AMRITA
VISHWA VIDYAPEETHAM
DEEMED TO BE UNIVERSITY UNDER SECTION 3 OF UGC ACT. 1956

BACHELOR OF COMPUTER APPLICATIONS

2026

BCA (Bachelor of Computer Applications)-2026

AMRITA VISHWA VIDYAPEETHAM

REGULATIONS FOR THE BCA PROGRAMME

UNDER COMPUTING

(Effective from 2026 admissions)

GENERAL

GENERAL

1. Candidates who have passed for admission to the UG degree programme. However, the eligibility criterion is subject to modification as per the directives of competent authorities.

2. The procedure for admission will be decided from time to time by the University in accordance with the guidelines from competent authorities. the final examination under the 10 +2 system or its equivalent, with a minimum of 50% of marks in aggregate, are eligible to apply

3. The duration of the Programme will normally be six semesters, spread over three academic years.

4. The award of the respective UG degree will be recommended by the Academic Council and approved by the Board of Management in accordance with the regulations of the University.

5. Notwithstanding anything stated above, the Amrita Vishwa Vidyapeetham reserves the right to modify any of the ordinances, as deemed fit, from time to time.

R.1 Admissions

R.1.1 The admission to the programme will be as per the ordinances and regulations of the University.

R.1.2 The intake to each school will be decided by the University from time to time.

R.1.3 Transfer of students from one campus to another is generally not permitted. However, based on the availability of vacancies in the discipline and the academic merit of the student, special cases may be allowed at the beginning of the third semester, on the mutual consent of the Heads of both the Departments and Schools and with the approval of the University. The decision of the University will be final in this matter.

R.2 Language of Instruction

The language of instruction will ordinarily be English for all courses. For *Cultural Education*, instruction may be given partly in Indian languages. In the case of languages, instruction may be in English or the language concerned.

R.3 Structure of the Programme

R.3.1 The Programme will be structured on a credit-based system and continuous evaluation, following a semester pattern.

R.3 2 The programme consists of the following:

(a) Core courses in the primary area of the programme, including seminars, projects, etc.

(b) Humanities and General Studies (like *Environmental Sciences, Open Electives, Languages, Amrita Value Programmes* and *Cultural Education*, etc.

(c) Electives (Regular, AI & DS, Cyber Security and UI/UX and Game Design Stream)

Additionally, soft skill training and social interaction/social work programmes, such as Live-in Labs, may also be offered.

R.3.3 The curriculum of the UG degree programme will have credits, apportioned as below in the following knowledge segments:

Core courses

Electives

Humanities and General Studies

R.3.4 Credits are assigned to the courses based on the following general pattern –

One credit for each lecture period per week

One credit for each tutorial period per week

One credit for each laboratory course/practical of two periods per week

R.3.5 Each UG degree programme shall have a prescribed curriculum and syllabi, which will be periodically updated according to the requirements and approved by the Academic Council.

R.3.6 All the Schools will be governed by the same curricula and syllabi, for the respective programmes.

R.3.7 Certain courses are identified as Core courses and a few others as electives.

There is a mandatory registration and credit earnings requirement for core courses. While it is mandatory to register for the elective courses, failure to earn credit in them does not necessarily require repeating the courses. Often another elective course may be permitted as a replacement course, through Regular registration, with the concurrence of the Class Advisor and the Head of the Department.

R.3.8 Students are allowed to take online courses through Government portals such as NPTEL and SWAYAM

1. Amrita's grade, equivalent to the score secured in online courses to be decided by the class committee, and the same is to be awarded to the students.
2. The Class committee should authorize the courses before registration.
3. Students who have a Cumulative Grade Point Average (CGPA) of 6.5 or higher are eligible to enroll in NPTEL/SWAYAM courses for credits. However, the number of credits should not exceed twelve.
4. The Course registration requisite of a maximum of 28 credits per semester is to be maintained while registering for online courses.

R.3.9 **Programme Educational Objectives (PEOs)**

PEO 1: Graduates will strive on a global platform to pursue their career in Computer Applications.

PEO 2: Graduates will contribute as entrepreneurs in interdisciplinary areas.

PEO 3: Graduates will demonstrate high regard for professionalism, integrity, and respect values in diverse cultures, and have a concern for society and the environment.

R.3.10 **Programme Outcomes (POs)**

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 focussing 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 Team Work:** 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.

R.4 Tuition Fees

At the beginning of each academic semester, students shall pay all the fees prescribed. A student who drops out of the programme or whose registration is cancelled due to any reason, cannot claim refund of any fees paid.

R.5. Mentor and Class Advisor

R.5.1 To (i) guide the students in planning their courses of study, (ii) advise them on academic programmes and (iii) monitor their progress, the departments will assign a batch (class) of a certain number of students to a faculty member, who will be designated as their mentor.

R.5.2 One among the mentors, shall be designated as the Class Advisor, who shall coordinate the functions of the Class mentors.

R.6. Course Committees

R.6.1. Course committees are constituted for running courses which are common for more than one discipline. Course committees will be set up in each School for each group of similar courses as decided by Head of the School.

R.6.2. Each course committee will consist of the following members:

(i) The chairperson of the course committee, nominated by the Head of the School.

(ii) All teachers involved in teaching the courses, shall be included in the course committee.

(iii) Two student members from each discipline nominated into the committee by the chairpersons of departments with equal representation to boys and girls, to the extent possible.

(iv) Chairpersons of the departments and the School Head may attend meetings of the course committees.

R.6.3. The Course Committees shall meet at least thrice in a semester. The Course committees shall meet at the beginning of the semester to finalize the course plans for the academic programme. They shall meet at the end of the semester, without the student representatives, to finalize the results of the respective courses. The results shall be submitted to the Head of the School, who shall approve and forward the same to the Examination section.

R.6.4. The Course committees shall be reconstituted at the beginning of every semester.

R.7 Class Committees

R.7.1 Every class of a Degree programme in each School will have a Class Committee constituted by the Head of the School, based on the recommendation of the Chairperson of the department.

R.7.2. The Constitution of the Class Committee will be as follows:

a) The Chairperson of the class committee, nominated by the Head of the School,

b) All the teachers handling courses for the class,

c) Two student representatives nominated by the Chairperson of the department, from each class with equal representation of boys and girls, to the extent possible.

d) The Chairperson of the department and the School Head may attend the committee meetings.

R.7.3. The Class Committee shall meet at least thrice in a semester. The Class committee shall meet at the beginning of the semester to finalise the academic programme. At the end of the semester, the committee (without student representatives) will meet to finalise the results. The results shall be submitted to the Head of the School, who shall approve and forward the same to the Examination section

R.7.4. The Class committees shall be reconstituted at the beginning of every semester.

R.8 Registration and Enrolment

R.8.1 Every student shall register for the courses that he/she wishes to take during a semester.

R.8.2 Except for the first semester, pre-registration for a semester will be done during a specified week before the end-of-semester examination of the previous semester. The consent of the Class Advisor is mandatory before registering for every course.

R.8.3 From the second semester onwards, all students have to enrol on a specified day at the beginning of a semester. A student will be eligible to enrol only if he/she has cleared all the dues to the Institution, hostel, library, etc., at the time of enrolment and if he/she is not debarred from enrolment, as part of any disciplinary action of the Institution.

R.8.4 Late enrolment will be permitted on payment of a prescribed late fee, up to a specified date, to be notified well in advance.

R.8.5 A student can register for a maximum of 28 credits in a semester, including all the remedial provisions.

R.8.6 **Pre-requisites:** A student is not permitted to register for a course unless he/she has already attended the pre-requisite course, wherever specified. A student will not be deemed to have attended the pre-requisite if he/she gets an 'FA' grade in such a course.

R.9 Dropping /Substituting Courses

R.9.1 If a student finds his/her load heavy in any semester, or for any other valid reasons, he/she may drop courses, within **first ten working days** of the commencement of the semester, with the written approval of his/her Class Advisor and Chairperson of the Department.

Withdrawal from one or more enrolled courses after the specified date will entail academic penalties in the form of a 'Failed due to insufficient attendance' (FA) grade appearing in the grade sheet.

R.9.2 A student can substitute a course registered earlier with another for valid reasons, within the **first ten working days** of the commencement of the semester, with the consent of the Class Advisor and Chairperson of the Department.

R.10 Maximum Duration of the Programme

R.10.1 A student is expected to complete the UG programme in six semesters. However, a student may complete the programme at a slow pace within ten semesters, with the prior permission of his/her Class Advisor, Chairperson of the Department and Head of the School.

R.10.2 A student may be permitted by the concerned Head of the School to withdraw from the programme for a semester or a longer period for reasons of ill health or on other valid grounds. However, the programme should be completed within a total span of ten semesters.

R.10.3 In the event of any student requiring more than ten semesters to complete the programme, the extension can be considered on the merits of the case, by the Vice-Chancellor and ratified by the Academic Council.

R.11 Attendance

R.11.1 Attendance of the students will be marked by the concerned teacher during every hour of the course.

R.11.2 Students who have been selected to be trained for International competitions or have secured distinction in the previous year's examinations and are working on directed research under a faculty member, and approved by the Chairperson of the Department, shall be given a waiver of up to 25% attendance.

R.11.3 Leave shall be availed by students only under unavoidable circumstances. Students must apply in the prescribed form before proceeding on leave. Leave letter recommended by the Class Advisor shall be submitted to the Chairperson of the department, who will consider the grant of the leave. Unauthorised absence will be treated as a breach of discipline.

A request for leave for more than three consecutive days on medical grounds must be supported by a proper medical certificate. In non-medical cases, requests for leave for more than three consecutive days must be countersigned by the parent/guardian or the Warden, whichever is applicable.

Leave granted will not be counted as physical presence.

R.11.4 Students going on official duty, such as representing the Campus/University for sports and cultural activities, or presenting papers in seminars, conferences, etc., will be eligible for 'duty leave' on the recommendation of the Class Advisor and approval by the Chairperson of the Department. **Students should get this leave sanctioned before proceeding on 'duty leave'. They will be granted attendance for the periods they missed on account of the duty leave upon production of the relevant participation certificate after attending the duty.**

All kinds of leave, authorized by the Chairperson of the Department, shall not exceed 25% of the total hours in the course.

R.11.5 Finalisation of attendance for every course shall be done three working days before the last instruction day of the semester. Any student failing to secure a minimum of 75% attendance in a course will not be eligible to appear for the end-of-semester examination in that course.

R.11.6 In case a student who is not permitted to attend the end-semester examination in any course due to a shortage of attendance, will be awarded an 'FA' grade in that course, indicating "failed due to insufficient attendance" and mentioned in the grade sheet.

Students awarded an 'FA' grade in a course shall re-register for the course when offered next or as a run-time re-do course.

R.12 Assessment Procedure

R.12.1 The academic performance of each student in each course will be assessed based on Internal Assessment (including Continuous Assessment) and an end-semester examination.

Normally, the teachers offering the course will evaluate the performance of the students at regular intervals and in the end-of-semester examination.

In theory courses (that are taught primarily in the lecture mode), the weightage for the Internal Assessment and End-semester examination will be 50:50. The Internal assessment in theory courses shall consist of one mid-term examination, weekly quizzes, assignments, tutorials, viva-voce, etc. The weightage for these components, for theory-based courses shall be 25 marks for the Continuous assessment, comprising quizzes, assignments, tutorials, viva-voce, etc. and 25 marks for the mid-term examination.

At the end of the semester, there will be an end-of-semester examination of three hours duration, with a weightage of 50 marks, in each lecture-based course.

R.12.2 ***Evaluation pattern for the course having only Theory components***

Courses having only lecture or tutorial hours without a lab component, the relative weight for Internal assessment and End-semester examination will be 50:50. 25 marks will be for continuous assessment, 25 marks for the mid-term examination, and 50 marks for the theory end-semester examination.

Evaluation pattern for the course having only lab components

In the case of laboratory courses and practicals, the relative weight for the internal assessment and End-semester examination will be 70:30. The weight for the components of the internal assessment will be decided by the course committee/class committee at the beginning of the course. 70 marks will be for continuous assessment, and 30 marks for the lab end-semester examination.

Evaluation pattern for the course having both Theory and Lab components:

Courses having one or more lecture hours with lab, the relative weight for Internal assessment and End-semester examination will be 70:30. The Lab. component evaluation will be based on continuous evaluation, without any end-semester practical evaluation. 10 marks will be for continuous assessment of the theory portion, 20 marks for the mid-term examination, 30 marks for the theory end-semester examination, and 40 marks for continuous assessment of lab work.

Courses having only tutorials without lecture hours will be treated as a Lab course, for evaluation purposes, and the evaluation pattern will be 70 marks for continuous assessment of the lab. work and 30 marks for the end-semester lab Examination.

R.12.3 It is mandatory that the students appear for the end-semester examinations in all theory and practical courses, for completion of the requirements of the course. Those who do not appear in the end-semester examinations will be awarded an 'F' grade, subject to meeting the attendance requirement.

At the end of a semester, examinations shall be held for all the subjects that were taught during that semester and those subjects of the previous semesters for which the students shall apply for supplementary examination, with a prescribed fee.

R.12.4 PROJECT WORK: The continuous assessment of project work will be carried out as decided by the course committee. At the completion of the project work, the student will submit a bound volume of the project report in the prescribed format. The project work will be evaluated by a team of duly appointed examiners.

The final evaluation will be based on the content of the report, presentation by student and a viva-voce examination on the project. There will be 60% weightage for continuous assessment and the remaining 40% for final evaluation.

If the project work is not satisfactory, he/she will be asked to continue the project work and appear for assessment later.

Course Category	**L-T-P**	**Internal: External**	**Internal (%)**		**External (%)**	**Total Theory Weightage (%)**	**Total Lab Weightage (%)**
			Mid-term	**CE**			
Theory without a lab component	4-0-0/3-1-0/3-0-0 / 2-1-0 /2-0-0/ 1-1-0/ 1-0-0	50:50	25	25	50	100	-
Theory with a lab component	2-0-2/ 3-0-2	70:30	20	50	30	60	40*
Lab courses	0-1-2/1-0-2/ 0-0-2/0-1-4/0-2-4	70:30	70		30	-	100
Mini/Major Project		60:40	60		40	-	-

	*No end-semester practical exam.

R.13 GRACE MARKS

R.13.1 All students who publish a paper in Scopus-indexed Journal/Conference will be awarded an additional mark of 5-10 for each publication, subject to a maximum of two publications.

The additional marks shall be awarded in the semester in which the paper is published or accepted for publication, if applied for, before the publication of the results of the concerned semester.

R.13.2 **Co-curricular Activities**

The students during their period of study in the University are encouraged to indulge in sports, arts, Social/Community service, and Seva activities. Bonus marks (5 to 10 marks) shall be awarded for representing AMRITA University in Sports, Cultural, and Seva activities. The procedure for awarding these marks will be published by the University from time to time.

R.14 REMEDIAL PROVISIONS

R.14.1 **Supplementary Examinations:**

Students who failed in a non-semester course (i.e. courses not registered by the student during the current semester) shall apply by appearing in the respective examination, paying a prescribed fee, and taking the examination.

A student who has secured an 'F' grade in a course may take the supplementary examination for a maximum of three additional attempts (excluding the regular end-semester examinations), carrying the previous Internal marks earned by them. Students failing to pass the course after three additional attempts shall henceforth appear for the supplementary examination for the entire 100 marks, and the Internal assessment marks earned by them in the regular registration shall not be considered.

If a student wishes to improve his/her internal marks, he/she can do so by re-registering for the course by choosing any of the appropriate remedial options. In this case, the internal marks obtained by the student will be valid for the end semester of the re-registration and three additional attempts.

R.14.2 **Other options:**

Certain courses may be offered as run-time-redo or as contact courses, as and when necessary to enable students who have dropped courses or failed in some courses to register and endeavor to complete them.

a) Re-registration: Students who have failed a course and opt to re-do the course may do so by re-registering for the course, along with a junior batch of students.

b) Run-time re-do: Certain courses may be offered specially for the benefit of failed students during the semester, on a regular pattern.

The above two modes enable possible improvement of the Internal assessment marks.

c) Contact courses: Final-semester students and term-out students (students who have completed three years) may register for contact mode, to clear the failed courses, if any, subject to the approval of the Head of the School.

A maximum of only two courses can be taken under contact mode in the entire programme of study.

R.14.3 Supplementary examinations will be evaluated against the most recent grade rule (whenever the course was offered recently in the regular semester).

R.15 Grading

R.15.1 Based on the performance in each course, a student is awarded at the end of the semester, a letter grade in each of the courses registered. Letter grades will be awarded by the Class Committee in its final sitting, without the student representatives.

The letter grades, the corresponding grade points and the ratings are as follows:

Letter Grade	***Grade Points***	***Ratings***
O	10.00	Outstanding
A+	9.50	Excellent
A	9.00	Very Good
B+	8.00	Good
B	7.00	Above Average
C	6.00	Average
P	5.00	Pass
F	0. 00	Fail
FA	0. 00	Failed due to insufficient attendance
I	0. 00	Incomplete (awarded only for Lab. courses/ Project /Seminar)
W		Withheld

R.15.2 'FA' grade once awarded stays in the record of the student and is replaced with the appropriate grade when he/she completes the course successfully later.

Students who have secured an 'FA' in a course must re-register for the course or register for the course, if offered, under run-time re-do mode.

R.15.3 A student who has been awarded an 'I' Grade in a Lab course, due to reasons for not completing the Lab, shall take up additional Lab whenever offered and earn a pass grade, which will be reflected in the next semester's grade sheet.

The 'I' grade, awarded in a Project/Seminar course, will be subsequently changed into an appropriate grade when the student completes the requirement during the subsequent semester. If he/she does not complete it in the next semester, it will be converted to 'F' grade.

R.15.4 A student is considered to have successfully completed the course and earned the credit, if he/she scores a letter grade 'P' or better in that course.

R.16 Declaration of Result

After finalization of the grades by the Class Committee and subsequent approval of the Head of the School, the result will be announced by the Controller of Examinations.

R.17 Revaluation of Answer Papers

On publication of the results, an aggrieved student can request for revaluation of answers scripts of the end-semester examination, within five working days of publication of the results, along with the prescribed revaluation fees. The request has to be made to the Examination Section, through the Head of the School.

If the revaluation leads to a better grade, the revised grade will be awarded to the student and in such cases, the revaluation fee will be refunded in full.

Revaluation is permitted only for lecture-based courses.

R.18 Course completion:

A student is said to have completed a course and earned the corresponding credits if he/she has:

- registered for the course :
- put in 75% or more attendance in the course
- appeared for the end-semester examinations
- obtained a passing grade 'P' or better in the course
- no pending disciplinary proceedings against him/her

R.19 Grade Sheet

The Grade Sheet issued to the student at the end of a semester will contain the following information:

- Name, Roll No. Grade Sheet No., Semester, Branch, Month and year of the Examination,
- Course Code, Course Title, Credits, Grade obtained and Grade points earned for the courses registered,
- Credits registered and earned during the semester
- Cumulative credits earned and Grade Points
- SGPA
- CGPA

R.20 Semester Grade Point Average (SGPA)

On completion of a semester, each student is assigned a Semester Grade Point Average (SGPA), which is computed as follows for all courses registered by the student during that semester.

Semester Grade Point Average = $\sum (C_i \times Gp_i) / \sum C_i$

, where C_i is the credit for i^{th}course in that semester, and Gp_i is the grade point for that course.

The summation is over all the courses registered by the student during the semester, including the failed courses. The SGPA is rounded off to two decimals.

R.21 Cumulative Grade Point Average (CGPA)

The overall performance of a student at any stage of the Degree programme is evaluated by the Cumulative Grade Point Average (CGPA) up to that point in time.

Cumulative Grade Point Average = $\sum (C_i \times Gp_i) / \sum C_i$

where C_i is the credit for i^{th} course in any semester and Gp_i is the grade point for that course.

The summation is over all the courses registered by the student during all the semesters up to that point of time, including the failed courses. The CGPA is also rounded off to two decimals.

R.22 Ranking

The ranking of the students in a batch at any intermediate or final stage is based on CGPA. Only those students who have passed all courses up to that stage in the first attempt are considered for ranking.

Students are eligible for final ranking only if they complete the programme within the normal duration, i.e., within three years from joining the programme.

R.23 Classification of successful candidates:

R.23.1 A student shall be considered to have completed the programme if he/she has:

i) registered and completed all the core courses, electives, and projects as mentioned in the curriculum;

ii) earned the required minimum number of credits as specified in the curriculum corresponding to the programme, within the stipulated time;

R.23.2 Candidates who have completed the programme, within six semesters of entering the programme, shall be classified as follows:

Candidates securing a CGPA of 8.00 and above – FIRST CLASS WITH DISTINCTION

Candidates securing a CGPA between 6.50 and 7.99 – FIRST CLASS, and the same is mentioned in the Degree certificate;

Suppose the programme is completed after six semesters of study. In that case, the candidates securing even a CGPA of 8.00 and above shall be classified as having completed the programme, only with FIRST CLASS.

R.24 Transcript

The Controller of Examinations will also issue, on request and payment of a prescribed fee, a detailed transcript with his signature or facsimile to every student after completion of the programme. It shall contain all the information that is contained in the grade sheets. Additionally, it shall also include the month and year of passing each course. The transcript card shall contain only the final grades secured, but will not indicate the earlier failures, if any. The detailed transcript, will contain the CGPA and the class, if any obtained.

R.25 Discipline

Every student is required and expected to observe strict discipline and decorous behavior both inside and outside the campus. He/she should not indulge in any activity that may tarnish the fair name and prestige of Amrita Vishwa Vidyapeetham. Any act of indiscipline or misbehaviour including unfair practice in the examinations will be dealt with by the Disciplinary Action Committee of the Institution, constituted by the Head of the School concerned. The committee will enquire into the charges and make recommendations to the Head of the School concerned. Based on the findings of the committee, Head of the School will take appropriate disciplinary action. Serious act of indiscipline on the part of the students may even attract penalty up to the extent of expulsion from the University.

R.26 Redressal of grievances

Students have the right to seek redress of grievances. For this, they have to appeal in writing to the Head of the School concerned, who will take the necessary steps in the matter.

R.27 Award of the Degree

A student will be declared eligible for the award of the respective Degree if he/she has:

a) completed the programme successfully as described in R.23.1 and

b) no outstanding dues against him/her.

c) Specialization – any student who completes the program with minimum requirement (5 and above in the respective stream out of 8 electives) in the concerned stream will be awarded the degree with the following specialization.

1. Artificial Intelligence and Data Science (AI&DS)

2. Cyber Security

3. UI/UX and Game Design

The UG Degree, indicating the discipline and specialization (if applicable), will be awarded by the Board of Management of Amrita Vishwa Vidyapeetham on the recommendation of the Academic Council.

R.28 Interpretation Clause

Related to any of the academic matters, whenever there arises any doubt or dispute on the interpretation of regulations or rules, the decision of the Academic Council will be final as well as binding on all concerned.

R.29 Amendment to Regulations

Notwithstanding anything stated above, the Amrita Vishwa Vidyapeetham reserves the right to modify any of the regulations, as deemed fit, from time to time.

CURRICULUM AND SYLLABUS
2026

SEMESTER I

Course Code	Title	L T P	Credit
22ADM101	Foundations of Indian Heritage	2 0 1	2
24ENG101	English I	2 0 0	2
	Language 1	2 0 0	2
	Mathematics for Computing 1	3 1 0	4
22AVP103	Mastery Over Mind	1 0 2	2
26ENV100	Environmental Studies	2 0 0	2
26CSA101	Computer Fundamentals and Digital Electronics	3 0 2	4
26CSA102	Programming Fundamentals	3 1 0	4
26CSA181	Programming Foundation Lab	0 0 2	1
26CSA182	Introduction To Linux – Lab	0 0 2	1
	Total		**24**

SEMESTER II

Course Code	Title	L T P	Credit
22ADM111	Glimpses of Glorious India	2 0 1	2
24ENG111	English II	1 0 2	2
	Language II	2 0 0	2
	Mathematics for Computing II	3 1 0	4
26CSA111	Object-Oriented Programming using Java	3 1 0	4
26CSA112	Computer Organization and Architecture	3 1 0	4
26CSA113	Database Management System	3 0 0	3
26CSA183	Object-Oriented Programming using Java LAB	0 0 2	1
26CSA184	Database Management System LAB	0 0 2	1
26CSA185	User Interface Design	0 0 2	1
	Total		**24**

SEMESTER III

Course Code	Title	L T P	Credit
	Amrita Value Programme 1	1 0 0	1
	Mathematics for Computing III	3 1 0	4
26CSA201	Data Structures	3 1 0	4
26CSA202	Operating Systems	3 0 0	3
26CSA203	Introduction to Python	3 0 0	3
26CSA204	Web Technologies	2 0 2	3
26CSA205	Computer Networks	3 0 2	4
26CSA281	Data Structures Lab	0 0 2	1
26CSA282	Python Programming Lab	0 0 2	1
	Total		**24**

SEMESTER IV

Course Code	Title	L T P	Credit
	Amrita Values Programme II	1 0 0	1
26CSA290*	Live in Labs I*/ Open Elective	3 0 0	3
26CSA211	Full Stack Frameworks	3 0 0	3
26CSA212	Software Engineering & UML	2 0 2	3
26CSA213	Fundamentals of AI	3 0 0	3
26CSA283	Full Stack Frameworks Lab	0 0 2	1
	Elective I		3
	Elective II		3
	Elective III		4
	Total		**24**

SEMESTER V

Course Code	Title	L T P	Credit
26CSA390*	Live in Labs II*/ Open Elective	3 0 0	3
26CSA301	Mobile Application Development	0 1 2	2
26CSA302	Algorithms	3 0 0	3
23LSK201	Life Skills I	1 0 2	2
26CSA381	Algorithms Lab	0 0 2	1
26CSA303	Competitive Programming	0 1 2	2
	Elective IV		3
	Elective V		4
26CSA396*/26CSA397#	Minor Project*/ Internship I#		4
	Total		**24**

SEMESTER VI

Course Code	Title	L T P	Credit
26CSA311	Automata Theory and Compiler Design	3 1 0	4
	Elective VI		3
	Elective VII		3
	Elective VIII		4
26CSA399*/26CSA398#	Major Project*/ Internship II#		6
	TOTAL		**20**

Mathematics for Computing

Course Code	Title	L T P	Credit
26MAT131	Algebra and Number Theory	3 1 0	4
26MAT132	Mathematical Foundation	3 1 0	4
26MAT133	Advanced Mathematical Foundation	3 1 0	4
26MAT134	Linear Algebra	3 1 0	4
26MAT135	Statistical and Numerical Methods	3 1 0	4

LANGUAGES

Sl. No.	Course Code	Course Title	L T P	Credits
Paper I				
1	24MAL101	Malayalam I	2 0 0	2
2	24HIN101	Hindi I	2 0 0	2
3	24KAN101	Kannada I	2 0 0	2
4	24SAN101	Sankrit I	2 0 0	2
5	24TAM101	Tamil I	2 0 0	2
6	24ENG100	Additional English – I	2 0 0	2
Paper II				
7	24MAL111	Malayalam II	2 0 0	2
8	24HIN111	Hindi II	2 0 0	2
9	24KAN111	Kannada II	2 0 0	2
10	24SAN111	Sanskrit II	2 0 0	2
11	24TAM111	Tamil II	2 0 0	2
12	24ENG110	Additional English - II	2 0 0	2

Electives - 3 Credits

AI & DS Stream

Sl. No.	Course Code	Course Title	L T P	Credits
1	26CSA331	Python for AI & DS	2 0 2	3
2	26CSA332	Introduction to Neural Networks	3 0 0	3
3	26CSA333	Fundamentals of Data Science	2 0 2	3
4	26CSA334	Applied Statistics for Data Science	3 0 0	3
5	26CSA335	Computer Vision Basics	2 0 2	3
6	26CSA336	Ethics and Data Privacy	3 0 0	3
7	26CSA337	Data Governance	3 0 0	3
8	26CSA338	Big Data Foundations	3 0 0	3

Cyber Security Stream

Sl. No.	Course Code	Course Title	L T P	Credits
1	26CSA341	Introduction to Cybersecurity	3 0 0	3
2	26CSA342	Network Security Basics	3 0 0	3
3	26CSA343	Cryptography Fundamentals	2 0 2	3
4	26CSA344	Cyber Laws & Digital Forensics	3 0 0	3
5	26CSA345	Linux Security & Hardening	2 0 2	3
6	26CSA346	Wireless & Mobile Security	3 0 0	3
7	26CSA347	Digital Forensics	3 0 0	3

UI/UX and Game Design

Sl. No.	Course Code	Course Title	L T P	Credits
1	26CSA351	Vector Animation	0 1 4	3
2	26CSA352	Motion Graphics & VFX	0 1 4	3
3	26CSA353	Game Programming	0 1 4	3
4	26CSA354	AI Tools for Media & Design	0 1 4	3
5	26CSA355	Visual Design & Branding	0 1 4	3
6	26CSA356	Game Story Design	0 1 4	3
7	26CSA357	Web & Mobile UI Design	0 1 4	3
8	26CSA358	User Research & Testing	0 1 4	3

Regular

Sl. No.	Course Code	Course Title	L T P	Credits
1	26CSA361	Client Server Computing	3 0 0	3
2	26CSA362	E-Commerce Technologies	3 0 0	3
3	26CSA363	Knowledge Management	3 0 0	3
4	26CSA364	Soft Computing	3 0 0	3
5	26CSA365	Systems and Network Administration	3 0 0	3
6	26CSA366	Multimedia Applications	3 0 0	3
7	26CSA367	Software Testing & Quality Assurance	2 0 2	3

Electives - 4 Credits

AI & DS Stream

Sl. No.	Course Code	Course Title	L T P	Credits
1	26CSA231	Machine Learning Basics	3 0 2	4
2	26CSA232	Computational Intelligence	3 0 2	4
3	26CSA233	Time Series Analysis	3 0 2	4
4	26CSA234	Non-Relational Databases	3 0 2	4
5	26CSA235	R Programming	3 0 2	4
6	26CSA236	Probability and Statistics for Machine Learning	3 1 0	4

Cyber Security Stream

Sl. No.	Course Code	Course Title	L T P	Credits
1	26CSA241	Blockchain & Web3	3 0 2	4
2	26CSA242	Intrusion Detection & Prevention Systems	3 0 2	4
3	26CSA243	IoT Security	3 0 2	4
4	26CSA244	Secure Software Development	3 0 2	4
5	26CSA245	Cyber Risk Management	3 1 0	4
6	26CSA246	Cybercrime & Criminology	3 1 0	4

UI/UX and Game Design

Sl. No.	Course Code	Course Title	L T P	Credits
1	26CSA251	Digital Media Production	0 2 4	4
2	26CSA252	Character Design for Games	0 2 4	4
3	26CSA253	Advanced UI/UX Design	0 2 4	4
4	26CSA254	3D Animation for Games	0 2 4	4
5	26CSA255	AR/VR Experience Design	0 2 4	4
6	26CSA256	Accessible UX Design	0 2 4	4
7	26CSA257	Game Audio Design	0 2 4	4

Regular

Sl. No.	Course Code	Course Title	L T P	Credits
1	26CSA261	IoT Architectures and Programming	3 0 2	4
2	26CSA262	Computer Graphics and Visualization	3 0 2	4
3	26CSA263	Architecture and Deployment of Secure and Scalable WAN	3 0 2	4
4	26CSA264	Bigdata Analytics	3 0 2	4
5	26CSA265	C# and ASP.NET	3 0 2	4
6	26CSA266	Cloud Computing	3 0 2	4
7	26CSA267	Web Mining	3 0 2	4

AMRITA VALUE PROGRAMMES FOR UG PROGRAMMES

Course Code	Title	L-T-P	Credits
22ADM201	Strategic Lessons from the Mahabharata	1-0-0	1
22ADM211	Leadership from Ramayana	1-0-0	1
22AVP210	Kerala Mural Art and Painting	1-0-0	1
22AVP201	Amma's Life and Message to the modern world	1-0-0	1
22AVP204	Lessons from the Upanishads	1-0-0	1
22AVP205	Message of the Bhagavad Gita	1-0-0	1
22AVP206	Life and Message of Swami Vivekananda	1-0-0	1
22AVP207	Life and Teachings of Spiritual Masters of India	1-0-0	1
22AVP208	Insights into Indian Arts and Literature	1-0-0	1
22AVP213	Traditional Fine Arts of India	1-0-0	1
22AVP214	Principles of Worship in India	1-0-0	1
22AVP215	Temple Mural Arts in Kerala	1-0-0	1
22AVP218	Insights into Indian Classical Music	1-0-0	1
22AVP219	Insights into Traditional Indian Painting	1-0-0	1
22AVP220	Insights into Indian Classical Dance	1-0-0	1
22AVP221	Indian Martial Arts and Self Defence	1-0-0	1
22AVP209	Yoga and Meditation	1-0-0	1

SYLLABUS

SEMESTER I

22ADM101	FOUNDATIONS OF INDIAN HERITAGE	L-T-P-C: 2-0-1-2

Course Objective(s)

To introduce students to the depths and richness of the Indian culture and knowledge traditions, and to enable them to obtain a synoptic view of the grandiose achievements of India in diverse fields. To equip students with a knowledge of their country and its eternal values.

Course Outcomes

COs	Description
CO1	Increase student understanding of true essence of India's cultural and spiritual heritage.
CO2	Emancipating Indian histories and practices from manipulation, misunderstandings and other ideological baggage thus shows its contemporary relevance.
CO3	Understand the ethical and political strategic concepts to induce critical approach to various theories about India.
CO4	Familiarize students with the multi dimension of man's interaction with nature, fellow beings and society in general.
CO5	Appreciate the socio-political and strategic innovations based on Indian knowledge systems. Gives an understanding of bringing Indian teaching into practical life.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	-	-	-	2	-	-	-
CO2	-	-	-	-	2	-	-	-
CO3	-	-	-	-	2	-	-	-
CO4	-	-	-	-	2	-	-	-
CO5	-	-	-	-	2	-	-	-

Syllabus

1. Chapter 1 - Educational Heritage of Ancient India
2. Chapter 2 - Life and Happiness
3. Chapter 3 - Impact of Colonialism and Decolonization
4. Chapter 4- A timeline of Early Indian Subcontinent
5. Chapter 5 - Indian approach towards life
6. Chapter 6 - Circle of Life
7. Chapter 7- Pinnacle of Selflessness and ultimate freedom
8. Chapter 8- Ocean of love; Indian Mahatmas.
9. Chapter 9 - Become A Strategic Thinker (Games / Indic activity)
10. Chapter 10 - Man's association with Nature
11. Chapter 11 - Celebrating life 24/7
12. Chapter 12 - Metaphors and Tropes
13. Chapter 13 - India: In the Views of foreign Scholars and Travellers.

Self-Study/ Self-reading

14. Chapter 14 - Personality Development Through Yoga.
15. Chapter 15 - Hallmark of Indian Traditions: Advaita Vedanta, Theory of oneness
16. Chapter 16 - Conversations on Compassion with Amma

Textbooks/References

1. Foundations of Indian Heritage

Evaluation Pattern

Assessment	Weightage (%)
Midterm	30
Continuous Assessment	20
End Semester Exam	50
Total Marks	100

24ENG101	English I	L-T-P-C: 2-0-0-2

Course Objective(s)

To help students obtain an ability to communicate fluently in English; to enable and enhance the students' skills in listening, speaking, reading, and writing; to impart an aesthetic sense and enhance creativity.

COs	Description
CO1	Demonstrate competence in the mechanics of writing
CO2	Summarise audio and written texts to convey messages effectively
CO3	Apply the mechanics of writing and AI tools to draft academic and professional documents
CO4	Organise ideas and thoughts for clear written and oral communication
CO5	Critically evaluate literary texts

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	-	-	-	2	-	-	2
CO2	-	-	-	-	2	-	-	2
CO3	-	-	-	-	2	-	-	2
CO4	-	-	-	-	2	-	-	2
CO5	-	-	-	-	2	-	-	2

Syllabus

Unit I

Mechanics of writing - Parts of speech – use of prepositions, adjectives, adverbs and determiners – word order – collocation – concord (Subject-Verb, Pronoun-Antecedent) – kinds and patterns of sentences

Unit II

Tenses - Modal auxiliaries - Reported speech - Active and Passive Voice - Phrasal Verbs - Linkers/ Discourse Markers - Question Tags

Unit III

Pre-writing techniques - Paragraph writing – Cohesion – Development – types: definition, comparison, classification, contrast, cause and effect - Essay writing: Descriptive and Narrative - Introduction to the use of Gen AI in writing (AI tools, Do's and Don'ts while using AI, how to write prompts, etc.)

Unit IV

Listening comprehension (3 pieces – Do Schools kill creativity? By Sir Ken Robinson, Steve Jobs' 2005 Stanford Commencement Address, India Questions Dr Abdul Kalam- Aired August 2007) - Reading Comprehension – Skimming and Scanning- Inference and Deduction – Reading different kinds of material – Speaking**:** Narration of incidents / stories/ anecdotes.

Unit V

Shashi Tharoor – "'Kindly Adjust' to Our English
A. G. Gardiner – "A Fellow Traveller"
Ruskin Bond – "The Eyes Have It"
Mrinal Pande – "Girls"
W. H. Auden – "Unknown Citizen"
W H Davies - "Leisure"

References:

1. Murphy, Raymond, Murphy's English Grammar, CUP, 2004
2. Syamala, V. Speak English in Four Easy Steps, Improve English Foundation Trivandrum: 2006
3. Martinet, Thomson, A Practical English Grammar, IV Ed. OUP, 1986.
4. The Week - June 03, 2018, LAST WORD; https://www.theweek.in/columns/shashi-tharoor/2018/05/25/kindly-adjust-to-our english.html?fbclid=IwAR3IhtdXqvuV4ySECn9S7SA6HmCEYISyd1QHd3BlwKgiNKKwdkeSg3qWp-U/
5. A G Gardiner – Leaves in the Wind, Digicat (e-book), 2015
6. Ruskin Bond – The Best of Ruskin Bond; India Penguin. April 2016.
7. Mrinal Pande – Stepping Out; Penguin India; 2003
8. W H Auden – Another Time; Random House Pub; 1940
9. William H Davies – Songs of Joy and Others; Andesite Press, August 2017.
10. Sir Ken Robinson – "Do schools kill creativity?". https://go.ted.com/6WoC
11. Steve Jobs' 2005 Stanford Commencement Address. https://youtu.be/UF8uR6Z6KLc?si=1nMNYJOk3Yw7H7tF
12. India Questions Dr Abdul Kalam (aired: August 2007). https://youtu.be/erg3CmVm6M4?si=YudsxXZOFY1do91C

Evaluation Pattern

Assessment	Weightage (%)
Midterm	30
Continuous Assessment	20
End Semester Exam	50
Total Marks	100

22AVP103	MASTERY OVER MIND (MAOM)	L-T-P-C: 1-0-2-2

Course Objective(s)

- Mastery Over Mind (MaOM) is an Amrita initiative to implement schemes and organize university-wide programs to enhance the health and wellbeing of all faculty, staff, and students (UN SDG -3).
- It gives an introduction to the immediate and long-term benefits of MA OM meditation and equips everyattendee to manage stressful emotions and anxiety, in turn facilitating inner peace and harmony.
- This course will enhance the understanding of experiential learning based on the University's mission: "Education for Life along with Education for Living" and is aimed to allow learners to realize and re-discover the infinite potential of one's true Being and the fulfilment of life's goals.

Course Outcomes

COs	Description
CO1	To be able to describe what meditation is and to understand its health benefits.
CO2	To understand the causes of stress and how meditation improves well-being.
CO3	To understand the science of meditation.
CO4	To learn and practice MAOM meditation in daily life.
CO5	To understand the application of meditation to improve communication and relationships.
CO6	To be able to understand the power of meditation in compassion-driven action.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	-	-	-	-	-	-	1
CO2	-	-	-	-	-	-	-	1
CO3	-	-	-	-	-	-	-	1
CO4	-	-	-	-	-	-	-	1
CO5	-	-	-	-	1	-	-	1
CO6	-	-	-	-	1	-	-	1

Syllabus

Unit I

Describe Meditation and Understand its Benefits (CO1)

A: Importance of meditation. How does meditation help to overcome obstacles in life (Pre- recorded video with Swami Shubhamritananda Puri)

Reading 1: Why Meditate? (Swami Shubamritananda ji)

Reading 2: 'Stillness of the Mind' Chapter 17 in Amritam Gamaya (2022). Mata Amritanandamayi Mission Trust.

Additional Reading: Abhyasa Yoga: The Yoga of Practice. (Br. Achyutamrita Chaitanya)

B: Understand how meditation works. Understand how meditation helps in improving physical and mental health. Understand how meditation helps in the development of personality (Pre-recorded video with Dr. Ram Manohar)

Reading 1: Allen, Cynthia (2020) The Potential Health Benefits of Meditation

Additional Reading: Sharma, Hari (2022) Meditation: Process and Effects

Unit II

Causes of Stress and How Meditation Improves Well-being (CO2)

A: Learn how to prepare for meditation. Understand the aids that can help in effectively practicing meditation. Understand the role of sleep, physical activity, and a balanced diet in supporting meditation. (Pre-recorded video with Dr. Ram Manohar)

B: Causes of Stress. The problem of not being relaxed. Effects of stress on health. How meditation helps to relieve stress. Basics of stress management at home and the workplace. (Pre-recorded video with Prof Udhaykumar)

Reading 1: Mayo Clinic Staff (2022, April 29). Meditation: A Simple, Fast Way to Reduce Stress. Mayo Clinic. https://www.mayoclinic.org/tests-procedures/meditation/in- depth/meditation/art-20045858 (PDF provided)

Reading 2: 'Efficient Action.' Chapter 28 in Amritam Gamaya (2022). Mata Amritanandamayi Mission Trust.

Unit III

The Science of Meditation (CO3)

A: A preliminary understanding of the Science of meditation. What can modern science tell us about this tradition-based method? (Pre-recorded video with Dr. Shyam Diwakar)

B: How meditation helps humanity according to what we know from scientific research (Pre-recorded video with Dr. Shyam Diwakar)

Reading 1: Does Meditation Aid Brain and Mental Health (Dr Shyam Diwakar)

Reading 2: 'Science and Spirituality.' Chapter 85 in Amritam Gamaya (2022). Mata Amritanandamayi Mission Trust.

Unit IV

Practicing MA OM Meditation in Daily Life (CO4)

Guided Meditation Sessions following scripts provided (Level One to Level Five)

Reading 1: MA OM and White Flower Meditation: A Brief Note (Swami Atmananda Puri)

Reading 2: 'Live in the Present Moment.' Chapter 71 in Amritam Gamaya (2022). Mata Amritanandamayi Mission Trust.

Unit V

Improving Communication and Relationships (CO5)

How meditation and mindfulness influence interpersonal communication. The role of meditation in improving relationship quality in the family, at the university and in the workplace. (Pre-recorded video with Dr Shobhana Madhavan)

Reading 1: Seppala E (2022, June 30th) 5 Unexpected Ways Meditation Improves Relationships a Lot. Psychology Today. https://www.psychologytoday.com/intl/blog/feeling-it/202206/5-unexpected-ways- meditation-improves-relationships-lot

Reading 2: 'Attitude.' Chapter 53 in Amritam Gamaya (2022). Mata Amritanandamayi Mission Trust.

Unit VI

Meditation and Compassion-driven Action (CO6)

Understand how meditation can help to motivate compassion-driven action. (Pre- recorded video with Dr Shobhana Madhavan)

Reading 1: Schindler, S., & Friese, M. (2022). The relation of mindfulness and prosocial behavior: What do we (not) know?. Current Opinion in Psychology, 44, 151-156.

Reading 2: 'Sympathy and Compassion.' Chapter 100 in Amritam Gamaya (2022). Mata Amritanandamyi Mission Trust.

Textbooks/References

1. Meditation and Spiritual Life-Swami Yatiswarananda, Ramakrishna Math
2. The Complete Works of Swami Vivekananda Vol Vii by Advaita Ashram Mayavati Almora Himalayas
3. Dhyana Yoga-Holy Gita Swami Chinmayanda
4. Voice of God, Chandrasekharendra Saraswati, 68th Acharya of Sri Kanchi Kamakoti Peetam,
5. Hindu Dharma-Chandrasekharendra Saraswati, 68th Acharya of Sri Kanchi Kamakoti Peetam,
6. Mind: It's Mysteries and control-Swami Sivananda Saraswati
7. Amritam Gamaya (2022). Mata Amritanandamayi Mission Trust.
8. Books on Amma's teachings like Awaken children, From Amma's Heart etc.
9. The Science of Meditation: How to Change Your Brain, Mind and Body by Daniel Goleman and Richard. J. Davidson.

