.). Cengage Learning, 2016.
7. Lesikar, R. V., Flatley, M. E., Rentz, K., & Lentz, P. *Lesikar's Business Communication: Connecting in a Digital World* (13<sup>th</sup> ed.). McGraw-Hill Education, 2019.
8. Madlock, P. E. The link between leadership style, communicator competence, and employee satisfaction. *Journal of Business Communication*, 45(1), 2008, 61–78.
9. Raman, M., & Sharma, S. *Technical communication: Principles and practice* (3<sup>rd</sup> ed.). Oxford University Press, 2015.
10. Robles, M. M. Executive perceptions of the top 10 soft skills needed in today's workplace. *Business Communication Quarterly*, 75(4), 2012, 453–465. <https://doi.org/10.1177/1080569912460400>

**COURSE OUTCOMES:**

On completion of the course, students will be able to

- CO1:** Demonstrate clarity in professional communication by selecting appropriate modes and formats for workplace interactions.

- CO2:** Deliver structured presentations with confidence, using relevant verbal and visual communication techniques.
- CO3:** Produce clear and effective written correspondence, including emails, and formal reports.
- CO4:** Interpret and apply non-verbal communication cues appropriately in professional contexts.
- CO5:** Exhibit workplace etiquette, digital conduct, and cultural sensitivity in professional environments.

**Board of Studies (BoS):**

18<sup>th</sup> BoS of the Department of English held on  
04.06.2025

**Academic Council:**

24<sup>th</sup> AC held on 26.08.2025

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	H		M					
CO2		H			M			
CO3	H			M				
CO4		H	H				L	L
CO5	H						H	M

**Note:** 1 - Low Correlation    2 - Medium Correlation    3 - High Correlation

**7SDG 4:** Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

**Statement:** This course ensures that the students acquire quality education and are also made eligible to obtain productive and decent employment.

**SDG 8:** Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

**Statement:** This course equips students with the competencies required for employment in a dynamic global workforce.

<b>CAFY 101</b>	<b>DATA SCIENCE AND CLOUD</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>SDG: 9</b>	<b>COMPUTING</b>	<b>3</b>	<b>0</b>	<b>2</b>	<b>4</b>

**COURSE OBJECTIVES:**

**COB1:** Understand the fundamentals of data science.

**COB2:** Develop the analytical skills required to prepare, analyze and interpret data effectively.

**COB3:** Examine Cloud Architecture and Models.

**COB4:** Familiarize the virtualization concepts in cloud environment.

**COB5:** Explore about the different online tools available in the cloud environment.

**MODULE I INTRODUCTION 9**

Introduction to Big Data – Convergence of key trends – Evaluation of Big Data – Importance of Big Data – Types of Data & Its Applications – Complexity of Data & Data Analysis – Big Data technologies– Big Data Use Cases– Difference between Traditional IT Approach and Big Data Technology – Data Model – structures, operations and constraints – Data Discovery – Big Data applications.

**MODULE II EXPLORATORY DATA ANALYSIS 9**

Exploratory Data Analysis – Getting and Cleaning data Statistical Inferences and Probability – Summarizing and Visualizing the Data–Descriptive Statistics – Mean, Standard Deviation, Skewness and Kurtosis – Box Plots – Pivot Table – Heat Map – Correlation Statistics – ANOVA – Linear Algebra.

**MODULE III CLOUD SERVICES 9**

Introduction to Cloud Computing: Cloud Computing in a Nutshell – Roots of Cloud Computing –Layers and Types of Cloud Computing – Evolution of Cloud Computing: Hardware Evolution – Internet Software Evolution – Server Virtualization – Web Services Delivered from the Cloud: Communication as a Service (CaaS) – Infrastructure as a Service (IaaS) – Platform as a Service (PaaS) – Software as a Service (SaaS) – Cloud Infrastructure Management.

**MODULE IV BIG DATA STORAGE 9**

Overview of Big Data Storage – Data Storages in Cloud Environment – Cloud Based Storage Services – AWS & Microsoft Azure – Azure Data Lake Analytics – Azure Data Factory – AWS Big Data Storage & Collection Services – ETL Techniques – Traditional ETL – Benefits of ETL in Big Data Analytics.

**MODULE V CASE STUDIES AND APPLICATIONS 9**

Application of Cloud computing technologies – Hybrid cloud and multicloud, Test and Development, Big Data Analytics and Disaster recovery. Case Study: Netflix and Cloud Computing– Big data streaming framework: data streaming process, tools for big data streaming, industry use cases for big data streaming– Collaborating via Web–Based Communication Tools.

**PRACTICALS**

List of Experiments:

1. Install, configure and run Hadoop in Google Colab.
2. Implement basic commands in Hadoop.
3. Implement word count / frequency programs using MapReduce.
4. Import data from MySQL into HDFS.
5. Create an account in amazon web services (AWS).
6. Implement the online cloud–enabled bookstore system.
7. Create a student attendance maintenance system using AWS.
8. Create a chatbot applications using Artificial Intelligence (AI) in AWS.