10. Allen, Cynthia (2020) The Potential Health Benefits of Meditation
11. Seppala E (2022, June 30th Unexpected Ways Meditation Improves Relationships a Lot.Psychology Today
12. Sharma, Hari (2022) Meditation: Process and Effects
13. Mayo Clinic Staff (2022, April 29). Meditation: A Simple, Fast Way to Reduce Stress.
14. Schindler, S., & Friese, M. (2022). The relation of mindfulness and prosocial behavior: What do we (not) know? Current Opinion in Psychology, 44, 151-156

Evaluation Pattern

Assessment	Weightage (%)
Continuous Assessment	70
End Semester Exam	30
Total Marks	100

24MAL101	Malayalam I	L-T-P-C: 2-0-0-2

Course Objectives:

- To enable the students to acquire basic skills in functional language.
- To develop independent reading skills and reading for appreciating literary works.
- Enable students to communicate in the language they have studied in a range of contexts and for a variety of purposes
- To analyse language in context to gain an understanding of vocabulary, spelling, punctuation and speech

Course outcomes:

COs	Description
CO1	Develop the ability to read and critically appreciate a given text.
CO2	Develop fluency in speaking the language.
CO3	Ability to blend language and Indian spirituality.
CO4	To learn and practice MAOM meditation in daily life.
CO5	To understand the application of meditation to improve communication and relationships.
CO6	To be able to understand the power of meditation in compassion-driven action.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	-	-	-	2	-	-	2
CO2	-	-	-	-	2	-	-	2
CO3	-	-	-	-	2	-	-	2
CO4	-	-	-	-	2	-	-	2
CO5	-	-	-	-	2	-	-	2
CO6	-	-	-	-	2	-	-	2

Syllabus

- Adhyatmaramayanam, Tharopadesam(Enthinnu Sokam….thulom). Jnanappana (sthanamanangal….Trishnakondubhramikkunnathokkeyum)
- Modern Poets: Mampazham-Vyloppilly Sreedharamenon Critical analysis of the poem.
- Short stories from period 1/2/3: **Poovanpazham**-Vaikaom Muhammed Basheer.
- Literary Criticism: **Bharatha Paryatanam-***Vyasante Chiri*–Ithihasa studies-Kuttikrishna Marar-Outline of literary Criticism in Malayalam Literature.
- Error-free Malayalam: 1. Language; 2. Clarity of expression; 3. Punctuation-Thettillatha Malayalam – Writing-a. Expansion of ideas; b.PrecisWriting; c. Essay Writing.

Textbooks

1. Adhyatmaramayanam – Thunjath Ramanujan Ezhuthachan
2. Ramayanavichinthanam-Dr. A. M. Unnikrishnan
3. Adhyatmaramayanam – Thunjath Ramanujan Ezhuthachan
4. Ramayanavichinthanam-Dr. A. M. Unnikrishnan
5. Thunjan Padhanangal-Prof.Panmana Ramachandran
6. Compleate Works including Jnanappana-Poonthanam
7. Vyloppilly-M.N.Vijayan
8. Vyloppilli-Vyakthi,Kavi-Dr.M.Leelavathi/S.Gupthan Nair
9. Basheerinte Poonkavanam-Prof.M.N.Karasseri
10. Basheer-Life & Works
11. Bharatha Paryatanam-Kuttikrishna Marar
12. Lavanyasastrathinte Yukthisilpam-Dr.Thomas Mathew
13. Thettillatha Malayalam – Prof.Panmana Ramachandran Nair(His all books on Error Free Malayalam)

Evaluation Pattern

Assessment	Weightage (%)
Continuous Assessment	20
Midterm	30
End Semester Exam	50
Total Marks	100

24HIN101	HINDI I	L-T-P-C: 2-0-0-2

Course Objectives:

The course will enable the students to understand the basics of grammar and usage, to appreciate the literary compositions, and to understand the intricacies of language and literature.

Course Outcomes:

COs	Description
CO1	Distinguish various literary genres.
CO2	Explore tradition and culture through literature.
CO3	Apply the basics of grammar.
CO4	Critically analyse the prescribed literary texts

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	-	-	-	2	-	-	2
CO2	-	-	-	-	2	-	-	2
CO3	-	-	-	-	2	-	-	2
CO4	-	-	-	-	2	-	-	2

Syllabus

UNIT 1

Hindi Sahithya ki Panch shresht Kahaniyam**:**

a. Sughmay Jeevan –Chandradhar Sharma ,Guleri

b. Dhan ki Bhent-Rabindranath Tagore

c. Anbola –Jayashankar Prasad

d. Swamini (Manasrovar bhagh-1) Premchand

UNIT 2.

Hindi Kavitha:

a. 'Aarya" –Maithili Sharan Gupth

b. "Meribhi abha he Ismein' .,"Mubarak Ho Naya Saal"-_Nagarjun

c. "Nishaa Ki rod eta Rakesh- Nihar se'.,Shoonya Mandir meinBanoongi-Sandhya Geet se - Mahadevi varma

d.'KhoobLadi Mardani vahtho Jhansi Vali rani thi'-subhadra Kumari chohan

UNIT 3.

Hindi Ekanki**:**

a) Mohan Rakesh :Andeke Chilke

b) Vishnu Prabhakar :Sarkari Noukari

UNIT 4.

Grammar: 1)Karak 2) Upasarg 3)Pratyay 4)Vakya Rachana 5)Padaparichay. 6) Sarvanam 7) kriya 8)Adjective 9) Adverb 10)Tenses.

Textbooks/ References:

1. Sugam Hindi Vyakarn, :Prof.Vanshidhar & Dharmapal Shastri
2. Vyavaharik Hindi Vyakarantatha Rachana: Dr.Hardev Bahari

Shiksharthi HindiVyakaran:Dr. Nagappa

3. Hindi Sahithya ki Panch shresht Kahaniyam**:** Edited by: Dr.Sachidanandh Shuklu

(Printed and Published by V&S publishers, Abridged, AnsariGanj, Delhi)

4. Hindi Samay.com,/Hindikahani.com/exotic indiaart.com
5. Adhyatmaramayanam – Thunjath Ramanujan Ezhuthachan
6. Ramayanavichinthanam-Dr. A. M. Unnikrishnan
7. Thunjan Padhanangal-Prof.Panmana Ramachandran
8. Compleate Works including Jnanappana-Poonthanam
9. Vyloppilly-M.N.Vijayan
10. Vyloppilli-Vyakthi,Kavi-Dr.M.Leelavathi/S.Gupthan Nair
11. Basheerinte Poonkavanam-Prof.M.N.Karasseri
12. Basheer-Life & Works
13. Bharatha Paryatanam-Kuttikrishna Marar
14. Lavanyasastrathinte Yukthisilpam-Dr.Thomas Mathew
15. Sugam Hindi Vyakarn, :Prof.Vanshidhar & Dharmapal Shastri
16. Vyavaharik Hindi Vyakarantatha Rachana: Dr.Hardev Bahari
Shiksharthi HindiVyakaran:Dr. Nagappa
17. Hindi Sahithya ki Panch shresht Kahaniyam**:** Edited by: Dr.Sachidanandh Shuklu
(Printed and Published by V&S publishers, Abridged, AnsariGanj, Delhi)
18. Hindi Samay.com,/Hindikahani.com/exotic indiaart.com**.**

Evaluation Pattern

Assessment	Weightage (%)
Continuous Assessment	20
Midterm	30
End Semester Exam	50
Total Marks	100

24KAN101	Kannada I	L-T-P-C: 2-0-0-2

Course Objectives:

- To enable the students to acquire basic skills in functional language.
- To develop independent reading skills and reading for appreciating literary works.
- Enable students to communicate in the language they have studied in a range of contexts and for a variety of purposes
- To analyse language in context to gain an understanding of vocabulary, spelling, punctuation and speech

Course Outcomes:

COs	Description
CO1	Develop the ability to read, listen and write in Kannada and to understand and use the language in a variety of contexts and situations
CO2	To Enable the learners to understand the grammatical structures of classes of words
CO3	Develop ability to speak fluently and interactively in both personal and professional context

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	-	-	-	2	-	-	2
CO2	-	-	-	-	2	-	-	2
CO3	-	-	-	-	2	-	-	2

Syllabus

UNIT – 1

Adalithadalli Kannadada balake: (Use of Kannada in business and administration)

Bhashe – swaroopa, stityantaragalu,

Aadu bhashe, pradeshika bhashe, Grantika bhashe

Paaribhaashika padagalu

UNIT – 2

Padagala rachane,deshiya – anya deshiya padagalu

Lekhana Chinnhegalu

Kannada bharavanigeya shuddha mattu ashuddha roopagalu,

Dwiruktigalu, jodunudigalu

UNIT – 3

Nudigattgalu, gaade vistarane

Listening to radio speech, tongue twister - practice

UNIT – 4

Patra Lekahna - aupachaarika haagu anoupachaarika
Kandikegala rachane
Prabandhagalu: vivaranaatmaka haagu niroopanatmaka

UNIT – 5

Poems

- Vachanagalu – kaalugalembavu gaali kandaya – Allamaprabhu,Ratnada sankoleyaadade todarallve – Akkamahadevi, ole hatti uridare nilabahudallade - Basavanna
- Keerthanegalu – Tanuva nirolagaddi phalavenu – Purandaradasa, Tallanisadiru kandya taalu manave - Kanakadaasa
- Tripadigalu – Saalavanu kombaaga haalogarundante - Sarvagna
- Janapada geetegalu - Yaake badtaadti tamma

Short stories

- Sambhanda – Shrikrishna Alanahalli
- Moksha – Sethuram

Prabandhagalu

- Namma Maneya Deepa – Ha.Ma.Nayak
- Bhadhuku Kanasalla, Ondhu Kale – N K Kulakarni

Textbooks/References

1. H.S.Krishnaswamy Iyangaar – Adalitha Kannada – Chetana publication, Mysuru
2. Kannada Vyakarana mattu Rachane – N.Gopalakrishna Udupa, M.C.C.Publication
3. G.H.Naayak – Kannada Sanna Kathegalu – Chetana Book House
4. Shatamaanada Lalitha Prabandha – Gurulinga Kaapase - Karnataka Sahitya Academy
5. Naavalla – Kathasankalana – Sethuram
6. Basavannanavara Vachanagalu – G.V.Shastri – Paaru prakashana
7. Kannadada Balake – H.S.Krishnaswamy Iyangaar – Chetana book house
8. Sarvagnana Vachanagalu – Venkata Subbaiha, Vijayavaahini Publications

Evaluation Pattern

Assessment	Weightage (%)
Continuous Assessment	20
Midterm	30
End Semester Exam	50
Total Marks	100

24SAN101	Sanskrit I	L-T-P-C: 2-0-0-2

Course Objectives:

- To enable the students to acquire basic skills in functional language
- To develop independent reading skills and reading for appreciating literary works.
- To analyse language in context to gain an understanding of vocabulary, spelling, punctuation and speech
- Grasp the connection between Sanskrit language and Indian philosophy

Course Outcomes:

COs	Description
CO1	Develop the ability to read, listen and write in Kannada and to understand and use the language in a variety of contexts and situations
CO2	To Enable the learners to understand the grammatical structures of classes of words
CO3	Develop ability to speak fluently and interactively in both personal and professional context

COs	Description
CO1	Read and understand Sanskrit verses and sentences and communicate in Sanskrit
CO2	Imbibe values of life and Indian tradition propounded by the scriptures

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	-	-	-	2	-	-	2
CO2	-	-	-	-	2	-	-	2

Syllabus

Unit I

Introduction to Sanskrit language, Devanagari script - Vowels and consonants, pronunciation, classification of consonants, conjunct consonants, words – nouns and verbs, cases – introduction, numbers, Pronouns, communicating time in Sanskrit. Practical classes in spoken Sanskrit.

Unit II

Verbs- Singular, Dual and plural — First person, Second person, Third person.

Tenses – Past, Present and future – Atmanepadi and parasmaipadi-kartharipraYoga.

Unit III

General group words for communication and moral stories.

Unit IV

ChanakyaNeeti chapter III (part I), Bhagavad Gita chapter 14 (part I)

Unit V

Translation of simple sentences from Sanskrit to English and vice versa.

Evaluation Pattern

Assessment	Weightage (%)
Continuous Assessment	20
Midterm	30
End Semester Exam	50
Total Marks	100

24TAM101	Tamil I	L-T-P-C: 2-0-0-2

Course Objectives:

To teach Tamil for effective communication in different spheres of life: - cultural relations in society.

Course Outcomes:

COs	Description
CO1	Giving exposure to the history of Tamil literature and the introduction of select Classics.
CO2	Initiating Students to the spirit of Bhakti literature
CO3	Encouraging the creativity of students by teaching Contemporary Literature poetry, modern poetry, Short Story, Prose, Novel, etc
CO4	Introduction of basic Grammar, Letter writing and essay writing skills of Tamil language

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	-	-	-	2	-	-	2
CO2	-	-	-	-	2	-	-	2
CO3	-	-	-	-	2	-	-	2
CO4	-	-	-	-	2	-	-	2

Syllabus

அலகு-1

தமிழ்இலக்கியவரலாற்றில்சங்கஇலக்கியம்: முதல், இடை, கடைசங்கம்.
சங்கஇலக்கியங்கள்பத்துப்பாட்டு.
குறுந்தொகை (6,8பாடல்கள்),
புறநானூறு (184,192பாடல்கள்).
சங்கம்மருவியகாலஇலக்கியம்:
சிலப்பதிகாரம் (வழக்குறைக்காதை),
பதிணெண்கீழ்கணக்குநூல்கள்,
திருக்குறள் (மருந்து)

UNIT-1 History of Tamil Literature: First, Intermediate, Last sangam. Sangam Literature, Pattuppaattu. Kuṟuntogai, Puṟanaanuuru.
Literature of the Sangam Maruviya period – Silappathiagaram (vazhakkuraikaathai), PatiṇeṇkiizhKaṇakkuNuulkal. TirukkuṟaL (Marunthu)

அலகு 2

பக்திஇலக்கியம்:–
பன்னிருதிருமுறைகள்அறிமுகம்,
மாணிக்கவாசகர் (திருவாசகம்- சிவபுராணம்)

UNIT 2 Bhakti Literature – Introduction to PanniruThirumuraikal, Manikkavasagar (Thiruvasagam- Siva Puranam)

அலகு -3

தற்காலஇலக்கியம்:-
கவிதை : பாதியார் (குயில்பாட்டு), பாரதிதாசன் (தமிழின்இனிமை).
உரைநடை: ஞா.தேவநேயப்பாவாணர் (தமிழும்திரவிடமும்சமமா?),
பரிதிமாற்கலைஞர் (தமிழ்மொழியின்வரலாறு (ஆதிவரலாறு)).
சிற்பி (வள்ளுவர்வகுக்கும்இன்பம்)
சிறுகதை: அழகியபெரியவன் – (வனம்மாள்)
நாவல்: இமையம் (பெத்தவன்)

UNIT-3 Contemporary Literature: Poetry - Bharathiar(kuyilpāṭṭu), Bharathidasan (tamiḻiṉiṉimai, iṉpattamiḻ) Pattukottai Kalyanasundaram.
Prose: G. DevaneyaBhavanar (TamizhumDhiravidamumsamamaa?), Paritimāṟkalaiñar (paranarkettaparisu), chirbi (valluvarvakukkuminbam)
Short Story: Azhagiya Periyavan – (VanammaaL)

Novel: Imaiyam (Peththavan)

அலகு – 4தொல்காப்பியம்:
எழுத்து – பிறப்பியல்.
நிறுத்தக்குறிகள்மற்றும்
கடிதம்எழுதுதலும்கட்டுரைஎழுதுதலும்

UNIT – 4tolkāppiyam: Alphabet – piṟappiyal. Punctuation marks and Letter writing and essay writing.

REFERENCE

இமையம், *பெத்தவன்*, க்ரியாவெளியீடு 2019.
அழகியபெரியவன் ,*அழகியபெரியவன்கதைகள்*, நற்றிணைபதிப்பகம், 2016
சி.பாலசுப்பிரமணியன், *கட்டுரை-வளம்*, நறுமலர்ப்பதிப்பகம், பத்தாம்பதிப்பு 1994
பரிதிமாற்கலைஞர் ,*தமிழ்மொழியின்வரலாறு*, பூம்புகார்பதிப்பகம், ஆறாம்பதிப்பு 2013.
அகளங்கன், *பன்னிருதிருமுறை – அறிமுகம்*, இந்துமாமன்றம்வவுனியா, 1994
ரா. சீனிவாசன ,*தமிழ்இலக்கியவரலாறு* ,https://ta.wikisource.org/s/99uk
மாணிக்கவாசகர் (திருவாசகம்- சிவபுராணம்
பொன்மணிமாறன் "அடோன்தமிழ்இலக்கணம் "அடோன்பப்ளிஷிங்குரூப், வஞ்சியூர், திருவனந்தபுரம், 2007.
http:/www.tamilvu.org/libirary/libindex.htm.
http:/www.gunathamizh.com/2013/07/blog0post_24.html

Evaluation Pattern

Assessment	Weightage (%)
Continuous Assessment	20
Midterm	30
End Semester Exam	50
Total Marks	100

24ENG100	Additional English I	L-T-P-C: 2-0-0-2

Course Objectives:

- To expose students to various genres of English literature
- To expose the students to Indian English Writing of different timelines.
- To develop a sensibility to read and understand literary works.
- To introduce a few linguistic devices to enable them to appreciate literary forms stylistically

Course Outcomes:

COs	Description
CO1	Develop the ability to read, listen and write in Kannada and to understand and use the language in a variety of contexts and situations
CO2	To Enable the learners to understand the grammatical structures of classes of words
CO3	Develop ability to speak fluently and interactively in both personal and professional context

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	-	-	-	2	-	-	2
CO2	-	-	-	-	2	-	-	2
CO3	-	-	-	-	2	-	-	2
CO4	-	-	-	-	2	-	-	2

Syllabus

Unit-I

Introduction to Literature – Nature & Elements of Literature, literature as an expression of personal & historic aspects. Narrative structure & technique. Introduction to Indian Literature: Pre-independence, postindependence, themes, writers, and problems.

Unit-II

Linguistic Devices: Theme, Diction, syntax & syntactical deviations, Rhetorical devices, figures of speech

Unit-III

Poetry:

The Frog and the Nightingale by Vikram Seth
An Indian Love Song *by Sarojini Naidu*
Death of the Wolf by Toru Dutt

Unit IV

Short stories:

Detail-

A Dog's Life by Mulk Raj Anand
Interpreter of Maladies by Jumpha Lahiri

Unit-V

Non-Detail Reading:

Three Persons by Vijay Sheshadri
The Wolf's Postcript To 'Little Red Riding Hood' **by Agha Shahid Ali**
The Naive Friends by Premchand
The Woman on Platform 8 by Ruskin Bond

Core Reading :

- Iyengar, Srinivasa **–** ***The Indian Contribution to English Literature*****.** Karnatak ishing House, Bombay, 1945
- Iyengar, Srinivasa – ***Indian Writing in English : 1800-1980*** – Sterling Publishing House, 2019

References

- Seth, Vikram, ***Beastly Tales,*** Penguin India, 2013
- Naidu, Sarojini, ***The Golden Threshold*** 1905

- Dutt, Toru - ***A Sheaf Gleaned in French Fields*** 1876
- Anand, Raj Mulk, ***Selected Short Stories*** Penguin India, 2006
- Tagore, Rabindranath, ***Mashi and Other Stories,*** True Sign Publishing House, 2021
- Lahiri, Jumpha - ***Interpreter of Maladies*** Harpercollins Publishers India, 2005
- Sheshadri, Vijay – POETRY Magazine, December 2010
- Ali, Shahid Agha, ***The Wolf's Postcript To 'Little Red Riding Hood'*** Academy of American Poets, poets.org
- ***Premchand - , Mindfuel's 4 In 1 Story By Munshi Premchand - Power Of A Curse, The Naive Friends, A Complex Problem & A Lesson In The Holy Life*** **Mindfuel Publishers,** ***2020***
- *Bond, Ruskin* - ***The Woman on Platform 8,*** **The Illustrated Weekly of India**

Evaluation Pattern

Assessment	Weightage (%)
Continuous Assessment	20
Midterm	30
End Semester Exam	50
Total Marks	100

26ENV100	Environmental Studies	L-T-P-C: 2-0-0-2

Course Objective(s)

- This course aims to familiarize students with basic environmental concepts, their relevance to business operations, and forthcoming sustainability challenges.
- This course will equip students to make decisions that consider environmental consequences.
- This course will enable future business graduates to become environmentally sensitive

Course Outcomes:

COs	Description
CO1	Explore the basic environmental concepts and issues relevant to the business and management field
CO2	Recognize the interdependence between environmental processes and socio-economic dynamics.
CO3	Determine the role of business decisions, policies, and actions in minimizing environmental degradation.
CO4	Identify possible solutions to curb environmental problems caused by managerial actions.
CO5	Develop skills to address immediate environmental concerns through changes in business operations, policies, and decisions.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	-	-	-	1	-	2	2
CO2	-	-	-	-	1	1	2	2
CO3	-	-	-	-	2	2	2	2
CO4	-	-	-	1	2	2	3	2
CO5	-	-	2	2	2	3	3	2

Syllabus

Unit I

Environment, Natural Resources & Sustainability. Concept and components of environment. Man–environment relationship and environmental movements. Natural resources: renewable and non-renewable. Over-utilization of resources and conservation strategies. Sustainability concepts and sustainable development. Issues: deforestation, water scarcity, energy security, food security. Intergenerational and intragenerational equity. Role of education and public awareness.

Unit II

Ecosystems, Biodiversity & Sustainable Practices. Structure and functions of ecosystems. Types of ecosystems (forest, grassland, aquatic – conceptual). Ecosystem resilience, homeostasis, and carrying capacity. Biodiversity: meaning, values, and threats. Conservation strategies: in situ and ex situ. Protected areas and India as a mega-diverse nation.

Unit III

Environmental Pollution, Waste & Disaster Management. Types of pollution: air, water, soil, noise, marine. Causes and impacts of pollution. Climate change, greenhouse effect, ozone depletion, acid rain. Pollution issues and case examples from India. Solid waste management and cleaner technologies. Natural and man-made disasters and disaster management. Role of organizations and businesses in disaster risk reduction.

Unit IV

Social Issues, Legislation & Sustainable Development. Sustainable development and environmental ethics. Role of industry and business in sustainability. Environmental legislation in India: Water (Prevention and Control of Pollution) Act, 1974, Air (Prevention and Control of Pollution) Act, 1981, Environment (Protection) Act, 1986. Role of judiciary in environmental protection. Environmental justice, refugees, rehabilitation and resettlement.

Textbooks/ References

1. Poonia, M.P. Environmental Studies (3rd ed.), Khanna Book Publishing Co.
2. Bharucha, E. Textbook of Environmental Studies (3rd ed.) Orient Blackswan Private Ltd.
3. Poonia, M.P. & S.C. Sharma, Environmental Engineering, Khanna Publishing House.
4. Kant & Kant, Air Pollution Control, Khanna Publishing House.
5. Gupta, O.P., Elements of Environmental Pollution Control, Khanna Publishing House

Evaluation Pattern

Assessment	Weightage (%)
Midterm	25
Continuous Assessment	25
End Semester Exam	50
Total Marks	100

26CSA101 COMPUTER FUNDAMENTALS AND DIGITAL ELECTRONICS L-T-P-C: 3-0-2-4

Course Objective(s)

1. To provide an understanding of the fundamental components and functional units of a Digital Computer and its functionalities.
2. To provide the understanding of how to perform number conversions from one system to another system.
3. To gain the knowledge of how to design basic digital electronic circuits.

Course Outcomes

COs	Description
CO1	Students will identify and design the basic components of computer systems and with its functionality.
CO2	Students will apply fundamental mathematical concepts to perform number conversions from one system to another system.
CO3	Students will use Boolean algebra to design and implementation of various logic circuits.
CO4	Implement and design various types of combinational circuits, sequential circuits, and develop its functionalities

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	1	-	-	-	-	-
CO2	3	1	2	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-

Syllabus

Unit I

Computer Fundamentals: Brief history of Computer, Classification of Computers, Functions & Components of a Computer, Central Processing Unit, Storage units, Bus, Input and output Devices. Types of memory, RAM, ROM, Variants of ROM, Secondary storage devices- hard disk-disk components and geometry. Other Secondary Storage devices: CD/DVD Family, Blue ray Disc, Flash Drive, Memory stick, smart cards. Computer Languages- Machine, Assembly Language and Higher Level languages. Operating systems, Bootstrapping. Program execution with illustrative examples.

Unit II

Number Systems: Decimal Numbers, Binary Numbers, Decimal to Binary Conversions, Binary Arithmetic, 1's and 2's complements of Binary Numbers, Signed Numbers, Arithmetic Operations with Signed numbers, Hexadecimal Numbers, Octal Numbers and Error Detection Codes.

Unit III

LOGIC GATES: The NOT gate, The AND gate, The OR gate, The NAND gate, NOR gate, The Exclusive–OR gate and Exclusive-NOR gate; Boolean algebra - Basic laws and theorems, Boolean functions, truth table, minimization of boolean function using K map method and SOP minimizations.

Unit IV

Logic Circuits: Combinational logic circuits: Half adder, Full adder, Parallel binary adder, subtractor, Decoders, Encoders, Multiplexers, De-multiplexers. Sequential logic circuits- Flip Flops – RS, JK, T and D Flip Flops, Edge triggered Flip Flops, Master slave Flip Flops.

Lab Syllabus:

Introduction to Computer Fundamental and Communication, Various components of a computer, Installing Windows operating system on a system, Installing Linux operating system on a system, Basics of digital electronics, Basic gates and Universal Gates, Half Adder and Full Adder, Half Subtractor and Full Subtractor, Encoder and Decoder, Multiplexer, Demultiplexer, Types of Multiplexers: 4:1, 8:1 and 16:1, Project Presentation and Document submission

Textbooks

1. Floyd, Thomas L: Digital Computer Fundamentals, 11th Edition, Pearson International, 2015.
2. Morris Mano, “Digital logic and Computer design”, First Edition, Prentice Hall of India, (2004).

References

1. Malvino, Paul Albert, Leach, Donald P,GautamSaha: Digital Principles And Applications, TMH ,8th Edition, 2015.
2. Bartee, Thomas C: Digital Computer Fundamentals, 6Edition,TMH, 2010.

Evaluation Pattern

Assessment	Weightage (%)
Midterm	20
Continuous Assessment	50
End Semester Exam	30
Total Marks	100

26CSA102	Programming Fundamentals	L-T-P-C: 3-1-0-4

Course Objective(s)

- Provide foundational understanding of programming concepts for students from non-computer science backgrounds.
- Develop problem analysis skills using algorithmic and logical thinking.
- Enable learners to design and structure programmatic solutions using fundamental constructs.
- Cultivate the ability to implement, test, and evaluate simple programs systematically.
- Foster self-learning capability and adaptability for learning new programming tools and technologies.

Course Outcomes

COs	Description
CO1	Analyze real-world problems and decompose them into step-by-step solutions using algorithms and flowcharts.
CO2	Design structured solutions using appropriate data types, operators, and control flow constructs
CO3	Implement modular program logic using functions and basic data structures.
CO4	Evaluate program correctness and efficiency through systematic testing and debugging
CO5	Apply computational thinking principles to adapt and learn new programming constructs independently

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	2	0	0	0	1
CO2	3	3	3	2	0	0	0	1
CO3	3	2	3	2	0	0	0	1
CO4	2	3	2	2	0	0	2	1
CO5	2	1	2	2	0	0	0	3

Syllabus

Unit I

Introduction to Programming & Problem Solving. What is a program? Programming vs Problem-solving. Characteristics of a good program. Program development life cycle. Problem analysis and decomposition. Introduction to Algorithms. Characteristics of algorithms. Writing algorithms using pseudocode. Flowcharts: Symbols and conventions. Flowchart for simple problems.

Unit II

Basics of Programming Concepts. Overview of high-level languages. Structure of a simple program. Variables and Constants. Data Types. Integer, floating point, character, Boolean. Operators: Arithmetic, relational, logical, assignment. Expressions and type conversion. Input and output concepts.

Unit III

Control Structures. Need for control flow. Decision Making: if, if–else, nested if. switch/case. Looping Constructs: for loop, while loop, do–while loop. Loop control statements (break, continue – idea level). Common programming logic patterns.

Unit IV

Modular Programming. Need for modularization. Function concept. Function definition and call. Parameters and return values. Scope of variables. Advantages of functions. Recursion.

Unit V

Arrays: One-dimensional arrays, Two-dimensional arrays, Common operations on arrays. Strings: String representation, Basic string operations. Introduction to Files. Purpose of file handling. Reading and writing data (conceptual level). Debugging & Testing. Common programming errors. Logical vs syntax errors.

Textbooks/ References

1. Programming in ANSI C, by E. Balagurusamy. McGraw-Hill
2. Programming with C by Byron Gottfried. Schaums Outline
3. Programming in C, by Reema Thareja. Oxford University Press

Evaluation Pattern

Assessment	Weightage (%)
Midterm	25
Continuous Assessment	25
End Semester Exam	50
Total Marks	100

26CSA181	Programming Foundation Lab	L-T-P-C: 0-0-2-1

Course Objective(s)

- Provide hands-on experience in implementing programming logic using basic constructs.
- Enable students to translate algorithms and flowcharts into executable programs.
- Develop skills in modular programming and systematic problem solving.
- Introduce testing, debugging, and validation practices essential for reliable software development.
- Encourage independent learning and experimentation with programming tools and environments.

Course Outcomes

COs	Description
CO1	**Analyze** simple real-world problems and convert them into algorithms and flowcharts
CO2	**Implement** program logic using variables, operators, and control structures
CO3	**Design and develop** modular programs using functions and basic data structures
CO4	**Test and evaluate** programs for correctness, efficiency, and logical accuracy
CO5	**Apply** modern programming tools and debugging techniques to learn new program constructs independently

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	1	0	0	0	1
CO2	3	2	3	2	0	0	0	1
CO3	3	2	3	2	1	0	0	1
CO4	2	3	2	2	0	0	2	1
CO5	2	1	2	3	0	0	0	3

Syllabus

- Orientation to programming environment, IDE, program compilation & execution
- Writing simple programs – input/output and expressions
- Programs using operators and type conversion
- Conditional statements – if, if-else
- Nested decision making and logical conditions
- Looping constructs – for loop
- while and do-while loops (iteration problems)
- Problem solving using combinations of loops and decisions
- One-dimensional arrays – basic operations
- Searching and simple array applications
- String handling and basic string operations
- Functions – definition, calling, parameter passing
- Modular programs using functions
- Debugging, testing, and error handling

Textbooks/ References

1. Programming in ANSI C, by E. Balagurusamy. McGraw-Hill
2. Programming with C by Byron Gottfried. Schaums Outline
3. Programming in C, by Reema Thareja. Oxford University Press

Evaluation Pattern

Assessment	Weightage (%)
Continuous Assessment	70
End Semester Exam	30
Total Marks	100

26CSA182	Introduction To Linux – Lab	L-T-P-C: 0-0-2-1

Course Objective(s)

To familiarize students with the architecture of Linux OS and the implementation of various applications in Operating Systems. Provides necessary skills for developing and debugging programs in Linux environment.

Course Outcomes

COs	Description
CO1	Experiment with basic Linux commands.
CO2	Working and demonstrate system and network management commands.
CO3	Build programs for process management using system calls
CO4	Build programs for systems management using system calls.
CO5	Working with shell programming for a given problem instance.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	1	1	1	-	-	-	-	-
CO2	1	1	1	-	-	-	-	-
CO3	1	1	1	-	-	-	-	-
CO4	1	1	1	-	-	-	-	-
CO5	1	1	1	1	1	-	-	-

Syllabus

Basic Linux and Windows DOS commands – System calls – fork, exec, getpid, exit, wait, close, stat, open, read, write. Implementation of systems calls in c programming. Linux directory structure, System management commands, Network management commands. Redirection-Input, Output redirection. Process related commands. Pipes. Shell scripting with syntax(if,while,until and for,switch case).

Textbooks

1: Operating Systems concepts, Silberschatz- alvinagne, ninth edition
2: S. Godbole-operating systems-Tata McGraw-Hil Publications

References

Operating System Lab Programs: Guide to Shell and Operating System Programs Kindle Edition by SYDHANI BEGUM (Author)

Evaluation Pattern

Assessment	Weightage (%)
Continuous Assessment	70
End Semester Exam	30
Total Marks	100

SEMESTER II

22ADM111	GLIMPSES OF GLORIOUS INDIA	L-T-P-C:2-0-1-2

Course Objective(s)

To introduce students to the depths and richness of the Indian culture and knowledge traditions, and to enable them to obtain a synoptic view of the grandiose achievements of India in diverse fields. To equip students with a knowledge of their country and its eternal values.

Course Outcomes

COs	Description
CO1	This part deals with two topics: The Need to Become Fearless in Life and the Role or Status of Women in India.
CO2	This part deals with three topics: Teachings and Principles of Chanakya, Difference between the terms God and Iswara and Contribution of Bhagavad Gita
CO3	This area handles two important concepts: Indian Soft powers and A portrayal of how nature was preserved through the medium of Faith. Inner power is about never giving up on your dreams. To manifest more of what you desire in life, you must be prepared to embrace your inner power. You must be persistent if you wantto succeed. Maintain your modesty and never stop learn-ing. Inner strength is an attitude to life. Faiths shape and direct how we think, act, and live our lives. However, faith's power is not solely spiritual. To preserve nature, our forefathers established systems and traditions based on faith. Our culture and faith are intricately bound to nature.
CO4	Two important topics are discussed here: A Brief history of Ancient Indian Cultures and a Discussion on Practical Vedanta. Indian culture is the legacy of the ethno-linguistically diverse country's social norms, moral principles, traditional practices, belief systems, political systems, artefacts, and technologies. Following every invasion or change of political control, new kingdoms carried their respective cultures with them, adding to the Indian culture. Vedanta is the philosophy of the Upanishads. Every soul possesses the potential to be divine. The objective is to manipulate this inner divinity by invoking both internal and external natural forces.
CO5	From this part, a student gets an insight into the contribution that India has made to the world. Moreover, foreign powers have been trying to humiliate and degrade India in front of the world for so long. However, it should be recognized that many inventions that are considered beneficial to the world today have been contributed by the great men of India.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	-	-	-	1	-	-	-
CO2	-	-	-	-	1	-	-	-
CO3	-	-	-	-	1	-	-	1
CO4	-	-	-	-	1	-	-	-
CO5	-	-	-	-	1	-	-	-

Syllabus

1. Chapter 1 - Face the Brutes
2. Chapter 2 - Role of Women in India
3. Chapter 3 - Acharya Chanakya
4. Chapter 4 - God and Iswara
5. Chapter 5 - Bhagavad Gita: From Soldier to Samsarin to Sadhaka

6. Chapter 6 - Lessons of Yoga from Bhagavad Gita
7. Chapter 7 - Indian Soft Powers: A Solution For Many Global Challenges
8. Chapter 8 - Nature Preservation through faith
9. Chapter 9 - Ancient Cultures what happened to them.
10. Chapter 10 - Practical Vedanta
11. Chapter 11 - To the World from India
12. Chapter 12 - IndianApproach to Science

Textbooks/References

1. Glimpses Of Glorious India

Evaluation Pattern

Assessment	Weightage (%)
Midterm	30
Continuous Assessment	20
End Semester Exam	50
Total Marks	100

24ENG111	ENGLISH II	L-T-P-C: 1-0-2-2

Course Objectives

To train students to convey and document information in a formal environment; to facilitate them to acquire the skill of self-projection in professional circles; to inculcate critical and analytical thinking.

Course Outcomes

COs	Description
CO1	Illustrate comprehension of the fundamentals of writing
CO2	Analyse audio text focussing on English phonetics, pronunciation and meaning comprehension
CO3	Apply theoretical knowledge to write professional documents
CO4	Infer from current news to formulate ideas and opinions
CO5	Prepare appropriate content for mini project and make effective presentation

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	-	-	-	2	-	-	2
CO2	-	-	-	-	2	-	-	2
CO3	-	-	-	-	2	-	-	2
CO4	-	-	-	-	2	-	-	2
CO5								

Syllabus

Unit I

Vocabulary Building: One-word substitutes; Antonyms and Synonyms; Words often Confused Error Analysis (Subject-Verb Agreement; Tense Sequence; Usage of Articles and Prepositions; Determiners; Redundancy); Modifiers (misplaced, dangling, etc.)

Unit II

Circulars; Memos; Formal Letter writing; e-Mail Etiquette; Instruction, Suggestion & Recommendation; Essay writing: Analytical and Argumentative

Unit III

Sounds of English: Stress, Intonation - Listening Comprehension (3 pieces – Women in Technology Panel discussion, India Questions Abdul Kalam, UPSC Topper Mock interview Akshat Jain) - Current News Awareness

Unit IV

Reports: Incident Report, Event Report

Situational Dialogue; Group Discussion (Opinion)

Unit V

Mini Project and Presentation

References:

1. Felixa Eskey. Tech Talk, University of Michigan. 2005
2. Michael Swan. Practical English Usage, Oxford University Press. 2005
3. Anderson, Paul. Technical Communication: A Reader Centered Approach, V Edition, Hercourt, 2003.
4. Martinet, Thomson, A Practical English Grammar, IV Ed. OUP, 1986.
5. Raymond V. Lesikar and Marie E. Flatley. Basic Business Communication, TataMcGraw Hill Pub. Co. New Delhi. 2005. Tenth Edition.
6. Thampi, G. Balamohan. Meeting the World: Writings on Contemporary Issues. Pearson, 2013.
7. Lynch, Tony. Study Listening. New Delhi: CUP, 2008.
8. Kenneth, Anderson, Tony Lynch, Joan Mac Lean. Study Speaking. New Delhi: CUP, 2008.
9. Marks, Jonathan. English Pronunciation in Use. New Delhi: CUP, 2007.
10. Syamala, V. Effective English Communication for You (Functional Grammar, Oral and Written Communication): Emerald, 2002.
11. Sample Question Papers from Competitive Examinations
12. Women in Technology Panel discussion
https://youtu.be/T44XdGH5s-8?si=A1cDVEt777FH7vFR

13. India Questions Abdul Kalam
https://youtu.be/erg3CmVm6M4?si=WjP_SV1vy6FrsGHg

14. UPSC Topper Mock interview, Akshat Jain
https://youtu.be/lsJBGvyiAHI?si=L-u6kTadzJmghHLI

Evaluation Pattern

Assessment	Weightage (%)
Internal Assessment	80
External Assessment	20
Total Marks	100

24MAL111	Malayalam II	L-T-P-C: 2-0-0-2

Course objective:

- To develop independent reading skills and reading for appreciating literary works.
- To develop elaboration and modernization of the vocabulary of a language
- To enable the students to plan, draft, edit & present a piece of writing.

Course outcomes:

CO1: Develop the ability to read and critically appreciate a given text

CO2: Develop fluency in communication

CO3: Develop interest in blending of language and Indian Spirituality

CO4: To enable the learners to understand the grammatical structures of classes of words

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	-	-	-	2	-	-	2
CO2	-	-	-	-	2	-	-	2
CO3	-	-	-	-	2	-	-	2
CO4	-	-	-	-	2	-	-	2

Unit Topic

1 Memoirs-One of the Selecrtion from Chiudambara Smarana-Balachandran Chullikkadu-Critical analysis of his poetry)

2 Ancient Drama: Kerala Sakunthalam (Act 4), Kalidasan (Transilated by Attoor Krishna Pisharody).

3 Satire One of the Selection from Chemmanam Chacko,VKN Or Punathil Kunjabdulla- philosophical dimens of Satire

4 Part of an auto-biography/travelogue:
Valarnnu varunna oratmavu(from Kanneerum Kinavum)-VT Bhattathirippad

5 Error-freeMalayalam: 1.Language; 2.Clarity of expression; 3.Punctuation-Thettillatha Malayalam – Writing-a. Expansion of ideas

Text books/Reference:

1) Hasa Sahithyam Kuttikrishna Mararu
2) Sakunthalam-Attoor/Kuttikrishna Marar
3) Kalidasa Hridayam-K.P.Narayana Pisharady
4) VKN-K.P.Appan
5) N.V.Krishna Warriar & Modern Poetry studies
6) Kanneerum Kinavum –V.T. Bhattathirippad
7) Adukkalayil Ninnu Arangatheykku-V.T.Bhattathirippadu
8) Nalla Malayalam- C.V.Vasudeva Bhattathiri
9) Tettum Sariyum-Prof. Panmana Ramachandran Nair

Evaluation Pattern

Assessment	Weightage (%)
Continuous Assessment	20
Midterm	30
End Semester Exam	50
Total Marks	100

24HIN111	HINDI II	2 0 0 2

Course Objective: The course will allow students to apply grammar in language structures, appreciate the literary compositions and provide them with a good command over translation techniques.

Course outcomes: By the end of the course the students will be able to:

1. Understand the postmodern trends of literature...
2. 2.Explore tradition and culture through literature.
3. Apply ethical and professional translation strategies.
4. Demonstrate linguistic competence in written communication.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	-	-	-	2	-	-	2
CO2	-	-	-	-	2	-	-	2
CO3	-	-	-	-	2	-	-	2
CO4	-	-	-	-	2	-	-	2

UNIT 1

Hindi Laghu Upanyas **:Mamatha Kaliya- ' Doud'**

UNIT 2

Hindi Natak**:** Swadesh Deepak- "Kort Marshal"

UNIT 3.

Adhunik Hindi Kavya a.Jayashankar Prasad-(Lahar, Aah!Vedhana Mili Vidayi)., b.Suryakanth Tripathi „Nirala"-(Anamika -4)., c.Subadhra Kumari , Chouhan- (Swadesh Ke Prathi, Smruthiyam), d.Gajanan Madhav Muktibodh- (ek swapna Katha)

UNIT 4.

A)Sankshepan,

B) .Anuvad: Paribhasha,Prakar,AnuvadKeLakshan,AnuvadKiAvashyakata,Passage (Translation)

c)Paragraph writing

D)Technical writing

REFERENCE

1. Prayojan Mulak Hindi Ke Naye Ayam : Dr. Pandit Banne
2. Prayojan Mulak Hindi Ki Nayi Bhumika : Kailash Nath Pandey
3. Prayojan Mulak Hindi Ke Vividh Roop : Dr. Rajendra Mishra, Rakesh Sharma
4. "Adhunik Kavya Sangraha" Edited by . Dr. Urvashi Sharma (Printed and Published by Malik & Company, Jaipur)
5. Hindi Samay.com,/Hindikahani.com/exotic indiaart.com

Evaluation Pattern

Assessment	Weightage (%)
Continuous Assessment	20
Midterm	30
End Semester Exam	50
Total Marks	100

24KAN111	Kannada II	L-T-P-C: 2-0-0-2

Objectives:

- To develop the standard of orthography and spelling system.
- To develop independent reading skills and reading for appreciating literary works.
- To develop elaboration and modernization of the vocabulary of a language.
- To enable the students to plan, draft, edit & present a piece of writing.