**L – 45; P–30; TOTAL HOURS –75**

**TEXT BOOKS:FORMAT NEEDS TO BE CHANGED**

1. Fundamentals of Data Science, Dr. Sunil Khilari, Dr. Ramesh Jadhav, Dr.Balasaheb Bhamangol, Prof.Suryakant Karande, January 2025.
2. Cloud Computing Dr. Ashok Kumar VAYU Education of India,January 2025.
3. An Introduction to Statistical Data Science: Theory and Models, Giorgio Picci,2024.

**REFERENCES:**

1. Data Science Unveiled: Fundamental Principles andTechniquesby Dr. A. P. Siva Kumar, Mr. Y. Ayyappa, Dr. O. Sri Nagesh Dr. N. Raghavendra Sai, December 2023.
2. Rittinghouse, John W.,and James F. Ransome, “Cloud Computing: Implementation, Management and Securityll,”CRC Press, 2017.
3. Kumar Saurabh, “Cloud Computing – Insights into New Era Infrastructure”, Wiley Indian Edition, 2011.

**COURSE OUTCOMES:**

**CO1:**Apply the Data Science Process and how its components interact.

**CO2:** Design the significance of exploratory data analysis (EDA) in data science.

**CO3:**Implement the architecture and various services offered by cloud computing.

**CO4:**Learn the different types of software's used in virtualization environment.

**CO5:** Explore the insights of online cloud based tools in developing software project applications.

**Board of Studies (BoS):**

21<sup>st</sup> BoS of Computer Applications held on  
13.06.2025

**Academic Council:**

24<sup>th</sup> AC held on 26.08.2025

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	H	L			M			
CO2	H	H		M			L	
CO3			H		H			L
CO4		M		M	H	M		
CO5	H	H	M	H	M		L	

**SDG 9:** Industry, Innovation and Infrastructure – Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

**Statement:** Promoting innovation through data-driven technologies and enabling the development of resilient and scalable digital infrastructure using cloud platforms.

<b>CAFY 102</b>	<b>CLOUD TECHNOLOGIES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>SDG: 4</b>		<b>3</b>	<b>0</b>	<b>2</b>	<b>4</b>

**COURSE OBJECTIVES:**

**COB1:** Explain the basic concept of cloud computing.

**COB2:** Explore about various cloud services provided by different service providers.

**COB3:** Illustrate the virtualization concepts in the cloud environment.

**COB4:** Expose various ways to deploy the cloud services online.

**COB5:** Learn about the different applications available in the cloud environment.

**MODULE I INTRODUCTION 9**

Cloud Computing in a Nutshell – Roots of Cloud Computing – Layers and Types of Cloud Computing – Cloud Infrastructure Management – Migration to Cloud Environment: Approaches – The Seven Step Model for Migration

Evolution of Cloud Computing: Hardware Evolution – Internet Software Evolution – Server Virtualization.

**MODULE II CLOUD ARCHITECTURE 9**

Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Infrastructure as a Service (IaaS) – Platform as a Service (PaaS) – Software as a Service (SaaS) – Datacenter Layer – Cloud Deployment Models: Private – Public – Hybrid – Multiclouds – Discovering Cloud Services Development Services and Tools – Google App Engine – IBM

**MODULE III VIRTUALIZATION 9**

Level of Virtualization – Virtualization Structure / Tools and Mechanism – Virtualization of CPU – Memory – I / O Devices – Virtual Clusters and Resource Management – Virtualization for Data Centre Automation.

**MODULE IV CLOUD SERVICES 9**

AWS: Amazon EC2 – Amazon Elastic Container Service (ECS) – Amazon Elastic Kubernetes Services (EKS) – AWS Lambda, Simple Email Service (SES) – Cloud front – Amazon Lex – Saga Maker.

GCP: Compute Engine (virtual machines), Cloud Storage (object storage), Cloud SQL (SQL database), Big Query (data warehouse), and Google Kubernetes Engine (GKE).

## **MODULE V                    APPLICATIONS AND SECURITY                    9**

Virtual Machine Creation Using EC2 – Bulk Email Application Using Lambda – Website Using with Web Application Firewall and Without Web Application Firewall – Air quality monitoring using AWS – Virtual Desktop Cloud Security Fundamentals: Confidentiality, Integrity, Availability and Access Control – Security Domains: Infrastructure Security, Data Security, Application Security – Case Studies.

**L – 45; P– 30; TOTAL HOURS – 75**

### **LIST OF EXPERIMENTS:**

1. Create an account in amazon web services (AWS).
2. Install and configure a virtual machine using VirtualBox or VMware. Show the virtualization of CPU and memory.
3. Create a VM using AWS EC2.
4. Explore the storage space of your EC2 instance using Amazon EBS.
5. Deploy a sample application on Google App Engine and document the steps.
6. Create a Compute Engine instance and upload data to Cloud Storage.
7. Create an AWS Lambda function to send emails using SES.
8. Implement a static website using S3, cloud front and EC2.
9. Design a Chabot using Amazon Lex.
10. Create a Text-to-speech Conversion with Sage Maker.

### **TEXT BOOKS:**

1. Thomas Erl and Eric Barceló Monroy, "Cloud Computing: Concepts, Technology, Security, and Architecture" Pearson, 2<sup>nd</sup> edition, August 2023.
2. Rittinghouse, John W., and James F. Ransome, "Cloud Computing: Implementation, Management and Securityll," CRC Press, 2017.
3. RajkumarBuyya, Christian Vecchiola, S.ThamaraiSelvi, "Mastering Cloud Computing", McGraw-Hill Education Private Ltd., ISBN : 9781259029950, 2013.

### **REFERENCES:**

1. Huawei Technologies Co., Ltd., "Cloud Computing Technology" Springer Singapore, October 2022.

2. Hurwitz, J. S., & Kirsch, D. Cloud computing for dummies. John Wiley & Sons. (2020).

**COURSE OUTCOMES:**

**CO1:** Acquire knowledge on the fundamentals of cloud computing.

**CO2:** Identify and implement the architecture and various services offered by cloud computing.

**CO3:** Analyze and implement on different types software's used in virtualization environment.

**CO4:** Apply the knowledge acquired to integrate the cloud-based technologies in real time scenario.

**CO5:** Evaluate and utilize applications in the cloud environment.

**Board of Studies (BoS):**

**Academic Council:**

21<sup>st</sup> BoS of Computer Applications held on 13.06.2025

24<sup>th</sup> AC held on 26.08.2025

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	H	M	M	M	L	L	L	M
CO2	M	H	H	H	M	M	M	H
CO3	M	H	H	L	M	L	M	M
CO4	M	M	H	H	M	H	M	H
CO5	M	M	M	H	M	M	M	H

**Note:** L– Low Correlation    M –Medium Correlation    H –High Correlation

**SDG 4:** Quality Education – Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

The basics of cloud computing and its techniques were taught in this course. Understanding the insights of cloud computing and virtualization will motivate the student to deploy cloud technology in needed real-time scenarios. The applications of cloud computing will improve the skill set of the student to meet the IT sector demand.

<b>CAFY 103</b>	<b>CYBER SECURITY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>SDG: 9</b>		<b>3</b>	<b>0</b>	<b>2</b>	<b>4</b>

**COURSE OBJECTIVES:**

**COB1:** Understand the key concepts, attacks, cyber threats and principles.

**COB2:** Learn various threats, attacks, and vulnerabilities in Digital systems.

**COB3:** Gain knowledge on system and Web security.

**COB4:** Explore on various Digital forensics and Network tools.

**COB5:** Provide learners insights and practical knowledge on how to thwart Cyber Attacks.

**MODULE I INTRODUCTION 9**

Cyber Security Concepts – layers of security – Vulnerability – Internet Governance – Challenges and Constraints – Computer Criminals – CIA Triad – Assets and Threat – motive of attackers – Types of attacks – Spectrum of attacks – Taxonomy of various attacks – IP spoofing – Methods of defense – Security Models – Risk management – Cyber Threats – Cyber Warfare – Cyber Crime – Cyber terrorism – Cyber Espionage – Malicious code – Countermeasures.

**MODULE II CYBERCRIME AND DIGITAL OFFENCES 9**

Cybercrime and Information Security – Cybercriminals – Classifications of Cybercrimes – Cybercrime in Mobile and Wireless devices: Proliferation – Credit Card Frauds in Mobile and Wireless Computing Era – Security Challenges – Authentication Service Security – Attacks on Mobile Phones – Security Policies and Measures – Laptops Cyberstalking – Cybercafe and Cybercrimes – Botnets.

**MODULE III SYSTEM AND WEB SECURITY 9**

Data Encryption Implementation – Setting and Configuring two factor authentication – Protect Remote Access – Secure Connection – Establish and Use a Firewall – Install and Use Anti-Malware Software – Unnecessary Software Removal – Disable Nonessential Services – Authenticated and non – Authenticated attacks – Privilege escalation – IPR issues – Web threats for Organizations – Security and Privacy Implications – Social Media Marketing: Security risks and Perils for organizations – Social computing and the associated challenges for organizations – XSS attacks – SQL Injection attacks.

**MODULE IV TOOLS 9**

IFconfig/Ipconfig – Whois – Nslookup – PING – Traceroute – Telnet – SecureShell – Nagios – SolarWinds – Wireshark – HoneyPot – John ripper – Qubes – Tails – Social Engineering – Kali Linux – Metasploit – Beef – XSS – secure E-mail, Proxy Servers and Anonymizers – Phishing – Password Cracking – Keyloggers and Creating backdoor viruses – Spywares – Steganography – DoS and DDoS attacks – Wi-Fi Attacks.

**MODULE V CASE STUDIES 9**

Data breaches – Attacks on Social Media (Facebook) – Password Phishing attacks – Unpatched software – The Indian Case of Online Gambling – Intellectual Property Crime – Financial Frauds in Cyber Domain – Ransomware attack – Cyber security and Cyber law for women.