Course Outcome

CO1	Develop the ability to read and critically appreciate a given text
CO2	Develop pattern of communication as required for different professional context
CO3	Develop fluency in speaking the language

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	-	-	-	2	-	-	2
CO2	-	-	-	-	2	-	-	2
CO3	-	-	-	-	2	-	-	2

Syllabus

UNIT – 1

Prabandhagalu

- Thotadacheya Bhoota – Kuvempu
- Bantu Bannada Holi – G. S. Shivarudrappa

UNIT – 2

Poems

- Ni hinga nodabayda Nanna – Da. Ra. Bendre
- Huttarihaadu – Panje Mangesh Rao
- Tungabadre – K.S.Narasimhaswamy
- Nanna Janagalu – Dr.Siddhalingaya

UNIT – 3

Novel

- Jugari Cross – Poornachandra Tejaswi

UNIT – 4

- Suttole
- Kadata
- prakatane
- Arjigalu
- Aadesha patraa

UNIT- 5

- Varadigalu
- Sanshikpta Baravanige
- Prabandhagalu: vaadaatmaka haagu vishleshanatmaka

References:

1. Jugari Cross – Poornachandra Tejaswi – Pustaka Prakashana
2. Shatamaanada Lalitha Prabandha – Gurulinga Kaapase - Karnataka Sahitya Academy
3. N.Gopalkrishna Adiga – Kannada Vyakarana mattu Rachane – MCC Publications
4. Maadhari Patragalu – S.R.Siddharaju – Kannada Saahitya Parishattu
5. H.S.Krishnaswamy Iyangar – Adalitha Kannada – Chetana publication, Mysuru

Evaluation Pattern

Assessment	Weightage (%)
Continuous Assessment	20
Midterm	30
End Semester Exam	50
Total Marks	100

24SAN111	Sanskrit II	L-T-P-C: 2-0-0-2

Module I

Seven cases, Avyayas, sentence making with Avyayas, Sapthakakaras.

Module II

Kthavathu Prathyaya, Upasargas, Kthvatha, Thumunnantha, LyabanthaPrathyaya. Three Lakaras – brief introduction, Lot lakara

Module III

New words and sentences for the communication, Slokas, moral stories, Subhashithas, riddles (Selected from the Pravesha Book)

Module IV

Introduction to classical literature, classification of Kavyas, classification of Dramas - Important five Mahakavyas

Module V

Translation of paragraphs from Sanskrit to English and vice versa

Module VI

Chanakya Neeti chapter III (Part II), Bhagavad Geeta chapter 14 (Part II)

Essential Reading:

1, Praveshaha; Publisher :Samskritabharati, Aksharam, 8th cross, 2nd phase, girinagar, Bangalore -560 085

2, Sanskrit Reader I, II and III, R.S. Vadhyar and Sons, Kalpathi, Palakkad

3, PrakriyaBhashyam written and published by Fr. John Kunnappally

4, Sanskrit Primer by Edward Delavan Perry, published by Ginn and Company Boston

5, Sabdamanjari, R.S. Vadyar and Sons, Kalpathi, Palakkad

6, Namalinganusasanam by Amarasimha published by Travancore Sanskrit series

7, SubhashitaRatnaBhandakara by Kashinath Sharma, published by Nirnayasagarpress

Evaluation Pattern

Assessment	Weightage (%)
Continuous Assessment	20
Midterm	30
End Semester Exam	50
Total Marks	100

24TAM111	TAMIL II	2 0 0 2

Course Objective: The course will allow students to understandthewriting competency in Tamil literature.

Course outcomes: By the end of the course the students will be able to:

1. Introduction to Tamil Folklore
2. Learning the nuances of Tamil spiritual literature
3. Exposure to the advanced aspects of Tamil grammar
4. Imbibing the spirit of language through familiarising with linguistics, translation and creative writing

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	-	-	-	2	-	-	2
CO2	-	-	-	-	2	-	-	2
CO3	-	-	-	-	2	-	-	2
CO4	-	-	-	-	2	-	-	2

அலகு 1
சிற்றிலக்கியங்கள்அறிமுகம்: கலிங்கத்துப்பரணி (பபோர்போடியது), முக்கூடற்பள்ளு 35. நோட்டுபுறவியல்: வரரவிலக்கணம், நோட்டுபுறப்போடல்கள், கரதகள், கரதப்போடல்கள், பழமமோழி, விடுகரதகள், கரலகள்.

Introduction to CiRRilakkiyam: Kalingaththupparani (Poor Padiyathu) - MukkdaRpallu 35. Folklore: Definition, Folksongs - Stories – kathaipPaadal - pazhamozhi - vidukathai - kalaikaL.

அலகு 2
பக்திஇலக்கியம்: ஆண்டோள்முழுவரலோறு, திருப்போரவ (1,2,3,4)

அலகு 3
மதோல்கோப்பியம்: மபோருளிலக்கணம் - மோல்லிலக்கணம்

அலகு 4
மமோழிமபயப்பு: மமோழிமபயப்புவரகக்கள், மமோழிமபயர்ப்பின்முக்கியதுவமும்பதரவயும், இயந்திரமமோழிமபயர்ப்பு, மகோள்ரகக்கள், இலக்கியமமோழிமபயர்ப்பு. மமோழியியல்அறிமுகம்: மமோழியும்மமோழியியலும், பயன்போடுமமோழியின்தன்ரமகள் ,மமோழியியல்துரறகள். பரடப்புஉருவோக்குதல் (கருத்துபரிமாற்றம் - கவிரதஇலக்கியம்- அறிமுகம், விடுதரலக்குமுன்னும்பின்னும் - நாடகம் - சிறுகதத).
Translation: Types of translation - Importance and need of translation - Machine translation - Principles - Literary translation.
Introduction to Linguistics: Language and Linguistics- Linguistics – Characteristics of applied language – Fields of Linguistics. Creation of creativity (Exchange of ideas - introduction to poetry literature, before and after liberation - drama - short story).

REFERENCES

மு.வரதரோன்“ தமிழ்இலக்கியவரலோறு” ோஹித்யஅகமடமிபப்ளிபகஷன்ஸ் , 2012
மபோன்மணிமோறன் “அபடோன்தமிழ்இலக்கணம் “அபடோன்பப்ளிஷிங்குரூப், வஞ்சியூர், திருவனந்தபுரம், 2007. http:/www.tamilvu.org/libirary/libindex.htm.

http:/www.gunathamizh.com/2013/07/blog0post_24.html நோ.வோனமோமரல, “தமிழர்நோட்டுப்போடல்கள்” நியூமஞ்சுரிபுத்தகமவளியீட்டகம் 1964,2006 நோ.வோனமோமரல “பழங்கரதகளும், பழமமோழிகளும் ”நியூமஞ்சுரிபுத்தகமவளியீட்டகம், 1980,2008

Evaluation Pattern

Assessment	Weightage (%)
Continuous Assessment	20
Midterm	30
End Semester Exam	50
Total Marks	100

24ENG110	Additional English – II	L-T-P-C: 2-0-0-2

Objectives:

- To expose the students to various genres of English Literature.
- To expose the students to Indian English Writing of different timelines.
- To develop sensibility to read and understand literature and thereby encourage them to be sensitive to the whole spectrum of human experience.

Course Outcomes

COs	Course Outcomes
CO 1	To demonstrate an ability to critically appreciate any literary text
CO 2	To exhibit an ability to narrate and express their thoughts and idea.
CO 3	To be able to evaluate and relate to common human experiences

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	-	-	-	2	-	-	2
CO2	-	-	-	-	2	-	-	2
CO3	-	-	-	-	2	-	-	2
CO4	-	-	-	-	2	-	-	2

Syllabus

Unit-I

Introduction:

Drama : Tragedy & Comedy, Characters, Setting

Prose: Fiction and Non-Fiction

Life Writing.: Biography, Autobiography, Memoirs

Unit-II

Essays:

Shashi Tharoor ***- A Child's Reading in India***

Sarvepalli Radhakrishnan ***- Gandhian Outlook***

Unit-III

Play: ***Silence! The Court is in Session'*** by Vijay Tendulkar

Unit-IV

Non-Detail reading:

Karma – Khushwant Singh

Kailash Satyarthi's Nobel Lecture on 10 December 2014 at Oslo City Hall, Norway

Of Mothers, among other things. By A.K. Ramanujan

Unit-V

Critical Appreciation and Creative Writing: Class Activity

Core Reading

- Habib, M.A.R, ***Literary Studies, A Norton Guide***, Norton & Co, 2020
- Naik, M.K., ***A History of Indian English Literature,*** Sahitya Academy

References:

- Tendulkar, Vijay, ***Silence! The Court is in Session,*** Oxford University Press, 1982

- *Tharoor, Shashi, **A Child's Reading in India,*** Washington Post, Dec 1991
- *Gandhi Outlook and Techniques* - Ministry of Education, January 1, 1953
- Singh, Khushwant, ***Collected Short Stories***, Ravi Dayal Publishers, 1989
- **Nobel Lecture – Audio** [https://www.youtube.com/watch?v=UNZNbcf5Hd8]

Evaluation Pattern

Assessment	Weightage (%)
Continuous Assessment	20
Midterm	30
End Semester Exam	50
Total Marks	100

26CSA111	OBJECT ORIENTED PROGRAMMING USING JAVA	L-T-P-C: 3-1-0-4

Course Objective(s)

The main objective of this course is to understand the basic concepts and techniques which form the object-oriented programming paradigm using Java Language.

Course Outcomes

COs	Description
CO1	Compose, compile, and run Java programs incorporating fundamental Java constructs.
CO2	Identify the necessary classes, objects, class attributes, and their relationships specifically designed to tackle a particular problem.
CO3	Utilizing the IO package and incorporating object-oriented design principles.
CO4	Develop multithreaded applications with synchronization and exception handling.
CO5	Utilize collection framework in java applications and build GUIs using Java AWT classes.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	3	2	-	-	-	-
CO2	3	3	3	2	-	-	-	-
CO3	3	3	3	2	1	-	-	-
CO4	3	3	3	2	1	-	-	-
CO5	3	3	3	3	1	-	-	-

Syllabus

Unit I

Java Environment, Introduction and Features of Java, JVM. Program Structure, Data types, Java Statements – Control and Looping, Type casting in Java programs - Types of Operators. Arrays – 1D, 2D.

Unit II

Introduction to object oriented software design, Comparison of programming methodologies, Object Basics, Classes and Object, Data Members, Access Specifiers, Array of Objects, Constructors, Static Keyword.

Unit III

Overview of Streams, Bytes vs. Characters, File Object, Binary Input and Output, Reading and Writing Objects, Method Overriding, Polymorphism, Super, Interfaces and Abstract Classes, Packages

Unit IV

Exception Handling, Introduction to Threads, Creating Threads, Thread States, Runnable Threads, Coordinating Threads, Interrupting Threads, Runnable Interface, Synchronization.

Unit V

Collection framework, Collection interfaces and classes, AWT, Event Handling.

Textbooks

- Herbert Scheldt, ―Java: The Complete Reference, Eleventh Edition‖, Oracle 2018
- Deitel PJ. Java how to program. Eleventh Edition, Pearson; 2018.

References

- Nino J, Hosch FA. Introduction to Programming and Object-oriented Design using Java. Wiley India Private Limited; 2010. 4. Naughton P. and Schildt H. Java
- The Complete Reference. Eighth Edition, Tata McGraw- Hill; 2011.
- Bahrami A. Object Oriented Systems Development. Second Edition, McGraw-Hill; 2008.
- Booch G, Maksimchuk RA. Object-oriented Analysis and Design with Applications. Third Edition, Pearson Education; 2009

Evaluation Pattern

Assessment	Weightage (%)
Midterm	25
Continuous Assessment	25
End Semester Exam	50
Total Marks	100

26CSA112	COMPUTER ORGANIZATION AND ARCHITECTURE	L-T-P-C: 3-1-0-4

Course Objective(s)

1. Explore the architecture of modern processors, including the design of the central processing unit (CPU).
2. Acquire knowledge about different types of memory systems, including cache memory, and main memory (RAM).
3. Implement the phases involved in executing an instruction.
4. Illustrate concepts related to parallel processing and pipeline design, including superscalar and vector architectures.

Course Outcomes

COs	Description
CO1	Demonstrate understanding of modern processor architecture, including CPU design, and instruction execution.
CO2	Exemplify how the memory organization is communicating with the processing unit.
CO3	Recognize the various I/O device communication methods and common I/O interfaces.
CO4	Comprehend ideas behind pipeline design and parallel processing, such as superscalar and vector architectures.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	1	-	-	-	-	-
CO2	3	2	1	-	-	-	-	1
CO3	3	2	2	1	-	-	-	1
CO4	3	2	2	1	-	2	-	1

Syllabus

Unit I

Fundamental concepts: Register transfers, fetching a word from memory, Storing a word in memory.
Execution of a complete instruction, Branch instructions, and A Complete processor.
Assembly language - Assembly language notation, Basic instruction types, Register Transfer Languages, Addressing modes, and subroutines.

Unit II

Memory Organization: Basic Concepts, Semiconductor RAMs, Read-only memories, Performance Analysis of memory
Cache memory: Types of cache memory, Mapping functions, Replacement algorithms
Virtual memory: Address Translation, Secondary storage.

Unit III

Introduction to I/O Operations, Peripheral devices, and Input/output interfaces.
Modes of transfer: Programmed I/O, Interrupt initiated I/O, Direct Memory access.

Unit IV

Parallel Processing, Introduction to pipelining: Instruction pipelining and Arithmetic pipelining.
Hazards: Data hazards, Instruction hazards, Handling data hazards, and instruction hazards.
Embedded Systems: Examples of embedded systems

Textbooks

1. Carl Hamacher, Zvonks Vranesic, Safea Zaky (2002), Computer Organization, 5th edition, McGraw Hill, New Delhi, India.
2. M Morris Mano, Computer System Architecture (3rd Edition)

References

1. William Stallings (2010), Computer Organization and Architecture- designing for performance, 8th edition, Prentice Hall, New Jersey.
2. Andrew S. Tanenbaum (2006), Structured Computer Organization, 5th edition, Pearson Education Inc.
3. John P. Hayes (1998), Computer Architecture and Organization, 3rd edition, Tata McGraw Hill.

Evaluation Pattern

Assessment	Weightage (%)
Midterm	25
Continuous Assessment (including lab)	25
End Semester Exam	50
Total Marks	100

26CSA113	DATABASE MANAGEMENT SYSTEMS	L-T-P-C: 3-0-0-3

Course Objective(s)

The objective of the course is to present an introduction to database management systems, with an emphasis on how to organize, maintain and retrieve - efficiently, and effectively - information from a DBMS.

Course Outcomes

COs	Description
CO1	Students will have a full comprehension of database concepts and their applications, including their functionalities.
CO2	Students will be able to master basics of SQL and apply it to construct queries for any given database such as create tables, applying constraints, insert/update/delete data, and building indexes on data RDBMS thereby building a successful application.
CO3	Students will be able to design entity relationship diagram, convert the entity relationship diagrams into RDBMS and formulate SQL queries on the data.
CO4	Implement the concept of normalization on the data and its usage in database design to complete an application with transaction properties such as concurrency control and recovery.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	-	1	-	-	-	-	-
CO2	2	3	2	1	-	-	-	-
CO3	2	2	3	1	-	-	-	-
CO4	3	2	2	1	-	-	-	-

Syllabus

Unit I

Introduction – Need of Databases - Data Independence - The Three Levels of Architecture - The External Level - Conceptual Level- Internal Level - Client/Server Architecture- System Structure, Instance and schema, Advantages and Disadvantages of File Systems, Types of users in DBMS, Data Models and Overall System Architecture.

Unit II

Key Constraints - CODD's Rules, Design Issues -ER – Model –Attribute types- Weak Entity Sets - Extended ER Features –ER to Relational Mapping, Structure of Relational Databases, Concept of Normalization and Types of Anomalies.

Unit III

Functional Dependency: Armstrong's axioms- closure of a relation and closure of attribute– Lossy/ Lossless decomposition- 1NF, 2NF, 3NF, Boyce - Codd Normal Form. The Relational Algebra - Query Processing and Optimization: Evaluation of Relational algebra Expressions Query Equivalence.

Unit IV

Transaction Processing: ACID properties, states of a transaction-Introduction to concurrency control-Deadlock-Recovery. Built in SQL functions- Set operations, Sub Queries-Joins-DCL – TCL- Views – Locks - Sequences – Index – PL/SQL Basics – Exceptions – Cursors - Stored Functions – Triggers

Textbooks

1. Silberschatz, Korth, "Data base System Concepts", 7th ed., McGraw hill, 2019.
2. Ivan Bayross: Sql- PL/SQL The Programming Language of Oracle – 4th Edition- Bpb Publications.

References

1. Data base Management Systems, Raghu Ramakrishnan, Johannes Gehrke, McGraw Hill Education (India) Private Limited, 3rd Edition.
2. Fundamentals of Database Systems" by Elmasri and Navathe.

Evaluation Pattern

Assessment	Weightage (%)
Midterm	25
Continuous Assessment	25
End Semester Exam	50
Total Marks	100

26CSA184	DATABASE MANAGEMENT SYSTEMS LAB	L-T-P-C: 0-0-2-1

Course Objective(s)

1. The objective of this lab course is to understand the practical applicability of database management system concepts.
2. Working on existing database systems, designing of database, creating relational database, analysis of table design.

Course Outcomes

COs	Description
CO1	Students will have a comprehension on designing and creating relational database systems
CO2	Develop queries in SQL to retrieve any type of information from a database
CO3	Implement various advanced queries execution using relational constraints, joins, set operations, aggregate function etc.
CO4	Apply PL/SQL objects (functions, cursors, triggers etc.) for solving real life database problems.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	1	-	-	-	2	-
CO2	3	1	2	-	-	-	-	-
CO3	3	1	1	-	-	-	-	-
CO4	3	2	2	-	-	-	1	-

Syllabus

Basics of SQL - Built in SQL functions: Create, Insert, Update. Operations – relational, logical, String operations and Aggregate Functions.
Alter – Joins – Types of Joins - Set operations, Sub Queries: Single row/ multiple row Sub queries -DCL – TCL Commands - Views – Sequences - Index and Locks
PL/SQL – Basic operations - Exceptions – Stored Functions and Triggers

Textbooks

Fundamentals of Data Base Management System, Mark Gillenson 3rd edition.

Evaluation Pattern

Assessment	Weightage (%)
Continuous Assessment	70
End Semester Exam	30
Total Marks	100

26CSA183	OBJECT ORIENTED PROGRAMMING USING JAVA LAB	L-T-P-C: 0-0-2-1

Course Objective(s)

The main objective of this course is to understand the basic concepts and techniques which form the object-oriented programming paradigm using Java Language.

Course Outcomes

COs	Description
CO1	Write, compile, and run Java programs incorporating fundamental Java constructs.
CO2	Design and implement classes, objects, and constructors to model real-world entities.
CO3	Utilize inheritance and polymorphism to create reusable and maintainable code with File Handling
CO4	Design and develop multithreaded applications to improve program performance with error handling mechanism.
CO5	Develop simple graphical user interfaces (GUIs) using AWT components.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	3	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-
CO3	3	3	3	-	1	-	-	-
CO4	3	3	3	-	1	-	-	-
CO5	3	3	3	-	1	-	-	-

Syllabus

1. Setting up Java development environment. Write and run simple Java programs using basic syntax.
2. Writing and compiling simple Java programs
3. Working with different data types and operators
4. Implementing conditional statements and loops
5. Work with arrays to store and manipulate collections of data
6. Creating classes and objects with Constructors
7. Exploring inheritance concepts
8. Utilizing polymorphism for code reusability using Abstract Class and Interface
9. Reading and writing data from files
10. Understanding multithreading concepts
11. Developing simple multithreaded applications
12. Implement exception handling mechanisms to manage errors effectively
13. Utilize built-in collections like ArrayList, HashMap, etc. to manage groups of objects efficiently.
14. Designing basic GUIs using AWT components with event handling in GUIs

Textbooks

- Herbert Scheldt, ―Java: The Complete Reference, Eleventh Edition‖, Oracle 2018
- Deitel PJ. Java how to program. Eleventh Edition, Pearson; 2018.

References

- Nino J, Hosch FA. Introduction to Programming and Object-oriented Design using Java. Wiley India Private Limited; 2010. 4. Naughton P. and Schildt H. Java
- The Complete Reference. Eighth Edition, Tata McGraw- Hill; 2011.
- Bahrami A. Object Oriented Systems Development. Second Edition, McGraw-Hill; 2008.
- Booch G, Maksimchuk RA. Object-oriented Analysis and Design with Applications. Third Edition, Pearson Education; 2009

Evaluation Pattern

Assessment	Weightage (%)
Continuous Assessment	70
End Semester Exam	30
Total Marks	100

26CSA185	USER INTERFACE DESIGN	L-T-P-C: 0-0-2-1

Course Objective(s)

- To familiarize the fundamental concepts of UI design with their importance
- To introduce the tools for desgining user interface

Course Outcomes

COs	Description
CO1	Integrate UI design principles and tools to create a user-centric design.
CO2	Designing user interfaces (UI) involves using various design tools to create a visually appealing and functional design.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	-	-	3	1	-	1	2
CO2	-	-	-	3	2	-	1	2

Syllabus

Unit I

Fundamentals of User Interface Design

Introduction to User Interface (UI) Design - Definition and importance of user interface design, Evolution of user interfaces. Principles of UI Design - Clarity, efficiency, and usability, Visual hierarchy, and layout. Design Thinking - Understanding design thinking process, Empathy, and user-centered design. Tools and Technologies - Overview of UI design tools (Sketch, Adobe XD, Figma), Introduction to basic HTML and CSS for prototyping

Unit II

Practical Application of UI Design

Prototyping - Building wireframes and mockups, Interactive prototypes using tools like Figma or Adobe XD. User Research and Testing - Techniques for user research, Conducting usability testing, and interpreting feedback. UI Design Standards and Guidelines - Accessibility standards, Responsive design principles.

Textbooks:

1. "Designing Interfaces: Patterns for Effective Interaction Design" by Jenifer Tidwell

References:

1. "Don't Make Me Think, Revisited: A Common Sense Approach to Web Usability" by Steve Krug
2. "The Design of Everyday Things" by Don Norman
3. "About Face: The Essentials of Interaction Design" by Alan Cooper

Evaluation Pattern

Assessment	Weightage (%)
Continuous Assessment	70
End Semester Exam	30
Total Marks	100

SEMESTER III

26CSA201	DATA STRUCTURES	L-T-P-C:3-1-0-4

Course Objective(s)

- Understand the concept and importance of organizing data using appropriate data structures.
- Develop the ability to analyze and select suitable data structures for solving computational problems.
- Enable students to design and implement abstract data types (ADTs) and their operations.
- Build competence in applying linear and non-linear data structures for problem solving.

Course Outcomes

COs	Description
CO1	**Analyze** data handling requirements and classify problems based on appropriate data structure selection
CO2	**Design** abstract data types (ADTs) and represent data using structured and dynamic data types
CO3	**Implement** linear data structures such as arrays, stacks, queues, and linked lists to solve problems
CO4	**Apply** non-linear data structures like trees and graphs in computational problem solving
CO5	**Evaluate** the efficiency and suitability of data structures for real-world applications

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	2	0	0	0	1
CO2	3	2	3	2	0	0	0	1
CO3	3	2	3	2	0	0	0	1
CO4	2	2	3	2	0	0	0	1
CO5	2	3	2	2	0	0	1	2

Syllabus

Unit I

Introduction and Definition of Data Structure, Classification of Data Structures: Primitive and Non-primitive data structures Linear and Non-linear data structures, Abstract Data Type (ADT). Introduction to implementation issues

Unit II

Enumerated, Structure, and Union Types– The Type Definition (typedef), Enumerated types, Structures –Declaration, initialization, accessing structures, operations on structures, structures, and functions, Passing structures through pointers. Introduction to Union

Unit III

Array ADT, Types of Arrays: 1-D, 2-D, and multi-dimension. Applications of Arrays: Linear Search, Binary Search and its analysis. Sorting: Bubble Sort, Insertion Sort, Selection Sort, and its analysis. Linked List, List as an ADT Types of Linked List, and insertion and deletion operations of linked list: Singly, Circular, and Doubly.

Unit IV

Stacks ADT, Operations on Stack: Push, Pop, and Traversing. Applications of Stack: Expression conversion, Postfix Evaluation, Recursion: Tower of Hanoi, Merge Sort, Quick Sort. Analysis of Recursive Algorithms using Back Substitution and Masters Method. Queue ADT, Operations on Queue: Insertion, Deletion, and Traversing. Circular Queue.

Unit 5

Graphs ADT, basic terminologies, types of graphs. Graph Representation: Adjacency Matrix, Incidence Matrix, Adjacency List. Tree ADT, Basic Terminologies, Binary tree properties, Tree Traversal: Pre-order, In-order, and Post-order.

Textbooks

1. E. Horowitz & Sahni, Fundamental Data Structure, Galgotia Book Source, 1983.
2. A. Tannenbaum, Data Structure Using C, Pearson Education, 2003.

References

Classic Data Structures by D. Samanta, Second Edition.

Evaluation Pattern

Assessment	Weightage (%)
Midterm	25
Continuous Assessment	25
End Semester Exam	50
Total Marks	100

26CSA202	OPERATING SYSTEM	L-T-P-C: 3-0-0-3

Course Objective(s)

- Outlines the basic principles of Operating System.
- Implementation of the Process Management and CPU scheduling algorithms.
- Demonstrates the importance of Deadlock and its characterization.
- Articulates the need for memory management, page replacement algorithms, and File system interface.

Course Outcomes

COs	Description
CO1	Demonstrate the principles of Operating System, calls, services, and System programs.
CO2	Ability to apply different types of Scheduling algorithms and their evaluation.
CO3	Analyze the importance of Deadlock and its characterization.
CO4	Implement the concepts of Memory management, page replacement algorithms, and File system interface

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	1	1	1	1	-	-	1	1
CO2	3	3	3	3	-	-	2	1
CO3	1	1	2	2	-	-	2	1
CO4	3	3	3	3	-	-	3	1

Syllabus

Unit I

Introduction to Operating Systems- Operating System Structures-Operating System Services-System Calls-System Programs- Operating Systems Generations

Unit II

Process Management- Process concepts, process states, process control block, Operations on processes, CPU Scheduling-Scheduling Criteria- scheduling algorithms and their Evaluation

Unit III

Deadlocks: System Model-Deadlock Characterization-Methods for handling Deadlocks-Deadlock Prevention- Deadlock Avoidance-Deadlock Detection-Recovery from deadlock

Unit IV

Memory Management: Background – Swapping – Contiguous memory allocation – Paging – Segmentation – Virtual Memory: Background – Demand paging- Page replacement algorithms.

File system interface- File Concept, Access Methods, Directory Structure, File System Structure, Allocation Methods, and Free-Space Management.

Textbooks

Silberschatz, Galvin, and Gagne, “Operating System Concepts”, 9th Edition, Wiley India Pvt Ltd, 2014.

References

1. Andrew S. Tanenbaum, “Modern Operating Systems”, 4th Edition, Pearson Education / PHI 2001.

2. Gary Nutt, “Operating Systems”, Third Edition, Pearson Education, 2009

3. Harvey M. Deital, “Operating Systems”, Third Edition, Pearson Education, 2004

Evaluation Pattern

Assessment	Weightage (%)
Midterm	25
Continuous Assessment	25
End Semester Exam	50
Total Marks	100

26CSA203	Introduction to Python	L-T-P-C: 3-0-0-3

Course Objective(s)

- Introduce the fundamentals of Python programming as a high-level, versatile language.
- Enable students to analyze problems and design Python-based solutions using structured programming constructs.
- Develop skills in implementing programs using Python data types, control structures, and functions.
- Familiarize students with Python libraries and programming paradigms relevant to modern computing.

Course Outcomes

COs	Description
CO1	**Analyze** problem statements and model solutions using Python programming constructs
CO2	**Design** Python programs using appropriate data types, control structures, and functions
CO3	**Implement** modular Python programs using built-in data structures and standard libraries
CO4	**Evaluate** Python programs by debugging, testing, and improving code efficiency
CO5	**Apply** Python programming knowledge to independently learn advanced technologies and tools

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	2	0	0	0	1
CO2	3	3	3	2	0	0	0	1
CO3	3	2	3	2	0	0	0	1
CO4	2	3	2	2	0	0	1	1
CO5	2	1	2	2	0	0	0	3

Syllabus

Unit I

Introduction to Python Programming. Overview of Python. Features and applications of Python. Python programming environment. Basic syntax and indentation. Variables and keywords. Input and output statements

Unit II

Data Types and Operators. Built-in data types: int, float, string, and Boolean. Type casting and dynamic typing. Operators: Arithmetic, Relational, Logical, Assignment. Expressions and evaluation.

Unit III

Control Structures. Conditional statements: if, if-else, elif. Iterative statements: for loop, while loop. Loop control: break, continue, pass. Nested control structures.

Unit IV

Functions: Function definition and invocation. Parameters and return values. Scope of variables. Built-in data structures: Lists, Tuples, Sets, Dictionaries. Basic operations and applications.

Unit V

Introduction to Python modules. Importing built-in and user-defined modules. Overview of Python standard libraries. File handling: Reading and writing text files. Basic exception handling. Introduction to Python applications in modern

computing.

Textbooks

1. "Python Crash Course, 2nd Edition: A Hands-On, Project-Based Introduction to Programming" Author: Eric MatthesPublisher: No Starch Press Year: 2019 ISBN-13: 978-1593279288
2. "Automate the Boring Stuff with Python: Practical Programming for Total Beginners" Author: Al Sweigart Publisher:No Starch Press Year: 2019 ISBN-13: 978-1593275990
3. "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, 2nd Edition" Author: Wes McKinney Publisher: O'Reilly Media Year: 2017 ISBN-13: 978-1491957660

Evaluation Pattern

Assessment	Weightage (%)
Midterm	25
Continuous Assessment	25
End Semester Exam	50
Total Marks	100

Course Objective(s)

- To understand the concepts and techniques underlying website creation with HTML, CSS.
- To create client scripting with JavaScript using loops and control statements.
- Able to create singe page web development applications in Angular JS and Server scripting.
- To create database applications with PHP and MYSQL.

Course Outcomes

COs	Description
CO1	Design basic web applications using HTML and CSS
CO2	Create interactive web applications using latest web technologies using JavaScript
CO3	Building single web page applications using various input methods
CO4	Database usage with interactive web applications using PHP and MYSQL

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	3	1	1	-	-	-
CO2	3	2	3	1	2	-	-	1
CO3	3	2	3	1	2	-	-	1
CO4	3	2	3	1	3	-	-	1

Syllabus

Unit I

HTML5 and CSS3: HTML5- Basic Tags, Tables, Forms.HTML5 Tags, HTML Graphics, HTML media, HTML Graphics, HTML, APIs.

CSS - Background, Borders, margin, Box model. Styling text, fonts, list, links, tables. CSS overflow, float, inline blocks, pseudo-classes, pseudo-elements. CSS border images, rounded corners.

Unit II

JavaScript - Client-side scripting using java script, Introduction to JavaScript, internal and external JavaScript files, variables, control statements, loops, Arrays, string handling, functions in JavaScript, inputting, and outputting from form elements to JavaScript. DOM concept, creating html elements using java script. Drawing 2D shapes, handling events. Introduction to AJAX

Unit III

Building Single page applications with Angular JS. Single page application – introduction, two-way data binding, MVC in angular JS, controllers, getting user inputs, loops, Client-side routing – accessing URL data, diverse ways to provide data in angular JS.

Unit IV

Server-side scripting, Difference between client side and server-side scripting languages. Introduction to PHP, variables, control statements, loops, Arrays, string handling, PHP forms, Global variables in PHP, Regular expression and pattern matching, Database programming: inputting and outputting data from MySQL using PHP, insertion, deletion and updating data.

State management in web applications, cookies, Application, and session state.

Lab Syllabus:

1. HTML5 Basics

- Create basic HTML pages
- Use headings, paragraphs, lists, images
- Internal & external CSS linking

2. HTML5 Tables, Forms & Media

- Create tables (row/column span)
- Build HTML forms
- Embed audio & video
- Basic canvas usage

3. HTML5 Semantic Tags & APIs

- Use semantic tags (header, section, etc.)
- Work with HTML5 APIs (local storage, geolocation – demo)
- Draw shapes using Canvas

4. CSS3 Fundamentals

- Apply selectors, classes, IDs
- Box model, borders, backgrounds
- Font & text styling

5. Advanced CSS3

- Style lists, tables, links
- Use floats, inline-block
- Apply pseudo-classes & pseudo-elements
- Rounded corners, border images
- Simple webpage layout

6. JavaScript Basics

- Internal & external JS
- Variables, datatypes, operators
- If/else & loops
- Taking input from user

7. JavaScript Arrays, Strings & Functions

- Array operations
- String handling
- User-defined functions
- Form validation
- DOM basics

8. DOM Programming & Events

- Creating & removing HTML elements using JS
- Accessing DOM elements
- Event handling (onclick, mouseover, etc.)
- 2D drawing with Canvas API

9. AJAX Introduction

- Asynchronous requests
- Updating webpage without reloading
- Simple AJAX form submission
- Handling JSON responses

10. AngularJS Basics

- AngularJS module creation
- Controllers
- Two-way data binding
- Directives (ng-model, ng-repeat)

11. AngularJS Routing & User Input

- Forms using AngularJS
- Handling user inputs
- Client-side routing
- Accessing URL parameters

12. PHP Basics (Server-Side Scripting)

- PHP syntax
- Variables, conditional statements, loops
- Arrays & string functions

- Handling form data with PHP ($_POST, $_GET)

13. PHP–MySQL Database Integration

- Connect PHP to MySQL
- Execute CRUD operations:
  - Insert
  - Update
  - Delete
  - Select
- Display DB results in HTML

14. State Management in Web Apps

- Cookies
- Sessions
- Simple login session handling

Textbooks:

1. The Complete Reference, HTML and CSS by Thomas A Powell latest edition

References:

1. XML: The Complete Reference Heather Williamson latest edition
2. Web Reference: w3schools.com

Evaluation Pattern

Assessment	Weightage (%)
Midterm	20
Continuous Assessment (including lab)	50
End Semester Exam	30
Total Marks	100

26CSA205	COMPUTER NETWORKS	L-T-P-C: 3-0-2-4

Course Objective(s)

- Build an understanding of the fundamental concepts of computer networking.
- Familiarize the student with the basic taxonomy and terminology of the computer networking area.
- Students will be able to gain expertise in some specific areas of networking such as the design and maintenance of individual networks.

Course Outcomes

COs	Description
CO1	Analyze the services of OSI, TCP/IP model and design of network topologies
CO2	Develop error control, correction and error detection methods for data transmission
CO3	Implement networking protocols and technologies in practical network scenarios.
CO4	Apply knowledge of the transport and application layer to design and implement network applications.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	3	-	-		-	1
CO2	2	3	3	1	-	-	-	2
CO3	2	2	3	2	-	-	-	1
CO4	2	2	3	2	-	-	-	2

Syllabus

Unit I

Evolution of Computer Networking - Types of Networks - networks topologies - Protocols Standards, World Wide Web Network Devices-The OSI reference model- TCP/IP Reference Model. Physical Layer: transmission media- Analog Transmission- Digital transmission

Unit II

Data Link Layer Design Issues-Services provided to the Network Layer-Framing-Error Control-Flow Control- Error Detection and Correction- Elementary Data Link Protocols- Sliding Window Protocols- Multiple Access Protocols, MAC Address.

Unit III

Introduction to Network Layer – Services - Circuit Switching Vs Packet Switching-Packet Switched Networks-Types of Routing-routing algorithms- congestion control algorithms- Network Protocols-IP- IPV4, IPV6, Subnets, Gateways-Congestion Avoidance in Network Layer.

Unit IV

The Transport Services – Services provided to the upper layers –Elements of transport Protocols –Internet Transport Protocols- Congestion Controls in Transport Layer, Application Layer: Domain Name System, and Hyper Text Transfer Protocol, Electronic mail, File Transfer Protocol, Remote login.

Lab syllabus

- Networking Commands & Basics — ping, traceroute, arp, ipconfig/ifconfig, netstat, nslookup, route; intro to WWW and protocols.
- Packet Sniffing with Wireshark — Capture & analyze Ethernet, ARP, IP, ICMP, TCP, UDP; observe 3-way handshake and DNS lookup.
- Topologies & Devices (Simulator) — Build bus/star/ring in Packet Tracer; hub vs switch vs router behavior.
- Physical Layer & Media — Compare UTP/STP/coax/fiber; attenuation/bandwidth demo; encoding overview (NRZ/Manchester).
- Framing Techniques (Code) — Implement character count, byte stuffing, and bit stuffing.
- Error Detection & Correction (Code) — CRC-16/32, Internet checksum, Hamming(7,4)/(12,8) with single-bit error correction.
- Flow Control Protocols (Sim/Code) — Stop-and-Wait; Sliding Window: Go-Back-N & Selective Repeat with timing diagrams.
- MAC Protocols (Sim) — CSMA/CD, CSMA/CA, token passing; collision/backoff observation.
- Routing Algorithms (Code) — Dijkstra (link-state) & Distance Vector; compute shortest paths and convergence behavior.
- IP Addressing & Subnetting — Design subnets/VLSM for a campus; subnet masks, gateways, route summarization.
- Router Config: Static & Dynamic (Simulator) — Static routes, RIP v2, OSPF single area; verify with show ip route/pings.
- IPv6 Configuration — Global/link-local, SLAAC, dual stack; simple inter-VLAN + routing verification.
- Congestion Control (Sim/Trace) — Leaky/Token Bucket, RED/WRED concepts; observe TCP throughput under loss/latency.
- Socket Programming — TCP and UDP client/server; file transfer over TCP; measure RTT/throughput.
- Application Layer Protocols — DNS (nslookup/dig), HTTP (requests, headers), SMTP/IMAP/POP3 (telnet demo), FTP & SSH.

Textbooks / References

1. Computer Networks (Fifth Edition) – Andrew S. Tanenbaum (Prentice Hall of India)
2. Computer Networking a Top-Down Approach (Fifth Edition)-James F. Kurose-Keith W. Ross(Pearson)
3. Computer Networks - Protocols, Standards and Interfaces (Second Edition) – Uyless Black (Prentice Hall of India Pvt. Ltd.)
4. Data communication and Networking (Fourth Edition)- Behrouz A Forouzan(Tata Mcgraw Hill)

Evaluation Pattern

Assessment	Weightage (%)
Midterm	20
Continuous Assessment (including lab)	50
End Semester Exam	30
Total Marks	100

26CSA281	DATA STRUCTURES LAB	L-T-P-C: 0-0-2-1

Course Objective(s)

- To gain knowledge about the fundamental concepts of algorithms, flowcharts, and performance analysis of the algorithms.
- To comprehensively understand different types of data structures used for problem-solving**.**

Course Outcomes

COs	Description
CO1	Devise algorithms using structures and unions
CO2	Utilization of both static and dynamic data structures in the design of algorithms
CO3	Implementing stack and queue data structures for various applications
CO4	Implement the concepts of non-linear data structures like graphs and trees to solve real-time problems

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	-	-	-	-	-
CO2	3	3	3	-	-	-	-	-
CO3	3	3	3	-	-	-	-	-
CO4	3	3	3	-	-	-	-	-

Lab Cycle:

1. Write a program to demonstrate linear search and perform the analysis.
2. Write a program to demonstrate structures.
3. Write a program to demonstrate unions.
4. Write a program to demonstrate structures and functions with pointers.
5. Write a program to illustrate a 1D array.
6. Write a program to illustrate a 2D array.
7. Write an algorithm to perform binary search and perform the comparison of linear and binary search.
8. Write an interactive program to perform sorting algorithms – Bubble sort, Insertion sort, Selection Sort, and its analysis.
9. Write an interactive program to illustrate insertion and deletion operations on a singly linked list.
10. Write an interactive program to illustrate insertion and deletion operations on a circular linked list.
11. Write an interactive program to illustrate insertion and deletion operations on a doubly linked list.
12. Write a program to illustrate stack operations.
13. Write a program to perform infix to postfix conversion.
14. Write a program to perform postfix evaluation.
15. Write a program to perform Merge sort.
16. Write a program to perform Quick sort.
17. Write a program to operate on a queue.
18. Write a program to perform operations on a circular queue.
19. Write a program to represent the graph using an adjacency matrix.
20. Write a program to represent the graph using an adjacency list.
21. Write an interactive program to perform binary tree traversal – Pre-order, In-order and Post-order.

Textbooks :

1. E. Horowitz & Sahni, Fundamental Data Structure, Galgotia Book Source, 1983.

2. A. Tannenbaum, Data Structure Using C, Pearson Education, 2003.

References :

Classic Data Structures by D. Samanta, Second Edition.

Evaluation Pattern

Assessment	Weightage (%)
Continuous Assessment	70
End Semester Exam	30
Total Marks	100

26CSA282	Python Programming Lab	L-T-P-C: 0-0-2-1

Course Objective(s)

- Gain hands-on experience in writing and executing Python programs.
- Translate algorithmic and problem-solving concepts into Python implementations.
- Develop the ability to design and implement modular programs using Python functions and data structures.
- Acquire proficiency in debugging, testing, and validating Python programs.

Course Outcomes

COs	Description
CO1	**Analyze** problem statements and design Python-based solutions
CO2	**Implement** Python programs using control structures and built-in data types
CO3	**Develop** modular Python programs using functions and data structures
CO4	**Test and evaluate** Python programs for correctness and efficiency
CO5	**Apply** Python programming skills to learn advanced tools and technologies independently

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	2	0	0	0	1
CO2	3	2	3	2	0	0	0	1
CO3	3	2	3	3	0	0	0	1
CO4	2	3	2	2	0	0	1	1
CO5	2	1	2	3	0	0	0	3

Syllabus

- Introduction to Python environment, IDE, and basic program execution
- Python syntax, variables, input/output programs
- Programs using operators and expressions
- Conditional statements (if, if-else, elif)
- Iterative constructs (for and while loops)
- Nested loops and control statements
- Lists and list operations
- Tuples, sets, and dictionary operations
- Functions—definition, parameters, return values
- Modular programming using functions
- String processing and applications
- File handling—reading and writing files
- Exception handling and error management
- Mini problem / case study using Python

Textbooks

1. "Python Crash Course, 2nd Edition: A Hands-On, Project-Based Introduction to Programming" Author: Eric MatthesPublisher: No Starch Press Year: 2019 ISBN-13: 978-1593279288
2. "Automate the Boring Stuff with Python: Practical Programming for Total Beginners" Author: Al Sweigart Publisher:No Starch Press Year: 2019 ISBN-13: 978-1593275990
3. "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, 2nd Edition" Author: Wes

McKinneyPublisher: O'Reilly Media Year: 2017 ISBN-13: 978-1491957660

References

1."Introduction to Computation and Programming Using Python: With Application to Understanding Data, 2nd Edition"Author: John V. Guttag Publisher: The MIT Press Year: 2016 ISBN-13: 978-0262529624

"Learning Python, 5th Edition" Author: Mark Lutz Publisher: O'Reilly Media Year: 2013 ISBN-13: 978-1449355739

Evaluation Pattern

Assessment	Weightage (%)
Continuous Assessment	70
End Semester Exam	30
Total Marks	100

SEMESTER IV

26CSA211	FULL STACK FRAMEWORKS	L-T-P-C: 3-0-0-3

Course Objective(s)

1. Explain the foundational concepts of web development and the MEARN stack, comprising MongoDB, Express.js, React.js, and Node.js.
2. Describe the significance of RESTful APIs (Application Programming Interfaces) and illustrate their construction using Node.js and Express.js to facilitate communication between front-end and back-end systems.
3. Evaluate and discuss CRUD (Create, Read, Update, Delete) operations, and demonstrate their implementation using MongoDB as the primary database management system.
4. Discuss and apply industry best practices in software development, emphasizing code modularity, scalability, and error handling techniques, to conceptualize and design robust and maintainable full stack applications.

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Course Outcomes

COs	Description
CO1	Apply fundamental concepts of HTML, CSS, and JavaScript to design interactive and visually appealing web interfaces.
CO2	Create single-page applications (SPAs) utilizing React.js to ensure efficient client-side rendering.
CO3	Manage HTTP requests and responses proficiently using Node.js for server-side scripting and backend development.
CO4	Construct RESTful APIs employing Express.js to develop robust backend services.
CO5	Execute CRUD operations and efficiently handle data persistence by integrating MongoDB into MEARN stack applications.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	1	2	1	2	-	-	2	3
CO2	1	2	1	2	-	-	-	3
CO3	1	2	1	2	-	-	-	3
CO4	1	2	1	2	-	-	-	3
CO5	1	2	1	2	-	-	-	3

Syllabus

Unit I

Introduction to MERN Stack Introduction to Web Development Overview of MERN Stack, Setting up Development Environment, Basics of HTML, CSS, and JavaScript Introduction to MongoDB

Unit II

Introduction to React.js, JSX Syntax and Components, State Management with Hooks, Routing and Navigation, Handling Forms and User Input

Unit III

Introduction to Node.js and npm, Building RESTful APIs with Express.js

CRUD Operations with MongoDB and Mongoose, Authentication and Authorization, Deployment and Hosting Option

Unit IV
Introduction to Express.js, Setting Up a Server, Routing and Middleware, Request and Response Handling, Error Handling and Debugging Techniques

Unit V
Introduction to MongoDB, Basic CRUD Operations, Data Modeling with MongoDB, Aggregation Framework, Indexing and Performance Optimization

Text Books:

1. "Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node" by Vasan Subramanian
2. Simon Holmes ,"Getting MEAN with Mongo, Express, Angular, and Node, Second Edition, Manning Publications; 1edition (31 October 2015)

References:

1. Jeff Dickey, "Write Modern Web Apps with Mean Stack, Peachpitpress, 2015
2. Ken Williamson, "Learning Angular JS", O′Reilly; 1 edition (24 March 2015)
3.MithunSatheesh, "Web development with MongoDBand Node JS",Packt Publishing Limited; 2nd Revised edition (30October 2015).

Evaluation Pattern

Assessment	Weightage (%)
Midterm	25
Continuous Assessment	25
End Semester Exam	50
Total Marks	100

26CSA212	Software Engineering & UML	L-T-P-C: 2-0-2-3

Course Objective(s)

- Understand the principles, processes, and methodologies involved in software development.
- Analyze customer requirements and convert them into structured software specifications.
- Design software systems using Unified Modeling Language (UML) diagrams.
- Apply modern software engineering tools and practices throughout the software life cycle.
- Develop awareness of professional ethics, teamwork, and project practices in software projects.

Course Outcomes

COs	Description
CO1	**Analyze** software requirements and formulate problem statements using standard software engineering practices
CO2	**Design** software architectures and detailed models using appropriate UML diagrams
CO3	**Apply** suitable software development life cycle models and agile practices for project execution
CO4	**Evaluate** software quality using verification, validation, and testing concepts
CO5	**Demonstrate** ethical responsibility, teamwork, and adaptability in software development activities

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	3	2	2	0	0	0	1
CO2	2	3	3	3	1	0	0	1
CO3	1	2	3	2	2	1	0	1
CO4	1	3	2	2	1	0	2	1
CO5	0	1	1	1	3	2	3	2

Syllabus

Unit I

Introduction to Software Engineering. Software and Software Engineering concepts. Software characteristics and challenges. Software Development Life Cycle (SDLC). Generic process framework. Software engineering ethics and professionalism.

Unit II

Software Process Models. Waterfall model. Incremental and Iterative models. Spiral model. Agile methodologies – Scrum overview. Comparison of process models.

Unit III

Requirements Engineering. User requirements vs system requirements. Functional and non-functional requirements. Requirements elicitation techniques. Software Requirement Specification (SRS). Requirement validation and management.

Unit IV

Software Design and UML. Introduction to design concepts. Architectural design. UML fundamentals

UML diagrams: Use Case diagram, Class diagram, Sequence diagram, Activity diagram.

Unit V

Software quality concepts. Verification and Validation. Levels of testing. Testing techniques (black-box and white-box overview). Introduction to software maintenance

Lab Syllabus

- CASE tool / UML tool introduction
- Problem identification and requirement analysis
- Preparation of Software Requirement Specification (SRS)
- Use Case modeling using UML
- Class diagram design
- Sequence diagram modeling
- Activity diagram modeling
- Architecture modeling
- Agile artifacts – user stories and backlog
- Software design review and documentation
- Test case design
- Verification and validation exercises
- Mini project – requirement to design
- Mini project – UML evaluation

Text Books:

1. Software Engineering: A Practitioner's Approach, 8th Edition, by Roger S. Pressman and Bruce R. Maxim. McGraw-Hill Education, 2015.
2. Software Engineering, by Ian Sommerville. 10th Edition, Pearson Education, 2016.

Evaluation Pattern

Assessment	Weightage (%)
Midterm	20
Continuous Assessment	50
End Semester Exam	30
Total Marks	100

26CSA213	FUNDAMENTALS OF AI	L-T-P-C: 3-0-0-3

Course Objective(s)

- Familiarise the basic concepts, principles, and techniques of artificial intelligence.
- Identify the various features of AI, further studies in AI-related fields or for careers in industries where AI technologies are increasingly prevalent.

Course Outcomes

COs	Description
CO1	Exhibit a comprehensive comprehension of the fundamental principles, theories, and frameworks that form the basis of artificial intelligence.
CO2	Expertise in the implementation and application of an extensive array of AI methodologies, including machine learning algorithms & search techniques.
CO3	Acquire robust analytic and evaluative proficiencies in order to assess AI models and systems with regard to their performance, limitations, and ethical ramifications; this includes taking into account fairness, transparency and bias.
CO4	Appraise the practical experience by actively participating in AI projects during the course and implementing acquired knowledge and skills to create viable solutions, conduct data analysis, and interpret outcomes.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	-	1	1	-	-	-	1
CO2	3	3	-	1	-	-	-	1
CO3	3	-	-	1	-	-	-	1
CO4	3	1	-	1	-	-	-	1

Syllabus

Unit I

AI problems, the foundation of AI and history of AI intelligent agents: Agents and Environments, Strategies - Control Strategy - State, Space, Search, - Stages of AI - Tasks in AI - AI Problem formulation with assumptions.

Unit II

Searching for solutions - Tic-Toc-Toe - Uniformed search strategies - Breadth-first search - Depth-first Search - Search with partial information (Heuristic search) Hill climbing - A* - AO* - Means-End Analysis

Unit III

Knowledge representation issues - predicate logic - logic programming, semantic nets - frames and inheritance - Constraint propagation - Representing knowledge using rules - Rules-based deduction systems. Reasoning under uncertainty - Review of probability in AI - Baye's probabilistic - Maximum Likelihood Estimation - Interferences and Dempstershafer theory.

Unit IV

First-order logic - Resolution method - Inference in first-order logic - Propositional knowledge vs. first-order inference - Unification & lifts - Forward chaining - Backward chaining - Resolution - Learning from observation Inductive learning Classification: Decision trees - Explanation-based learning - Statistical Learning methods - Reinforcement Learning, fundamentals of neural networks.

Textbooks:

1. Artificial Intelligence (Second Edition) – Elaine Rich, Kevin knight (Tata McGraw-Hill)

References:

1. S. Russel and P. Norvig, “Artificial Intelligence – A Modern Approach”, SecondEdition, Pearson Education
2. David Poole, Alan Mackworth, Randy Goebel, ”Computational Intelligence : a logical approach”, Oxford University Press.
3. G. Luger, “Artificial Intelligence: Structures and Strategies for complex problemsolving”, Fourth Edition, PearsonEducation.

Evaluation Pattern

Assessment	Weightage (%)
Midterm	25
Continuous Assessment	25
End Semester Exam	50
Total Marks	100

26CSA283	FULL STACK FRAMEWORKS LAB	L-T-P-C: 0-0-2-1

Course Objective(s)

1. Understand the foundational concepts of web development and the MEARN stack, including MongoDB, Express.js, React.js, and Node.js.
2. Construct RESTful APIs (Application Programming Interfaces) using Node.js and Express.js for seamless communication between front-end and back-end.
3. Analyze and implement CRUD (Create, Read, Update, Delete) operations using MongoDB as the database management system.
4. Apply best practices in software development, including code modularity, scalability, and error handling, to create robust and maintainable full stack applications.

Course Outcomes

COs	Description
CO1	Implement fundamental concepts of HTML, CSS, and JavaScript to create interactive and visually appealing web interfaces.
CO2	Develop single-page applications (SPAs) using React.js for efficient client-side rendering.
CO3	Handle HTTP requests and responses using Node.js for server-side scripting and backend development.
CO4	Construct RESTful APIs using Express.js for building robust backend services.
CO5	Perform CRUD operations and manage data persistence efficiently by integrating MongoDB into MEAN stack applications.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	1	2	1	2	-	-	-	3
CO2	1	2	1	2	-	-	-	3
CO3	1	2	1	2	-	-	-	3
CO4	1	2	1	2	-	-	-	3
CO5	1	2	1	2	-	-	-	3

Syllabus

Unit 1: Basics of Web Development

1. Create a simple webpage layout that includes a header, a navigation bar, a main content area with two columns, and a footer.
2. Apply basic CSS styling to make the webpage visually appealing, including background colors, font styles, and margins.
3. Write a JavaScript function to validate a contact form. Ensure that the name, email, and message fields are not empty before allowing form submission. Display error messages if any field is left blank.
4. Create an HTML table with headers for each column and populate it with sample data. Use attributes like colspan and rowspan to merge cells for more complex layouts.

Unit 2: React.js Lab Programs

1. Set up a React.js project using Create React App.
2. Create functional and class based React components for a simple UI.
3. Implement state management using React's useState and useContext hooks.
4. Integrate React Router for client-side routing in a React.js application.
5. Fetch data from a RESTful API and display it dynamically in a React.js application

Unit 3: Node.js Lab Programs

1. Create a simple HTTP server using Node.js.
2. Implement basic file I/O operations (read/write) using Node.js fs module.
3. Implement a program to read the query string using Node JS(Using URL Module)
4. Set up routing and request handling using the built-in HTTP module in Node.js.
5. Implement email service using NodeJS nodemailer service**.**
6. Integrate third-party APIs (e.g., weather API) into a Node.js application

Unit 4: **Express.js Lab Programs**

1. Set up an Express.js project structure with routing.
2. Create RESTful APIs for a simple to-do list application using Express.js.
3. Implement middleware functions for authentication and error handling in an Express.js application.
4. Integrate Express.js with MongoDB using Mongoose for CRUD operations.

Unit 5: MongoDB Lab Programs

1. Install MongoDB and set up a local database server.
2. Create a MongoDB database and define collections.
3. Perform CRUD operations (Create, Read, Update, Delete) on MongoDB collections using the MongoDB shell.
4. Connect a Node.js application to MongoDB using the official MongoDB Node.js driver.
5. Implement basic data validation and schema definition using Mongoose in a Node.js application.

Textbooks:

1. https://www.sites.google.com/site/amritaevs/home
2. R. Rajagopalan, Environmental Studies: From Crisis to Cure. Oxford University Press, 2011, 358 pages. ISBN: 9780198072089.
3. Daniel D. Chiras, Environmental Science. Jones & Bartlett Publishers, 01-Feb-2012, 669 pages. ISBN: 9781449645311.

References:

1. Andy Jones, Michel Pimbert and Janice Jiggins, 2011. Virtuous Circles: Values, Systems, Sustainability. IIED and IUCN CEESP, London. URL:http://pubs.iied.org/pdfs/G03177.pdf
2. Annenberg Learner, The Habitable Planet, Annenberg Foundation 2015. URL: http://www.learner.org/courses/envsci/unit/pdfs/textbook.pdf

Evaluation Pattern

Assessment	Weightage (%)
Continuous Assessment	70
End Semester Exam	30
Total Marks	100

SEMESTER V

26CSA301	MOBILE APPLICATION DEVELOPMENT	L-T-P-C: 0-1-2-2

Course Objective(s)

To make the student understand the basic concepts of mobile application development, be aware of the characteristics of mobile applications, User-interface design, and the basics of graphics and multimedia. To gain knowledge about the testing and publishing of mobile applications.

Course Outcomes

COs	Description
CO1	Demonstrate a foundational understanding of the Android development environment, tools, and basic programming concepts.
CO2	Design and implement user interfaces for iOS applications using essential UI components and event handling.
CO3	Design and implement user interfaces with activities, fragments, navigation drawers, and notifications in Android applications.
CO4	Utilize SQLite for data persistence in Android applications

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	3	3	-	1	-	-	1
CO2	2	3	3	-	1	-	-	1
CO3	2	3	3	-	2	-	-	1
CO4	2	3	3	1	2	-	2	1

Syllabus

Unit 1: Introduction

Overview of Android & iOS
Dalvik/ART runtime
APK structure & Android API levels
Introduction to Android Studio
Project structure, Gradle basics
Creating & running the first Android app

Unit 2: UI/UX

Views, Layouts, Input Controls
Drawable resources
Toasts and basic input events
Advanced UI components:
ListView, GridView
Menus: options, context, sub-menus
Pickers (date/time), Spinners

Unit 3: Navigation and Notifications

Activities, Activity lifecycle
Fragments & Fragment lifecycle
Intents: explicit & implicit
Passing data between activities
Navigation Drawer (concepts + workflow)

Notifications:
Toast
Dialogs (Alert, Date, Time, Progress)
Notification Manager
Push notification concept

Unit 4: Database

Introduction to SQLite database
SQLiteOpenHelper
Creating database & tables
CRUD operations using SQLite
Insert
Update
Delete
Select
Using Cursors
Using SQLite in simple apps

Lab

1. Setting Up the Development Environment
2. Create a basic Android project in Android Studio
3. Write simple Java code to display a message on the screen
4. Run the app on an emulator and understand the debugging process
5. Experiment with different layout components like buttons, text fields, images, etc.
6. Build simple app screens using linear layouts and relative layouts
7. Implement layouts like Grid View and List View
8. Create menus (option menu, context menu)
9. Use pickers (date and time pickers) and spinners
10. Develop a simple app with multiple activities to understand the activity lifecycle
11. Introduce fragments and explore their lifecycle methods
12. Implement communication between activities using explicit and implicit intents
13. Integrate a navigation drawer into an app
14. Display simple notifications using Toast messages
15. Create dialogs with pickers (date/time) and progress bars
16. Explore push notifications (requires additional setup)
17. Set up a local SQLite database using SQLite Open Helper
18. Practice basic database operations: creating tables, inserting data, querying data, updating, and deleting data

Textbooks:

Head first Android Development.

References:

Android Programming: Pushing the Limits, Wiley By Erik Hellman
Android Application Development Black Book, Dreamtech Press, Pradeep Kothari, KLSI

Evaluation Pattern

Assessment	Weightage (%)
Continuous Assessment	70
End Semester Exam	30
Total Marks	100

26CSA302	Algorithms	L-T-P-C:3-0-0-3

Course Objective(s)

- Introduce algorithmic thinking and problem-solving strategies.
- Develop the ability to analyze algorithm efficiency using complexity measures.
- Enable students to design algorithms using standard paradigms.
- Train students to evaluate and compare algorithms based on performance and applicability.

Course Outcomes

COs	Description
CO1	**Analyze** computational problems and express solutions using algorithms and flowcharts
CO2	**Evaluate** algorithms using time and space complexity and asymptotic notations
CO3	**Design** efficient algorithms using iterative and recursive approaches
CO4	**Apply** searching and sorting algorithms and compare their performance
CO5	**Assess** algorithmic strategies to select optimal solutions for given problems

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	2	0	0	0	1
CO2	3	3	2	2	0	0	0	1
CO3	2	3	3	2	0	0	0	1
CO4	2	2	3	2	0	0	0	1
CO5	2	3	2	2	0	0	1	2

Syllabus

Unit I

Algorithms vs Flowcharts, Characteristics of algorithms, Algorithm representation techniques, Time and Space Complexity Best, Average, and Worst-case analysis, Asymptotic Notations: Big-O, Big-Ω, Big-Θ.

Unit II

Algorithm analysis methodology. Analyzing iterative programs. Simple algorithm analysis examples. Comparative analysis of algorithms. Performance measurement techniques

Unit III

Introduction to recursion. Examples: Tower of Hanoi. Factorial, Fibonacci. Analysis of recursive algorithms. Back Substitution method. Master's Theorem. Divide and Conquer approach.

Unit IV

Searching algorithms: Linear Search (analysis), Binary Search (analysis). Sorting algorithms: Bubble Sort, Insertion Sort, Selection Sort, Merge Sort, Quick Sort. Comparative analysis of sorting algorithms.

Unit V

Brute Force technique. Divide and Conquer strategy. Greedy method (introductory examples). Limitations of algorithms and trade-offs.

Text Books

1. Analysis of Algorithms, Jeffrey J McConnel, Jones and Bartlett Publishers, Inc, 2nd Revised edition, 2 November 2007
2. Introduction to the Design and Analysis of Algorithms, Anany Levitin, Third Edition, Pearson Education, 2012
3. Introduction to Algorithms, Thomas H Cormen, Charles E Leiserson, Ronald L Rivest, and Clifford Stein. Third Edition, Prentice-Hall of India Private Limited; 2009.

Evaluation Pattern

Assessment	Weightage (%)
Midterm	25
Continuous Assessment	25
End Semester Exam	50
Total Marks	100

23LSK201	LIFE SKILLS I	L-T-P-C: 1-0-2-2

Pre-requisite: An open mind and the urge for self-development, basic English language skills, knowledge of high school level mathematics.

Course Objective: To assist students in inculcating soft skills, developing a strong personality, empowering them to face life's challenges, improving their communication skills and problem-solving skills.

Course Outcomes

CO1: Soft Skills - To develop greater morale and positive attitude to face, analyze, and manage emotions in real life situations, like placement process.

CO2: Soft Skills - To empower students to create better impact on a target audience through content creation, effective delivery, appropriate body language and overcoming nervousness, in situations like presentations, Group Discussions and interviews.

CO3: Aptitude – To analyze, understand and solve questions in arithmetic and algebra by employing the most suitable methods.

CO4: Aptitude - To investigate and apply suitable techniques to solve questions on logical reasoning.

CO5: Verbal – To infer the meaning of words & use them in the right context. To have a better understanding of the nuances of English grammar and become capable of applying them effectively.

CO6: Verbal - To identify the relationship between words using reasoning skills. To develop the capacity to communicate ideas effectively.

Skills: Communication, self-confidence, emotional intelligence, presentation skills and problem-solving Skills.

Syllabus

Soft Skills

Soft Skills and its importance: Pleasure and pains of transition from an academic environment to work-environment. New-age challenges and distractions. Learning to benefit from constructive criticisms and feedback. Need for change in mindset and up-skilling to keep oneself competent in the professional world.

Managing Self: Knowing oneself, Self-perception, Importance of positive attitude, Building and displaying confidence, Avoiding being overconfident, Managing emotions, stress, fear. Developing Resilience and handling failures. Self-motivation, Self-learning, and continuous knowledge up-gradation / Life-long learning. Personal productivity - Goal setting and its importance in career planning, Self-discipline, Importance of values, ethics and integrity, Universal Human Values.

Communication: Process, Language Fluency, Non-verbal, Active listening. Assertiveness vs. aggressiveness. Barriers in communication. Digital communication

Aptitude

Numbers: Types, Power Cycles, Divisibility, Prime, Factors & Multiples, HCF & LCM, Surds, Indices, Square roots, Cube Roots and Simplification.

Percentage: Basics, Profit, Loss & Discount, and Simple & Compound Interest.

Ratio, Proportion & Variation: Basics, Alligations, Mixtures, and Partnership.

Averages: Basics, and Weighted Average.

Equations: Basics, Linear, Quadratic, Equations of Higher Degree and Problems on ages.

Logical Reasoning I: Blood Relations, Direction Test, Syllogisms, Series, Odd man out, Coding \& Decoding, Cryptarithmetic Problems and Input - Output Reasoning.

Verbal Skills

Vocabulary: Familiarize students with the etymology of words, help them realize the relevance of word analysis and enable them to answer synonym and antonym questions. Create an awareness about the frequently misused words, commonly confused words and wrong form of words in English.

Grammar (Basics): To learn the usage of grammar and facilitate students to identify errors and correct them.

Reasoning: Stress the importance of understanding the relationship between words through analogy questions. Emphasize the importance of avoiding the gap (assumption) in the argument/ statements/ communication.

Speaking Skills: Make students conscious of the relevance of effective communication in today's world through individual speaking activities.

Writing Skills: Introduce formal written communication and keep the students informed about the etiquette of email writing.

References:

1. Gulati. S., (1006) "Corporate Soft Skills", New Delhi, India: Rupa & Co.
2. The hard truth about Soft Skills, by Amazon Publication.
3. Verbal Skills Activity Book, CIR, AVVP
4. Nova's GRE Prep Course, Jeff Kolby, Scott Thornburg & Kathleen Pierce

5. The BBC and British Council online resources
6. Owl Purdue University online teaching resources
7. www.thegrammarbook.com online teaching resources
8. www.englishpage.com online teaching resources and other useful websites
9. Student Workbook: Quantitative Aptitude & Reasoning, Corporate & Industry Relations, Amrita Vishwa Vidyapeetham.
10. Quantitative Aptitude for All Competitive Examinations, Abhijit Guha.
11. How to Prepare for Quantitative Aptitude for the CAT, Arun Sharma.
12. How to Prepare for Data Interpretation for the CAT, Arun Sharma.
13. How to Prepare for Logical Reasoning for the CAT, Arun Sharma.
14. Quantitative Aptitude for Competitive Examinations, R S Aggarwal.
15. A Modern Approach to Logical Reasoning, R S Aggarwal.
16. A Modern Approach to Verbal & Non-Verbal Reasoning, R S Aggarwal.

Evaluation Pattern

Assessment	Internal	External
Continuous Assessment (CA)* – Soft Skills	30	-
Continuous Assessment (CA)* – Aptitude	10	25
Continuous Assessment (CA)* – Verbal	10	25
Total	50	50

*CA - Can be **presentations, speaking activities and tests.**

26CSA381	Algorithms Lab	L-T-P-C:0-0-2-1

Course Objective(s)

- Provide hands-on experience in implementing standard algorithms.
- Enable students to analyze time and space complexity through practical experimentation.
- Develop skills in designing and comparing algorithmic solutions.
- Reinforce recursive and iterative problem-solving techniques.

Course Outcomes

COs	Description
CO1	**Implement** searching and sorting algorithms and analyze their performance
CO2	**Analyze** iterative and recursive algorithms using empirical and theoretical methods
CO3	**Design and implement** algorithms using standard design paradigms
CO4	**Evaluate** algorithm efficiency using asymptotic notation and complexity analysis
CO5	**Apply** algorithmic problem-solving skills to learn advanced computing techniques independently

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	3	2	0	0	0	1
CO2	3	3	2	2	0	0	0	1
CO3	2	3	3	2	1	0	0	1
CO4	3	3	2	2	0	0	1	1
CO5	2	1	2	2	0	0	0	3

Syllabus

- Introduction to algorithm lab environment and problem analysis
- Linear search and binary search – implementation and comparison
- Bubble sort – performance analysis
- Insertion sort and selection sort
- Comparative study of simple sorting algorithms
- Divide and conquer – merge sort
- Quick sort and performance comparison
- Recursion fundamentals – factorial, Fibonacci
- Tower of Hanoi – recursive analysis
- Analysis of iterative vs recursive algorithms
- Back substitution method for recurrence relations
- Master's theorem – practical validation
- Greedy algorithm (basic problems)
- Algorithm optimization case study

Text Books

1. Analysis of Algorithms, Jeffrey J McConnel, Jones and Bartlett Publishers, Inc, 2nd Revised edition, 2 November 2007
2. Introduction to the Design and Analysis of Algorithms, Anany Levitin, Third Edition, Pearson Education, 2012
3. Introduction to Algorithms, Thomas H Cormen, Charles E Leiserson, Ronald L Rivest, and Clifford Stein. Third Edition, Prentice-Hall of India Private Limited; 2009.

Evaluation Pattern

Assessment	Weightage (%)
Continuous Assessment	70
End Semester Exam	30
Total Marks	100

26CSAXXX	Competitive Programming Lab	L-T-P-C:0-1-1-2

Course Objective(s)

- Develop strong algorithmic problem-solving skills through continuous practice.
- Apply efficient algorithms and data structures for solving time-constrained problems.
- Enhance the ability to analyze problem constraints and select optimal solutions.
- Familiarize students with online competitive programming platforms and tools.

Course Outcomes

COs	Description
CO1	**Analyze** problem statements to identify constraints and suitable algorithmic strategies
CO2	**Design** efficient algorithms for computational problems under time and space constraints
CO3	**Implement** optimized solutions using appropriate programming languages and techniques
CO4	**Evaluate** solution efficiency and correctness by testing against diverse input cases
CO5	**Demonstrate** independent learning and adaptability by solving progressively complex problems

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	2	0	0	0	1
CO2	2	3	3	2	0	0	0	1
CO3	3	2	3	2	0	0	0	1
CO4	2	3	2	2	0	0	0	1
CO5	2	1	2	2	0	0	0	3

Syllabus

Introduction to competitive programming and online judges
Input/output optimization and constraints handling
Implementation of basic problem-solving patterns
Searching problems (binary search applications)
Simple sorting-based problems
Mathematical and number-theory basics
Greedy strategy problems
Recursion and backtracking problems
Divide and conquer problem solving
Two-pointer and sliding window techniques
Basic dynamic programming problems
String-processing challenges
Timed contest / mock competition
Problem discussion and optimization techniques

Text Books

1. Competitive Programming 4, Volumes 1 & 2, Competitive Programming Community, 2020 by Steven Halim and Felix Halim.
2. Guide to Competitive Programming: Learning and Improving Algorithms Through Contests, by Antti Laaksonen. Springer, 2017.

Evaluation Pattern

Assessment	Weightage (%)
Continuous Assessment	70
End Semester Exam	30
Total Marks	100

26CSA396	MINOR PROJECT	4 Credits

Course Objectives

- The main objective of the Project is for the students to learn and experience all the major phases and processes involved in solving real-life problems.

Course Outcomes

The major outcome of the minor project must be well-trained students. More specifically, students must have acquired the following skills:

COs	Description
CO1	Able to practice acquired knowledge within the chosen area of technology for project development.
CO2	Identify, discuss, and justify the technical aspects of the chosen project with a comprehensive and systematic approach.
CO3	Reproduce, improve, and refine technical aspects for the projects.
CO4	Work as an individual or in a team in development of technical projects.
CO5	Communicate and report effectively project related activities and findings.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	3	2	-	2	3	1	3
CO2	1	2	2	-	2	1	3	2
CO3	2	2	3	3	2	3	2	3
CO4	1	2	2	-	3	1	2	2
CO5	-	-	-	-	3	-	3	-

Evaluation Pattern

Assessment	Weightage (%)
Continuous Assessment	60
End Semester Exam	40
Total Marks	100

SEMESTER VI

26CSA311 AUTOMATA THEORY AND COMPILER DESIGN L-T-P-C: 3-1-0-4

Course Objective(s)

- Provide an overview of computer science theoretical foundations focusing on formal languages and Automata Theory.
- Introduce the role and importance of compilers in converting computer programs into executable formats.
- Cover the essential areas of computer science required for compiler design, including logic, formalism, mathematics, data structures, algorithms, and programming.
- Outline the stages involved in the design of standard compilers, starting from front-end compilation to back-end processes.

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Course Outcomes

COs	Description
CO1	To Demonstrate a comprehensive understanding of kinds of finite automata and their capabilities.
CO2	Design Finite Automata for different Regular Expressions and Languages, construct context-free grammar for various languages.
CO3	Develop stages of compilation, and lexical Analysis, compare different types of parsers (Bottom-up and Top-down) and construct a parser for a given grammar.
CO4	Perform analysis of syntax directed translation and representations of intermediate code, describe type checking.
CO5	Illustrate code optimization and code generation techniques in the compilation

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	3	3	-	1	-	-	2
CO2	2	3	3	-	1	-	-	2
CO3	2	3	3	-	1	-	-	1
CO4	2	3	3	-	1	-	-	1
CO5	2	3	3	-	1	-	-	1

Syllabus

Unit I

Finite Automata (FA): Introduction, Deterministic Finite Automata (DFA) -Formal definition, simpler notations (state transition diagram, transition table), the language of a DFA. Nondeterministic Finite Automata (NFA)- Definition of the FA, language of an NFA, Equivalence of Deterministic and Nondeterministic Finite Automata, Applications of Finite Automata, Minimization of Deterministic Finite Automata.

Unit II

Regular Expressions (RE): Introduction, Identities of Regular Expressions, Finite Automata and Regular Expressions- Converting from DFA's to Regular Expressions, Converting Regular Expressions to Automata, Context Free Grammar (CFG): Derivation Trees, Sentential Forms, Rightmost and Leftmost derivations of Strings.

Unit III

Introduction To Compilers: Definition of compiler, interpreter and its differences, the phases of a compiler, role of lexical analyzer, regular expressions, finite automata, from regular expressions to finite automata. Parsing: Parsing, the role the of parser, context free grammar, derivations, parse trees, elimination of left recursion, left factoring, predictive parsers, LL(1) grammars. Bottom Up Parsing: Definition of bottom-up parsing, LR grammars, LR parsers-simple LR, canonical LR(CLR) and Look Ahead LR (LALR) parsers, error recovery in parsing, parsing ambiguous grammars.

Unit IV

Syntax Directed Translation: Syntax directed definition, construction of syntax trees, S-attributed and L-attributed definitions, translation schemes. Intermediate Code Generation: intermediate forms of source programs– abstract syntax tree, polish notation and three address code, Type Checking: Definition of type checking, type expressions, type systems.

Unit V

Code Optimization: Organization of code optimizer, basic blocks and flow graphs, optimization of basic blocks, the principal sources of optimization, the directed acyclic graph (DAG) representation of basic block, and global data flow analysis. Code Generation: Machine dependent code generation, object code forms, the target machine, a simple code generator, register allocation and assignment, peephole optimization.

Textbooks:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman (2007), Introduction to Automata Theory Languages and Computation, 3rdedition, Pearson Education, India.
2. Alfred V.Aho, Monica S. Lam, Ravi Sethi and Jeffrey D. Ullman, "Compilers: Principles, Techniques and Tools", Prentice Hall, Second Edition, 2006.

References:

1. Martin, John C., Introduction to Languages and the Theory of Computation, 3rd ed., Tata McGraw Hill Education Private Limited.
2. Keith Cooper and Linda Torczon, "Engineering a Compiler", Second Edition, Morgan Kauffmann, 2011.
3. Andrew W. Appel and Jens Palsberg, "Modern Compiler Implementation in Java", Cambridge University Press, Second Edition, 2002.
4. Tremblay and Sorenson, The Theory and Practice of Compiler Writing, Tata McGraw Hill & Company.

Evaluation Pattern

Assessment	Weightage (%)
Midterm	25
Continuous Assessment	25
End Semester Exam	50
Total Marks	100

26CSA399	MAJOR PROJECT	6 Credits

Course Objectives

- To allow students to develop their own ideas and get experienced in industrial and research projects.
- It provides an opportunity in solving a real life problem by applying the knowledge gained through various courses of study and an exposure on different phases of software /system development life cycle.

Course Outcomes

The major outcome of the major project must be well-trained students. More specifically students must have acquired the following skills:

COs	Description
CO1	Able to practice acquired knowledge within the chosen area of technology for project development.
CO2	Identify, discuss, and justify the technical aspects of the chosen project with a comprehensive and systematic approach.
CO3	Reproduce, improve, and refine technical aspects for the projects.
CO4	Work as an individual or in a team in development of technical projects.
CO5	Communicate and report effectively project related activities and findings.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	3	2	-	2	3	1	3
CO2	1	2	2	-	2	1	3	2
CO3	2	2	3	3	2	3	2	3
CO4	1	2	2	-	3	1	2	2
CO5	-	-	-	-	3	-	3	-

Evaluation Pattern

Assessment	Weightage (%)
Continuous Assessment	60
End Semester Exam	40
Total Marks	100

MATHEMATICS FOR COMPUTING

26MAT131	ALGEBRA AND NUMBER THEORY	L-T-P-C: 3-1-0-4

Course Objective(s)

- Understand the fundamentals of group theory.
- Familiarize yourself with the theorems of divisibility, congruence, Fermat and Wilson.
- Learn the concepts of vector spaces, linear transformations, eigen values, and eigen vectors.
- Learn to implement the concepts of eigen values, diagonalisation, inner product space, orthogonality, projection, and decomposition.

Course Outcomes

COs	Description
CO1	Develop the concepts of group theory.
CO2	Analyse divisibility theory, basic properties of congruences, and different theorems on modular algorithms.
CO3	Acquire the knowledge of vector spaces and subspaces to implement linear transformation rules.
CO4	Implement diagonalisation using eigen values and vectors.
CO5	Apply the concept of inner product spaces, projection, and decomposition to determine orthogonality and reduce dimensionality.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	-	-	-	-	1
CO2	3	3	3	-	-	-	-	1
CO3	3	3	3	-	-	-	-	1
CO4	3	3	3	-	-	-	-	1
CO5	3	3	3	-	-	-	-	1

Syllabus

Unit I

Definition of Groups, Basic Examples - Symmetric Groups, Matrix Groups, Subgroups, Cyclic Group and Factor Groups; Normal Subgroups; Quotients of Groups; Homomorphisms, Automorphisms; Cayley's Theorem, Permutation Groups.

Unit II

Divisibility theory and congruences: Division algorithm, Greatest Common Divisor, Euclidean algorithm, Extended Euclidean algorithm. Basic propertiesof congruences, Binary and decimal representation of integers, Linear congruences and Chinese Remainder Theorem. Fermat's Theorem and its Generalization, Fermat's Little theorem, Wilson's theorem.

Unit III

Vector space - Vector spaces, Sub spaces, Linear independence, Basis, Dimension, Finite dimensional vector space, null and column space; Linear Transformations

Unit IV

Problems in Eigen Values and Eigen Vectors, Diagonalization, Orthogonal Diagonalization, Quadratic Forms, Diagonalizing Quadratic Forms.

Unit V

Inner Products, Angle and Orthogonality in Inner Product Spaces, Length of a Vector, Schwarz Inequality, Orthogonal Vectors, Orthogonal Complement, Orthogonal Bases: Gram-Schmidt Process; Decomposition-LU-Decompositions-The Power Method- QR method- SVD- Data Compression Using Singular Value Decomposition

Textbooks:

1. Gilbert Strang,' Linear Algebra and its Applications, Fourth Edition, Cengage Learning, 2014
2. Howard Anton and Chris Rorres, 'Elementary Linear Algebra', 9th Edition, Wiley, 2005.
3. David M. Burton, Elementary Number Theory (7th edition), McGraw Hill Education (India)

References:

1. John B. Fraleigh, 'A First Course in Abstract Algebra', Narosa Publishing House, 2003.
2. Joseph A. Gallian, 'Contemporary Abstract Algebra', Cengage Learning, 2013.
3. David C. Lay, Linear Algebra and its Applications, Pearson

Evaluation Pattern

Assessment	Weightage (%)
Midterm	25
Continuous Assessment	25
End Semester Exam	50
Total Marks	100

26MAT132	MATHEMATICAL FOUNDATION	L-T-P-C: 3-1-0-4

Course Objective(s)

- Understand the preliminary concept of operation on sets and mathematical logic.
- Understand the fundamental aspects of number theory.
- Learn different types of matrices, their properties, and operations.
- Familiarize yourself with the fundamentals of differential equations.
- Familiarize yourself with the fundamentals of differential calculus.

Course Outcomes

COs	Description
CO1	Implement set theory, mathematical logic, and different types of statements.
CO2	Develop the concepts of number theory.
CO3	Apply various matrix operations and Caley Hamilton theorem on different types of matrices to determine the rank.
CO4	Apply the concept of separations of variables to determine first and second-order differential equations.
CO5	Develop the basic concepts of limits and derivatives.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	-	-	-	-	1
CO2	3	3	3	-	-	-	-	1
CO3	3	3	3	-	-	-	-	1
CO4	3	3	3	-	-	-	-	1
CO5	3	3	3	-	-	-	-	1

Syllabus

Unit 1

Basic concepts of set theory and operations on sets - Mathematical logic – statements – connectives - negation, conjunction, disjunction - conditional and bi-conditional statements –Truth tables - tautology – contradiction – equivalence law – Predicates, Quantifiers, & Arguments.

Unit 2

Matrix Algebra-Introduction-Types of matrices-matrix operations- transpose of a matrix -determinant of matrix - inverse of a matrix- Cramer's rule - normal form-echelon form- finding rank of a matrix -Cayley Hamilton theorem.

Unit 3

Number theory: Divisibility- Primality Testing. GCD- Properties of the Greatest Common Divisor- Euler's Theorem - Euclid's Algorithm-Extended Euclid's Algorithm. The Fundamental Theorem of Arithmetic. The Prime Number Theorem. Modular Arithmetic- Congruence - Arithmetic with a Prime Modulus- Multiplicative Inverses- Fermat's Little Theorem- Chinese Remainder Theorem.

Unit 4

Differential calculus - Functions and limits - Simple Differentiation of Algebraic Functions — Evaluation of First and Second Order Derivatives – Maxima and Minima

Unit 5

Differential Equations: Introduction to differential equations – Separation of Variables – First order differential equations - Second order constant coefficient homogeneous linear equations.

Textbooks:

1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", Tata McGraw- Hill Publishing Company Limited, New Delhi, Sixth Edition, 2007.
2. P.R.Vittal-Business Mathematics and Statistics, Margham Publications, Chennai.
3. Stewart 2015, CALCULUS: Early Transcendentals, 8th Edition, Cengage learning, India.

References:

1. Liu, "Elements of Discrete Mathematics", Tata McGraw- Hill Publishing Company Limited, 2004.
2. Gilbert Strang, "Linear Algebra and its Applications", Third Edition, Harcourt College Publishers, 1988.

Evaluation Pattern

Assessment	Weightage (%)
Midterm	25
Continuous Assessment	25
End Semester Exam	50
Total Marks	100

26MAT133	ADVANCED MATHEMATICAL FOUNDATION	L-T-P-C: 3-1-0-4

Course Objective:

- Learn different types of relations, functions, and their properties.
- Familiarize yourself with the advanced counting techniques and graph theory.
- Understand the fundamentals of group theory.
- Learn to implement the concepts of linear transformation, eigenvalues, diagonalization, and inner product.

Course Outcomes:

COs	Description
CO1	Implement various relations, functions, and their properties.
CO2	Solve linear recurrence relations using the divide and conquer algorithm and inclusion-exclusion principle.
CO3	Determine the basic characteristics of graph theory and its real-life applications.
CO4	Develop the concepts of group theory.
CO5	Implement linear transformation rules and the concept of inner product.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	-	2	-	-	1
CO2	3	3	3	-	2	-	-	1
CO3	3	3	3	-	2	-	-	1
CO4	3	3	3	-	1	-	-	1
CO5	3	3	3	-	2	-	-	1

Syllabus:

Unit 1

Relations and Their Properties - Representing Relations, Closure of Relations, Partial Ordering, Equivalence Relations and partitions, Functions- definition, types, and composition.

Unit 2

Counting Techniques: Basic countings, Permutation and Combination – Advanced Countings, Recurrence Relations, Generating Functions, Solving linear homogeneous Recurrence Relations, Divide and Conquer algorithm, Inclusion-Exclusion.

Unit 3

Graph Theory - Graphs and subgraphs, isomorphism, matrices associated with graphs, degrees, walks, connected graphs, Euler and Hamilton Graphs: Graph coloring, shortest path algorithm, Chinese-postman problem, approximate solutions of traveling salesman problem.

Unit 4

Group theory: Binary Operations, Definition of Groups, Proparties of Groups, Basic Examples , Subgroups, Cyclic Group, Lagrange's Theorem.

Unit 5

Linear Transformations: Reflection, Dilation, Shearing, Eigen values and vectors, Inner Products.

Textbooks:

1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", Tata McGraw- Hill Publishing Company Limited, New Delhi, Sixth Edition, 2007.
2. I N. Herstein, 'Topics in Algebra', Second Edition, John Wiley and Sons, 2000.
3. Gilbert Strang,' Linear Algebra and its Applications, Fourth Edition, Cengage Learning, 2014
4. Howard Anton and Chris Rorres, 'Elementary Linear Algebra', 9th Edition, Wiley, 2005.

References:

1. R.P. Grimaldi, "Discrete and Combinatorial Mathematics", Pearson Education, Fifth Edition, 2007.
2. Liu, "Elements of Discrete Mathematics", Tata McGraw- Hill Publishing Company Limited, 2004.
3. John B. Fraleigh, 'A First Course in Abstract Algebra', Narosa Publishing House, 2003.

Evaluation Pattern

Assessment	Weightage (%)
Midterm	25
Continuous Assessment	25
End Semester Exam	50
Total Marks	100

26MAT134	LINEAR ALGEBRA	L-T-P-C: 3-1-0-4

Course Objective(s)

- Understand matrix operations, system of linear equations, and the solution mechanisms.
- Familiarize yourself with the basic concepts of vector spaces, subspaces, basis, and dimension.
- Apply linear transformation rules in different aspects related to kernel, range, and change of basis.
- Learn to implement the concepts of eigen values, diagonalisation, inner product space, orthogonality, projection, and decomposition.

Course Outcomes

COs	Description
CO1	Develop the concepts of system of linear equations, rank of matrix, and solution methods for a system of linear equations.
CO2	Learn vector spaces and subspaces to determine basis, dimension, and linear independency.
CO3	Implement linear transformation rules to obtain kernel and range of a transformation.
CO4	Implement diagonalisation using eigen values and vectors.
CO5	Apply the concept of inner product spaces and projection to determine orthogonality.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	-	-	-	-	1
CO2	3	3	2	-	-	-	-	1
CO3	3	3	2	-	-	-	-	1
CO4	3	3	2	-	-	-	-	1
CO5	3	3	2	-	-	-	-	1

Syllabus

Unit 1

Linear Systems and Matrix Operations - System of Linear equations, Row reduction and echelon form, Rank of a matrix by row echelon form, Gauss elimination, Inverse of a matrix by Gauss Jordan, LU decomposition

Unit 2

Vector space - Vector spaces, Sub spaces, Linear independence, Basis, Dimension, Finite dimensional vector space, null and column space

Unit 3

Linear Transformations - Linear transformation, Relation between matrices and linear transformations, Kernel and range, Change of basis, Nilpotent transformations

Unit 4

Eigen values and Eigen vectors - Eigen Values and Eigen Vectors, Diagonalization, Orthogonal Diagonalization, Quadratic Forms, Diagonalizing Quadratic Forms; Similarity of linear transformations -Diagonalization and its applications.

Unit 5

Inner Product Spaces - Inner products, Orthogonality, Orthogonal complements, Orthonormality, Projection on subspace, Gram Schmidt Process, Least Square Principle, QR Decomposition

Textbooks:

1. Howard Anton and Chris Rorrs, “Elementary Linear Algebra”, Ninth Edition, John Wiley & Sons, 2000.
2. D C Lay, S R Lay and JJ McDonald, Linear Algebra and its Applications, Pearson India, Fifth edition.

References:

1. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
2. Gilbert Strang, “Linear Algebra and its Applications”, Third Edition, Harcourt College Publishers, 1988.

Evaluation Pattern

Assessment	Weightage (%)
Midterm	25
Continuous Assessment	25
End Semester Exam	50
Total Marks	100

26MAT135	STATISTICAL AND NUMERICAL METHODS	L-T-P-C: 3-1-0-4

Course Objective(s)

- Understand the basic measures of central tendency and dispersion.
- Learn the fundamentals of correlation and regression analysis.
- Understand the preliminary concept of probability and different types of probability distribution.
- Familiarize yourself with different interpolation methods and various numerical techniques to find the solution of equation and simultaneous linear equations.

Course Outcomes

COs	Description
CO1	Develop the concepts of descriptive statistics by employing measures of central tendency and dispersion.
CO2	Apply the concepts of correlation and regression in various problems.
CO3	Develop the fundamental concept of probability theory and distribution functions.
CO4	Implement different interpolation methods.
CO5	Determine the solutions of an equation by bisection and Newton Raphson method and simultaneous linear equations by Gauss Elimination methods.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	-	-	1	-	-	-	-	-
CO2	3	3	3	2	-	-	1	-	-	-	-	-
CO3	3	3	3	2	-	-	1	-	-	-	-	-
CO4	3	3	3	2	-	-	1	-	-	-	-	-
CO5	3	3	3	2	-	-	1	-	-	-	-	-

Syllabus

Unit 1

Statistics-Introduction - Measures of central tendency – AM, Median, Mode, Measures of dispersion and its coefficients – range, QD, SD, MD.

Unit 2

Correlation- Karl Pearson's and Spearman's rank correlation, Regression- regression equations, regression coefficients, Method of least squares – fitting of a straight line.

Unit 3

Introduction to Probability - addition theorem, multiplication theorem, independent events, conditional probability, Baye's theorem, Probability distribution - Binomial, Poisson, Normal.

Unit 4

Interpolation- Newton's forward &backward method- Lagrange's Method.

Unit 5

Solutions of Numerical, Algebraic and transcendental methods- bisection method, Newton Raphson method, Simultaneous linear equations -Gauss elimination.