**L –45 ;P – 30 TOTAL HOURS – 75**

**LIST OF EXPERIMENTS:**

1. Installation of Kali Linux
2. Implementation to gather information from any PC connected to the LAN using whois, port scanners, network scanning and Angry IP scanners.
3. Implementation of Data hiding in different image types
4. Implementation of MITM– attack using Wireshark/ network sniffers
5. Implementation of Windows security using firewall and other tools
6. Install Metasploitable2 on the virtual box and search for unpatched vulnerabilities in the webserver.
7. Implementation to identify web vulnerabilities, using OWASP project
8. Analyze the Network traffic using Wireshark.
9. Implementation of OS hardening and RAM dump analysis to collect the artifacts and other information.
10. Implementation of Cyber Security tools for Disk Imaging, Data acquisition, Data extraction and Data Analysis and recovery.
11. Bypassing windows using live kali Linux.

**TEXT BOOKS:**

1. MarjieT.Britz, “Computer Forensics and Cyber Crime: An Introduction 3rd Edition, Prentice Hall, 2013.

- Nina Godbole, SunitBelapure, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India Pvt. Ltd.,2011.

#### REFERENCES:

- B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithms, Applications, and Perspectives, CRC Press, 2018.
- George K.Kostopoulos, Cyber Space and Cyber Security, CRC Press, 2013.
- MarttiLehto, PekkaNeittaanmäki, Cyber Security: Analytics, Technology and Automation, Springer International Publishing Switzerland 2015.
- Chwan–Hwa (John) Wu, J. David Irwin, Introduction to Computer Networks and Cyber security, CRC Press T&F Group, 2013.
- Charles B. Pfleeger, Shari Lawrence Pfleeger, "Security in Computing",3<sup>rd</sup> Edition, Pearson Education,2003.

#### COURSE OUTCOMES:

**CO1:** Implement secure data handling practices to protect sensitive data.

**CO2:** Analyze and resolve security issues in Digital devices.

**CO3:** Evaluate security measures to protect Information systems and data from Cyber threats.

**CO4:** Apply various Cyber security tools in Real time Scenario.

**CO5:** Interpret and forensically investigate security incidents.

#### Board of Studies (BoS):

21<sup>st</sup> BoS of Computer Applications held on  
13.06.2025

#### Academic Council:

24<sup>th</sup> AC held on 26.08.2025

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	L	L	M	-	-	-	L	M
CO2	M	M	H	M	H	-	M	H
CO3	-	H	M	H	H	-	H	H
CO4	-	H	H	H	H	-	H	H
CO5	-	H	H	H	H	-	M	H

**Note:** L– Low Correlation    M –Medium Correlation    H –High Correlation

**SDG 9:** Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

**Statement:** Cybersecurity course provides training on protecting systems, networks, and data from digital threats. Courses include practical exercises and simulations to develop real–world skills in defending against cyber threats.

<b>CAFY 104</b>	<b>ARTIFICIAL INTELLIGENCE AND MACHINE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>SDG: 9</b>	<b>LEARNING</b>	<b>3</b>	<b>0</b>	<b>2</b>	<b>4</b>

**COURSE OBJECTIVES:**

**COB1:** Introduce foundational concepts, evolution, and applications of Artificial Intelligence.

**COB2:** Understand agent-based systems, search strategies, and knowledge representation.

**COB3:** Learn supervised learning techniques for classification and prediction tasks.

**COB4:** Explore unsupervised and reinforcement learning for adaptive systems.

**COB5:** Examine deep learning applications and address ethical issues in AI.

**MODULE I INTRODUCTION TO ARTIFICIAL INTELLIGENCE 9**

Definition and Evolution of AI – Applications of AI – Agents and Environments – Properties of Agents – Types of Agents – Search Problems – Uninformed Search Techniques: Breadth-First Search, Depth-First Search, Uniform Cost Search – Informed Search: Best-First Search, A\* Algorithm, Hill Climbing.

**MODULE II KNOWLEDGE REPRESENTATION AND REASONING 9**

Knowledge-Based Agents – Propositional Logic – First Order Predicate Logic – Inference Mechanisms – Forward and Backward Chaining – Uncertainty – Bayesian Networks – Fuzzy Logic – Rule-Based Systems – Applications of Reasoning in Real World.

**MODULE III SUPERVISED LEARNING TECHNIQUES 9**

Introduction to Machine Learning – Types of Machine Learning Techniques – Supervised vs Unsupervised Learning – Supervised Learning: Linear and Logistic Regression – Decision Trees – Random Forest – Naive Bayes Classifier – Support Vector Machines–Evaluation Metrics.

**MODULE IV UNSUPERVISED LEARNING AND REINFORCEMENT LEARNING 9**

Clustering: K-Means, Hierarchical Clustering – Association Rule Mining – Dimensionality Reduction Techniques –Reinforcement Learning: INTRODUCTION – Markov Decision Processes – Q-Learning – Applications: Games and Robotics.