Textbooks:

1. P.R.Vittal-Business Mathematics and Statistics, Margham Publications, Chennai,
2. M.K.Venkataraman: Numerical methods in Science and Engineering-National Publishing Company, Chennai

References:

1. Ross S.M., Introduction to Probability and Statistics for Engineers and Scientists, 3rd edition, Elsevier Academic Press.
2. S.A. Mollah, Numerical Analysis and Computational Procedures, 5th edition, Books & Allied Ltd

Evaluation Pattern

Assessment	Weightage (%)
Midterm	25
Continuous Assessment	25
End Semester Exam	50
Total Marks	100

Electives – 3 Credits

AI & DS Stream

26CSA331	Python for AI and DS	L-T-P-C:2-0-2-3

Course Objective(s)

- Equip students with Python workflows for AI/DS: environments, notebooks, packages, and reproducibility.
- Analyze and transform real-world datasets using NumPy/pandas for downstream ML.
- Design and implement EDA and visualization using matplotlib/seaborn to derive insights.
- Construct preprocessing pipelines (scikit-learn) for robust model-ready datasets; use baseline models at API level.

Course Outcomes

COs	Description
CO1	Analyze AI/DS tasks and design Python-based data workflows
CO2	Implement data ingestion, cleaning, reshaping, and feature engineering with NumPy/pandas.
CO3	Develop insightful EDA and visualize patterns using matplotlib/seaborn.
CO4	Construct preprocessing pipelines and evaluate baseline models using standard metrics

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	3	1	0	0	2
CO2	3	2	2	3	0	0	1	1
CO3	2	2	2	2	1	0	0	1
CO4	2	3	3	3	0	0	1	1

Syllabus

Unit I

Python DS Foundations. Environments (venv/conda), Jupyter/VS Code, reproducibility (seeds), notebooks as reports. Python refresher (brief): iterables, comprehensions, functions, modules. NumPy arrays: vectorization, broadcasting, indexing, performance notes.

Unit II

Data Wrangling with pandas. DataFrames/Series; read/write (CSV/Excel/JSON); datetime and categorical data. Cleaning: missing values, outliers (IQR/percentiles), type conversion, joins/merge, reshape (melt/pivot)Feature engineering: binning, scaling (concept), encoding (one-hot/ordinal at API level).

Unit III

EDA & Visualization. Descriptive statistics, distributions, correlations, groupby/aggregation. matplotlib & seaborn: hist, kde, box/violin, pairplot, heatmap, catplots. Communicating insights: labeling, aesthetics, dashboards.

Unit IV

Preprocessing Pipelines & Baselines. Train/test split; leakage pitfalls. scikit-learn: Pipeline, ColumnTransformer, scalers, encoders. Baseline models (API-level only; no theory): Linear/Logistic (fit/predict), k-NNMetrics usage (definitions only): MAE/MSE/R^2; accuracy, precision, recall, F1, ROC-AUC.

Lab Syllabus

- Setup env + notebook hygiene + Git; NumPy warm-up
- pandas I/O & data cleaning (missing, types)
- pandas transforms (merge, reshape, groupby)
- Feature engineering (encoding, binning, scaling via API)
- EDA I: distributions, summary stats, correlation heatmaps
- EDA II: categorical vs numeric visualizations, pairplots
- Train/test split; data leakage demo
- Pipelines & ColumnTransformer (numeric + categorical)
- Baseline regression (fit/predict; residual plots; MAE/MSE/R^2)
- Baseline classification (confusion matrix; precision/recall/F1/ROC)
- Model selection via simple CV (API use only)

Text Books

1. Wes McKinney, Python for Data Analysis, 3e, O'Reilly.
2. Jake VanderPlas, Python Data Science Handbook, O'Reilly.

Evaluation Pattern

Assessment	Weightage (%)
Midterm	20
Continuous Assessment	50
End Semester Exam	30
Total Marks	100

26CSA332	Introduction to Neural Networks	L-T-P-C:3-0-0-3

Course Objective(s)

- Introduce the biological inspiration and mathematical foundations of neural networks.
- Develop an understanding of basic neuron models and learning rules.
- Enable students to analyze single-layer and multi-layer neural network architectures.
- Explain training mechanisms, convergence issues, and limitations of neural networks.
- Provide a conceptual foundation for advanced neural and deep learning courses

Course Outcomes

COs	Description
CO1	**Analyze** the biological and mathematical basis of artificial neural networks
CO2	**Explain and evaluate** neuron models and learning rules
CO3	**Analyze** single-layer and multi-layer neural network architectures
CO4	**Evaluate** training algorithms, convergence behavior, and generalization issues
CO5	**Assess** the suitability and limitations of neural networks for real-world problems

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	1	1	0	0	0	1
CO2	3	3	2	1	0	0	0	1
CO3	3	3	2	2	0	0	0	1
CO4	2	3	3	2	0	0	0	1
CO5	2	2	2	1	0	0	1	2

Syllabus

Unit I

Biological neurons and brain inspiration. Artificial neuron concept. McCulloch–Pitts neuron model. Threshold logic units. Linear separability.

Unit II

Learning paradigms: Supervised learning, Unsupervised learning. Hebbian learning rule. Perceptron learning algorithm. Adaline and LMS rule. Limitations of single-layer perceptrons.

Unit III

Multi-Layer Neural Networks. Need for hidden layers. Multi-Layer Perceptron (MLP) architecture. Activation functions: Sigmoid, Tanh, ReLU (conceptual introduction only). Network capacity and representation power.

Unit IV

Training Neural Networks. Error functions. Backpropagation algorithm (conceptual and mathematical overview). Gradient descent learning. Learning rate, momentum. Convergence behavior. Overfitting and generalization.

Unit V

Pattern classification. Function approximation. Associative memory. Hopfield networks (intro). Limitations of neural networks: Local minima. Interpretability. Data dependency. Ethical considerations in neural decision systems.

Text Books

1. Neural Networks and Learning Machines, 3rd Edition by Simon Haykin. Pearson, 2009.
2. Artificial Neural Networks by B. Yegnanarayana. PHI Learning, 2009.

Evaluation Pattern

Assessment	Weightage (%)
Midterm	25
Continuous Assessment	25
End Semester Exam	50
Total Marks	100

26CSA333	Foundations of Data Science	L-T-P-C:2-0-2-3

Course Objective(s)

- Introduce students to data-centric thinking and the end-to-end data science lifecycle.
- Develop the ability to understand, interpret, and contextualize data from multiple sources.
- Enable learners to prepare, explore, and validate data quality for downstream analytics.
- Build skills in communicating insights using data narratives and visual reasoning.
- Create awareness of ethical, legal, and societal aspects of data usage.

Course Outcomes

COs	Description
CO1	**Analyze** real-world problems to identify data requirements, sources, and constraints
CO2	**Examine and validate** datasets for structure, quality, and suitability for analysis
CO3	**Apply** data preparation and exploratory reasoning techniques to derive meaningful insights
CO4	**Evaluate** data-driven findings and communicate them effectively using visual and narrative methods
CO5	**Assess** ethical, legal, and societal implications in the collection and use of data

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	3	2	1	0	0	0	1
CO2	2	3	2	1	0	0	1	1
CO3	2	3	3	2	1	0	0	1
CO4	1	2	2	2	2	0	0	1
CO5	1	2	1	1	0	0	3	2

Syllabus

Unit I

What is Data Science? Data-driven decision making vs intuition. Roles in a data science team. Data science lifecycle: Problem framing, Data understanding, Insight generation, Action and feedback. Use cases across domains (health, finance, cyber, governance).

Unit II

Types of data: Structured, semi-structured, unstructured. Data formats: Tabular, text, logs, time-series, images (conceptual). Data sources: Sensors, surveys, transactions, APIs, open data. Data acquisition challenges. Data ownership and provenance.

Unit III

Importance of data quality. Common data quality issues: Missing values, Inconsistencies, Duplicates, Noise and bias. Data cleaning concepts (logic-level, not coding-heavy). Data labeling and annotation. Data documentation and metadata.

Unit IV

Exploratory reasoning vs confirmatory analysis. Pattern recognition in data (non-statistical). Correlation vs

causation (conceptual pitfalls). Data visualization principles: Choosing the right chart, Misleading visualizations.

Unit V

Data privacy and consent. Personal Identifiable Information (PII). Algorithmic bias from data. Fairness, transparency, accountability. Legal and regulatory awareness (intro level). Responsible use of data in AI systems.

Lab Syllabus

- Understanding datasets and problem contexts
- Identifying data types and data sources
- Exploring dataset structure and metadata
- Data quality assessment (missing, duplicates)
- Data cleaning strategies (logical steps)
- Dataset versioning and documentation
- Basic exploratory summaries (non-statistical)
- Visualization for understanding data patterns
- Identifying misleading visualizations
- Correlation vs causation case studies
- Data storytelling exercise
- Ethics case study: biased datasets
- Privacy and anonymization discussion

Text Books:

1. Data Literacy: A User's Guide, Routledge, 2020 by Kathy Schrock
2. Doing Data Science, O'Reilly Media, 2013, by Cathy O'Neil and Rachel Schutt

Evaluation Pattern

Assessment	Weightage (%)
Midterm	20
Continuous Assessment	50
End Semester Exam	30
Total Marks	100

26CSA334	Applied Statistics for Data Science	L-T-P-C: 3-0-0-3

Course Objective(s)

- Understand the basic mechanisms of descriptive statistics
- Familiarize yourself with inferential statistics by studying the estimation theory and hypothesis testing

Course Outcomes:

COs	Description
CO1	Implement various methods of descriptive statistics using central tendency, dispersion, skewness, kurtosis, correlation and regression analysis, and least squares.
CO2	Apply the estimation theory to obtain maximum likelihood estimator, moments, and confidence interval.
CO3	Explain the importance of estimating the parameters and testing of hypotheses for both small and large samples.
CO4	Apply statistical testing for various data sets.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	3	2	-	0	0	0	1
CO2	2	3	2	-	0	0	1	1
CO3	2	3	3	-	1	0	0	1
CO4	1	2	2	-	2	0	0	1
CO5	1	2	1	-	0	0	3	2

Syllabus:

Unit 1

Introduction to Statistics: Definition, importance in ML, and types of data (Nominal, Ordinal, Interval, Ratio), Measures of Central Tendency (Mean, Median, Mode), Measures of Dispersion (Range, Quartile Deviation, Variance, Standard deviation,), skewness and kurtosis, Correlation and Regression analysis, Method of least squares, Coefficient of determination

Unit 2

Estimation theory - Point Estimation: criteria of point estimation, method of maximum likelihood estimation and method of moments, Interval Estimation: Introduction – confidence Interval for mean of a Normal Distribution with Variance known and unknown – Confidence Interval for the two means of a Normal Distribution with Variance known and unknown, Confidence interval for one and two Population Proportions

Unit 3

Hypothesis testing – large sample tests for single mean and two means – large sample tests for single proportion and two proportions, small sample tests for single mean and two means – paired t-test – test for single variance – test for equality of two variances

Unit 4

Chi-square goodness of fit for Binomial, Poisson and Normal distributions, Independence of attributes

Textbooks:

1. Douglas C. Montgomery and George C. Runger, Applied Statistics and Probability for Engineers, John Wiley and Sons Inc., 2005
2. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, Probability and Statistics for Engineers and Scientists, 8th Edition, Pearson Education Asia, 2007.
3. Gupta, S. C. and Kapoor, V.K., Fundamentals of Applied Statistics, 4th Edition (Reprint), Sultan Chand & Sons, 2008

References:

1. Ross S.M., Introduction to Probability and Statistics for Engineers and Scientists, 3rd edition, Elsevier Academic Press.
2. Ravichandran, J. Probability and Statistics for engineers, First Reprint Edition, Wiley India, 2012.

Evaluation Pattern

Assessment	Weightage (%)
Midterm	25
Continuous Assessment	25
End Semester Exam	50
Total Marks	100

26CSA335	Computer Vision Basics	L-T-P-C:2-0-2-3

Course Objective(s)

- Introduce the fundamental principles of computer vision and image understanding.
- Explain digital image representation, acquisition, and transformations.
- Enable students to analyze and apply classical image processing techniques.
- Develop understanding of feature extraction and traditional vision algorithms.

Course Outcomes

COs	Description
CO1	**Analyze** the process of image formation and digital image representation
CO2	**Apply** image enhancement and transformation techniques to improve visual information
CO3	**Analyze and extract** meaningful features from images using classical methods
CO4	**Evaluate** traditional computer vision techniques for detection and recognition tasks
CO5	**Assess** the limitations, ethical concerns, and real-world challenges of computer vision systems

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	1	1	0	0	0	1
CO2	3	3	2	2	0	0	0	1
CO3	3	3	2	2	0	0	0	1
CO4	2	3	3	2	0	0	1	1
CO5	1	2	1	1	0	0	3	2

Syllabus

Unit I

Introduction to Computer Vision and Image Representation. What is Computer Vision? Human vision vs computer vision. Applications of computer vision. Image acquisition and sensors

Digital image representation: Pixels, Resolution, Bit depth. Color models: Grayscale, RGB, HSV. Image file formats.

Unit II

Image enhancement: Contrast stretching, Histogram equalization. Image filtering: Mean, median filters, Gaussian smoothing. Noise models (conceptual): Salt & pepper, Gaussian noise. Image transformations: Scaling, Rotation.

Unit III

Edge detection: Gradient concept, Sobel and Prewitt operators, Canny edge detection (conceptual). Thresholding techniques. Region-based segmentation. Morphological operations: Dilation, Erosion.

Unit IV

Feature detection and description. Template matching. Shape representation and contours

Object detection using classical techniques (rule-based).

Unit V

Classical vision applications: Face detection (Haar-like features – overview). Motion detection (frame

differencing) Challenges in computer vision: Illumination, Occlusion, Scale and viewpoint, Privacy, surveillance, and ethical issues, Limitations of traditional computer vision.

Lab Syllabus

- Image reading, display, and pixel operations
- Color space conversions
- Image enhancement techniques
- Noise addition and filtering
- Histogram analysis and equalization
- Spatial transformations
- Edge detection using Sobel/Prewitt
- Canny edge detection
- Thresholding and segmentation
- Morphological operations

Text Books

1. Computer Vision: Algorithms and Applications, by Richard Szeliski. Springer.
2. Digital Image Processing, 4th Edition, by Rafael C. Gonzalez and Richard E. Woods. Pearson

Evaluation Pattern

Assessment	Weightage (%)
Midterm	20
Continuous Assessment	50
End Semester Exam	30
Total Marks	100

26CSA336	ETHICS AND DATA PRIVACY	L-T-P-C: 3-0-0-3

Course Objective(s)

1. Understand the foundational ethical theories, including utilitarianism, deontology, and virtue ethics, and apply them to analyze ethical considerations in handling personal and sensitive data.
2. Analyze the ethical implications of various data collection methods, such as surveillance and data mining, and assess the privacy concerns arising from data processing techniques like profiling and data analytics.
3. Examine the legal and regulatory frameworks governing data privacy, including international and national data protection laws, and evaluate the compliance requirements for organizations handling personal data.
4. Develop ethical decision-making skills in data-driven environments by exploring ethical frameworks for decision making in data science and analytics and assessing the ethical implications of artificial intelligence and machine learning technologies.

Course Outcomes

COs	Description
CO1	Understand ethical theories such as utilitarianism, deontology, and virtue ethics.
CO2	Evaluate the ethical implications of various data collection methods like surveillance and data mining.
CO3	Apply ethical frameworks to guide decision-making in data science and analytics.
CO4	Recognize the importance of ethics and corporate social responsibility in data-driven organizations.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	-	-	-	-	2	-
CO2	3	3	-	-	-	-	2	-
CO3	3	3	2		-	-	-	-
CO4	3	3	-	2	-	-	-	-

Syllabus

Unit-1 Introduction to Ethics and Data Privacy:
Overview of ethical theories -utilitarianism, deontology, virtue ethics, Introduction to data privacy concepts and regulations- GDPR, CCPA, Ethical considerations in handling personal and sensitive data.

Unit: 2 Ethical Issues in Data Collection and Processing:
Ethical implications of data collection methods-surveillance, data mining, Privacy concerns in data processing-profiling, data analytics.
Legal and Regulatory Frameworks: Overview of international and national data protection laws, Compliance requirements for organizations handling personal data.

Unit 3: Ethical Decision Making in Data-Driven Environments and Privacy Engacing Practices:
Ethical frameworks for decision making in data science and analytics, Ethical considerations in algorithm development and deployment Ethical implications of artificial intelligence and machine learning technologies.
Privacy-Enhancing Technologies and Practices- Overview of privacy-enhancing technologies (PETs), Best practices for implementing privacy-by-design principles

Unit 4: Ethical Leadership,Corporate Responsibility,Emerging Issues and Future Trends: Role of ethics and corporate social responsibility (CSR) in data-driven organizations, Ethical leadership in promoting transparency, accountability, and trust. Exploration of emerging ethical issues in data privacy in IoT and biometrics, Ethical considerations in the era of big data, IoT, and ubiquitous computing.
Textbook

1. "Ethics for the Information Age" by Michael J. Quinn
2. "Data and Goliath: The Hidden Battles to Collect Your Data and Control Your World" by Bruce Schneier
3. "Privacy in Context: Technology, Policy, and the Integrity of Social Life" by Helen Nissenbaum

Reference

1. "Privacy on the Ground: Driving Corporate Behavior in the United States and Europe" by Kenneth A. Bamberger and Deirdre K. Mulligan
2. "The Ethics of Information Technology and Business" edited by Richard T. De George and Joseph R. Varner
3. "Privacy in the Age of Big Data: Recognizing Threats, Defending Your Rights, and Protecting Your Family" by Theresa M. Payton and Ted Claypoole

Evaluation Pattern

Assessment	Weightage (%)
Midterm	25
Continuous Assessment	25
End Semester Exam	50
Total Marks	100

26CSA337	DATA GOVERNANCE	L-T-P-C: 3-0-0-3

Course Objective(s)

- Delving into Data Governance aids individuals in comprehending the laws and regulations dictating data management. It enables them to devise and execute policies and procedures ensuring adherence to compliance standards.
- Engaging in Data Governance empowers individuals with the expertise required to effectively manage data across its lifecycle, encompassing collection, utilization, and disposal phases. Furthermore, it equips them with data management tools and methodologies aimed at enhancing data quality and consistency.

Course Outcomes

COs	Description
CO1	Comprehend the necessity of Data Governance within organizations and analyse how organizational culture influences Data Governance practices and articulate the challenges associated with implementing Data Governance
CO2	Identify the various types of assets that require governance and Assess different data models and their implications on Data Governance.
CO3	Analyse the relationship between data stewardship and Data Governance and understand the types of data stewardship roles and responsibilities within organizations.
CO4	Develop a framework for successful Data Governance strategies and understand the importance of information exchanges in Data Governance implementations.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	-	-	-	2	-	2	-
CO2	3	-	-	-	-	-	2	2
CO3	-	3	-	-	-	-	2	2
CO4	-	-	3	-	-	-	2	-

Syllabus

Unit 1

Data Governance -The Need for Data Governance - How Data Governance fits into Organizational Strategy Data Governance Maturity Models -Data Governance Life Cycle - how to Manage Risk with Data Governance - Or- ganizational Culture Affects Data Governance - Articulate the Challenges of Data Governance

Unit 2

Metadata Framework - Evaluate and Explain Master Data Management - Types of Assets that Require Governance - Analyze and Describe Metadata Use for Data Governance - Evaluate the Varying Data Models and Their Bearing on Governance Regulatory and Operational Risk Through Data Governance - The Relationship Between IT and Business in an Organization - Information Governance Framework Optimize Performance with Data Governance - Formal Structure Impacts Data Governance - Create a Data Governance Document that Describes the Business Need for Data Governance

Unit 3

Data Stewardship and Governance – How they fit together – Types of data stewardship – Roles and responsibilities

Unit 4

- Application of Data Governance in Business - Challenges of Data Governance in a Big Data world - Frame- work for successful Data Governance strategies - Information Exchanges

References

1. Data Governance: Creating Value from Information Assets, Neera Bhansali, 2013. Auerbach Publications, ISBN: 978-1439879139.
2. Data Governance: Perspectives and Practices, Harkish Sen, Technics Publications, 2019
3. Data stewardship: an actionable guide to effective data management and data governance, David Plotkin, Amsterdam : Elsevier, 2014

Evaluation Pattern

Assessment	Weightage (%)
Midterm	25
Continuous Assessment	25
End Semester Exam	50
Total Marks	100

26CSA338	Big Data Foundations	L-T-P-C:3-0-0-3

Course Objective(s)

- Introduce the characteristics and challenges of big data in modern computing systems.
- Explain the architectural principles behind distributed data storage and processing.
- Familiarize students with the big-data ecosystem and frameworks at a conceptual level.
- Develop understanding of data ingestion, storage, and processing workflows at scale.
- Build awareness of security, governance, and ethical aspects of big data systems.

Course Outcomes

COs	Description
CO1	**Analyze** the characteristics and challenges of big data in real-world applications
CO2	**Explain and evaluate** distributed architectures for big-data storage and processing
CO3	**Examine** big-data frameworks and ecosystem components used in large-scale systems
CO4	**Assess** data ingestion, management, and processing workflows for scalability and reliability
CO5	**Evaluate** security, governance, and ethical issues associated with big-data platforms

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	1	0	0	0	1
CO2	3	3	2	2	0	0	0	1
CO3	2	3	2	2	0	0	0	1
CO4	2	3	3	2	0	0	1	1
CO5	1	2	1	1	0	0	3	2

Syllabus

Unit I

Introduction to Big Data. Evolution of data storage and processing. Limitations of traditional data systems. Big Data definitions and 5 Vs. Big data use cases (industry, government, cyber). Challenges of big data systems. Big data vs data analytics vs data science.

Unit II

Distributed System Foundations. Basics of distributed computing. Cluster and cloud computing overview. CAP theorem (conceptual understanding). Fault tolerance and replication. Scalability and availability. Data locality concept.

Unit III

Big Data Storage and Processing Models. Distributed file systems: HDFS architecture (conceptual). Data models: Key-value stores, Column-oriented stores, Document stores. Batch vs stream processing.

Unit IV

Big Data Ecosystem. Hadoop ecosystem overview: Hadoop Common, HDFS, YARN, MapReduce (conceptual model only).

NoSQL databases (architecture-level): HBase, MongoDB. Data ingestion tools (conceptual): Flume, Sqoop, Kafka (overview).

Unit V

Data governance and stewardship. Data quality in large data systems. Privacy and compliance (intro): Data anonymization concepts. Security challenges in big data: Access control, Data integrity, Auditing. Ethical issues in big-data usage. Future trends in big-data systems.

Text Books

1. Big Data: A Revolution That Will Transform How We Live, Work, and Think, by Viktor Mayer-Schönberger and Kenneth Cukier. Houghton Mifflin Harcourt.
2. Hadoop: The Definitive Guide, by Tom White. O'Reilly Media.

Evaluation Pattern

Assessment	Weightage (%)
Midterm	25
Continuous Assessment	25
End Semester Exam	50
Total Marks	100

Cyber Security Stream

26CSA341	Introduction to Cyber Security	L-T-P-C: 3-0-0-3

Course Objectives:

- To introduce the core principles and practices of modern cybersecurity.
- To develop an understanding of common attacks, threats, and vulnerabilities.
- To explain basic security mechanisms used to protect systems and networks.
- To familiarise students with authentication, authorisation, and access control.
- To provide awareness of cyber laws, ethics, and digital rights.

Course Outcomes

1. Explain the fundamental concepts and terminology of cybersecurity.
2. Identify various types of cyber threats and vulnerabilities.
3. Understand basic network security mechanisms and defensive strategies.
4. Describe authentication, authorisation, and access control models.
5. Demonstrate awareness of cyber laws, ethical issues, and legal frameworks.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	1	1	1	1	-	2	2
CO2	2	2	1	1	1	-	2	2
CO3	2	2	1	2	1	-	2	2
CO4	1	2	1	1	1	-	3	2
CO5	2	3	2	2	2	1	2	2

Syllabus

Unit I

Foundations of Cybersecurity: Definition and importance of cybersecurity, Security goals: Confidentiality, Integrity, Availability (CIA Triad). Security Challenges in the Modern Digital World. Terminology: Threats, vulnerabilities, exploits, risks. Overview of cybersecurity domains (network, application, cloud, IoT, mobile). Basics of security governance and policies.

Unit II

Cyber Threats, Attacks & Vulnerabilities: Types of threats: Internal vs external. Types of attacks: Malware (virus, worm, trojan, ransomware, spyware), Social engineering attacks, Phishing, spear-phishing, DoS, DDoS attacks, Man-in-the-middle attacks. Software vulnerabilities: buffer overflow, injection, and misconfigurations. Zero-day vulnerabilities (conceptual overview).

Unit III

Network security concepts: perimeter, defence-in-depth. Firewalls: purpose, types, rule filtering basics. Intrusion Detection and Prevention Systems (IDS/IPS). Virtual Private Networks (VPNs) – basic idea. Secure communication basics: HTTPS, TLS, SSL. Wi-Fi security (WEP, WPA, WPA2/WPA3 – conceptual comparison).

Unit IV

Authentication: Passwords, OTPs, biometrics, multifactor authentication (MFA). Authorization: Role-based access control (RBAC), rule-based, attribute-based (ABAC). Access control policies & models. Identity & access management (IAM) basics. Password attacks and password hygiene.

Unit V

Overview of cybersecurity standards: ISO 27001, NIST (brief introduction). Indian Cyber Laws: IT Act 2000 & Amendments. Intellectual property rights related to IT. Digital evidence and forensics basics. Cyber ethics: responsible behaviour online. Privacy principles and data protection basics (GDPR overview).

Textbooks/ References

1. Computer Security: Principles and Practice. Authors: William Stallings & Lawrie Brown. Edition: 5th Edition (2023). Publisher: Pearson.
2. Security in Computing. Authors: Charles P. Pfleeger, Shari Lawrence Pfleeger, Lizzie Coles-Kemp. Edition: 6th Edition (2023). Publisher: Addison-Wesley / Pearson.
3. CompTIA Security+ Guide to Network Security Fundamentals. Author: Mark Ciampa. Edition: 8th Edition (2024/2025). Publisher: Cengage Learning / Course Technology

Evaluation Pattern

Assessment	Weightage (%)
Midterm	25
Continuous Assessment	25
End Semester Exam	50
Total Marks	100

26CSA342	Network Security Basics	L-T-P-C: 3-0-0-3

Course Objectives:

- To explain the fundamentals of network security and threat models.
- To introduce key network security technologies and protocols.
- To describe defensive mechanisms such as firewalls, IDS/IPS, and VPNs.
- To understand basic secure communication and encryption in networks.
- To develop awareness of wireless security standards and vulnerabilities.

Course Outcomes

1. Define basic network security concepts and threat types.
2. Identify and explain vulnerabilities in common network architectures.
3. Describe how firewalls, IDS/IPS, and VPNs function.
4. Understand secure communication mechanisms (TLS, HTTPS).
5. Evaluate basic wireless security measures and limitations.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	-	1	-	-	-	2	2
CO2	2	3	2	1	1	-	2	2
CO3	2	2	3	1	1	-	2	2
CO4	3	2	2	1	1	1	3	2
CO5	3	2	2	1	1	1	3	2

Syllabus

Unit I

Introduction to Network Security. Role of network security in organizations. Basic network architecture (LAN, WAN, Internet). Network attack surface. Types of threats: intrusions, spoofing, scanning, sniffing. Security policies and principles (least privilege, defense in depth).

Unit II

Network Protocols & Vulnerabilities. OSI & TCP/IP models: where security fits. Common protocol vulnerabilities (ARP spoofing, DNS poisoning). Port scanning basics. Secure vs insecure protocols (HTTP vs HTTPS, Telnet vs SSH). Basics of packet filtering and inspection.

Unit III

Firewalls: purpose, types (packet-filtering, stateful, application-level). Firewall rule design (conceptual, non-config oriented). Network Address Translation (NAT) and its role in security. IDS vs IPS. Signature-based vs anomaly-based detection systems. Use cases and limitations.

Unit IV

Basics of encryption in networks. Public key infrastructure (concept only). TLS/SSL and HTTPS. Digital certificates (conceptual only). VPN fundamentals. Tunneling & encapsulation basics. IPsec overview (very high level).

Unit V

Wi-Fi basics: SSID, access points, authentication models. Wireless threats: rogue AP, eavesdropping, evil-twin attacks. Wireless encryption standards: WEP, WPA, WPA2, WPA3. Secure Wi-Fi configuration principles (UG-level best practices). Introduction to mobile and IoT network security risks (overview only).

Textbooks/ References

1. Computer Security: Principles and Practice. Authors: William Stallings, Lawrie Brown. Edition: 5th Edition (2023). Publisher: Pearson.
2. Security in Computing. Authors: Charles P. Pfleeger, Shari L. Pfleeger, Lizzie Coles Kemp. Edition: 6th Edition (2023). Publisher: Addison Wesley / Pearson
3. CompTIA Security+ Guide to Network Security Fundamentals. Author: Mark Ciampa. Edition: 8th Edition (2024/2025). Publisher: Cengage Learning.

Evaluation Pattern

Assessment	Weightage (%)
Midterm	25
Continuous Assessment	25
End Semester Exam	50
Total Marks	100

26CSA343	Cryptography Fundamentals	L-T-P-C: 2-0-2-3

Course Objectives:

- Understand core concepts and evolution of cryptography.
- Explain how classical and modern ciphers work.
- Distinguish symmetric and asymmetric encryption.
- Understand the purpose of hashing, message integrity, and digital signatures.
- Learn how cryptography is applied in authentication, HTTPS, email security, and real-world systems.

Course Outcomes

1. Describe the goals, principles, and fundamental terminology of cryptography.
2. Explain the operation and weaknesses of classical ciphers (substitution and transposition).
3. Distinguish between symmetric and asymmetric encryption and describe commonly used algorithms (AES, RSA) at a conceptual level.
4. Explain the role of hashing, MACs, and digital signatures in ensuring integrity and authentication.
5. Analyze basic real-world scenarios to select appropriate cryptographic techniques and recommend safe practices.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	1	1	1	1	-	2	2
CO2	2	2	1	1	1	-	2	2
CO3	2	2	1	2	1	-	2	2
CO4	2	3	2	2	1	-	2	2
CO5	2	3	2	3	2	1	2	2

Syllabus

Unit I

Foundations of Cryptography: Need for cryptography; CIA + authentication + non-repudiation. Terminology: plaintext, ciphertext, keys, entropy. Types of cryptanalytic attacks.

Unit II

Classical Encryption Techniques. Caesar cipher, monoalphabetic substitution Vigenère cipher. Transposition ciphers. Frequency analysis.

Unit III

Modern Symmetric & Asymmetric Cryptography. Symmetric key concepts. DES overview; AES structure (conceptual rounds). Asymmetric encryption basics. RSA and Diffie–Hellman at high level. Applications: secure communication, storage.

Unit IV

Hashing, MACs & Digital Signatures. Cryptographic hash functions, SHA-2 / SHA-3. MACs: purpose and usage. Digital signatures: conceptual process. Certificates & PKI basics.

Unit V

Password storage (hashing + salting). HTTPS basics. Email signing. Choosing the right cryptographic tool. Simple risk-based scenarios.

Textbooks/ References

1. Computer Security: Principles and Practice – William Stallings & Lawrie Brown. 5th Edition, Pearson (2023).
2. Security in Computing – Pfleeger, Pfleeger & Coles Kemp. 6th Edition, Addison Wesley/Pearson (2023).
3. Cryptography and Network Security – William Stallings. 8th Edition, Pearson.

Evaluation Pattern

Assessment	Weightage (%)
Midterm	25
Continuous Assessment	25
End Semester Exam	50
Total Marks	100

26CSA344	Cyber Laws & Digital Forensics	L-T-P-C: 3-0-0-3

Course Objectives:

- To familiarize students with Indian and global cyber laws.
- To explain the legal implications of cybercrimes and digital evidence.
- To introduce fundamental concepts of digital forensics.
- To explain the forensic investigation process and reporting principles.
- To promote ethical and legally compliant use of digital technologies.

Course Outcomes

1. Describe major cyber laws, legal frameworks, and IT Act provisions relevant to cybersecurity and digital data.
2. Identify various categories of cybercrimes and understand their legal implications under national and international frameworks.
3. Explain the fundamentals of digital forensics, types of evidence, and chain of custody principles.
4. Describe the digital forensic investigation process, including acquisition, preservation, analysis, and reporting.
5. Analyze simple case scenarios and recommend legally compliant and ethical actions in cybersecurity and forensic contexts.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	1	1	1	1	1	-	3	2
CO2	1	3	1	1	1	-	3	2
CO3	2	2	1	1	1	-	3	2
CO4	2	2	2	2	1	1	2	2
CO5	2	3	2	2	2	1	3	2

Syllabus

Unit I

Introduction to Cyber Laws. Need for cyber legislation. Indian IT Act 2000 and Amendments (2008). Legal definitions: electronic documents, digital signatures. Regulatory bodies and enforcement mechanisms.

Unit II

Cybercrimes & Legal Response: Types of cybercrimes: identity theft, phishing, cyberstalking, fraud, data breaches. Legal implications and penalties under IT Act. Overview of global cyber laws (US, EU, GDPR). Case studies from CERT-In advisories.

Unit III

Foundations of Digital Forensics: Definition and scope of digital forensics. Types of digital evidence (volatile vs non-volatile). Chain of custody: documentation, integrity, and admissibility. Roles & responsibilities of forensic investigators.

Unit IV

Digital Forensics Process: Forensic process models. Acquisition: imaging concepts, write blockers, preservation & documentation. Analysis & reporting principles. Common tools overview (FTK Imager, Autopsy – conceptual only).

Unit V

Case Studies & Ethical Considerations. Real-world case scenarios: financial fraud, online harassment, data theft. Ethical issues in investigation. Privacy rights & data protection principles. Responsible reporting and compliance.

Textbooks/ References

1. Niranjan Reddy & Pavan Duggal – The Information Technology Act, 2000: A Handbook.
2. Eoghan Casey – Digital Evidence and Computer Crime.
3. Nelson, Phillips & Steuart – Guide to Computer Forensics and Investigations.

Evaluation Pattern

Assessment	Weightage (%)
Midterm	25
Continuous Assessment	25
End Semester Exam	50
Total Marks	100

26CSA345	Linux Security & Hardening	L-T-P-C: 2-0-2-3

Course Objectives:

- Understand core Linux security concepts and the importance of system hardening.
- Learn how Linux file permissions, users/groups, and privilege separation enhance security.
- Explore authentication, password policies, and pluggable authentication modules.
- Understand system hardening techniques and secure service configuration.
- Develop the ability to analyze simple system-level security issues and recommend mitigations.

Course Outcomes

1. Explain fundamental concepts of Linux security, privilege separation, and the need for system hardening.
2. Describe Linux permission models, user/group management, and access control mechanisms.
3. Explain authentication mechanisms, password policies, and basic PAM concepts.
4. Describe Linux system hardening techniques, including service management, firewall basics, and configuration security.
5. Analyze simple Linux security scenarios and recommend appropriate hardening steps or best practices.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	1	1	1	1	-	2	2
CO2	2	2	1	2	1	-	2	2
CO3	2	2	1	2	1	-	2	2
CO4	2	2	2	3	1	-	2	2
CO5	2	3	2	3	2	1	2	2

Syllabus

Unit I

Introduction to Linux Security: Principles of Linux security, Threat landscape for Linux servers, Principle of least privilege, User vs root vs sudo, Why Linux needs hardening (misconfiguration, default services, weak authentication).

Unit II

Users, Groups & File Permissions. Linux file permissions: rwx, user/group/others. Permission modification (chmod, chown, chgrp), Special permissions: SUID, SGID, Sticky Bit (conceptual at UG level), User and group, management fundamentals, Understanding /etc/passwd, /etc/shadow (conceptual only).

Unit III

Authentication & Account Security. Password policy basics. Account lockout strategies. Introduction to PAM (concept only). SSH security basics (password vs key-based authentication), Disabling root login, restricting access.

Unit IV

System Hardening & Secure Configuration. Hardening approach: disable unnecessary services, patching, updates, Basics of systemd service control, Firewall basics (UFW/Firewalld – conceptual usage), Log monitoring using syslog/journalctl, Introduction to AppArmor and SELinux (concept only; MCA covers advanced SELinux).

Unit V

Case Studies & Best Practices. Common misconfigurations (world-writable directories, exposed SSH, open ports), File integrity checks: Tripwire (concept only), Simple audit scenarios: "identify risk + recommend mitigation", Security checklists for Linux servers, Ethical and responsible system administration.

Lab syllabus

- Baseline System Security Assessment – Create non-root user, analyze running services, identify default risks.
- Users, Groups & Least-Privilege Configuration – Group creation, sudo configuration with visudo, checking privileges.
- File Permissions Management (rwx, chmod, chown) – Modify permissions, secure file/directory access, configure umask.
- Special Permissions: SUID, SGID, Sticky Bit – Identify SUID binaries, evaluate risks, secure shared directories.

- Understanding /etc/passwd and /etc/shadow – Analyze fields, differentiate system vs human accounts, lock/unlock accounts.
- Password Policy & Account Aging – Configure login.defs, set password expiry with chage, enforce minimum password days.
- Account Locking & Basic PAM Demonstration – Implement simple login lockout using pam_tally2 or faillock.
- SSH Hardening – Key-based authentication, disable password logins, restrict users, disable root login.
- System Hardening with systemd & Updates – Disable unnecessary services, manage units, apply updates.
- Firewall Configuration (UFW or Firewalld) – Default deny, allow essential services, verify rules and connectivity.
- Log Monitoring with syslog & journalctl – Filter authentication logs, detect failed SSH attempts, generate summaries.
- Introduction to AppArmor/SELinux (Concept + Light Hands-on) – Inspect profiles, switch modes, observe denials.
- Misconfiguration Hunt – Identify world-writable locations, exposed SSH, unnecessary listening services.
- File Integrity Checking (Tripwire Concept Demo) – Initialize baseline, modify files, run checks, interpret the report.

Textbooks/ References

1. Mastering Linux Security and Hardening (Third Edition, 2023) by Donald A. Tevault.
2. Linux Security and Administration: Safeguarding Your Linux System with Proactive Administration Practices (2024 Guide for Beginners) by Randall Blair.
3. Mastering Linux Security and Hardening, 3rd Edition by Tevault, Donald A, Packt Publishing, 2023.

Evaluation Pattern

Assessment	Weightage (%)
Midterm	20
Continuous Assessment	50
End Semester Exam	30
Total Marks	100

26CSA346	Wireless & Mobile Security	L-T-P-C: 3-0-0-3

Course Objectives:

- Understand security issues unique to wireless and mobile environments
- Learn wireless security standards and protocols
- Identify vulnerabilities and attack vectors targeting mobile and wireless systems
- Understand mobile operating system security models
- Apply best practices for securing wireless networks and mobile devices

Course Outcomes

1. Explain the fundamentals of wireless and mobile security, including threat models and risk factors.
2. Describe wireless network security standards, protocols, and common attacks.
3. Explain mobile operating system security architectures and permission models..
4. Describe security risks, attacks, and protection mechanisms in mobile devices and wireless communication.
5. Analyze basic wireless/mobile security scenarios and recommend appropriate mitigation strategies and best practices.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	1	1	1	1	-	2	2
CO2	2	2	1	2	1	-	2	2
CO3	2	2	1	2	1	-	2	2
CO4	2	2	2	2	1	-	2	2
CO5	2	3	2	3	2	1	2	2

Syllabus

Unit I

Fundamentals of Wireless & Mobile Security. Characteristics of wireless and mobile environments. Differences between wired v/s wireless security. Threat Models for Wireless and Mobile Systems. Risk assessment fundamentals. Security challenges in mobility and roaming.

Unit II

Wireless Network Security. Wi-Fi architecture and components. Wireless security protocols: WEP, WPA, WPA2, WPA3. Authentication methods: PSK, Enterprise (conceptual). Wireless attacks: eavesdropping, rogue AP, evil twin, de-authentication. Secure Wi-Fi configuration best practices

Unit III

Cellular & Mobile Communication Security. Overview of cellular networks (2G–4G conceptual). SIM-based authentication concepts. Mobile communication threats: IMSI catching (high-level), spoofing. Security in mobile data transmission. Limitations of mobile communication security.

Unit IV

Mobile Operating System Security. Mobile OS architecture overview. Android & iOS security models (sandboxing, permissions). App lifecycle and permission control. Secure app installation and updates. Mobile Device Management (MDM) Concepts.

Unit V

Mobile Threats, Privacy & Case Studies. Mobile malware types: spyware, adware, trojans (intro level). Mobile phishing and SMS attacks. Data privacy concerns and location tracking. Case studies: insecure Wi-Fi usage, malicious apps. Security best practices for users and organizations.

Textbooks/ References

1. CompTIA Security+ Guide to Network Security Fundamentals, 8th Edition, by Mark Ciampa. Cengage Learning, 2024.
2. Computer Security: Principles and Practice, 5th Edition, by William Stallings. Pearson, 2023
3. Hacking Exposed Wireless, Latest Edition, by Joshua Wright. McGraw-Hill.

Evaluation Pattern

Assessment	Weightage (%)
Midterm	25
Continuous Assessment	25
End Semester Exam	50
Total Marks	100

26CSA347	Digital Forensics	L-T-P-C: 3-0-0-3

Course Objectives:

- To introduce the scope and importance of digital forensics in cybersecurity
- To understand types of digital evidence and forensic principles
- To explain standardized forensic investigation processes
- To familiarize students with basic forensic techniques and tools (conceptual)
- To develop ethical reasoning and legal awareness in handling digital evidence

Course Outcomes

1. Explain the objectives, scope, and principles of digital forensics and its role in cybercrime investigation.
2. Identify different types of digital evidence and explain principles such as integrity, authenticity, and chain of custody.
3. Describe the standard digital forensic investigation process and documentation requirements.
4. Explain basic techniques and tools used in computer, network, and mobile forensics at a conceptual level.
5. Analyze simple forensic case scenarios and recommend appropriate investigative steps while ensuring ethical and legal compliance.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	1	1	1	1	-	2	2
CO2	2	2	1	1	1	-	3	2
CO3	2	2	2	2	1	1	2	2
CO4	2	2	1	3	1	-	2	2
CO5	2	3	2	2	2	1	3	2

Syllabus

Unit I

Introduction to Digital Forensics. Evolution and scope of digital forensics. Role of digital forensics in cybersecurity and law enforcement. Branches of digital forensics (computer, network, mobile, cloud). Challenges in digital forensic investigations. Overview of forensic standards and best practices.

Unit II

Digital Evidence & Legal Considerations. Types of digital evidence. Volatile vs non-volatile data. Rules of evidence and admissibility. Chain of custody and documentation. Introduction to cyber laws and forensic relevance.

Unit III

Forensic Investigation Process. Common forensic process models (conceptual). Evidence identification and acquisition. Preservation techniques. Analysis overview. Reporting and expert testimony basics

Unit IV

Forensic Tools & Techniques. Disk and file system forensics (conceptual overview). Log analysis fundamentals. Network traffic evidence basics. Mobile device forensics overview. Common forensic tools: FTK, EnCase.

Unit V

Case Studies, Ethics & Emerging Trends. Financial fraud investigation. Data breach scenario. Ethical issues in digital forensics. Privacy and compliance considerations. Emerging trends: cloud forensics, IoT forensics (overview).

Textbooks/ References

1. Digital Evidence and Computer Crime, 3rd Edition, by Eoghan Casey. Academic Press (Elsevier)
2. Guide to Computer Forensics and Investigations, 6th Edition, by Nelson, Phillips & Steuart. Cengage Learning
3. Cybercrime and Forensics, Latest Edition, Pearson by Bill Nelson

Evaluation Pattern

Assessment	Weightage (%)
Midterm	25
Continuous Assessment	25
End Semester Exam	50
Total Marks	100

UI/UX and Game Design Stream

26CSA351	VECTOR ANIMATION	L-T-P: 0-1-4-3

Course Objective

The course aims to introduce students to the fundamentals of Digital 2D Animation, enabling them to understand movement, timing, and visual storytelling through industry-standard tools. Students will learn the essential principles of animation, explore character and background creation, and develop skills in frame-by-frame animation and basic tweening technique and create simple, engaging animations that demonstrate clarity, appeal, and professional workflow practices.