**MODULE V DEEP LEARNING AND AI ETHICS 9**

Neural Networks – Perceptron – Back propagation – Deep Neural Networks – Convolutional Neural Networks (CNN) – Recurrent Neural Networks (RNN) – Applications in Healthcare, Smart Cities, and Industrial Automation – AI in Robotics, IoT, and Automation – AI Ethics and Impact on Future Technologies.

**PRACTICALS**

List of Experiments:

**1. Implement Uninformed Search Algorithms:**

Write a program to implement Breadth–First Search and Depth–First Search on a given problem graph.

**2. Solve a Problem using A\* Algorithm:**

Implement the A\* algorithm using appropriate heuristics to find the optimal path in a maze or route network.

**3. Knowledge Representation using Propositional Logic:**

Design a knowledge base and perform logical inference using propositional logic in Python or Prolog.

**4. Bayesian Network for Weather Prediction:**

Create a simple Bayesian Network to predict weather outcomes based on given conditions.

**5. Supervised Learning – Classification using Decision Trees:**

Implement a Decision Tree classifier using a dataset (e.g., Iris, Titanic) and evaluate its performance.

**6. Unsupervised Learning – K–Means Clustering:**

Apply K–Means clustering on a real dataset (e.g., customer segmentation) and visualize the clusters.

**7. Linear Regression:**

Use Python to build a linear regression model predicting scores based on hours studied.

**8. Tic–Tac–Toe AI using Rule–Based Logic:**

Create a simple AI for the Tic–Tac–Toe game using if–else conditions or basic rules.

**L – 45 ; P– 30 TOTAL HOURS –75**

**TEXT BOOKS:**

- 1."Co–Intelligence: Living and Working with AI" by Ethan Mollick Publisher: Penguin Random House, 2024
- 2."Understanding Deep Learning" by Simon J.D. Prince Publisher: MIT Press, 2024.
3. "Hands–On Machine Learning with Scikit–Learn, Keras, and TensorFlow", Aurélien Géron, 2nd Edition, O'Reilly Media, 2019.
4. "Artificial Intelligence: A Modern Approach\*", Stuart Russell and Peter Norvig, 3rd Edition, Pearson Education, 2015

#### REFERENCES:

1. Ethem Alpaydin, \*Introduction to Machine Learning\*, 4th Edition, MIT Press, 2020.
2. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, \*Deep Learning\*, MIT Press, 2016.
3. Tom M. Mitchell, \*Machine Learning\*, 1st Edition, McGraw–Hill Education, 1997.

#### COURSE OUTCOMES:

**CO1:** Understand basic concepts and models of artificial intelligence.

**CO2:** Apply logical and probabilistic reasoning for knowledge representation.

**CO3:** Implement supervised learning algorithms for prediction and classification tasks.

**CO4:** Analyze unsupervised and reinforcement learning methods.

**CO5:** Develop and deploy AI applications using deep learning, considering ethical concerns.

#### Board of Studies (BoS):

21<sup>st</sup> BoS of Computer Applications held on  
13.06.2025

#### Academic Council:

24<sup>th</sup> AC held on 26.08.2025

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	H	–	H	L	–	–	M	M
CO2	H	H	H	M	–	–	–	M
CO3	H	H	H	H	L	L	L	M
CO4	H	H	H	H	L	L	L	M
CO5	H	H	H	H	L	H	H	H

**Note:** L– Low Correlation    M –Medium Correlation    H –High Correlation

**SDG 9:**

Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

**STATEMENT:**

The Course equips students with AI and ML skills essential for driving innovation in smart industries and intelligent systems. It promotes the development of sustainable, tech-driven infrastructure through real-world applications like automation, IoT, and deep learning. By fostering innovation and ethical AI usage, the course contributes to building resilient and inclusive industrial ecosystems.

CAFY 105	INTERNET OF THINGS	L	T	P	C
SDG: 9		3	0	2	4

**COURSE OBJECTIVES:**

**COB1:** Understand fundamentals, Architecture and Technology.

**COB2:** Learn about various sensors and actuators.

**COB3:** Familiarize different design methodology and principles used for IoT design.

**COB4:** Explore the use of data analytics in IoT.

**COB5:** Develop industrial applications and various IoT case studies.

**MODULE I INTRODUCTION 9**

Evolution of IoT – Characteristics– functional requirements– motivation– Physical design – Challenges in IoT – Network Architecture and Design – IoT Protocols, Communication models, Communication APIs – IoT enabled Technologies – Domain Specific IoT's : Home, City, Environment, Energy, Agriculture and Industry.

**MODULE II SMART OBJECTS 9**

Sensing and Actuation – Sensors – Features –Types of Sensors –Analog and Digital Sensors– Interfacing of Temperature, Humidity, Motion, Light and Gas Sensor with Arduino – Integration of Actuators with Arduino – Actuator – Types of Actuators – Purpose of Sensors and Actuators in IoT –Smart Objects –Sensor Networks – Connecting Smart Objects – Communications Criteria – IoT Access Technologies.

**MODULE III DESIGN PRINCIPLES FOR WEB CONNECTIVITY 9**

IoT Design Methodology – Web Communication Protocols for Connected Devices – Message Communication Protocols for Connected Devices – Web Connectivity for Connected Devices – Network using Gateway, SOAP, REST, HTTP and Web Sockets.

**MODULE IV IOT APPLICATION DEVELOPMENT 9**

Framework for IoT – Applications – Implementation of Device integration – Data acquisition and Integration – Device data storage on cloud/local server – Authentication – Authorization of devices – Application Protocols: MQTT, REST / HTTP, CoAP, MySQL – Application Development for mobile Platforms – Overview of Android App Development tools.

**MODULE V IOT DATA ANALYTICS 9**

Data analytics – Challenges, Machine Learning, Big Data Analytics Tools and Technology for IoT, Edge Streaming Analytics, Network Analytics – Strategies to organize Data for IoT Analytics – Linked Analytics Data Sets – Managing Data lakes – Dash boarding– Designing visual analysis for IoT data – Creating a dashboard – Creating and visualizing alerts – Case

Studies: Industrial Automation, Transportation, Smart cities, smart supply chain, Remote site monitoring.

### Practicals

#### List of Experiments:

1. Select any one development board (Eg., Arduino or Raspberry Pi) and control LED using the board.
2. Using the same board as in (1), read data from a sensor. Experiment with both analog and digital sensors.
3. Control any two actuators connected to the development board using Bluetooth.
4. Explore different communication methods with IoT devices (Zigbee, GSM, Bluetooth)
5. Create any cloud platform account, explore IoT services and register a thing on the platform.
6. Control an actuator through the Cloud.
7. Accesses the data pushed from sensor to cloud and apply any Data Analytics or Visualization services.
8. Create a mobile app to control an actuator.
9. Create a program to upload Arduino temperature data using LM35, given IoT cloud service and ESP8266. Also view and verify the temperature logs on the IoT cloud service.
10. Build a Restful web service for IoT Management.

**L –45; P–30 ; TOTAL HOURS –75**

#### TEXT BOOKS:

1. Thompson Carter, “Understanding the Internet of Things (IOT): A Beginner’s Guide to Building Connected Devices and Smart Systems”, Kindle Edition, 2025.
2. Raj Kamal, INTERNET OF THINGS (IOT): Architecture and Design Principles, McGraw Hill Education (India) Private Limited, 2nd Edition, India, 2022

#### REFERENCES:

1. Simone Cirani, Gianluigi Ferrari, Marco Picone, Luca Veltri, “Internet of Things Architectures, Protocols and Standards”, Wiley Publications, 2019
2. Andrew Minter, “Analytics for the Internet of Things (IoT)”, Packt Publishing, 2017.
3. Arshdeep Bahga and Vijay K. Madiseti, “Internet of Things – A hands-on approach”, Orient Blackswan Private Limited – New Delhi; First Edition, 2015.

**COURSE OUTCOMES:**

**CO1:** Apply the underlying architectures and models in IoT

**CO2:** Interpret the key attributes of sensors and actuators along with their significance in diverse IoT context

**CO3:** Implement communication Protocols and web Connectivity for connected devices.

**CO4:** Develop new ideas and innovations in IoT applications

**CO5:** Analyze data analytics techniques in IoT.

**Board of Studies (BoS):**

21<sup>st</sup> BoS of Computer Applications held on  
13.06.2025

**Academic Council:**

24<sup>th</sup> AC held on 26.08.2025

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	H			M	L		L	L
CO2		H	H					L
CO3	H	M		M				
CO4			H					
CO5		H		M				

**Note:** L– Low Correlation    M –Medium Correlation    H –High Correlation

**SDG 9:**

Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

**STATEMENT:**

Internet of things, where the key use cases of IoT have been focused on industry and infrastructure which emphasis on creating resilient and sustainable infrastructure and industry. Thus, learning Internet of Things helps in promoting preventive maintenance, improve navigation, prevent collisions and enable various levels of vehicle autonomy and other interesting services where connected operations can lift productivity, lower energy consumption and reduce costs.

<b>CAFY 106</b>	<b>ARTIFICIAL INTELLIGENCE AND</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>SDG: 9</b>	<b>DATA SCIENCE</b>	<b>3</b>	<b>0</b>	<b>2</b>	<b>4</b>

**COURSE OBJECTIVES:**

**COB1:** Understand the fundamentals of AI and its potential for decision making.

**COB2:** Familiarize on the concept of knowledge and reasoning Bayesian learning to build AI models

**COB3:** Examine the need of Bayesian Learning to build AI models

**COB4:** Introduce the need of Data science

**COB5:** Explore the Data analysis and modeling techniques

**MODULE I INTRODUCTION TO AI 9**

Foundation of AI–Intelligent Agents: Agents and Environments–Rationality–Nature of Environments–Structure of Agents. Problem Solving by Search: Problem Solving agents–Uniform search strategies – Informed Search–Optimization problems.