Course Outcomes

CO1	Learn Digital drawing techniques using fundamental tools in the software to create clean and structured artwork.
CO2	Develop a strong foundation in producing expressive and efficient 2D animations by combining manual drawing with digital tweening techniques.
CO3	Create Industry standard Animations using different animation methods and implementing animation principles
CO4	Understand the phonemes and creating lip-sync and match audio / background score
CO5	Build, and execute a believable and visually engaging animation that demonstrates strong understanding of movement, design principles, and storytelling, while meeting current industry standards of quality

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	1	2	2	0	0	0	1
CO2	1	2	3	2	1	0	0	2
CO3	1	2	3	2	1	0	1	2
CO4	1	2	2	2	1	0	1	2
CO5	1	2	3	3	2	1	1	3

Syllabus

Unit 1: Designing for Animation

Beginning with the fundamentals of digital drawing and understanding basic tools in the software, Students also explore character design, background and layout creation.

Unit 2: Frame by Frame v/s Tweening

In this unit, students learn the fundamentals of frame-by-frame animation, starting with creating key poses, in-betweens, and smooth transitions to understand traditional animation principles. They also explore various types of Tweening in Animate CC, including motion tween, shape tween, and classic tween.

Unit 3: Animation inside Symbols

For realistic and believable animations and complex, layered movements and without disturbing the main timeline, animations done inside symbols.

Unit 4: Audio and lip syncing and head movements

Students learn how to match character mouth movements and actions precisely with recorded dialogue or sound. They understand how to import and manage audio layers, identify phonemes, and create accurate mouth shapes for each sound

Unit 5: Motion Graphics

Students learn how to create dynamic visual elements by combining shapes, text, images, and symbols with smooth movement and transitions. Techniques for animating logos, title sequences, infographics, and promotional visuals

Textbook

- **Adobe Animate CC Classroom in a Book** by Russell Chun
- **Learn Adobe Animate CC for Multiplatform Animations** by Joseph Labrecque & Rob Schwartz
- **The Animator's Survival Kit** by Richard

References

- ✓ **Adobe Animate User Guide (Official Website)** – Complete documentation for tools, panels, and workflows.
- ✓ **Adobe Learn & Support** – Video tutorials, troubleshooting, and step-wise lessons.
- ✓ **Adobe Creative Cloud Tutorials** – Beginner-friendly tutorials for animation, motion graphics, vector art, et

Evaluation Pattern

Assessment	Weightage (%)
Continuous Assessment	70
End Semester Exam	50
Total Marks	100

26CSA352	MOTION GRAPHICS & VFX	L-T-P: 0-1-4-3

Course Objectives

To train students in creating professional-quality motion graphics and visual effects using Adobe After Effects by developing strong fundamentals in animation, compositing, tracking, visual storytelling, and post-production workflows.

Course Outcomes (COs)

1. Create motion graphics using keyframes, shape layers, and text animation.
2. Apply visual effects such as masking, rotoscoping, and chroma keying.
3. Perform motion tracking and camera tracking for seamless VFX integration.
4. Composite multiple elements into realistic visual scenes.
5. Compile a professional portfolio showcasing various titling and motion graphics projects.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	1	2	2	0	0	0	1
CO2	1	2	3	2	1	0	1	2
CO3	1	2	3	3	1	0	1	2
CO4	1	2	3	3	1	0	1	2
CO5	1	1	3	2	3	2	1	3

Syllabus

Unit I – Fundamentals of Motion Graphics & After Effects

- Basics of motion graphics and visual effects
- Overview of the Adobe After Effects interface
- Composition settings and project organization

Unit II – Animation Techniques

- Keyframe animation (Position, Scale, Rotation, Opacity)
- Easy Ease, Graph Editor, and motion paths
- Text animators and presets
- Basics of kinetic typography

Unit III – Shape Animation & Keying

- Creating and animating vector shape layers
- Stroke and fill animation
- Trim Paths animation
- Green screen and chroma key techniques
- Spill suppression and edge refinement

Unit IV – Tracking & Broadcast Graphics

- Motion tracking techniques
- Video stabilization

- Attaching graphics to moving footage
- 3D Camera Tracking workflow
- Adding 3D text and objects
- Creating virtual camera movement
- Titles and broadcast graphics
- Lower thirds, logo animation, and intro/outro creation

Unit V – Plugins & Project Production

- Introduction to Element 3D
- Particle effects using basic plugins
- Planning and developing a motion graphics project
- Title design project
- 3D title project
- Motion tracking project
- Asset management and final project execution

Textbook

Creative Motion Mastery with Adobe After Effects by Vishu Aggarwal (2024)

After Effects: The Power of Expression by Francois Lefebvre

DESIGN FOR MOTION: FUNDAMENTALS AND TECHNIQUES OF MOTION DESIGN

Evaluation Pattern

Assessment	Weightage (%)
Continuous Assessment	70
End Semester Exam	50
Total Marks	100

26CSA353	GAME PROGRAMMING	L-T-P: 0-1-4-3

Course Description / Objective

This course introduces the fundamental principles of programming for interactive media and game development. Students learn how gameplay systems operate, how logic is structured and how interactions are programmed within digital environments. The course covers object behaviour, player control, events, physics-based interactions, collision handling, scoring mechanisms and gameplay loops, with a focus on how programming supports both user experience and game design.

Course Outcome

CO1 Explain the architecture of game engines and the role of scripts in controlling game objects.
CO2 Implement player control and movement systems for two-dimensional and three-dimensional environments.
CO3 Program interactions between objects, including collisions, triggers, scoring and environmental responses.
CO4 Apply physics concepts and simple enemy behaviours to create engaging game mechanics.
CO5 Develop a small playable game prototype demonstrating a complete gameplay loop and interface elements.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	1	2	0	0	1	1
CO2	2	2	3	3	1	0	1	2
CO3	2	3	3	3	1	0	1	2
CO4	2	2	3	3	1	0	1	2
CO5	1	2	3	3	3	2	1	3

Syllabus

Unit 1: Game Engines, Scripts and Core Concepts
Component-based architecture of game engines; game objects, scenes and environments; introduction to scripting for interactive behaviours; variables, data types, functions and control structures; real-time update cycles and frame-based logic; creating basic interactions between objects.

Unit 2: Player Controls, Movement Systems and Input Handling
Capturing user input for movement and actions; movement systems for side-scrolling, top-down and three-dimensional spaces; smooth and responsive character motion; jumping, running, turning and camera-linked movement; player-state logic (idle, walking, running, jumping); feedback mechanisms for player actions.

Unit 3: Object Interaction, Collisions and Environment Behaviour
Collision detection and trigger events; interactions with platforms, obstacles and hazards; scoring, timers, pickups and simple inventory elements; environmental behaviours such as patrolling platforms, moving objects and activation mechanisms; win and lose conditions; visual and audio feedback for gameplay events.

Unit 4: Physics, Game Mechanics and Basic Enemy Behaviour
Gravity, forces, velocity and friction in game worlds; programming physics-based movement and collisions; health systems, power-ups and difficulty scaling; simple enemy or non-player character behaviours (chase, flee, patrol); pattern creation, obstacles and challenge design; balancing mechanics to support fair and engaging gameplay.

Unit 5: Final Game Project – Gameplay Loop and Refinement
Planning a compact game concept with defined objectives and environment; structuring a gameplay loop with challenge, reward and progression; integrating user interface elements such as score displays, timers and instructions; refining control responsiveness and interaction feedback; debugging and polishing behaviour; presenting the final prototype with explanation of mechanics, design choices and player experience.

Text Books

1. Game Programming Patterns – Robert Nystrom.
2. Game Engine Architecture – Jason Gregory.

Reference Books

1. Programming Game AI by Example – Mat Buckland.
2. The Art of Game Design: A Book of Lenses – Jesse Schell.
3. Game Design Workshop – Tracy Fullerton.

Evaluation Pattern

Assessment	Weightage (%)
Continuous Assessment	70
End Semester Exam	50
Total Marks	100

26CSA354	AI TOOLS FOR MEDIA AND DESIGN	L-T-P: 0-1-4-3

Course Objectives:

To enable students to explore and apply core concepts of artificial intelligence to create and enhance media content and design workflows. The course focuses on generative techniques for visual, audio, and interactive media, structured prompt design, and practical integration of AI across the content creation pipeline.

Course Outcomes

CO1: Explain foundational AI principles and their applications in creative media.
CO2: Apply generative AI methods for creating visual, audio, and textual content.
CO3: Develop structured prompts and workflows for creative content generation.
CO4: Analyze and evaluate AI outputs considering usability, ethics, and creativity.
CO5: Build a media prototype using AI-generated assets integrated into a user-centered design.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	2	1	2	0	0	2	2
CO2	1	2	3	3	1	0	2	2
CO3	1	2	3	3	1	0	2	3
CO4	1	3	3	2	1	0	3	3
CO5	1	2	3	3	3	2	2	3

Syllabus

Unit 1: Generative Visual Media
Overview of AI for graphic and visual design; text-to-image synthesis techniques; style transfer, layout generation, visual iteration strategies; quality assessment of AI-generated images; ethical use and curation of outputs.

Unit 2: Generative Video and Animation
AI in storyboarding, animation planning, avatar-driven sequences; video style adaptation, frame interpolation and augmentation; integrating voice and visual elements for short-form video creation.

Unit 3: Generative Audio and Text
Audio synthesis, music loops, sound effects with AI; natural language processing for script writing, captioning and UI copy; coherence and tone control in AI-generated language.

Unit 4: AI-Augmented Design Workflow
Prompt engineering strategies; AI-driven ideation and prototyping; generative assistance in layout, copywriting, and asset reuse; using AI outputs in design systems and creative pipelines.

Unit 5: Ethics and Future of Creative AI
Bias in datasets, copyright and authorship of AI-generated work; fairness, accessibility, and responsible usage; human-in-the-loop creativity; case studies of AI in professional design contexts.

Text Books

1. Deep Learning – Ian Goodfellow et al.
2. The Creativity Code – Marcus du Sautoy

Reference Books

1. Aimultiple – Guide to Generative AI Ethics

Evaluation Pattern

Assessment	Weightage (%)
Continuous Assessment	70
End Semester Exam	50
Total Marks	100

26CSA355	VISUAL DESIGN & BRANDING	L-T-P: 0-1-4-3

Course Objective

The course aims to introduce students to the core principles of visual design and the strategic role of branding in communication. Students will learn how to create compelling visual identities by exploring colour theory, typography, composition, and brand storytelling. Through hands-on projects, they will understand how to design logos, brand assets, and cohesive visual systems that effectively communicate a brand's personality and values across various media platforms.

Course Outcome

CO1	Use fundamental Photoshop tools to edit, enhance, and create digital images with clarity and accuracy.
CO2	Apply advanced skills in color, typography, and layout to create visually appealing branding assets that meet industry standards.
CO3	Create original brandmarks that use clear strategy, meaningful symbols, and appeal to the target audience
CO4	Design unified branding materials—like stationery, packaging, and digital ads—that keep the message clear and the visuals consistent
CO5	Develop a full branding project by blending research, design ideas, and visuals into one clear, professional brand identity

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	1	2	2	0	0	0	1
CO2	1	2	3	2	1	0	1	2
CO3	1	3	3	2	1	0	1	2
CO4	1	2	3	2	1	0	1	2
CO5	1	2	3	2	3	2	1	3

Syllabus

1. **Creative Photo Craft –** Students will learn to enhance and transform images using Photoshop. They learn essential photo editing, apply creative photo effects, perform accurate color corrections, and explore photo manipulation -9 **Hours**
2. **Brandmark Creation –** Students learn to design unique and memorable brandmarks (Logos) by exploring symbolism, forms, and identity-building techniques. -0 **Hours**
3. **Visual Branding Essentials –** Covers the fundamentals of brand identity through color theory, typography, imagery, and consistent visual language. -9 **Hours**
4. **Market Reach** – Introduces strategies to enhance brand visibility using targeted communication and audience-centered design approaches and effective Ad Designing.

   9 Hours
5. **Visual Print Solutions –** Focuses on creating effective print-based brand materials such as posters, brochures, and packaging using industry-standard practices. -9 **Hours**

Textbook

- **Adobe Photoshop Classroom in a Book (Latest Edition)** – Adobe Creative Team
- **Non-Designer's Designing Book –** Robin Williams
- **Adobe Photoshop Studio Techniques** – Ben Willmore
- **Logo Design Love / Identity Designed** – David Aire
- **Designing Brand Identity** – Alina Wheeler

References

Online Learning Platforms

✓ **Coursera –** Branding courses from top universities
Good for structured academic learning.

- ✓ **Skillshare**
  Practical branding, logo design, color theory, and Adobe tools tutorials.
- ✓ **Udemy**
  Affordable branding design courses and Photoshop/Illustrator mastery.

YouTube Channels

- ✓ **The Futur (Chris Do)** – Branding strategy, identity design, client workflow.
- ✓ **Satori Graphics** – Logo design skills and Adobe Illustrator tutorials.
- ✓ **Flux Academy** – UI, branding, and freelance workflow.
- ✓ **Charli Marie TV** – Design thinking and creative processes.

Evaluation Pattern

Assessment	Weightage (%)
Continuous Assessment	70
End Semester Exam	50
Total Marks	100

26CSA356	GAME STORY DESIGN	L-T-P: 0-1-4-3

Course Objective

To enable students to understand and apply narrative design principles in the context of games. The course explores character development, world-building, dialogue writing, and interactive storytelling structures, culminating in the development of a story-based game prototype or narrative design document.

Course Outcomes

CO1: Identify narrative structures and apply them in designing game storylines.
CO2: Develop characters and backstories suitable for interactive formats.
CO3: Write dialogues and branching conversation paths that adapt to player choices.
CO4: Integrate gameplay mechanics into narrative arcs and mission structures.
CO5: Prototype and document a complete interactive game story experience.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	1	3	2	1	0	0	1	2
CO2	1	3	2	1	1	0	1	2
CO3	1	3	3	1	1	0	1	2
CO4	1	2	3	1	1	0	1	2
CO5	1	2	3	2	3	2	1	3

Syllabus

Unit 1: **Introduction to Game Narrative**

Story structure (three-act, hero's journey); game genre conventions; comparison of linear and non-linear storytelling; narrative immersion through interactivity.

Unit 2: **Characters and Dialogue**

Sroryboard creation and Character development, archetypes and growth arcs; writing dynamic and branching dialogue; emotional tone, pacing and subtext in interactive conversations.

Unit 3: **World-Building and Lore**

Creating immersive settings, histories and environmental storytelling elements; map and scene design to support narrative progression; props, audio, and scenery as lore tools.

Unit 4: **Interactive Structures**

Branching narrative trees; player choice and consequence; integrating story with game mechanics, quest design, cutscenes and emergent storytelling.

Unit 5: **Prototyping and Documentation**

Game design documents (GDD), scriptwriting formats, storyboards and flowcharts; playtesting and revision; preparing a presentation or pitch for narrative-driven games.

Text Books

1. Video Game Storytelling – Evan Skolnick
2. Narrative in Game Design – Utah Open Curriculum
3. Game Writing: Narrative Skills for Videogames – Chris Bateman
4. Rules of Play: Game Design Fundamentals – Katie Salen, Eric Zimmerman
5. The Writer's Guide to Games – George C. Brown

Reference Books

1. The Art of Game Design – Jesse Schell
2. Narrative Design for Indie Games – GameDev Blog Series
3. GDC Vault – Game Developers Conference talks (Free & Subscription-based)
4. Interactive Storytelling for Video Games – Josiah Lebowitz & Chris Klug
5. Game Narrative Toolbox – Heussner, Finley, Marcotte, and Spencer

Evaluation Pattern

Assessment	Weightage (%)
Continuous Assessment	70
End Semester Exam	50
Total Marks	100

26CSA357	WEB & MOBILE UI DESIGN	L-T-P: 0-1-4-3

Course Objective

To enable students to design effective user interfaces for web and mobile platforms by applying principles of visual hierarchy, layout, mobile-first thinking and responsive design, and by following a structured workflow from research and ideation to wireframing, interface detailing and interactive prototyping for digital products and game interfaces.

Course Outcomes

CO1 Explain the principles of interface design, visual hierarchy, typography and colour for web and mobile environments.
CO2 Apply mobile-first and responsive design approaches to structure layouts across multiple screen sizes and devices.
CO3 Create low-fidelity and high-fidelity wireframes, components and screen flows for web and mobile applications.
CO4 Develop cohesive interface systems using design patterns, reusable components and interaction specifications.
CO5 Produce an end-to-end interface project from concept to interactive prototype with appropriate documentation.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	2	2	1	0	0	1	2
CO2	1	2	3	2	1	0	1	2
CO3	1	2	3	3	1	0	1	2
CO4	1	2	3	3	1	0	1	2
CO5	1	2	3	3	3	2	1	3

Syllabus

Unit 1: Fundamentals of Interface Design
Interface design within digital product ecosystems; grid systems, spacing, alignment and layout structure; principles of visual hierarchy and information arrangement; typography selection and readability for digital screens; colour systems, contrast, accessibility considerations and visual consistency; composition through balance, rhythm and emphasis.

Unit 2: Designing for Mobile Environments
Mobile-first design methodology; device constraints and opportunities; gesture-based interactions (tap, swipe, long-press, drag, multi-touch); mobile navigation structures (tab bars, sliding menus, bottom navigation, floating actions); micro-interactions and feedback indicators in mobile contexts; planning seamless task flows for common app functionalities.

Unit 3: Wireframing and Interaction Planning
Low-fidelity and high-fidelity wireframing techniques; content placement, alignment rules and interface zoning; creation of component libraries (buttons, text fields, cards, menus, icons); interactive flows for onboarding, authentication, dashboards and settings; page architecture planning for web and mobile; mapping user journeys into coherent screen flows.

Unit 4: Interface Components, Design Systems and Prototyping
Construction of consistent interface components (forms, navigation bars, lists, overlays, dialogs); design systems and pattern libraries; responsive components for desktop, tablet and mobile; spacing tokens, type scales and colour styles for multi-screen systems; building clickable prototypes that communicate interaction behaviour; documentation for design-to-development handoff.

Unit 5: Web and App Interface Project
Problem identification and user need definition; mood boards, sketches and concept directions; complete screen sets for both web and mobile variants; applying responsiveness, accessibility and usability principles; creation of a fully linked prototype demonstrating major flows; final presentation of design decisions, iterations and reflections on process.

Text Books

1. Interaction Design: Beyond Human–Computer Interaction – Rogers, Sharp & Preece, Wiley.
2. Don't Make Me Think, Revisited: A Common Sense Approach to Web Usability – Steve Krug, New Riders.

Reference Books

1. About Face: The Essentials of Interaction Design – Cooper, Reimann, Cronin & Noessel, Wiley.
2. The UX Book: Agile UX Design for a Quality User Experience – Hartson & Pyla, Morgan Kaufmann.
3. Designing Interfaces: Patterns for Effective Interaction Design – Tidwell, Brewer & Valencia, O'Reilly.

Evaluation Pattern

Assessment	Weightage (%)
Continuous Assessment	70
End Semester Exam	50
Total Marks	100

26CSA358	USER RESEARCH AND TESTING	L-T-P: 0-1-4-3

Course Objectives

To introduce students to user-centred research methods and evaluation techniques that help understand user behaviour, identify needs and assess the quality of interaction in applications, websites and games, thereby enabling evidence-based design decisions.

Course Outcomes

CO1 Describe key concepts of user behaviour, needs, mental models and experience contexts in digital products.
CO2 Plan and conduct user research using interviews, surveys, contextual inquiry and task analysis.
CO3 Design and execute usability tests to identify navigation, interaction and comprehension issues in interfaces.
CO4 Conduct playtesting sessions to evaluate player experience, challenge, engagement and game balance.
CO5 Synthesise research findings into structured reports and propose actionable design recommendations.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	1	3	1	1	0	0	1	2
CO2	1	3	2	1	1	0	1	2
CO3	1	3	3	2	1	0	1	2
CO4	1	3	3	2	1	0	1	2
CO5	1	3	3	2	3	2	1	3

Syllabus

Unit 1: Understanding Users and Experience Contexts
User behaviour in digital environments; user goals, motivations, frustrations and mental models; persona development from demographic, psychographic and behavioural attributes; user journey maps capturing actions, touchpoints, emotions and pain points; expectations across applications, websites and game interfaces; contexts of use including mobile, desktop, short-session interactions and accessibility needs.

Unit 2: Research Methods for Digital Product Design
Overview of qualitative and quantitative methods; structured, semi-structured and unstructured interviews; design and administration of surveys; contextual inquiry and observation in natural settings; task analysis to uncover friction points; combining multiple methods for triangulation; ethical practices in human-centred research including consent, confidentiality and data handling.

Unit 3: Usability Testing and Evaluation Techniques
Planning usability studies: objectives, hypotheses, test plans and participant selection; moderated and unmoderated testing; creating realistic tasks and scenarios for apps, websites and interactive systems; observation of behaviour, hesitation and frustration signals; heuristic evaluation using established usability principles; identification of problems in navigation, clarity, feedback, error handling and information structure.

Unit 4: Playtesting for Games and Interactive Experiences
Role of testing in game development; challenge, engagement, flow and reward systems; collecting feedback during and after gameplay; evaluation of difficulty progression, clarity of instructions and narrative feedback; detecting issues in controls, pacing, visual communication and progression; group playtesting sessions and comparative analysis of player responses.

Unit 5: Reporting Findings and Design Recommendations
Organising qualitative and quantitative data from research activities; recognising patterns, clusters, pain points and usability flaws; prioritisation of issues using impact–effort and severity frameworks; communication of insights through

reports, visual summaries, journey maps and problem statements; proposing redesign strategies for apps, websites and game interfaces; presenting refined user flows and design improvements to stakeholders.

Text Books

1. The UX Book: Agile UX Design for a Quality User Experience – Hartson & Pyla, Morgan Kaufmann.
2. Handbook of Usability Testing – Rubin & Chisnell, Wiley.

Reference Books

1. Interaction Design: Beyond Human–Computer Interaction – Rogers, Sharp & Preece.
2. Interviewing Users: How to Uncover Compelling Insights – Steve Portigal, Rosenfeld Media.
3. Rocket Surgery Made Easy – Steve Krug, New Riders.

Evaluation Pattern

Assessment	Weightage (%)
Continuous Assessment	70
End Semester Exam	50
Total Marks	100

Regular Stream

26CSA361	CLIENT SERVER COMPUTING	L-T-P-C: 3-0-0-3

Course Objective(s)

The objective of this course is to familiarize with client server computing concepts, to understand the components of client server application, client server system development and the data storage concepts in client server computing.

Course Outcomes

COs	Description
CO1	Explore the concept of client server computing.
CO2	Analyze the components of client server application.
CO3	Design the client server network.
CO4	Develop Client Server System applications.
CO5	Explore the data Storage concepts in client server computing.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	2
CO4	-	2	3	2	-	-	-	-

Syllabus

Unit1

Client/Server Computing: DBMS concept and architecture, Single system image, Client Server architecture, mainframe-centric client server computing, downsizing and client server computing, preserving mainframe applications investment through porting, client server development tools, advantages of client server computing.

Unit-2

Components of Client/Server application: The client: services, request for services, RPC, windows services, fax, print services, remote boot services, other remote services, Utility Services. Dynamic Data Exchange (DDE), Object Linking and Embedding (OLE), Common Object Request Broker Architecture (CORBA). The server: Detailed server functionality, the network operating system, available platforms, the network operating system, available platform, the server operating system.

Unit-3

Client/Server Network: connectivity, communication interface technology, Interposes communication, wide area network technologies, network topologies (Token Ring, Ethernet, FDDI, CDDI) network management, Client-server system development: Software, Client–Server System Hardware: PC-level processing unit, Macintosh, notebooks, pen, UNIX workstation, x-terminals, server hardware.

Unit-4

Client Server Systems Development: Services and Support, system administration, Availability, Reliability, Serviceability, Software Distribution, Performance, Network management, Help Disk, Remote Systems Management Security, LAN and Network Management issues. Training, Training advantages of GUI Application, System Administrator training, Database Administrator training, End-user training.

Textbooks/ References

1. Patrick Smith & Steave Guengerich, ―Client / Server Computing‖, PHI
2. Dawna Travis Dewire, ―Client/Server Computing‖, TMH

References

1. Robert Orfali, Dan Harkey, and Jeri Edwards, ―Client / Server Survival Guide, Third Edition, JOHN WILEY & SONS. INC.

Evaluation Pattern

Assessment	Weightage (%)
Midterm	25
Continuous Assessment	25
End Semester Exam	50
Total Marks	100

26CSA362	E-Commerce Technologies	L-T-P-C:3-0-0-3

Course Objective(s)

- Introduce the fundamental concepts and evolution of electronic commerce systems.
- Explain the architectures and technologies enabling e-commerce platforms.
- Develop an understanding of electronic payment systems and transaction processing.
- Familiarize students with security, privacy, and trust mechanisms in e-commerce.
- Provide awareness of legal, ethical, and societal aspects of e-commerce technologies..

Course Outcomes

COs	Description
CO1	**Analyze** the structure and operation of electronic commerce systems
CO2	**Explain and evaluate** e-commerce architectures and enabling technologies
CO3	**Assess** electronic payment models and transaction processing mechanisms
CO4	**Evaluate** security, privacy, and trust requirements for e-commerce platforms
CO5	**Analyze** legal, ethical, and emerging trends in electronic commerce

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	1	0	0	0	1
CO2	3	3	2	2	0	0	0	1
CO3	2	2	3	2	0	0	1	1
CO4	2	3	2	2	0	0	3	1
CO5	1	2	1	1	0	0	3	2

Syllabus

Unit I

Introduction to electronic commerce. Evolution of e-commerce. Traditional commerce vs e-commerce
Types of e-commerce: B2C, B2B, C2C, G2C. E-commerce business models (technology perspective). Features and components of an e-commerce system.

Unit II

E-Commerce Architecture and Technologies. E-commerce system architecture. Client–server and multi-tier architectures. Web and application servers. Role of databases in e-commerce. Middleware and integration technologies. APIs and service-based architectures.

Unit III

Fundamentals of electronic payment systems. Online transaction processing
Payment models: Credit and debit cards, Net banking, Digital wallets, UPI and mobile payments (conceptual). Payment gateways and intermediaries. Risks and challenges in electronic payments.

Unit IV

Security requirements in e-commerce: Confidentiality, Integrity, Authentication, Non-repudiation. Encryption and digital signatures (overview). Secure Socket Layer (SSL/TLS). Public Key Infrastructure (PKI). Trust models and certification authorities. Fraud and cyber threats in e-commerce.

Unit V

Legal issues in e-commerce: Electronic contracts, Digital signatures. Consumer protection (overview). Privacy and data protection concerns. Ethical issues in online commerce. Emerging technologies: Mobile commerce (m-commerce), Social commerce, Blockchain in e-commerce (conceptual). Future trends and challenges.

Text Books

1. Electronic Commerce by Gary P. Schneider. Cengage Learning
2. E-Commerce: Business, Technology, Society, by Kenneth C. Laudon and Carol Guercio Traver. Pearson Education

Evaluation Pattern

Assessment	Weightage (%)
Midterm	25
Continuous Assessment	25
End Semester Exam	50
Total Marks	100

26CSA363	KNOWLEDGE MANAGEMENT	L-T-P-C: 3-0-0-3

Course Objective(s)

- Acquire the knowledge on basics of knowledge management and knowledge management cycle.
- Explore the various knowledge management models and their roles in business strategies'
- Develop understanding in using tools and technology for KM implementation and its use cases

Course Outcomes

COs	Description
CO1	Recognise the basic concepts of knowledge management**,** thematic analysis and dynamics
CO2	Role of knowledge Management models in business strategies.
CO3	Focus on knowledge transfer and organisation learning
CO4	Interpret the tools and technology for KM implementation and survey the business case illustrations

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	1	-	-	-	-	-	-	-
CO2	1	-	-	-	-	-	-	-
CO3	1	2	2	3	-	-	-	-
CO4	-	2	2	3	-	-	-	-

Syllabus

UNIT- 1

Focuses on Knowledge Economy - Context and Relevance of KM in the Business and Paradigm Shift , Emergence of Knowledge Economy - Demanding Knowledge Driven Strategic approach to Business .Focuses on Data, Information, Knowledge , attributes of knowledge , ethics , Types of Knowledge - Tacit and Explicit Knowledge , evolution, Knowledge: a Driver for Creativity and Innovation , Knowledge a Strategic Resource.

Focuses on Management of Knowledge - Knowledge Management , Knowledge Development and Management Cycle , Thematic Analysis of Knowledge Management , Knowledge Transformation and its Dynamics , Business Case for Knowledge Management

UNIT- 2

Focuses on KM Design and Architecture- Generic Model of Knowledge Management System , Challenges in Developing KMS , KM System Design and Architecture.

Focuses on KM for Business strategy - KM, Business Strategy and Knowledge Link , A Knowledge Strategy Framework , Validation of Knowledge through Knowledge Models , Creation and Acquisition of Knowledge , Knowledge Acquisition Techniques (KAT)

UNIT-3

Focuses on KM to Transfer, Measure, Capitalise and Control - Knowledge Transfer and Sharing , Knowledge Mapping , Knowledge Asset, Intellectual Capital and Property.

Focuses on Organisation Learning and Learning Organization - The Concept and Building of a learning organization , Five Core Disciplines of a Learning Organisation, Organization Learning

UNIT -4

Focuses on Tools and Technology for Successful KM Implementation - ICT, UCT, WiMAX Technology, Groupware Technology , Data Warehouse and Data Mining for Knowledge Search. Focuses on Case Illustrations of Knowledge Management and Making a Business Case for Knowledge , Management where following Tools and Technology are Used - Data Warehousing and Data Mining , Knowledge Portal, Knowledge Products , Intelligent Agents

Textbooks /References

1. Knowledge Management –Waman S Jawadekar,Tata McGraw Hill Education Private Limited-2011
2. Knowledge Management –E Sudhir Warier, Vikas Publishing House Pvt. Ltd. -2009
3. Measuring and Managing Knowledge: Tom Housel and Arthur Bell 2001, International Edition, Tata , McGraw-Hill
4. Knowledge Management: Ganesh Natarajan, President & CEO Aptech

Evaluation Pattern

Assessment	Weightage (%)
Midterm	25
Continuous Assessment	25
End Semester Exam	50
Total Marks	100

26CSA364	SOFT COMPUTING	L-T-P-C: 3-0-0-3

Course Objective(s)

1. Identify the characteristics of Soft computing systems and explore various applications of Soft computing techniques
2. Investigate applications of Neural Networks including Associative Memory, Adaptive Resonance theory, and Self Organizing Maps.
3. Analyse applications of Fuzzy Logic in decision-making, control systems, and classification.
4. Explore applications of hybrid Soft computing techniques and Analyse the convergence of GA and its multi-level optimization capabilities.

Course Outcomes

COs	Description
CO1	Demonstrate an understanding of the characteristics of Soft computing systems and their advantages over traditional computing paradigms.
CO2	Use Neural Networks for various domains such as pattern recognition, associative memory, and optimization, and evaluate their performance.
CO3	Optimize Fuzzy Logic-based systems for improved performance in different application domains.
CO4	Critically evaluate hybrid Soft computing approaches and Genetic Algorithms to solve real-world optimization problems

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-
CO3	3	3	3	2	-	-	-	-
CO4	3	3	3	2	-	-	-	-

Syllabus

Unit 1

Introduction to Soft Computing: Concept of computing systems, "Soft" computing versus "Hard" computing, Characteristics of Soft computing, Some applications of soft computing techniques.

What is Neural Network, Learning rules and various activation functions, Single layer Perceptron, Back Propagation networks, Architecture of Backpropagation (BP)Networks, Backpropagation Learning, to Associative Memory, Adaptive Resonance theory and Self Organizing Map, Recent Applications.

Unit 2

Fuzzy Set theory, Fuzzy versus Crisp set, Fuzzy Relation, Fuzzification, Minmax Composition, Defuzzification Method, Fuzzy Logic, Fuzzy Rule-based systems, Predicate logic, Fuzzy Decision Making, Fuzzy Control Systems, Fuzzy Classification.

Unit 3

Hybrid Soft Computing Techniques and Applications: Neuro-fuzzy hybrid systems, Genetic neuro hybrid systems, Genetic fuzzy hybrid and fuzzy genetic hybrid systems, simplified fuzzy ARTMAP – Applications: A fusion approach of multispectral images with SAR, optimization of traveling salesman problem using genetic algorithm approach, soft computing-based hybrid fuzzy controllers.

Unit 4

Genetic Algorithm: -History of Genetic Algorithms (GA), Working Principle, Various Encoding methods, Fitness function, GA Operators- Reproduction, Crossover, Mutation, Convergence of GA, Bitwise operation in GA, Multi-level Optimization.

Textbooks:

1. Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications, S.Rajasekaran, G. A. Vijayalakshami, PHI
2. S.N.Sivanandam and S.N.Deepa, ―Principles of Soft Computing‖, Wiley India Pvt Ltd, 2011.

References

1. J.S.R.Jang, C.T.Sun, and E.Mizutani, “Neuro-Fuzzy and Soft Computing”, PHI, 2004, Pearson Education 2004.
2. Timothy J. Ross, “Fuzzy Logic with Engineering Applications”, McGraw-Hill, International Editions, Electrical Engineering Series, Singapore.
3. Stamatios V. Kartalopoulos “Understanding Neural Networks and Fuzzy Logic Basic Concepts & Applications”, IEEE Press, PHI, New Delhi.
4. Davis E.Goldberg, “Genetic Algorithms: Search, Optimization and Machine Learning”, Addison Wesley, N.Y.

Evaluation Pattern

Assessment	Weightage (%)
Midterm	25
Continuous Assessment	25
End Semester Exam	50
Total Marks	100

26CSA365	SYSTEMS AND NETWORK ADMINISTRATION	L-T-P-C: 3-0-0-3

Course Objective(s)

The main aim of this course is to provide basic ideas to manage and administer computer systems as well as networks. Students are trained with practical sessions

Course Outcomes

COs	Description
CO1	Analyse the role of a System and Network administrator.
CO2	Explore the basic software commands for managing and administering the Systems and networks.
CO3	Develop skills in doing subnets, routing, and VPN installation.
CO4	Develop the skill to test the security vulnerabilities and their countermeasures.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	-	-	-	-	-	-	1
CO2	1	1	1	-	-	-	-	1
CO3	1	-	1	-	-	-	1	1
CO4	1	-	1	-	-	-	-	1

Syllabus

Unit 1: Understanding System Administration – Importance of Port Number, Tracking Services and processes. Monitoring your System, Network Operating System - Admin User - Administration Tools – Commands - Configuration Files – Log Files - Backup and Restore Files.

Unit 2: User Management - Issues - Registration – Account Policy – Login environment – Setting up and Supporting Users – Disk Quotas.

Unit 3: Network Administration – Topologies – Network Devices - Network Configuration – Static and Dynamic -Routing, Switching, VPN and other security Protocols-Firewall administration

Unit 4: Introduction to File Server – Setting Up a File Server – Network File Systems - SAMBA – Web Server. Understanding Directory Services- Active Directory

Textbooks/ References

1. Red Hat Linux - System Administration
2. Windows Server 2016 Administration Fundamentals by Bekim Dauti
3. UNIX and Linux System Administration Handbook, 4thEd., by Nemeth, Snyder, Hein and Whaley (Prentice Hall, 2010)
4. The Practice of System and Network Administration, 2nd Ed., by Limoncelli, Hogan and Chalup (Addison Wesley, 2007)
5. Mark Burgess – Principles of Network and System Administration –2nd Edition - John Wiley & Sons 6. Essential System Administration: Tools and Techniques for Linux and Unix Administration, 3rd Edition 3rd Edition by Æleen Frisch
7. LDAP System Administration: Putting Directories to Work 1st Edition by Gerald Carter
8. TCP/IP Network Administration (3rd Edition; O'Reilly Networking) Third Edition by Craig Hunt
9. Network Troubleshooting Tools (O'Reilly System Administration) 1st Edition by Joseph D Sloan
10. Linux Cookbook: Essential Skills for Linux Users and System & Network Administrators 2nd Edition by Carla Schroder

Evaluation Pattern

Assessment	Weightage (%)
Midterm	25
Continuous Assessment	25
End Semester Exam	50
Total Marks	100

26CSA366	MULTIMEDIA APPLICATIONS	L-T-P-C: 3-0-0-3

Course Objective(s)

1. Understand the concept and evolution of multimedia, including its history, early computing, and the principles of hypermedia and hypertext.
2. Develop skills in photo editing using Photoshop, including cropping, adjusting tone/color/brightness/contrast, retouching, and saving images appropriately.
3. Learn about graphic design principles, including types of graphic design, image-based and type-based design, symbol and logo design, and the graphic design process.
4. Gain proficiency in video and animation techniques, including visual representation, digitalizing video, and utilizing animation tools to create engaging multimedia content.

Course Outcomes

COs	Description
CO1	Understand multimedia's evolution and diversity, differentiate between linear and interactive formats, and integrate varied media to communicate effectively.
CO2	Apply audio and video principles, mastering techniques such as digitization and signal processing, to create dynamic multimedia presentations.
CO3	Acquire expertise in photo editing and graphic design, demonstrating skills in image manipulation, color correction, and the creation of visually compelling graphics and logos.
CO4	Analyse the components and functionalities of multimedia systems, evaluating the roles of perception, representation, storage, and transmission mediums in multimedia content delivery

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-
CO3	1	1	3	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-

Syllabus

Unit-1 Introduction to Multimedia: Introduction to multimedia, a concise history of multimedia, early multimedia computing, hypermedia and hypertext, combining content from various media, linear VS. Interactive multimedia, nonlinear interactive multimedia, kinds of multimedia.

Unit: 2 Audio fundamentals and Video and Animation: Audio fundamentals, sound waves, sound transducer, signal fundamentals, measurement of sound, sound wave and signal, analog/ digital conversion, quantizes sound signal, Fourier transform.

Video and Animation: Introduction to video animation, visual representation, video resolution, digitalizing video, video capture cards, video formats, animation, controlling animation, animation tools.

Unit 3: Photo editing and Graphic Designing: Photoshop- image editing, create a copy of your original image, crop and straighten your picture, check your image size and resolution, fix tone, color, brightness, contrast, retouch as necessary, sharpen your image, save your image appropriately.

Graphic Designing: Types of graphic design, image-based design, type-based design, image and type design, symbols, logos and logo types, the graphic design process, briefing, design, art work, production.

Unit 4: Media and data streams: Multimedia: media and data streams, main properties of a multimedia system, the perception medium, the representation medium, the storage medium, the transmission medium, representation values and representation spaces, representation dimensions.

Textbook

1. Introduction to Multimedia Communications: Applications, Middleware, Networking" by Kamisetty Rao and Feng Wu
2. "Audio in Media" by Stanley Alten
3. Understanding Animation" by Paul Wells

Reference

1. "The Adobe Photoshop CC Book for Digital Photographers" by Scott Kelby
2. "Graphic Design School: The Principles and Practice of Graphic Design" by David Dabner, Sandra Stewart, and Abbie Vickress
3. "Multimedia: Making It Work" by Tay Vaughan

Evaluation Pattern

Assessment	Weightage (%)
Midterm	25
Continuous Assessment	25
End Semester Exam	50
Total Marks	100

26CSA367	Software Testing and Quality Assurance	L-T-P-C:2-0-2-3

Course Objective(s)

- Introduce the fundamental concepts and objectives of software testing and quality assurance.
- Explain testing principles, levels, and methodologies used in the software life cycle.
- Develop the ability to analyze software requirements and design effective test cases.
- Familiarize students with quality models, standards, and process improvement frameworks.
- Promote awareness of ethical responsibility, reliability, and customer trust in software products...

Course Outcomes

COs	Description
CO1	**Analyze** the role of testing and quality assurance in the software development life cycle
CO2	**Design and evaluate** test cases using appropriate functional and structural test design techniques
CO3	**Analyze** different testing levels, strategies, and life-cycle models
CO4	**Evaluate** software quality using models, metrics, and international standards
CO5	**Assess** ethical, reliability, and risk-related issues in software testing and quality assurance

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	3	2	1	0	0	1	1
CO2	3	3	3	2	0	0	1	1
CO3	2	3	2	1	0	0	1	1
CO4	2	2	3	2	0	0	2	1
CO5	1	2	1	1	0	0	3	2

Syllabus

Unit I

Introduction to Software Testing and QA. Need for software testing. Software testing vs debugging. Verification vs validation. Objectives and principles of software testing. Role of testing in SDLC. Quality assurance vs quality control. Cost of software defects

Unit II

Software Testing Life Cycle (STLC). Test planning and test strategy. Levels of testing: Unit testing, Integration testing, System testing, Acceptance testing. Alpha and beta testing. Regression testing.

Unit III

Test Design Techniques. Black-box testing techniques: Equivalence class partitioning, Boundary value analysis, Decision table testing. White-box testing techniques: Control flow testing, Statement, branch, and path coverage. Grey-box testing (conceptual). Test case design and documentation.

Unit IV

Software quality concepts. Software quality models: McCall's model, ISO/IEC 25010 quality model. Software metrics: Product metrics, Process metrics. Defect management and reporting. Introduction to standards: ISO 9001, CMMI (overview).

Unit V

Static testing: Reviews and inspections. Risk-based testing. Software reliability concepts. Introduction to non-functional testing: Performance, Security. Usability testing. Ethical issues in testing: Data privacy, Responsible disclosure. Future trends in software testing.

Textbooks

1. Software Testing: Principles and Practice, by Srinivasan Desikan and Gopalaswamy Ramesh. Pearson Education.
2. The Art of Software Testing, by Glenford J. Myers, Corey Sandler, and Tom Badgett. 3rd Edition, Wiley.

Evaluation Pattern

Assessment	Weightage (%)
Midterm	25
Continuous Assessment	25
End Semester Exam	50
Total Marks	100

Electives – 4 Credits

AI & DS Stream

26CSA231	Machine Learning Basics	L-T-P-C:3-0-2-4

Course Objective(s)

- Introduce the fundamental concepts and paradigms of machine learning.
- Develop the ability to formulate problems as suitable machine learning tasks.
- Enable students to select, apply, and compare classical ML algorithms.
- Build competence in model evaluation, validation, and performance trade-offs.
- Create awareness of limitations, bias, and ethical issues in ML systems.

Course Outcomes

COs	Description
CO1	**Analyze** real-world problems and **formulate** them as supervised or unsupervised learning tasks
CO2	**Design and apply** classical machine learning models for regression and classification
CO3	**Evaluate and compare** machine learning models using appropriate metrics and validation techniques
CO4	**Apply** clustering and dimensionality-reduction techniques for exploratory analysis
CO5	**Assess** limitations, bias, and ethical concerns in machine-learning-based decision systems

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	2	0	0	1	2
CO2	3	3	2	2	0	0	1	1
CO3	2	2	3	2	1	0	0	1
CO4	2	3	3	2	0	0	1	1
CO5	2	3	3	2	1	0	2	2

Syllabus

Unit I

What is Machine Learning? ML vs Programming vs AI. Types of Learning: Supervised learning, Unsupervised learning. Learning workflow: Data → Model → Prediction → Evaluation. Applications of classical ML. Limitations of ML systems.

Unit II

Regression problem formulation. Linear Regression. Assumptions and interpretation. Error functions (MSE, MAE). Regularization. Ridge and Lasso (conceptual understanding). Model performance evaluation. Overfitting and underfitting.

Unit III

Classification problem formulation. Logistic Regression. k-Nearest Neighbour (k-NN). Decision Tree Classifier. Information gain / Gini (conceptual). Performance metrics: Confusion matrix, Accuracy, Precision, Recall, F1-score, ROC curve (interpretation).

Unit IV

Clustering. k-Means algorithm. Hierarchical clustering. Cluster evaluation: Inertia, silhouette score. Dimensionality Reduction. Principal Component Analysis (PCA). Variance interpretation. Applications in data analysis.

Unit V

Training, validation, and test sets. Cross-validation (k-fold). Hyperparameter tuning (grid/random – idea level). Bias–variance trade-off. Class imbalance issues. Ethics in Machine Learning. Bias, fairness, transparency. Responsible ML practices.

Lab Syllabus

- Problem formulation & metrics selection; baselines
- Linear regression: bias–variance, residuals, regularization paths (ridge/lasso)
- Logistic regression: decision boundaries, threshold tuning, PR/ROC curves
- k-NN: distance metrics; effect of k; scaling sensitivity
- Model selection: CV & grid/random search; nested CV (concept demo)
- Clustering (k-means): choosing k;
- Compare models using metrics

Text Books

1. *An Introduction to Statistical Learning (ISLR)*, 2nd Edition, by Gareth James et al. Springer.
2. Introduction to Machine Learning with Python, by Andreas C. Müller & Sarah Guido, O'Reilly.

Evaluation Pattern

Assessment	Weightage (%)
Midterm	20
Continuous Assessment	50
End Semester Exam	30
Total Marks	100

26CSA232	COMPUTATIONAL INTELLIGENCE	L-T-P-C: 3-0-2-4

Course Objective(s)

- Provide a comprehensive understanding of core CI paradigms like Neural Networks, Fuzzy Logic, and Evolutionary Computation.
- Implement basic CI algorithms using Python libraries.
- Analyze, evaluate and compare different CI approaches for specific tasks.

Course Outcomes

COs	Description
CO1	Gain an understanding of the core concepts, scope, and historical development of Computational Intelligence techniques. Explore the relationship between CI, Artificial Intelligence, and Machine Learning and the difference by evaluating a real-world applications.
CO2	Analyze the biological inspiration behind Artificial Neural Networks. Explore different network architectures, learning algorithms, impact of activation functions on network performance and learn various training techniques.
CO3	Acquire knowledge about fuzzy sets, components of fuzzy inference systems, rule-based systems and their applications in decision-making and control.
CO4	Explore the principles of evolutionary algorithms and their role in optimization and search problems. Delve into Genetic Algorithms, including selection, crossover, mutation operators and implement various evolutionary algorithms

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	1	1	1	-	2
CO2	2	2	3	2	1	1	-	1
CO3	2	2	3	2	1	1	-	1
CO4	2	2	3	2	1	1	-	1

Syllabus

Unit 1: Introduction to Computational Intelligence

Definition, scope, and applications of Computational Intelligence (CI) - Historical development of CI techniques - Relationship of CI to Artificial Intelligence (AI) and Machine Learning (ML) - Types of CI: Neural Networks, Fuzzy Logic, Evolutionary Computation

Unit 2: Artificial Neural Networks

Biological inspiration and neuron models - Network architectures (Perceptron, Multi-Layer Perceptron) - Learning algorithms (Backpropagation, Gradient Descent) - Activation functions and their impact - Training techniques: Gradient Descent, Stochastic Gradient Descent, Mini-batch Gradient Descent - Applications of neural networks

Unit 3: Fuzzy Logic Systems

Fuzzy sets and fuzzy logic concepts: Fuzzy Logic - Fuzzy rules - Fuzzy inference - Membership functions and fuzzy reasoning - Fuzzy rule-based systems and their design - Applications of fuzzy logic systems

Unit 4: Evolutionary Computation

Introduction to evolutionary algorithms (EAs) - Genetic Algorithms (GAs): Selection, Crossover, Mutation - Applications of GAs (optimization, search problems) - Introduction to other EAs (Particle Swarm Optimization, Ant Colony Optimization)

Lab syllabus:

1. Install and explore Python libraries for CI: TensorFlow, scikit-fuzzy, DEAP.
2. Write simple Python scripts to perform basic mathematical operations using these libraries.
3. Implement a Perceptron algorithm in Python to perform binary classification on a sample dataset.
4. Explore different activation functions (e.g., Sigmoid, ReLU) and analyze their impact on network performance.
5. Implement a Multi-Layer Perceptron (MLP) network with backpropagation for a more complex classification task.
6. Analyze the effect of hidden layers and the number of neurons on the performance of the MLP.

7. Implement fuzzy sets and membership functions in Python for a given variable.
8. Design a simple fuzzy rule-based system for decision-making.
9. Implement the fuzzy reasoning process using Python to evaluate the system's output for different inputs.
10. Analyze the impact of changing membership functions on the system's behavior.
11. Implement a basic Genetic Algorithm (GA) in Python to solve a simple optimization problem.
12. Analyze the impact of different selection methods on the performance of the GA.
13. Explore crossover and mutation operators and their effect on the diversity of the population.
14. Implement a simple Particle Swarm Optimization (PSO) algorithm and compare its performance to GA for a chosen problem.

Textbooks

1. Stuart Russell, Peter Norvig, ―Artificial Intelligence: A Modern Approach‖, Third Edition, Pearson Education / Prentice Hall of India, 2010.
2. Elaine Rich and Kevin Knight, ―Artificial Intelligence‖, Third Edition, Tata McGraw Hill, 2010.

References

1. Patrick H. Winston. "Artificial Intelligence", Third edition, Pearson Edition, 2006.
2. Dan W.Patterson, ―Introduction to Artificial Intelligence and Expert Systems‖, PHI, 2006.
3. Nils J. Nilsson, ―Artificial Intelligence: A new Synthesis‖, Harcourt Asia Pvt. Ltd., 2000.

Evaluation Pattern

Assessment	Weightage (%)
Midterm	20
Continuous Assessment (including lab)	50
End Semester Exam	30
Total Marks	100

26CSA233	Time Series Analysis	L-T-P-C: 3-0-2-4

Course Objective(s)

- Enhance the ability to analyse the timely data with trend estimation and seasonal forecasting.
- Pre-requisite: Probability and statistics,

Course Outcomes

COs	Description
CO1	Introduce the overview of time series analysis and importance of its properties.
CO2	Describe the regression, type and importance of regression and role of model selection in time series
CO3	Analyse the data about its covariance and prediction about time series data and its models.
CO4	Classify different types of spectral representation and estimation of time series analysis.
CO5	Building the multivariate and spatial time series and its higher applications.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	1	1	1	-	-	-	-
CO2	3	1	2	3	-	-	-	-
CO3	3	2	2	3	-	-	-	-
CO4	3	3	2	2	-	-	-	-
CO5	3	2	2	-	-	-	-	-

Syllabus

Unit 1

Introduction to Time Series Analysis- Signal Vs Noise - Graphics - Stationary Process - Ensemble methods - Random walk Vs trend - Periodicity - Linear Process - Estimators: Mean, ACF, PACF and Variorum. Properties of Covariance and Normality.

Unit 2

Regression Models - Trend - Difference of time - Backshift operator - Harmonic regression - Periodogram - Signal processing, novel asymptote theory - Nonparametric regression - smoothening - Periodic functions; Model selection-AIC, BIC, SIC, bias-variance trade-of; ARMA models-polynomial approximation, causality, notation.

Unit 3

Covariances-identification Prediction - recursion; Estimation - MLE, LS, forward-backward State - space models - Kalman filter Properties -equivalence with ARMA, nonlinear models - Switching models-hidden Markov models (HMM).

Unit 4

Hilbert spaces-infinite dimension, L2, martingale; Spectral representation-integral representation, Woldde composition; Periodogram-discrete Fourier transform (DFT); Spectral estimation-linear filters.

Unit 5

Multivariate time series-VAR, cross-correlation, trans function, spectral regr; Cointegration- principal components; Seasonality-X-11, Dynamic multiple regression models, Quasi variant step regression models, seasonal differencing; Wavelets- multi resolution analysis; Spatial time series-kriging, spatial AR models

Textbooks:

1. R. H. Shumway and D. S. Stoffer (2006), Time series analysis and its applications (With R Examples, Second Edition). Springer, New York.

References:

1. ″The Analysis of Time Series: An Introduction” by Chris Chatfield.
2. ″Forecasting: Principles and Practice” by Rob J. Hyndman and George Athanasopoulos.
3. ″Introduction to Time Series Analysis and Forecasting” by Douglas C. Montgomery, Chery L. Jennings, and Murat Kulahci.

List of Experiments:

1. Use time series analysis techniques to forecast future inventory needs and optimize stock levels. This can help to reduce stockouts and holding costs.
2. Build a time series model to predict future stock prices. It is important to remember that this is a complex task and the results should not be used for financial decision-making.
3. To forecast future website traffic and identify patterns in user behavior. This information can be used to improve website design and content marketing strategies.
4. Use time series analysis to identify trends in social media activity and understand how different factors can impact these metrics.
5. Focus to predict the temperature in the near future in any geo location with an multi variate trend estimation.
6. Use time series analysis to forecast future sales and identify factors that can impact sales.
7. Analyse the data Trend using exponential smoothening technique.

Evaluation Pattern

Assessment	Weightage (%)
Midterm	20
Continuous Assessment (including lab)	50
End Semester Exam	30
Total Marks	100

26CSA234	NON-RELATIONAL DATABASES	L-T-P-C: 3-0-2-4

Course Objective(s)

- Gain a foundational understanding of Exploratory Data Analysis (EDA) concepts.
- Learn how to import and manipulate data using Python libraries (e.g., Pandas, NumPy).
- Perform data cleaning and pre-processing techniques.
- Create informative data visualizations using Python libraries (e.g., Matplotlib, Seaborn).
- Summarize and describe data using statistical methods.

Course Outcomes

COs	Description
CO1	Students will have a neat comprehension of how NoSQL databases differ from relational databases from a practical perspective.
CO2	Students will be able to master the basics concepts of designing NoSQL database management system.
CO3	Students will be familiar with selecting a particular NoSQL database for specific use cases.
CO4	Students will be able to apply all types of NoSQL database to implement based on business requirements.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	1	1	-	-	1	-	-
CO2	2	1	1	-	-	2	-	-
CO3	1	2	2	-	-	-	-	-
CO4	2	1	1	-	-	-	-	-

Syllabus

Unit 1
Database Management System – introduction, history of database, management systems characteristics of dbms, definition, objectives, merits and demerits, entity relationship model, concurrency control. Data Models – definition, designing databases, hierarchical data model, network data model.

Unit 2
RDBMS – relational data model, techniques & components of relational data model, definition of relational terms, features, 12 rules for a fully RDBMS.

Unit 3
NOSQL Systems-Introduction to NoSQL, Disadvantages of NoSQL technology, NOSQL Systems, weakness of RDBMS, Key-value database-Key values database, more elements of key values database, Properties of Key-value store.

Unit 4
Columnar Databases - Characteristics of a columnar database. Document databases with MongoDB - Implement a document database with Mongo DB. Graph Databases - Graph databases, properties of graph model, graph traversal problems and adjacency matrix.

Lab Syllabus

- Explore DBMS features, objectives, limitations; compare hierarchical, network, and relational data models.
- Draw ER diagrams, identify entities, attributes, relationships, and convert real-world scenarios into ER models.
- Convert ER diagrams into relational schemas, define keys, constraints, relations, and practice normalization basics.
- Hands-on SQL for Understanding RDBMS Concepts

- Create tables, insert data, define keys, and run basic queries to reinforce relational model fundamentals.
- Evaluate an RDBMS installation (MySQL/PostgreSQL) against Codd's rules; check where relational systems fall short.
- Analyze NoSQL characteristics, CAP theorem concepts (conceptual), identify scenarios where RDBMS is weak.
- Install Redis or similar; perform basic SET, GET, DEL operations; explore data persistence modes.
- Work with Redis lists, sets, hashes; understand key-value store properties and performance features.
- Implement a session store, caching scenario, or user-preference storage using Redis key-value patterns.
- Explore Cassandra / ClickHouse concepts; inspect column families, partitioning, and primary key design.
- Create column families, insert sample data, retrieve data using typical columnar access patterns.
- Install MongoDB; create databases and collections; insert JSON documents; retrieve and filter data.
- Implement embedded documents, references, arrays; perform CRUD operations and aggregation pipeline queries.

Textbooks:

1. Advanced Data Management: For SQL, NoSQL, Cloud and Distributed Databases By Lena Wiese
2. Getting Started with Nosql by Gaurav Vaish.

Evaluation Pattern

Assessment	Weightage (%)
Midterm	20
Continuous Assessment (including lab)	50
End Semester Exam	30
Total Marks	100

26CSA235	R PROGRAMMING	L-T-P-C: 3-0-2-4

Course Objective(s)

- Understand the core syntax, data structures (vectors, matrices, data frames) and how to navigate the R environment.
- Learn to import data from various sources, clean and transform datasets, handle missing values and outliers, and effectively structure data for analysis.
- Gain the ability to summarize data with descriptive statistics, create informative visualizations (histograms, scatterplots, boxplots) and identify patterns and relationships within datasets.
- Develop an understanding of foundational statistical concepts like hypothesis testing (p-values) and perform simple linear regression analysis.
- Learn to write basic R scripts to streamline data manipulation and analysis processes.

Course Outcomes

COs	Description
CO1	Apply the R programming fundamental to setup environment, write basic R scripts, and utilize core programming constructs to effectively.
CO2	Develop expertise in importing data from various formats, cleaning and manipulating datasets, and efficiently structuring data for further analysis.
CO3	Perform exploratory data analysis (EDA), including summarizing data with descriptive statistics, creating informative data visualizations, and identifying patterns and trends within datasets.
CO4	Develop a solid understanding of fundamental statistical concepts like hypothesis testing and be able to perform basic statistical analysis methods, such as simple linear regression, using R.
CO5	Equipped to write basic R scripts to automate data analysis tasks, improving efficiency and streamlining the data analysis workflow.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	-	-	-	-	-	3	-
CO2	3	-	-	3	-	-	-	-
CO3	-	3	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-
CO5	-	2	2	2	-	-	2	-

Syllabus

Unit 1

Introduction to R: Introduction to R programming and its applications. Setting up R environment and basic syntax. Working with data objects (vectors, matrices, data frames). Importing data from various sources (CSV, Excel). Hands-on practice: Basic data manipulation in R.

Unit 2

Data Manipulation and Wrangling: Data cleaning & transformation techniques. Handling missing values and outliers. Working with dates and times in R. Merging and reshaping data sets. Hands-on practice: Data cleaning and wrangling exercises.

Unit 3

Exploratory Data Analysis (EDA): Descriptive statistics and data visualization fundamentals. Creating informative visualizations (histograms, scatterplots, boxplots). Summarizing data with tables and charts. Identifying patterns and relationships in data. Hands-on practice: Conducting EDA on real-world data.

Unit 4

Introduction to Data Analysis: Basic statistical concepts (hypothesis testing, p-values), Simple linear regression analysis, Introduction to data modelling in R. Hands-on practice: Performing statistical analysis on data.

Lab Syllabus

- Write an R program to create and manipulate vectors, matrices, and data frames.
- Write an R program to import data from CSV and Excel files and display basic information.
- Write an R program to filter, subset, and modify data frame columns (basic data manipulation).
- Write an R program to clean data by handling missing values (remove/replace NA).
- Write an R program to detect and treat outliers using summary statistics and boxplot method.
- Write an R program to work with dates and times using the lubridate package.
- Write an R program to merge two data sets using different join types.
- Write an R program to reshape data using pivot_longer() and pivot_wider().
- Write an R program to compute descriptive statistics (mean, median, mode, variance).
- Write an R program to create visualizations—histogram, scatterplot, and boxplot using ggplot2.
- Write an R program to perform Exploratory Data Analysis (EDA) on a real-world dataset.
- Write an R program to generate summary tables and correlation plots.
- Write an R program to perform hypothesis testing (t-test or chi-square test).
- Write an R program to perform simple linear regression using lm() and visualize the fitted line.

TEXTBOOKS:

1. Data Science with R: A Step-by-Step Guide with Visual Illustrations & Examples, Andrew Oleksy.
2. Practical Data Science with R, Nina Zumel and John Mount, Dreamtech/Manning, 2014
3. R Programming for Data Science, Roger D. Peng, Lean publishing, 2015.

REFERENCES:

1. "R for Data Science", Hadley Wickham and Garett Grolemund, O'Reilly, 2017
2. "Data Mining for Business Analytics: Concepts, Techniques and Applications in R", GalitShmueli, et al, Wiley India, 2018.

Evaluation Pattern

Assessment	Weightage (%)
Midterm	20
Continuous Assessment (including lab)	50
End Semester Exam	30
Total Marks	100

26CSA236	Probability and Statistics for Machine Learning	L-T-P-C: 3-1-0-4

Course Objective(s)

- Understand the basic mechanisms of descriptive statistics
- Understand the preliminary concept of probability and different types of probability distribution
- Learn different types of two-dimensional probability distributions and correlation analysis
- Familiarize yourself with inferential statistics by studying the estimation theory and hypothesis testing

Course Outcomes:

COs	Description
CO1	Implement various methods of descriptive statistics using central tendency, dispersion, skewness, kurtosis, correlation and regression analysis, and least squares.
CO2	Develop the fundamental concept of probability theory.
CO3	Develop the concept of probability distribution functions.
CO4	Learn two-dimensional probability distribution theory for discrete case.
CO5	Apply the estimation theory to obtain maximum likelihood estimator, moments, and confidence interval and hypothesis testing for both large and small samples.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	-	-	-	-	-	3	-
CO2	3	-	-	3	-	-	-	-
CO3	-	3	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-
CO5	-	2	2	2	-	-	2	-

Syllabus:

Unit 1

Introduction to Statistics: Definition, importance in ML, and types of data, Measures of Central Tendency and Dispersion, skewness and kurtosis, Correlation and Regression analysis, Coefficient of determination.

Unit 2

Introduction to Probability, Probability, Conditional Probability, Multiplication and Total Probability rules, Independence, Bayes theorem

Unit 3

Random variables, Probability Distributions. Mathematical expectation and variance, Uniform, Binomial, Poisson, Exponential, and Normal distributions

Unit 4

Two dimensional random variables - Joint, marginal and conditional probability distributions for discrete case only, correlation analysis

Unit 5

Estimation theory - Point Estimation: criteria of point estimation, method of maximum likelihood estimation and method of moments, Hypothesis testing, large and small sample tests for single mean and two means, paired t-test, Chi-square goodness of fit, Independence of attributes

Textbooks:

1. Douglas C. Montgomery and George C. Runger, Applied Statistics and Probability for Engineers, John Wiley and Sons Inc., 2005
2. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, Probability and Statistics for Engineers and Scientists, 8th Edition, Pearson Education Asia, 2007.

References:

1. Ross S.M., Introduction to Probability and Statistics for Engineers and Scientists, 3rd edition, Elsevier Academic Press.
2. Ravichandran, J. Probability and Statistics for engineers, First Reprint Edition, Wiley India, 2012.

Evaluation Pattern

Assessment	Weightage (%)
Midterm	25
Continuous Assessment (including lab)	25
End Semester Exam	50
Total Marks	100

Cyber Security Stream

26CSA241	Blockchain & Web3	L-T-P-C: 3-0-2-4

Course Objective(s)

- To introduce the fundamentals of blockchain and *decentralised* systems
- To explain blockchain architecture, consensus mechanisms, and transactions
- To understand smart contracts and *decentralised* applications (DApps)
- To explore Web3 concepts and real-world use cases
- To provide practical exposure to blockchain development basics

Course Outcomes

COs	Description
CO1	Analyze centralized and decentralized system models to justify the need for blockchain-based solutions.
CO2	Evaluate blockchain architectures, transaction flows, and consensus mechanisms for suitability in different application contexts.
CO3	Apply cryptographic concepts, wallets, and key management techniques to secure blockchain transactions and identities.
CO4	Design and implement basic smart contracts and decentralized applications using blockchain development tools.
CO5	Analyze real-world blockchain and Web3 use cases and identify suitable application scenarios.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	1	1	1	1	-	2	2
CO2	2	2	1	2	1	-	2	2
CO3	2	2	1	2	1	-	2	2
CO4	2	2	**3**	**3**	2	1	2	2
CO5	2	**3**	**3**	2	2	1	2	2

Syllabus

Unit I

Introduction to Blockchain & Distributed Ledgers. Evolution from centralized to decentralized systems. Need for trust less systems. Blockchain definition and characteristics. Distributed ledger technology (DLT). Types of blockchains: public, private, consortium. Benefits and limitations of blockchain.

Unit II

Blockchain Architecture & Consensus. Block structure and hash chaining. Transactions and Merkle trees (conceptual). Consensus mechanisms: PoW, PoS, PBFT (high-level). Nodes, miners, validators. Transaction validation and finality.

Unit III

Blockchain & Cryptography Essentials. Hash functions and digital signatures in blockchain. Public/private keys and wallets. Addresses and key management. Introduction to cryptocurrency (Bitcoin, Ethereum overview). Gas, fees, and incentives

(concepts only)

Unit IV

Smart Contracts & Ethereum Platform. What are smart contracts? Ethereum architecture. Smart contract lifecycle. Intro to Solidity programming language (syntax & structure). Advantages and risks of smart contracts.

Unit V

Web3, DApps & Use Cases. Web1 vs Web2 vs Web3. Decentralized applications (DApps). Web3 components: wallets, smart contracts, front-ends. Use cases: supply chain, finance, healthcare, identity, NFTs. Legal, ethical, and environmental considerations.

Lab Syllabus

1. Introduction to Remix IDE, MetaMask wallet, and Ethereum test networks.
2. Create and manage a wallet using MetaMask; explore public/private keys.
3. Perform and observe transactions on a test network; understand gas fees.
4. Write and deploy a simple Solidity smart contract.
5. Create a contract to store and retrieve data on blockchain.
6. Implement a simple token (ERC-20 style – simplified).
7. Read/write data from deployed smart contracts using Remix.
8. Create a simple front-end to interact with a smart contract.
9. Observe common risks (e.g., improper access control).
10. Design a simple blockchain use case (e.g., voting, student record, supply chain demo).

Textbooks/ References

1. Mastering Blockchain, 3rd Edition, by Imran Bashir. Packt Publishing
2. Blockchain Basics, by Daniel Drescher. Apress

Evaluation Pattern

Assessment	Weightage (%)
Midterm	20
Continuous Assessment	50
End Semester Exam	30
Total Marks	100

26CSA242	Intrusion Detection & Prevention Systems	L-T-P-C: 3-0-2-4

Course Objective(s)

- To analyze the nature of cyber intrusions and attack patterns
- To evaluate different IDS and IPS architectures and detection techniques
- To understand rule-based, signature-based, and anomaly-based detection
- To implement basic IDS/IPS solutions using open-source tools
- To evaluate alerts, false positives, and system limitations ethically and responsibly

Course Outcomes

COs	Description
CO1	Analyze cyber-attack patterns and intrusion techniques to determine detection requirements in networked systems.
CO2	Evaluate host-based and network-based intrusion detection and prevention architectures for different security environments.
CO3	Design rule-based and signature-based detection strategies using IDS/IPS concepts and traffic characteristics.
CO4	Implement and demonstrate basic IDS/IPS solutions using open-source tools to detect and prevent simulated attacks.
CO5	Analyze and assess IDS/IPS alerts to differentiate true attacks from false positives and recommend appropriate response actions.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	3	1	1	1	-	2	2
CO2	2	3	1	2	1	-	2	2
CO3	2	2	**3**	3	2	1	2	2
CO4	2	2	**3**	**3**	2	1	2	2
CO5	2	3	2	2	2	1	**3**	2

Syllabus

Unit I

Intrusions, Threats & Detection Requirements. Nature of cyber intrusions and attack lifecycle. Threat actors and intrusion techniques. Detection vs prevention – conceptual distinctions. Limitations of traditional security controls. Need for IDS and IPS in modern networks.

Unit II

IDS/IPS Architectures & Deployment Models. Host-based IDS (HIDS). Network-based IDS (NIDS). Inline IPS vs passive IDS. Centralized vs distributed architectures. Deployment challenges and performance considerations.

Unit III

Detection Techniques & Analysis Methods. Signature-based detection. Anomaly-based detection. Rule-based detection systems. Heuristics and threshold analysis. Strengths, weaknesses, and evasion techniques.

Unit IV

IDS/IPS Technologies & Tools. Overview of IDS/IPS tools: Snort, Suricata, Zeek (conceptual + practical orientation). Rule structure and alert generation. Log and alert analysis basics. Integration with firewalls and access controls. Ethical and legal considerations in monitoring.

Unit V

Alert Management, Response & Case Studies. Intrusion alert classification. False positives vs false negatives. Incident response basics for detected intrusions. Case studies: scan detection, brute-force attacks, DoS indicators. IDS/IPS limitations and future trends.

Lab Syllabus

1. Installation and overview of IDS tools and lab setup.
2. Capturing and analyzing basic traffic for intrusion indicators.
3. Configure Snort in IDS mode and understand rule structure.
4. Create and test simple Snort rules for port scanning and ICMP alerts.
5. Observe traffic deviations and anomaly indicators using IDS output.
6. Analyze IDS logs and classify alerts based on severity.
7. Demonstrate prevention concepts using inline or blocking rules.
8. Distinguish benign traffic from malicious alerts.
9. Detect brute-force or scan activity in a controlled environment.
10. Design and demonstrate an IDS/IPS deployment for a small organization, including rules and response logic.

Textbooks/ References

1. Guide to Intrusion Detection and Prevention Systems, by Scarfone & Mell. NIST (SP 800-94) – Conceptual foundation.
2. Intrusion Detection Systems, by Bace & Mell. Macmillan Technical Publishing
3. Intrusion Detection & Prevention by Carl Endorf et al. McGraw-Hill

Evaluation Pattern

Assessment	Weightage (%)
Midterm	20
Continuous Assessment	50
End Semester Exam	30
Total Marks	100

26CSA243	IoT Security	L-T-P-C: 3-0-2-4

Course Objective(s)

- To analyze security risks specific to IoT architectures and deployment environments
- To evaluate vulnerabilities in IoT devices, communication protocols, and data flows
- To design secure mechanisms for device authentication, communication, and updates
- To implement basic IoT security controls and protections in simulated environments
- To assess IoT security practices considering ethical, privacy, and sustainability concerns

Course Outcomes

COs	Description
CO1	Analyze IoT architectures and threat models to identify security risks at device, network, and application layers.
CO2	Evaluate vulnerabilities in IoT communication protocols and data handling mechanisms.
CO3	Design secure authentication, authorization, and data protection mechanisms suitable for constrained IoT devices.
CO4	Implement and demonstrate basic security controls for IoT devices and gateways using appropriate tools and configurations.
CO5	Assess and recommend IoT security solutions for real-world scenarios considering privacy, ethics, and sustainability requirements.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	3	1	1	1	0	2	2
CO2	2	3	1	2	1	0	2	2
CO3	2	2	**3**	3	2	1	2	2
CO4	2	2	**3**	**3**	2	1	2	2
CO5	2	3	**3**	2	2	1	**3**	2

Syllabus

Unit I

IoT Architecture & Threat Landscape. IoT ecosystem components: devices, gateways, cloud, applications. IoT reference architectures. Attack surface in IoT environments. IoT-specific threat models and risk vectors. Constraints in securing IoT systems (power, memory, connectivity).

Unit II

IoT Device & Hardware Security. Device identity and trust. Secure boot concepts. Firmware security & OTA updates. Physical attacks and tampering risks. Secure device provisioning.

Unit III

IoT Communication & Network Security. IoT communication protocols: MQTT, CoAP, HTTP (security aspects). Transport-level security for IoT. Gateway security concepts. Network segmentation for IoT. Threats: replay, spoofing, man-in-the-middle.

Unit IV

Data, Cloud & Application Security in IoT. Data lifecycle in IoT systems Access control and authentication mechanisms. Secure APIs and IoT cloud platforms (conceptual). Privacy risks and data leakage. Logging and monitoring basics for IoT systems.

Unit V

IoT Security Management & Case Studies. IoT security best practices and frameworks. Case studies: smart home, healthcare IoT, smart city. Ethics, privacy, and regulatory considerations. Incident response for IoT environments. Future challenges in IoT security.

Lab Syllabus

1. Introduction to IoT devices, gateways, and lab tools.
2. Configure basic authentication for an IoT device or simulator.
3. Publish and subscribe using secure MQTT (TLS simulation).
4. Capture and analyze IoT protocol traffic using Wireshark.
5. Study firmware update process and identify security weaknesses.
6. Configure basic firewall rules for IoT gateway device.
7. Implement role-based access control for IoT data access.
8. Observe effects of replay or spoofing attacks in controlled environment.
9. Implement basic device and gateway logging.
10. Design and demonstrate a secure IoT use case (e.g., smart home or sensor network) with identified risks and mitigations.

Textbooks/ References

1. Practical Internet of Things Security, by Brian Russell & Drew Van Duren. Packt Publishing
2. Security and Privacy in Internet of Things (IoTs), by Fei Hu. CRC Press

Evaluation Pattern

Assessment	Weightage (%)
Midterm	20
Continuous Assessment	50
End Semester Exam	30
Total Marks	100

26CSA244	Secure Software Development	L-T-P-C: 3-0-2-4

Course Objective(s)

- To analyze security risks throughout the software development lifecycle
- To design software systems using secure design principles and patterns
- To implement secure coding practices in common programming languages
- To apply testing and analysis techniques to detect software vulnerabilities
- To evaluate software systems for compliance with security and ethical standards

Course Outcomes

COs	Description
CO1	Analyze software security requirements and threats across different phases of the SDLC.
CO2	Design secure software architectures using security principles and design patterns.
CO3	Implement secure coding practices to mitigate common software vulnerabilities.
CO4	Apply and demonstrate software security testing techniques to identify and fix vulnerabilities.
CO5	Evaluate and recommend improvements to software systems considering security, ethics, and compliance requirements.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	3	1	1	1	0	2	2
CO2	2	2	**3**	2	2	1	2	2
CO3	2	2	**3**	**3**	2	1	2	2
CO4	2	3	2	**3**	2	1	2	2
CO5	2	3	2	2	2	1	**3**	2

Syllabus

Unit I

Secure Software Development Lifecycle & Threat Analysis. Security in SDLC: requirements, design, implementation, testing, deployment. Security requirements engineering. Threat modeling fundamentals (STRIDE – conceptual). Risk assessment and attack surface analysis. Aligning security with business and ESG goals.

Unit II

Secure Design Principles & Architecture. Security design principles (least privilege, defense-in-depth, fail-safe defaults). Secure architecture patterns. Authentication and authorization models. Secure session and state management. Design reviews and architectural risk analysis.

Unit III

Secure Coding Practices & Vulnerabilities. Input validation and output encoding. Secure error handling and logging. Memory and resource management (conceptual). OWASP Top 10 vulnerabilities (high-level). Safe use of cryptographic APIs.

Unit IV

Software Security Testing & Analysis. Static Application Security Testing (SAST) – overview. Dynamic Application Security Testing (DAST) – overview. Code review techniques. Secure dependency and library management. Introduction to DevSecOps concepts.

Unit V

Secure Deployment, Maintenance & Case Studies. Secure configuration and deployment practices. Patch management and vulnerability disclosure. Secure APIs and microservices (intro level). Legal, ethical, and compliance considerations. Case studies: insecure applications and breaches.

Lab Syllabus

1. Analyze a simple application and identify security risks in each SDLC phase.
2. Create a basic threat model for a given application using STRIDE principles.
3. Implement input validation to prevent injection vulnerabilities.
4. Implement role-based access control in a sample application.
5. Modify an application to handle errors securely without information leakage.
6. Use a static analyzer to detect security issues in source code.
7. Map application vulnerabilities to OWASP Top 10 categories.
8. Identify and fix vulnerable third-party dependencies.
9. Perform peer code review and apply security fixes.
10. Design, implement, and harden a secure software application with documented security controls.

Textbooks/ References

1. Writing Secure Code, 2nd Edition, by Michael Howard & David LeBlanc. Microsoft Press.
2. Secure Coding: Principles and Practices, by Mark G. Graff & Kenneth R. Van Wyk. O'Reilly Media.

Evaluation Pattern

Assessment	Weightage (%)
Midterm	20
Continuous Assessment	50
End Semester Exam	30
Total Marks	100

26CSA246	Cybercrime & Criminology	L-T-P-C: 3-1-0-4

Course Objective(s)

- To analyse cybercrime using criminological theories and behavioural models
- To examine different categories of cybercrimes and offender typologies
- To evaluate legal, policing, and judicial responses to cybercrime
- To assess the social, psychological, and economic impacts of cybercrime
- To promote ethical reasoning and preventive strategies in combating cybercrime

Course Outcomes

COs	Description
CO1	Analyze traditional and cyber-specific criminological theories to explain cybercriminal behavior and motivations.
CO2	Classify and evaluate different types of cybercrimes based on offender methods, victim profiles, and impact severity.
CO3	Assess legal, law-enforcement, and judicial mechanisms used to prevent, investigate, and prosecute cybercrimes.
CO4	Analyze social, psychological, and economic impacts of cybercrime on individuals, organizations, and society.
CO5	Design and justify preventive strategies and awareness programs to reduce cybercrime risks ethically and responsibly.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	3	1	1	1	0	2	2
CO2	2	3	1	1	1	0	2	2
CO3	2	2	2	1	1	1	2	2
CO4	2	1	1	1	**3**	2	2	1
CO5	2	3	**3**	2	2	1	**3**	2

Syllabus

Unit I

Foundations of Criminology & Cybercrime. Fundamentals of criminology. Crime causation theories (classical, positivist, sociological). Transition from traditional crime to cybercrime. Cyberspace as a criminogenic environment. Evolution and trends of cybercrime.

Unit II

Cybercriminal Behaviour & Offender Typologies. Cyber offender profiles and motivations. Organized cybercrime groups and lone actors. Hacking cultures and underground communities. Insider threats and socio-technical factors. Radicalization and cyber extremism (overview).

Unit III

Cybercrime Types & Modus Operandi. Financial cybercrimes (fraud, ransomware, scams). Crimes against individuals (cyberstalking, harassment). Crimes against organizations (data breaches, APTs). Crimes against society and state (cyber terrorism – overview). Emerging cybercrime trends

Unit IV

Legal, Policing & Judicial Response to Cybercrime. Cyber law enforcement mechanisms. Cyber policing and digital investigations (conceptual). Jurisdictional challenges and transnational crime. Evidentiary issues in cybercrime prosecution. Role of national and international agencies.

Unit V

Impact, Ethics & Cybercrime Prevention. Psychological and social impact on victims. Economic consequences of cybercrime. Victimology in cybercrime. Ethics and digital responsibility. Prevention strategies: policy, awareness, education.

Textbooks/ References

1. Cybercrime and Digital Forensics, by Thomas J. Holt, Adam M. Bossler, Kathryn C. Seigfried-Spellar. Routledge.
2. Cybercrime and Society, by Majid Yar. Sage Publications
3. Digital Evidence and Computer Crime, by Casey E. Academic Press

Evaluation Pattern

Assessment	Weightage (%)
Midterm	25
Continuous Assessment	25
End Semester Exam	50
Total Marks	100

26CSA245	Cyber Risk Management	L-T-P-C: 3-1-0-4

Course Objective(s)

- To analyse cyber threats, vulnerabilities, and impacts from a risk management perspective
- To apply cyber risk assessment frameworks and methodologies
- To design cyber risk mitigation and treatment strategies aligned with organizational goals
- To evaluate governance, compliance, and regulatory requirements related to cyber risk
- To develop informed decision-making capabilities for managing cyber risk ethically and responsibly

Course Outcomes

COs	Description
CO1	Analyze cyber threats, vulnerabilities, and impacts to identify organizational cyber risks.
CO2	Apply cyber risk assessment frameworks to evaluate likelihood and impact of cyber incidents.
CO3	Design cyber risk treatment and mitigation strategies aligned with organizational objectives.
CO4	Evaluate governance, compliance, and regulatory requirements influencing cyber risk decisions.
CO5	Assess and justify cyber risk management decisions considering ethics, finance, and sustainability.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	3	1	1	1	0	2	2
CO2	2	3	2	2	1	1	2	2
CO3	2	2	3	2	2	2	2	2
CO4	2	2	2	1	2	2	3	2
CO5	2	3	2	1	2	3	3	2

Syllabus

Unit I

Cyber Risk Fundamentals & Threat Landscape. Evolution of cyber risk. Difference between cyber threats, vulnerabilities, and risks. Cyber attack surfaces and threat actors. Business impact of cyber incidents. Introduction to qualitative vs quantitative risk.

Unit II

Cyber Risk Assessment Frameworks & Methodologies. Cyber risk lifecycle. Risk identification techniques. Risk analysis and evaluation. Risk matrices and scoring models. Introduction to NIST Cybersecurity Framework and ISO/IEC 27005.

Unit III

Cyber Risk Mitigation & Treatment Strategies. Risk treatment options: mitigate, transfer, accept, avoid. Control selection and prioritization Technical, administrative, and legal controls. Role of cybersecurity investments. Cost-benefit analysis in cyber risk decisions.

Unit IV

Cyber Governance, Compliance & Regulatory Risk. Cyber risk governance structures. Roles and responsibilities (CISO, Risk Officer, Board). Compliance standards: ISO 27001, GDPR, IT Act (India). Audits, assurance, and reporting. Cyber risk metrics and key risk indicators (KRIs).

Unit V

Incident Response, Ethics & Strategic Risk Decisions. Cyber incidents as risk events. Incident response planning (risk perspective). Cyber insurance (introductory concepts). Ethical decision-making in cyber risk. Case studies: ransomware, data breach, supply-chain risk.

Textbooks/ References

1. Principles of Information Security, by Michael E. Whitman & Herbert J. Mattord. Cengage Learning
2. How to Measure Anything in Cybersecurity Risk, by Hubbard & Seiersen. Wiley
3. Guide for Conducting Risk Assessments. NIST Special Publication 800-30.

Evaluation Pattern

Assessment	Weightage (%)
Midterm	25
Continuous Assessment	25
End Semester Exam	50
Total Marks	100

UI/UX and Game Design

26CSA251	DIGITAL MEDIA PRODUCTION	L-T-P: 0-2-4-4

Course Objective

To equip students with essential image and video production skills—digital photography, videography, audio integration, and editing workflows—through hands-on tutorials and practical exercises, enabling them to create authentic visual assets, understand media generation principles, and enhance interactive design experiences in UI prototyping, game environments, and immersive digital narratives..

Course Outcome

CO1	Apply camera operations, exposure control, and lens techniques.
CO2	Demonstrate composition and framing skills to produce visual narratives using camera techniques.
CO3	Execute videography sequences with proper shot selection, movement, and continuity.
CO4	Record and synchronize audio elements with visual media.
CO5	Produce integrated digital media projects combining edited photos, video, and audio.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	1	1	2	0	0	0	1
CO2	1	2	2	1	0	0	0	1
CO3	1	2	3	2	1	0	0	1
CO4	1	1	2	2	1	0	0	1
CO5	1	1	3	3	2	1	1	1

Syllabus

Unit 1: Camera Fundamentals - 12 Hours

Camera types; Digital sensors; Principles of light; Natural vs Artificial light; Camera handling: Modes and focusing; Exposure triangle: ISO, shutter speed, aperture; Metering modes; White balancing; Type of lenses, focal length; Depth of field; File formats and codecs; Frame rates; Shutter angle.

Unit 2: Image composition, aesthetics and editing - 12 Hours

Elecments of composition: Rule of thirds, Symmetry, Golden ratio; Leading lines, Perspective, Balance, Visual hierarchy, Color, Contrast, Texture; Types of shots; Types of angles; RAW image editing: crop, exposure adjustment, contrast, hue/saturation, batch processing, file export optimization.

Unit 3: Videography Essentials

Introduction to videography for digital media; Differences between photography and video workflows; Video resolution standards (HD, Full HD, 4K); Aspect ratios for screens, games, and UI applications; Frame rates and motion perception; Camera movements: pan, tilt, dolly, tracking, handheld; Shot continuity and visual flow; Shot sizes and sequencing; Basic visual storytelling concepts; Lighting for video: three-point lighting, practical lighting, natural light usage.

Unit 4: Audio Production for Digital Media

Role of audio in digital experiences and storytelling; Types of audio: dialogue, ambience, sound effects, music; Microphone types and applications; Audio recording techniques for video and interactive media; Audio levels and monitoring; Syncing audio with video; Introduction to Foley and sound effects creation; Audio formats and compression; Audio aesthetics for games, UI interactions, and immersive narratives.

Unit 5: Editing & Media Integration

Introduction to non-linear editing concepts; Editing workflows for images, video, and audio; Timeline-based editing principles; Basic cuts, transitions, and pacing; Visual continuity and rhythm; Color correction fundamentals; Audio cleanup and balancing; Export settings for web, mobile, games, and UI prototypes; Media optimization for performance and quality; Integrating visual and audio assets into interactive design pipelines; Overview of media usage in UI/UX, game environments, and immersive digital storytelling.

Textbook

1. Freeman, M. (2018). The photographer's eye: Composition and design for better digital photos. Routledge.
2. Sawdon Smith, R., Langford, M., & Fox, A. (2012). Langford's basic photography: The guide for serious photographers. Routledge.
3. Compesi, R. J., Gomez, J. S. (2017). Introduction to Video Production: Studio, Field, and Beyond. United Kingdom: Taylor & Francis.

References

1. Hill, P. (2020). Approaching photography. Routledge.
2. Kelby, S. (2020). The digital photography book. Rocky Nook, Inc.
3. Barnbaum, B. (2018). The art of photography: A personal approach to artistic expression. Rocky Nook.
4. Wells, L. (2015). Photography: A critical introduction. Routledge.
5. Galer, M. (2007). Photography: Foundations for art & design: The creative photography handbook. Focal Press.

Evaluation Pattern

Assessment	**Weightage (%)**
Continuous Assessment	70
End Semester	30
Total	**100**

26CSA252	CHARACTER DESIGN FOR GAMES	L-T-P: 0-2-4-4

Course Objective

This course aims to equip students with the essential skills to create compelling and functional game characters from concept to final design. Students will explore construction with basic forms, line of action, posing, stylization, costume drapery, expressions, and model sheets to develop visually engaging characters suited for various game genre.

Course Outcome

By the end of the semester, students will be able to:

CO1	**Apply** fundamental construction methods, line of action to create clear and appealing game characters.
CO2	**Develop** stylized characters that reflect specific game genres
CO3	Design costumes, drapery, and accessories that clearly show the character's identity and fit the game world.
CO4	**Create** expressive character sheets, including turnarounds, gestures, and facial expressions
CO5	Produce clear character model sheets that effectively communicate the design to game artists, animators, and developers.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	1	2	1	0	0	0	1
CO2	1	3	2	1	0	0	1	1
CO3	1	2	3	1	0	0	2	1
CO4	1	2	3	1	1	0	1	1
CO5	1	2	3	2	3	1	1	1

Syllabus

1. Building Characters with Basic Shapes/ Forms

Covers construction using spheres, cubes, cylinders, volumes, proportions, and silhouette clarity.

2. Line of Action & Dynamic Posing

Focuses on movement flow, gesture drawing, balance, action rhythm, and creating energetic poses.

3. Stylization & Visual Personality

Explores exaggeration, proportions, art styles, genre adaptation, and creating unique visual identities.

4. Drapery & Costume Design for Gameplay

Includes fabric behavior, costume layers, functional outfits, texture hints, and character role readability.

5. Expressions, Turnarounds & Model Sheets

Covers facial expression sets, body language, turnaround sheets, expression boards, and final character packs.

Textbook

- Creative Character Design by Bryan Tillman
- Draw It with Me - Creating Character Designs with Impact at the Heart of Your Story by Brian C. Hailes
- ***Creating Characters with Personality*** by Tom Bancroft

References

Online Learning Platforms

- Alison – *Introduction to Digital Character Design*
- Skillademia – *Character Design Megacourse* or *Free Character Design Course for Beginners*

YouTube Channels

- **https://www.youtube.com/watch?v=kGU9dE9qFcs**

- https://www.youtube.com/watch?v=jguEBQhPxmw&utm_source=chatgpt.com
- https://www.youtube.com/watch?v=8wm9ti-gzLM&utm_source=chatgpt.com

Evaluation Pattern

Evaluation Pattern

Assessment	Weightage (%)
Continuous Assessment	70
End Semester	30
Total	**100**

Course Objective

To develop advanced competencies in user interface and user experience design through the creation of design systems, detailed interaction patterns, complex UX flows and accessibility-oriented solutions, culminating in a comprehensive case study suitable for professional portfolios.