**MODULE II KNOWLEDGE AND REASONING 9**

Logical Agents: Knowledge Based Agents–Logic–Propositional Logic–Propositional Theorem Proving–Model Checking–Agent based on Propositional Logic. First–Order Logic: Syntax and Semantics– Using First–Order Logic–Knowledge Engineering. Inferences, Unification and Lifting, Forward and Backward chaining

**MODULE III PROBABLISTIC MODELS 9**

Linear Regression, Logistic Regression, Linear Discriminant analysis, Bayes' Rule. Bayesian Learning: Maximum Likelihood and Least Squared error hypothesis– Maximum Likelihood hypotheses for predicting probabilities– Naïve Bayes classifier – Bayesian Belief networks –Expectation Maximization algorithm.

**MODULE IV INTRODUCTION TO DATA SCIENCE 9**

Introduction to Data Science – Data Science Process –Univariate analysis: Frequency–Mean–Median–Mode–Variance–Skewness and Kurtosis–Bivariate analysis: Correlation Analysis –Regression Analysis– Introduction to Data Visualization:Graphical representation – Bar Plot–Histograms, Box Plot–Scatter Plot.

**MODULE V DATA ANALYTICS****9**

Sampling Distributions – Re–sampling –Statistical Inferences. Prediction models: Dimensionality Reduction – Supervised and Unsupervised algorithms –Time Series Analysis.

**PRACTICALS**

List of Experiments

1. Write a program to illustrate problem solving as a search.
2. Demonstrate agent based on propositional logic.
3. Write a program to implement the naïve Bayesian classifier for a sample training data set. Compute the accuracy of the classifier, considering few test data sets.
4. Apply EM algorithm to cluster a set of data stored in a .CSV file.
5. Implement Logistic Regression to classify the problems such as spam detection. Diabetes predictions so on.
6. Download, install and explore the features of R/Python for data analytics.
7. Use the Diabetes data set from UCI and Pima Indians Diabetes data set for performing the following:
  - a) Univariate Analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis.
  - b) Bivariate Analysis: Linear and logistic regression modeling.
8. Write a program to implement k–Nearest Neighbor algorithm to classify the data set.
9. Implement Support Vector Classification for linear kernel.

**L – 45 ; P – 30 ; TOTAL HOURS – 75****TEXT BOOKS:**

3. Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach” , Third Edition Pearson Education Limited, 2015
4. Rachel Schutt, Cathy O’Neil, “Doing Data Science”, O’Reilly, First Edition,2013

**REFERENCES:**

1. Patterson W. D., Introduction to Artificial Intelligence and Expert Systems, Pearson (2015) 1st ed.

2. Foster Provost, Tom Fawcet, "Data Science for Business", O'Reilly, First Edition, 2013.
3. Umesh R Hodeg hatta, Umesha Nayak, "Business Analytics Using R – A Practical Approach", Apress, First Edition, 2017.

**COURSE OUTCOMES:**

**CO1:** Apply the techniques of Problem Solving in Artificial Intelligence.

**CO2:** Implement Knowledge and Reasoning for real world problems

**CO3:** Create learning model using AI algorithms

**CO4:** Perform univariate and multi variate Data Analysis.

**CO5:** Convert real world problems to hypothesis and perform statistical analysis

**Board of Studies (BoS):**

21<sup>st</sup> BoS of Computer Applications held on 13.06.2025

**Academic Council:**

24<sup>th</sup> AC held on  
26.08.2025

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	M	H	-	-	-	-	-	-
CO2	M	H	H	H	-	-	-	-
CO3	L	M	H	H	-	-	-	M
CO4	M	H	M	H	-	-	-	-
CO5	-	H	H	H	H	H	M	M

**Note:** L– Low Correlation    M –Medium Correlation    H –High Correlation

**SDG 9:**

Build resilient Infrastructure, promote inclusive and sustainable industrialization and foster innovation.

**STATEMENT:**

Artificial intelligence (AI) and Data science, is transforming various industries by providing advanced data analysis, automation, and data-driven decision-making capabilities.

<b>CAFY 107</b>	<b>NATURAL LANGUAGE PROCESSING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>SDG: 9</b>		<b>3</b>	<b>0</b>	<b>2</b>	<b>4</b>

**COURSE OBJECTIVES:**

**COB1:** Introduce foundational concepts, evolution, and practical applications of NLP.

**COB2:** Explore linguistic structures and statistical methods for language modeling.

**COB3:** Understand syntactic structures, parsing algorithms, and grammar formalisms.

**COB4:** Analyze semantic aspects of language and their computational representation.

**COB5:** Apply NLP techniques in real-world case studies, including translation, sentiment analysis, and healthcare applications.

**MODULE I INTRODUCTION 9**

Introduction – History and evolution – Applications of NLP in the real world – NLP pipeline: Lexical – syntactic – semantic – pragmatic levels – Challenges in NLP: Ambiguity – data sparsity – multilinguality – Basic text processing: Tokenization – stemming – lemmatization – stopword removal.

**MODULE II LINGUISTIC ESSENTIALS AND LANGUAGE MODELING 9**

Language structure: Morphology– syntax– semantics– pragmatics – POS tagging: Rule–based and probabilistic tagging – N–gram language models: Unigram– Bigram– Trigram – Smoothing techniques: Laplace– Good–Turing – Perplexity and evaluation of language models.

**MODULE III SYNTAX AND PARSING TECHNIQUES 9**

Context– Free Grammars– Grammar rules for English – Normal Forms for grammar – Dependency Grammar – Syntactic Parsing– Ambiguity– Dynamic Programming parsing – Shallow parsing – Probabilistic CFG.

**MODULE IV SEMANTIC ANALYSIS 9**

Importance of semantics in language understanding – Lexical semantics vs. compositional semantics – Meaning representation: First-order logic – semantic networks– Bag-of-Words and TF-IDF – Word Embeddings: Word2Vec – GloVe– FastText – Lexical Semantics: WordNet– ConceptNet – Latent Semantic Analysis (LSA)– Latent Dirichlet Allocation (LDA) – Lexical semantics: Word sense– polysemy– synonymy.

**MODULE V APPLICATIONS AND CASE STUDIES IN NLP 9**

Information Retrieval System – Search Engine – E-mail filtering system– Social media monitoring – Case studies: Sentiment analysis in social media – Language translation – Medical text analysis – Question answering system –Text classification and sentiment analysis – Named Entity Recognition (NER) – Machine Translation: Statistical and Neural approaches – Text summarization: Extractive vs Abstractive –Chatbots and dialog systems – Case studies: BERT for QA and classification – Google Translate using Transformer – NLP in healthcare and finance.

**L- 45- P-30 – TOTAL HOURS – 75**

**LIST OF EXPERIMENTS**

1. Installing NLTK (Prerequisite)
2. Write a program to perform tokenization by word and sentence using nltk.
3. Write a program to eliminate stopwords using nltk.
4. Develop a program to implement Porter and N-gram stemming techniques.
5. Write a program to implement
  - (i) Dictionary based Lemmatization technique
  - (ii) Rule-base Lemmatization technique
6. Write a program to identify the Basics of Part-of-Speech (POS) Tagging using
  - (i) Hidden Markov Model (HMM)
  - (ii) Conditional Random Fields (CRF)
7. Write a program to perform replace specific words in a sentence using a dictionary.
8. Write a program to implement Synonym & Antonym Replacement

9. Write a program to convert speech input to text and apply NLP preprocessing (tokenizing, cleaning).
10. Write a program to perform Compute Term Frequency – Inverse Document Frequency (TF–IDF) for a sample corpus.

**TEXT BOOKS:**

1. Daniel Jurafsky & James H. Martin, “Speech and Language Processing, An Introduction to Natural Language Processing, Computational Linguistics, and Speech, Recognition”, 3<sup>rd</sup> edition, 2023
2. Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta & Harshit Surana, “Practical Natural Language Processing A Comprehensive Guide to Building Real– World NLP Systems” O’Reilly Media, Inc., USA, June 2020.

**REFERENCES:**

1. Goldberg, Y. “Neural network methods in natural language processing”, Morgan & Claypool Publishers, 2017.
2. Eisenstein, Jacob, “Introduction to natural language processing”, MIT press, 2019.
3. Rao, Delip, and Brian McMahan, “Natural language processing mit PyTorch: intelligente Sprachanwendungen”, MIT Deep Learning erstellen. O’Reilly, 2019.
4. Breck Baldwin, “Language Processing with Java and LingPipe Cookbook”, Atlantic Publisher, 2015.
5. Goyal, Palash, Sumit Pandey, and Karan Jain. "Deep learning for natural language processing." New York: Apress, 2018.
6. Steven Bird, Ewan Klein, and Edward Loper, “Natural Language Processing with Python”, O’Reilly Media, Inc. USA, 2009.

**COURSE OUTCOMES:**

**CO1:** Apply basic text preprocessing techniques like tokenization and lemmatization.

**CO2:** Build and evaluate N–gram language models with smoothing techniques.

**CO3:** Apply context–free grammar rules and normal forms to syntactic analysis.

**CO4:** Explore lexical semantics using tools like WordNet and statistical models like LSA and LDA.

**CO5:** Evaluate NLP use cases in domains such as finance, healthcare, and Chatbots.

**Board of Studies (BoS):**

21<sup>st</sup> BoS of Computer Applications held on  
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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	H	M	L	H	L	–	L	M
CO2	H	H	M	H	M	L	L	H
CO3	H	H	M	H	L	L	L	M
CO4	M	M	M	H	M	L	L	H
CO5	M	H	H	M	M	M	M	M

**Note:** L– Low Correlation    M –Medium Correlation    H –High Correlation

**SDG 9:**

Industry, Innovation and Infrastructure – Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.

**Statement:**

The course introduces fundamental and advanced concepts in Natural Language Processing, enabling learners to innovate and develop intelligent systems for language understanding. Through real-world applications such as chatbots, sentiment analysis, machine translation, and medical text analysis, students learn to harness NLP tools that contribute to building smart, inclusive, and sustainable digital infrastructure. This fosters innovation in sectors like education, healthcare, finance, and governance, supporting the growth of AI-driven industries.