Course Outcomes

CO1 Construct scalable design systems with coherent visual styles and reusable interface components.
CO2 Design micro-interactions and advanced interaction patterns that enhance clarity and user feedback.
CO3 Model complete UX flows and information structures for multi-platform digital products.
CO4 Integrate accessibility and inclusive design principles into interface solutions.
CO5 Produce a detailed UI/UX case study documenting research, design decisions, prototypes and outcomes.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	1	3	3	1	1	1	1
CO2	1	2	3	3	1	0	1	1
CO3	1	3	3	2	1	1	1	1
CO4	1	2	3	2	1	0	3	1
CO5	1	2	3	2	3	2	2	2

Syllabus

Unit 1: Design Systems and Scalable Interface Architecture

Purpose and benefits of design systems; defining foundational styles such as colour palettes, typography scales, spacing and grids; component-driven design of buttons, forms, lists, cards and navigation elements; establishing patterns shared across mobile and web interfaces; documentation of design standards for collaboration; maintaining and evolving design systems over time.

Unit 2: Micro-Interactions and Advanced Interaction Design

Concept and psychology of micro-interactions; triggers, rules, feedback and loops; states of interface components (hover, focus, active, pressed, disabled, error); timing, easing and motion principles for guiding attention; interactive patterns for gestures, transitions and feedback; integration of micro-interactions into multi-step journeys such as onboarding, search and checkout.

Unit 3: UX Flows, Task Mapping and Information Structuring

Creation of user task flows for major product features; comparison of navigation models—hierarchical, flat, hub-and-spoke, linear and nested; mapping actions into coherent screen sequences; information architecture for efficient discovery and retrieval; multi-platform flows spanning mobile and web; identification of drop-off, confusion and friction points in experience pathways.

Unit 4: Accessibility, Inclusive Design and Ethical UX
Overview of disability types and user diversity; inclusive design principles for broad user groups; designing accessible interface components with clear hierarchy and structure; writing accessible content, labels and error messages; designing for varied device capabilities and network conditions; ensuring accessibility across platforms; ethical considerations such as transparency, cognitive load and responsible persuasion.

Unit 5: UI/UX Case Study – Research, Design and Presentation
Selection of a design problem and definition of scope through user research; development of mood boards and visual direction; creation of complete screen sets for mobile and web; application of design systems, interaction rules and accessibility criteria; building an interactive prototype illustrating complex flows; preparation of a formal case study with narrative, iterations and final outcomes; oral and visual presentation tailored for portfolio use.

Text Books

1. *About Face: The Essentials of Interaction Design* – Cooper, Reimann, Cronin & Noessel.
2. *Designing Interfaces: Patterns for Effective Interaction Design* – Tidwell, Brewer & Valencia.

Reference Books

1. *The UX Book: Agile UX Design for a Quality User Experience* – Hartson & Pyla.
2. *Human–Computer Interaction* – Dix, Finlay, Abowd & Beale.
3. *The Human–Computer Interaction Handbook* – Jacko (Ed.).

Evaluation Pattern

Assessment	Weightage (%)
Continuous Assessment	70
End Semester	30
Total	**100**

26CSA254	3D ANIMATION FOR GAMES	L-T-P: 0-2-4-4

Objective

To provide students with foundational knowledge and practical skills in 3D modelling, rigging, animation, and real-time integration for game development, enabling them to create simple animated game characters and assets.

Course Outcomes (COs)

CO1: Understand the concepts and workflow of 3D animation in games.
CO2: Create simple low-poly 3D models suitable for game environments.
CO3: Apply basic texturing and material techniques for game assets.
CO4: Rig and animate basic 3D characters for real-time applications.
CO5: Integrate animated assets into a game engine and build a simple interactive scene.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	2	1	1	0	0	0	1
CO2	2	1	3	2	1	0	0	1
CO3	1	1	2	2	0	0	1	1
CO4	2	1	3	3	1	0	1	1
CO5	1	2	3	3	2	2	1	2

Syllabus

Unit I: Fundamentals of 3D Animation for Games

- Introduction to game animation
- Principles of animation (timing, spacing, squash & stretch)
- Film animation vs game animation
- Game development pipeline overview

Unit II: 3D Modelling for Game Assets

- Introduction to 3D software like Blender
- Viewport navigation and transforms
- Low-poly modelling techniques
- Creating simple props (crates, barrels, basic weapons)

Unit III: Texturing and Materials

- UV mapping and unwrapping
- Texture painting basics
- Introduction to materials
- Optimizing textures for real-time rendering

Unit IV: Rigging and Character Animation

- Bone structure and skeleton creation
- Skinning and weight painting
- Basic character animation:

- o Idle
- o Walk cycle
- o Run cycle
- o Jump animation

Unit V: Game Engine Integration and Real-Time Animation

- Introduction to Unity and Unreal Engine
- Importing models and animations
- Creating animation controllers/state machines
- Basic user input for triggering animations
- Mini project: Simple playable character demo

Textbooks

Autodesk Maya 2025 Basics Guide **by Kelly Murdock**

Rig it Right! : Maya Animation Rigging Concepts **by Tina O'Hailey is popular.**

Autodesk Maya Basics Guide (e.g., 2024, 2025) Published by SDC Publications.

The Animator's Survival Kit **by Richard Williams.**

The Illusion of Life: Disney Animation **by Frank Thomas & Ollie Johnston**

Evaluation Pattern

Assessment	**Weightage (%)**
Continuous Assessment	70
End Semester	30
Total	**100**

26CSA255	AR/VR EXPERIENCE DESIGN	L-T-P: 0-2-4-4

Course Objective

To introduce students to the fundamentals of Augmented Reality (AR) and Virtual Reality (VR) and enable them to design simple, user-centered immersive experiences using industry-standard tools and platforms.

Course Outcomes

1. Explain the basic concepts of AR and VR technologies.
2. Design simple AR/VR experiences with user interaction.
3. Create basic 3D assets for immersive environments.
4. Create prototypes using AR/VR development tools.
5. Apply usability and experience design principles in immersive media.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	2	1	1	0	0	0	1
CO2	1	3	3	2	1	0	1	1
CO3	1	1	2	2	0	0	0	1
CO4	1	2	3	3	1	0	1	1
CO5	1	3	3	2	1	1	2	2

Syllabus

Unit I – Foundations of AR, VR & MR

- Difference between AR, VR, and MR
- Applications in gaming, education, healthcare, and marketing

Unit II – Hardware & 3D Environment Basics

- Overview of VR headsets and mobile AR devices
- Input devices and sensors
- Basics of 3D space: coordinates, scale, and perspective
- Introduction to 3D navigation

Unit III – Immersive UX and Development Tools

- Principles of spatial UI/UX design
- User comfort and motion sickness fundamentals
- Overview of the Unreal Engine interface
- Project setup and asset importing

Unit IV – AR/VR Environment Design & Interactivity

- Designing basic VR environments (virtual rooms)
- Lighting and material setup
- Marker-based AR concepts
- Placing and anchoring 3D objects in real-world space
- Gaze-based and controller interactions
- Simple triggers and events

Unit V – Audio, Optimization & Project Development

- Rapid prototyping methods
- User testing and feedback collection
- Performance optimization techniques
- Reducing latency and improving frame rate
- Project planning and concept development
- Project production and final presentation

Textbooks

Stepping into Virtual Reality (2023) by Gutierrez, Vexo, & Thalmann

Augmented Reality: Where We Will All Live (2021) by Mark Pesce

Advances in Augmented and Virtual Reality (2022) edited by Verma & Paul

Evaluation Pattern

Assessment	**Weightage (%)**
Continuous Assessment	70
End Semester	30
Total	**100**

26CSA256	ACCESSIBLE UX DESIGN	L-T-P: 0-2-4-4

Course Objective

To equip students with the knowledge and skills required to design inclusive digital experiences by understanding disability, applying accessibility guidelines, designing accessible interfaces for web, mobile and games, and performing structured accessibility audits.

Course Outcomes

CO1 Explain different types of disabilities and usage contexts that influence interaction with digital products.
CO2 Interpret and apply accessibility guidelines and principles to interface design.
CO3 Design accessible user interfaces for web and mobile platforms with appropriate hierarchy, contrast and structure.
CO4 Evaluate and enhance accessibility in games and interactive media.
CO5 Conduct accessibility audits and propose redesign recommendations based on identified barriers.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	1	2	2	1	0	0	3	2
CO2	1	3	3	2	0	0	3	2
CO3	1	2	3	2	1	0	2	2
CO4	1	2	3	2	1	0	2	2
CO5	1	3	3	2	1	1	3	3

Syllabus

Unit 1: Understanding Disabilities and User Diversity

Permanent, temporary and situational disabilities; categories of impairments including visual, auditory, motor, cognitive and neurological; overview of assistive technologies such as reading aids, alternative input devices and captioning tools; barriers arising from conventional interface design; empathy-based approaches to understanding user limitations; varied usage contexts such as low bandwidth, challenging lighting and device constraints.

Unit 2: Accessibility Standards, WCAG Principles and Legal Frameworks

Role of accessibility standards in digital design; principles of perceivable, operable, understandable and robust content; success criteria and conformance levels; legal and organisational responsibilities regarding accessibility; incorporation of guidelines into design and development processes; aligning project goals with inclusive practice.

Unit 3: Designing Accessible Interfaces for Web and Mobile

Visual hierarchy and adequate contrast; accessible navigation structures, buttons, forms and tables; inclusive wording of labels, instructions and error messages; support for keyboard and alternative input navigation; simplification of complex interactions for users with cognitive or motor limitations; responsive layouts for diverse screen sizes; review of focus order, touch targets, spacing and feedback cues.

Unit 4: Accessibility in Games and Interactive Media
Barriers unique to gameplay, such as reaction-time pressure, complex control schemes and sensory overload; adaptable difficulty levels and assist options; colour-blind friendly palettes and readable heads-up displays; customisable input mapping; clear instructions, progressive onboarding and tutorial design; inclusion of subtitles, captions, audio descriptions and visual indicators; analysis of accessible and inaccessible game examples.

Unit 5: Accessibility Audit and Redesign Recommendations
Planning and conducting accessibility evaluations for apps, websites and games; identification of visual, structural, interaction and comprehension barriers; use of checklists and heuristic frameworks; prioritisation of issues by severity and user impact; formulation of redesign proposals grounded in accessibility principles; preparation of audit reports with actionable recommendations; presentation of findings and revised concepts to stakeholders.

Text Books

1. *Accessibility for Everyone* – Laura Kalbag, A Book Apart.
2. *Human–Computer Interaction* – Dix, Finlay, Abowd & Beale (Chapters on Universal Access).

Reference Books

1. *A Web for Everyone: Designing Accessible User Experiences* – Horton & Quesenbery.
2. *Inclusive Design Guidelines* – W3C WAI documentation (general principles).
3. *Designing with the Mind in Mind* – Jeff Johnson.

Evaluation Pattern

Assessment	Weightage (%)
Continuous Assessment	70
End Semester	30
Total	**100**

26CSA257	Game Audio Design	L-T-P: 0-2-4-4

Course Objective

To equip students with advanced audio production and implementation skills field recording, sound synthesis, dialogue processing, and interactive music design through hands-on tutorials and practical exercises, enabling them to create authentic and impactful sonic assets, understand the principles of adaptive and spatial audio generation, and enhance interactive design experiences in gameplay feedback, dynamic storytelling, and immersive digital environments.

Course Outcomes

CO1	Analyse sound in various game genres, linear, ambient, feedback, and diegetic/non-diegetic audio roles.
CO2	Apply professional recording, design and edit library stylized sound effects (SFX), Foley, and dialogue assets.
CO3	Demonstrate mastery of audio middleware playback, adaptive mixing, and multi-layered music loops ..
CO4	Integrate audio assets into a game engine
CO5	Develop and deliver a complete, optimized audio mix for a game level

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	1	3	2	1	0	0	2	1
CO2	1	2	3	2	1	0	2	1
CO3	1	2	3	3	1	0	2	2
CO4	1	2	3	3	1	1	1	2
CO5	1	2	3	3	2	2	2	3

Syllabus

Unit 1:The Role of Sound in Interactive Media

linear and interactive audio; The psychological role of sound in player immersion, feedback, and narrative. Audio Types in Games: Dialogue (VO), Sound Effects (SFX), Ambience, and Music; Pitch, Frequency, Amplitude, Timbre; Audio Fundamentals: Sampling Rate and Bit Depth; Common audio file formats (WAV, MP3, OGG); Lossy vs. Lossless compression.

Unit 2: Sound Asset Creation and Production

Microphone Techniques: Dynamic vs. Condenser; Polar Patterns (Cardioid, Omnidirectional); Close-miking and distance-miking. Field Recording:recording sound effects (SFX) and ambiences outdoors, Foley & Prop Recording: Sound Synthesis Fundamentals: Audio Editing Workflow: Trimming, looping, fading, and normalizing audio; Creative Sound Design: Layering multiple

Unit 3: Dialogue and Music for Games

Dialogue Recording & Direction: Recording clean Voice Over (VO) VO director; Pacing and performance. Dialogue Editing & Processing: Noise reduction, de-essing, Music Asset Preparation: Breaking down a music track into stems (layers) for adaptive mixing Jingles, Stingers, and Loops: Designing short musical cues

Unit 4: Implementation and Middleware Fundamentals

The role of Middleware, Audio Project Setup: Creating the Middleware project structure.Importing sound assets from your DAW. Packaging audio files for the game to load. Basic overview of the Game Engine interface

Unit 5: Spatial Audio & Dynamic Control
3D Sound & Positioning: 3D Panners: Tools for placing sounds in the 3D game world. Environmental Effects: Audio Obstruction: Adaptive Audio: Real-Time Parameter Controls (RTPCs): Creating music that adapts to the current gameplay intensity. Mixing Control Optimization: Finalization Reviewing and refining the final mix for clarity and impact.

Textbook

Stevens, R., & Raybould, D. (2015). *Game audio implementation: A practical guide using the Unreal Engine*. Focal Press.

Sinclair, J. L. (2020). *Principles of game audio and sound design: Sound design and audio implementation for interactive and immersive media*. Routledge.

Phillips, W. (2017). *A composer's guide to game music*. The MIT Press.

Collins, K. (2008). *Game sound: An introduction to the history, theory, and practice of video game music and sound design*. The MIT Press.

Viers, R. (2008). *The sound effects bible: How to create and record great sound effects for film, video, and games*. Michael Wiese Productions.

References
1.Stevens, R., & Raybould, D. (2015). Game audio implementation: A practical guide using the Unreal Engine. Routledge.
2.Phillips, W. (2017). A composer's guide to game music. The MIT Press.
3. Collins, K. (2008). Game sound: An introduction to the history, theory, and practice of video game music and sound design. The MIT Press.
4. Marks, A. (2017). Aaron Marks' complete guide to game audio: For composers, sound designers, musicians, and game developers (3rd ed.). CRC Press.
5. Viers, R. (2008). The sound effects bible: How to create and record great sound effects for film, video, and games. Michael Wiese Productions.
Evaluation Pattern

Assessment	**Weightage (%)**
Continuous Assessment	70
End Semester	30
Total	**100**

Regular Electives

26CSA261	IoT Architectures and Programming	L-T-P-C: 3-0-2-4

Course Objective(s)

- Gain a foundational understanding of machine learning concepts, including supervised learning, unsupervised learning, and reinforcement learning.
- Pre-requisite: Linear algebra, Probability and statistics

Course Outcomes

COs	Description
CO1	Acquire the core concepts and principles behind the Internet of Things (IoT), including sensors, actuators, connectivity protocols, and IoT architectures.
CO2	Develop proficiency in programming languages commonly used in IoT development, such as Python, C/C++, or JavaScript, with a focus on their application in IoT contexts.
CO3	Learn techniques for collecting, processing, and analyzing data from IoT devices, including sensor data fusion, real-time data streaming, and data visualization.
CO4	Explore various networking and communication protocols used in IoT ecosystems, including Wi-Fi, Bluetooth, MQTT, CoAP, and HTTP, and their application in different IoT scenarios.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	-	1	1	-	-	-	-
CO2	3	3	3	3	-	-	-	-
CO3	2	2	2	2	-	-	-	-
CO4	3	2	2	2	-	-	-	-

Syllabus

Unit 1

Introduction to Internet of Things- Definition and Characteristics of IoT, Sensors, Actuators, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs – Home, City, Environment, Energy, Agriculture and Industry.

Components in IoT: Control Units - Sensors - Communication modules - Power Sources - Communication Technologies - RFID - Bluetooth - Zigbee - Wifi - Rflinks - Mobile Internet - Wired Communication.

Unit 2

IoT and M2M: M2M - Difference between IoT and M2M - Software Defined Networks - Network Function virtualization - IoT System Management with NETCONF - YANG - Need for IoT systems management - SNMP - Network Operator requirements - IoT systems management. Developing IoT: IoT Design Methodology: Purpose & Requirements Specification - Process Specification - Domain Model Specification - Information Model Specification - Service Specifications - IoT Level Specifications - Functional View Specification - Operational View Specification - Device & Component Integration - Application Development - Case study on IoT for Weather Monitoring.

Unit 3

Introduction to Arduino and Raspberry Pi- Installation, Interfaces (serial, SPI, I2C). IoT Physical Devices and Endpoints: Motivation for using Python, Python Packages of Interest for IoT, Building blocks of an IoT Device, Exemplary device: Raspberry Pi, Linux on Raspberry Pi, Raspberry Pi Interfaces - Serial, SPI, I2C, Programming Raspberry Pi with Python - Other IoT Devices. Controlling Hardware- Connecting LED, Buzzer, Switching High Power devices with transistors, Controlling AC Power devices with Relays, Controlling servo motor, speed control of DC Motor, unipolar and bipolar Stepper motors

Unit 4

The IoT building Blocks - IoT Application Enablement Platforms - Characterizing IoT or M2M Application Platforms - IoT AEPs - Azure IoT Hub - Amazon Web service IoT Platform - the Axeda IoT Platform - IoT data Analytics Platforms - IoT Data Virtualization Platforms - IoT Data Visualization Platform - IoT Edge Data Analytics. The Next generation Clouds for IoT Applications and Analytics - Motivation for Cloud Enabled Environments - IoT and cloud Inspired Smarter environments - Hybrid Clouds - Emergence of Edge/Fog Clouds - Building Blocks of Software Defined Networking - Software Defined Storage. Purpose of Cloud in IoT - Expounding the Edge/Fog Computing paradigm: Introduction to Edge/Fog Computing - Fog Computing Concepts - Use Cases of Fog/Edge Computing - Edge Analytics.

List of Experiments: (Platform: Rasspian / Arduino / Python)

1. Experiment with integrating various sensors (e.g., temperature, humidity, motion, light) with IoT devices. Collect real-time data from sensors using IoT protocols such as MQTT or CoAP.
2. Set up edge computing nodes to process data locally before transmitting it to the cloud. Experiment with lightweight machine learning algorithms for edge analytics (e.g., anomaly detection, predictive maintenance).
3. Evaluate the performance of different wireless communication protocols (e.g., Zigbee, LoRaWAN, NB-IoT) in terms of range, data rate, and power consumption.
4. Experiment with mesh networking techniques to extend network coverage and improve reliability.
5. Conduct penetration testing to identify vulnerabilities in IoT devices and networks. Implement encryption techniques (e.g., SSL/TLS, AES) to secure data transmission and storage.
6. Explore privacy-preserving techniques such as differential privacy and data anonymization.

Textbooks:

1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things: A Hands of Approach” , Arshdeep Bagha & Vijay Madisetti, 1st Edition, 2014.
2. Pethuru Raj, Anupama C.Raman ,″The Internet of Things: Enabling Technologies, Platforms, and use cases”, CRC Press, 1st Edition, 2017.
3. Charalampos Doukas, ″Building Internet of Things with the Arduino”, Volume 1, Create Space Independent Publishing Platform, 2012.

References:

1. Adrian McEwen, Hakim Cassimally, ″Designing the Internet things”, John Wiley and Sons, 1st Edition, 2014.

Evaluation Pattern

Assessment	Weightage (%)
Midterm	20
Continuous Assessment (including lab)	50
End Semester Exam	30
Total Marks	100

26CSA262	COMPUTER GRAPHICS AND VISUALIZATION	L-T-P-C: 3-0-2-4

Course Objective(s)

- Compare and contrast physical and synthetic images and explain the role of a graphics pipeline.
- Utilize the Matlab library for basic 2D and 3D object creation and rendering.
- Implement common geometric transformations (translation, rotation, scaling, shear) using homogeneous coordinates.
- Differentiate between classical and computer viewing systems and apply perspective and parallel projections.
- Explain the various animation and visualization techniques.

Course Outcomes

COs	Description
CO1	Apply the fundamental concepts and principles of computer graphics and visualization.
CO2	Explore basic rendering techniques such as rasterization and ray tracing.
CO3	Develop 3D models using appropriate techniques and tools.
CO4	Apply animation techniques to create dynamic visualizations.
CO5	Analyse and critique various visualization techniques and their effectiveness in conveying information

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-
CO3	-	-	3	3	-	-	-	-
CO4	3	3	1	3	-	-	-	-
CO5	2	2	2	-	-	-	-	-

Syllabus

Unit 1

Introduction to Computer Graphics: Overview of computer graphics, Graphics systems and models, Graphics pipeline, Basics of raster graphics and vector graphics, Graphics APIs and libraries. Rendering Techniques: Introduction to rendering, Rasterization algorithms, Ray tracing basics, Shading models and lighting techniques, Texture mapping.

Unit 2

Introduction to Matlab: Points, Lines. Specifying a 2D World Coordinate Reference Frame in Matlab- Matlab Point Functions, Line Functions Polygon Fill Area Functions, Vertex Arrays. Line Drawing Algorithms, Circle Generation Algorithm Filled Area Primitives Matlab fill Area Functions, Scan Line Polygon Filling Algorithms, Boundary Fill, Flood Fill Algorithms Attributes of Output Primitives. Geometric Transformations: Basic 2D transformations-Other Transformations: Reflection and Shearing. Matlab Geometric Transformation Functions.

Unit 3

3D Object Representation: Fractals, Geometrical Transformation for 3D Objects, Viewing and Clipping 2D Viewing Functions Clipping Operations. Three-Dimensional Viewing: Viewing Pipeline, Viewing Coordinates. Projections: Parallel Projections, Perspective Projections. Matlab Two-Dimensional and Three-Dimensional Viewing Functions.

Unit 4

Visible Surface Detection and Illumination Models: Visible Surface Detection Methods, Illumination Methods and Surface Rendering, Polygon. Rendering Methods: Constant Intensity Shading, Grouard Shading, Phong Shading. Matlab Illumination and Surface Rendering Functions, GUI – Matlab Interactive Input Device Functions. The User Dialog Interactive Picture Construction Techniques, Colour Models. Computer Animation: Animation principles, Keyframing and interpolation, Skeletal animation, Procedural animation, Motion capture techniques.

Lab:

1. Introduction to computer graphics concepts and setting up the MATLAB environment for graphics.
2. Implement basic 2D graphics primitives (lines, circles, polygons) using MATLAB functions.
3. Implement functions to draw lines by slope-intercept or Bresenham's line algorithm.
4. Create a function to draw filled circles using parametric equations and the Midpoint circle algorithm.
5. Apply geometric transformations (translation, rotation, scaling) in 2D.
6. Generate a square and triangle, and apply translation, rotation, and scaling transformations using matrix multiplication in 3D.
7. Visualize a 3D coordinate system using lines and labels.
8. Create 3D plots of lines and surfaces using plot3 and surf functions.
9. Implement functions to adjust camera position (e.g., view) and orientation for different viewing perspectives.
10. Create a function to generate a cube mesh with vertices and faces using fill3 or patch.
11. Develop a function to generate a sphere mesh with appropriate subdivisions using parametric equations.
12. Create a function to generate a cylinder mesh using points along a circle and extruded lines.
13. Implement flat shading for basic colouring of objects based on face Normals.
14. Employ different shading and lighting models to enhance visual realism.
15. Create basic animations to visualize dynamic scenes or processes.

Textbook:

1. Adams, Richard S., and Richard E. Hall. Fundamentals of Computer Graphics (4th ed.). Addison-Wesley Professional, 2016.
2. Gonzalez, Rogelio, Richard E. Woods, and Steven L. Eddins. MATLAB Graphics Programming (3rd ed.). Pearson Education Limited, 2009.
3. Roy A. Plastock and Gordon Kalley, “Schaum’s Outline Series – Theory and Problems of Computer Graphics”, Second Edition, Tata McGraw-Hill, 2000.
4. Foley J.D, Van Dam A, Eiener S.K. and Hughes J.F., “Computer Graphics Principles and Practice”, Second Edition, Pearson Education, 1996.

Evaluation Pattern

Assessment	Weightage (%)
Midterm	20
Continuous Assessment (including lab)	50
End Semester Exam	30
Total Marks	100

26CSA263 ARCHITECTURE AND DEPLOYMENT OF SECURE AND SCALABLE WAN L-T-P-C: 3-0-2-4

Course Objective(s)

This course offers an introductory overview of secure and scalable Wide Area Network (WAN) setups, including the configuration of Wireless Local Area Networks (WLANs) and WAN technologies. Additionally, it introduces students to various network protocols and methodologies for troubleshooting network issues using a range of tools.

Course Outcomes

COs	Description
CO1	Employ the importance of scaling networks in modern IT infrastructure by implementing LAN redundancy solutions to enhance network reliability.
CO2	Demonstrate proficiency in configuring secure wireless LANs and troubleshoot OSPF routing issues in single and multiarea OSPF environments
CO3	Design hierarchical network architectures for scalability and implement first-hop redundancy protocols to ensure network availability.
CO4	Troubleshoot WAN connectivity issues using systematic troubleshooting methods and configure NAT and troubleshoot NAT-related issues to ensure proper network address translation.
CO5	Device and configure site-to-site connectivity and VPNs to ensure secure network communication and monitor network performance using Syslog, SNMP, and Netflow tools.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	-
CO4	-	-	3	2	-	-	-	2
CO5	-	-	3	2	-	-	-	2

Syllabus

Unit 1:

Introduction to Scaling Networks, implementing a Network Design, LAN Redundancy, Spanning Tree Concepts and protocols.

Unit 2:

Link Aggregation Concepts and Configuration, Wireless LAN Concepts, operations and Security, Wireless LAN Configuration, Troubleshoot Single-Area OSPF, Multiarea OSPF

Unit 3:

Operation and configuration. Hierarchical Network Design, WAN Technologies, Spanning Tree Configuration, First-Hop Redundancy Protocols, Point-to-Point Connections.

Unit 4:

PPP Operation and Configuration, HDLC protocol, Troubleshoot WAN Connectivity, Frame Relay concepts and Configurations, NAT Operation & Configuration, Troubleshooting NAT

Unit 5:

Tele working, Broadband Solutions, Configuring xDSL Connectivity, Securing Site-to-Site Connectivity, VPNs, Site-to-Site GRE Tunnels, IPsec, Monitoring the Network – Syslog, SNMP, Netflow, Network Troubleshooting with a Systematic Approach.

Lab Exercises:

1. Design and implement a basic network topology using Packet Tracer or GNS3.
2. Configure LAN redundancy using redundant links and protocols such as HSRP or VRRP.
3. Implement Spanning Tree Protocol (STP) on a network topology to prevent loops and ensure network stability.
4. Configure link aggregation (EtherChannel) between switches to increase bandwidth and provide redundancy.
5. Set up a wireless LAN (WLAN) with appropriate security measures such as WPA2 encryption.
6. Troubleshoot a single-area OSPF network by identifying and resolving routing issues.
7. Configure multiarea OSPF routing to improve scalability and efficiency in a network.
8. Design and implement a hierarchical network structure with core, distribution, and access layers.
9. Configure WAN technologies such as PPP or HDLC for point-to-point connections between routers.
10. Set up Frame Relay connections between routers and troubleshoot connectivity issues.
11. Configure Network Address Translation (NAT) to enable private IP addresses to access the internet.
12. Troubleshoot NAT translation issues and ensure proper communication between internal and external networks.
13. Implement teleworking solutions by configuring remote access VPNs for off-site employees.
14. Configure broadband solutions such as xDSL connectivity for high-speed internet access.
15. Secure site-to-site connectivity by implementing VPN tunnels using IPsec encryption.
16. Configure GRE tunnels between remote sites to create a virtual private network (VPN).
17. Monitor network performance using syslog to collect and analyze system logs.
18. Set up Simple Network Management Protocol (SNMP) to monitor network devices and performance metrics.
19. Capture and analyze network traffic using Wireshark to troubleshoot connectivity and performance issues.
20. Implement a systematic approach to network troubleshooting, including identifying symptoms, isolating the problem, and resolving issues.

Suggested Softwares: Packet Tracer, Wireshark, Putty, NetFlow Analyzer

References:

1. Youlu Zheng and ShakilAkhtar, Networks for Computer Scientists and Engineers.
2. Peterson & Davie, "Computer Networks, A Systems Approach", 5th Edition, Morgan Kaufmann, 2011.
3. Scaling Networks - Course Booklet - Cisco Press.
4. Switched Networks - Course Booklet - Cisco Press.

Evaluation Pattern

Assessment	Weightage (%)
Midterm	20
Continuous Assessment (including lab)	50
End Semester Exam	30
Total Marks	100

26CSA264	BIG DATA ANALYTICS	L-T-P-C: 3-0-2-4

Course Objective(s)

- This course comprehends the fundamentals of Big Data, including its importance, characteristics, and applications in various domains.
- Gain proficiency in working with Hadoop and its ecosystem, including HDFS, MapReduce paradigm, YARN, and Zookeeper, for managing and processing large-scale datasets efficiently.
- Develop skills in utilizing advanced tools and technologies such as Hive, Pig, Spark, and MongoDB for data querying, processing, and analysis, enabling effective decision-making and insights extraction from diverse data sources.

Course Outcomes

COs	Description
CO1	Employ the concept of Big Data, its applications and its impact on decision-making processes.
CO2	Acquire in-depth knowledge of the Hadoop MapReduce paradigm and its role in distributed data processing
CO3	Gain proficiency in hive and pig for data processing tasks in Hadoop environments.
CO4	Explore the concept of Resilient Distributed Datasets (RDDs) in Spark and their significance in distributed data processing.
CO5	Develop skills in creating and querying indexes for efficient data retrieval through MongoDB JavaScript Shell.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-
CO3	-	3	1	-	-	-	-	2
CO4	-	-	3	2	-	-	-	2
CO5	-	-	-	1	2	-	-	-

Syllabus

Unit 1: Introduction to Big Data

Introduction to Big Data and its importance, 3 Vs and more, Big data analytics, Big data applications. Hadoop & Hadoop EcoSystem, Moving Data in and out of Hadoop, Inputs and outputs of MapReduce, Hadoop Architecture, HDFS, Common Hadoop Shell commands, NameNode, Secondary NameNode, and DataNode,

Unit 2: Hadoop, Map Reduce and YARN

Hadoop MapReduce paradigm, Map and Reduce tasks, Job, Task trackers , Algorithms using map reduce, Examples of Map Reduce (Word count problem, Matrix-Vector Multiplication), YARN & Zookeeper, Hadoop Cluster Setup & Hadoop Configuration, HDFS Administration: Monitoring & Maintenance

Unit 3: Hive and PIG

Hive Architecture, Comparison with Traditional Database, HiveQL - Querying Data - Sorting And Aggregating, Map Reduce Scripts, Joins & Subqueries, HBase concepts, Advanced Usage, Schema Design & Indexing - PIG, Zookeeper

Unit 4: Spark

Spark: RDD's in Spark, Data Frames & Spark SQL, Spark Streaming

Unit 5: Mongo DB

Introduction to MongoDB key features, Core Server tools, MongoDB through the JavaScript's Shell, Creating and Querying through Indexes, Document-Oriented, principles of schema design, Constructing queries on Databases, collections and Documents, MongoDB Query Language.

Lab syllabus

- Write a program to explore Hadoop HDFS: create, list, copy, move, and delete files using Hadoop shell commands.
- Write a program to demonstrate basic MapReduce: implement the Word Count example.
- Write a program to implement MapReduce for counting maximum/minimum/average values from a dataset.
- Write a program to implement Matrix–Vector Multiplication using MapReduce.
- Write a program to demonstrate Hadoop YARN: submitting, monitoring, and killing YARN jobs.
- Write a program to configure and run a simple Hadoop cluster (pseudo-distributed mode).
- Write a Hive program to create databases and tables, load data, and run basic HiveQL queries.
- Write a Hive program to perform sorting, grouping, aggregation, joins, and subqueries.
- Write a PIG program to load, filter, transform, group, and aggregate large datasets.
- Write a program to query data from HBase: create tables, insert data, retrieve data using shell commands.
- Write a Spark program to create RDDs and perform map, filter, reduce, and aggregate operations.
- Write a Spark SQL program to create DataFrames, run SQL queries, and perform aggregations.
- Write a Spark Streaming program to read live data streams (e.g., socket stream) and compute word counts.
- Write a MongoDB program using JavaScript shell to create databases, collections, and insert/query documents.

References:

1. Understanding Big data, Chris Eaton, Dirk Deroos et al McGraw Hill, 2012
2. Big Data and Analytics, Seema Acharya, Subhashini Chellappan, Wiley Publication, 2015.
3. Hadoop: The Definitive Guide, Tom White, O'Reilly Publications.
4. Data Analytics with Spark Using Python, Aven Jeffrey, Pearson Paperback 2018
5. Mongo DB in Action, Kyle Banker, Manning Publications Company

Evaluation Pattern

Assessment	Weightage (%)
Midterm	20
Continuous Assessment (including lab)	50
End Semester Exam	30
Total Marks	100

26CSA265	C# and ASP.NET	L-T-P-C: 3-0-2-4

Course Objective(s)

- Understand the foundation of CLR execution.
- Learn technologies of .NET framework and know OOP aspects in C#.
- Able to develop desktop based applications using C#.
- Able to develop web based applications using C#. (ASP.NET)

Course Outcomes

COs	Description
CO1	Understand .NET framework and architecture
CO2	Design and build console applications using the basic and OOP in C#
CO3	Build desktop based applications using Windows forms in C#
CO4	Design and develop web based appilcations using C#

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	3	-	1	2	-	-
CO2	3	2	3	-	1	2	-	-
CO3	3	2	3	-	1	2	-	-
CO4	3	2	3	-	1	2	-	-

Syllabus

Unit 1

Introduction: The C# language, The .Net Architecture and .Net Framework, The Common Language Runtime (CLR), Microsoft Intermediate Language (MSIL) Code, Just In Time Compilers (JITers), The Common Languages Specification (CLS), The Common Type System (CTS), Garbage Collection (GC), The .Net Framework, Working with Visual Studio.Net. **C# Basics:** Data Types, Variables & Constants, Operators in C#, Arithmetic Operators, Prefix and Postfix notation, Assignment Operators, Relational Operators, Other Operators, Operators precedence, Flow Control and Conditional Statements if-else statement, switch statement, Loops in C#, for loop, do-while loop, Array in C#, foreach Loop.

Unit 2

Object and Classes: Concept of a class, Objects, Fields, Methods, Instantiating the class, Accessing the members of a class, Access modifiers, Properties, Static members of the class, Constructors, Desturctors, Overloading Constructors, Value types (out & ref keywords). **Inheritance & Polymorphism:** Implementing inheritance in C#, The base keyword, Protected Access Modifier, sealed keyword, Polymorphism, using the reference of the base type for referencing the objects of the child class, using methods with the same name in the base and Sub-class, Overriding the methods, the new keywords, Type casting, is and as keywords, Boxing and Un-boxing.

Unit 3

Exceptions in C# and .Net: Handling Exceptions using the try-catch-finally blocks, Delegates Basics, Delegates in the .Net Framework, Passing delegates to methods, Multicast Delegates, Events and Events, handling in C#, Multicast events. **Windows Form Applications:** Controls- The Button Control, Adding the Event Handlers, The Label and LinkLabel Controls, The TextBox Control, Adding the Event Handlers, The RadioButton and CheckBox Controls, The ListBox and CheckedListBox Controls, ListBox Properties, The ComboBox Control. ADO.NET.

Unit 4

ASP.NET: Overview of ASP.NET framework, Stages in Web Forms Processing, Introduction to Server Controls, HTML Controls, Validation Controls, User control, Data Binding Controls, Configuration, Personalization, Session State, Adding controls to a web form, Buttons, Text Box , Labels, Checkbox, Radio Buttons, ListBox, etc.

Lab Syllabus

- Write a C# program to demonstrate data types, variables, constants, and basic operators.
- Write a C# program using conditional statements (if–else, switch) and loop structures (for, while, do-while).
- Write a C# program to create and manipulate one-dimensional and multi-dimensional arrays, including foreach loop.
- Write a C# program to define a class with fields and methods, create objects, and access class members.
- Write a C# program to demonstrate constructors, overloaded constructors, static members, and destructors.
- Write a C# program to illustrate the use of ref and out parameters.
- Write a C# program to implement single-level and multi-level inheritance, using base and protected members.
- Write a C# program to demonstrate method overriding, runtime polymorphism, and use of new, is, and as keywords.
- Write a C# program to demonstrate boxing and unboxing with value types and reference types.
- Write a C# program to handle exceptions using try-catch-finally blocks, including multiple exception types.
- Write a C# program to demonstrate delegates, multicast delegates, and events.
- Write a Windows Forms application demonstrating basic controls (Button, Label, TextBox) with event handling.
- Write a Windows Forms application using ListBox, ComboBox, RadioButton, and CheckBox controls.
- Write a C# program using ADO.NET to connect to a database, insert, update, delete, and retrieve records.

Textbooks:

1. Faraz Rasheed “Programmer Heaven C# School”.

References:

1. Stephen Walthert “ASP.NET 3.5 unleased”, SAMS
2. Shibi Panikkar and Kumar Sanjeev, “C# with .NET Frame Work”, Firewall Media.
3. Jeffrey Richter, “Applied Microsoft .Net Framework Programming”, (Microsoft)
4. Balagurusamy, “Programming with C#”, TMHom

Evaluation Pattern

Assessment	Weightage (%)
Midterm	20
Continuous Assessment (including lab)	50
End Semester Exam	30
Total Marks	100

26CSA266	CLOUD COMPUTING	L-T-P-C: 3-0-2-4

Course Objective(s)

- To understand the principles of cloud architecture, models and infrastructure.
- To understand the concepts of virtualization and virtual machines.
- To gain knowledge about virtualization Infrastructure.
- To explore and experiment with various Cloud deployment environments.
- To learn about the security issues in the cloud environment.

Course Outcomes

COs	Description
CO1	Identify the design challenges inherent in cloud computing, including scalability, resource management, and data security considerations
CO2	Apply the concept of virtualization and its various types, such as full virtualization, para-virtualization, and hardware-assisted virtualization.
CO3	Experiment with virtualization of hardware resources and explore ocker for lightweight application deployment.
CO4	Develop and deploy services on the cloud platforms demonstrating proficiency in setting up and managing a cloud environment.
CO5	Analyze the security challenges posed by cloud computing to develop robust security strategies and protocols.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	1	-	-	1	-	-	-
CO2	3	1	-	2	1	-	-	-
CO3	3	2	1	2	1	-	-	-
CO4	3	2	2	3	1	-	-	-
CO5	3	3	2	3	1	-	-	-

Syllabus

UNIT I

Cloud Architecture: System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture – Cloud deployment models – Cloud service models; Cloud Infrastructure: Architectural Design of Compute and Storage Clouds – Design Challenges.

UNIT II

Virtual Machine Basics – Taxonomy of Virtual Machines – Hypervisor – Key Concepts –Virtualization structure – Implementation levels of virtualization – Virtualization Types: Full Virtualization – Para Virtualization – Hardware Virtualization – Virtualization of CPU, Memory and I/O devices.

UNIT III

Desktop Virtualization – Network Virtualization – Storage Virtualization – System-level of Operating Virtualization – Application Virtualization – Virtual clusters and Resource Management – Containers vs. Virtual Machines – Introduction to Docker – Docker Components – Docker Container – Docker Images and Repositories.

UNIT IV

Google App Engine – Amazon AWS – Microsoft Azure; Cloud Software Environments – Eucalyptus – OpenStack.

UNIT V

Virtualization System-Specific Attacks: Guest hopping – VM migration attack – hyper jacking. Data Security and Storage; Identity and Access Management (IAM) - IAM Challenges - IAM Architecture and Practice.

Lab Experiments:
1. Install Virtualbox/VMware/ Equivalent opensource cloud Workstation with different flavours of Linux or Windows OSon top of windows 8 and above.
2. Install a C compiler in the virtual machine created using a virtual box and execute SimplePrograms.
3. Install Google App Engine. Create a hello world app and other simple web applications usingpython/java.
4. Use the GAE launcher to launch the web applications.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not presentin CloudSim.
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Install Hadoop single node cluster and run simple applications like wordcount.
8. Creating and Executing Your First Container Using Docker.
9. Run a Container from Docker Hub.

Text books:
1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to theInternet of Things", Morgan Kaufmann Publishers, 2012.
2. James Turnbull, "The Docker Book", O'Reilly Publishers, 2014.
3. Krutz, R. L., Vines, R. D, "Cloud security. A Comprehensive Guide to Secure Cloud Computing", Wiley Publishing, 2010.

References:
1. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/MorganKaufmann, 2005.
2. Tim Mather, Subra Kumaraswamy, and Shahed Latif, "Cloud Security and Privacy: an enterprise perspective on risksand compliance", O'Reilly Media, Inc., 2009

Evaluation Pattern

Assessment	Weightage (%)
Midterm	20
Continuous Assessment (including lab)	50
End Semester Exam	30
Total Marks	100

26CSA267	WEB MINING	L-T-P-C: 3-0-2-4

Course Objective(s)

Familiarize students with fundamental principles and methods in Information Retrieval, Web Search, Data Mining, andMachine Learning, specifically tailored for knowledge extraction from web sources. Enhance proficiency in utilizing contemporary data mining tools to address real-world challenges in Web Mining. Cultivate self-directed learning and research capabilities through hands-on experience and independent study

Course Outcomes

COs	Description
CO1	Students will demonstrate the ability to pre-process and clean web data, including handling missing values, dealing with noise and outliers, and transforming data into appropriate formats for analysis.
CO2	Students will be able to employ various web crawling and scraping techniques to effectively extract structured and unstructured data from web sources.
CO3	Students will gain a deep understanding of different web mining techniques, including content mining, structure mining, and usage mining, and will be able to apply these techniques to extract actionable insights from web data.
CO4	Students will develop the ability to critically evaluate web mining results, interpret findings, and make informed decisions based on the insights derived from web data analysis.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	2	-	-	-	-
CO2	3	3	3	2	-	-	-	-
CO3	3	3	3	2	-	-	-	-
CO4	3	3	2	2	-	-	-	-

Syllabus

Unit 1

Information Retrieval and Web Search: Information Retrieval Models, Text and Web Page Pre-Processing -Stopword Removal, Stemming, Web Page Pre-Processing, Inverted Index and Its Compression - Inverted Index, Search Using an Inverted Index. Latent Semantic Indexing, Web Search, Web Spamming. Link Analysis: Social Network Analysis, Co- Citation and Bibliographic Coupling, PageRank, HITS, Community Discovery- Bipartite Core Communities, Maximum Flow Communities, Email Communities Based on Betweenness

Unit 2

Web Crawling: A Basic Crawler Algorithm - Breadth-First Crawlers, Preferential Crawlers. Implementation Issues, Universal Crawlers, Focused Crawlers, Topical Crawlers, Evaluation, Crawler Ethics and Conflicts. Structured Data Extraction: Wrapper Induction, Automatic Wrapper Generation, String Matching and Tree Matching, Multiple Alignment, Extraction Based on a Single List Page and Multiple pages.

Unit 3

Information Integration: Introduction to Schema Matching, Pre-Processing for Schema Matching, Schema-Level Match, Domain and Instance-Level Matching, Combining Similarities, Integration of Web Query Interfaces. Opinion Mining: Sentiment Classification, Feature-Based Opinion Mining and Summarization, Comparative Sentence and Relation Mining, Opinion Search, Opinion Spam.

Unit 4

Web Usage Mining: Data Modeling for Web Usage Mining, Discovery and Analysis of Web Usage Patterns - Session andVisitor Analysis, Cluster Analysis and Visitor Segmentation, Analysis of Sequential and Navigational Patterns.

Lab Exercises:

1. Web Crawling and Scraping: Building a web crawler to collect data from a specific website.
2. Text Mining: Analyzing the content of web pages to extract keywords and perform sentiment analysis.
3. Link Analysis: Implementing algorithms like PageRank to analyze the link structure of the web.

4. Web Usage Mining: Analyzing user behavior on a website to identify patterns and trends
5. Recommender Systems: Building a simple recommender system using web mining techniques.
6. Final Project: Applying web mining techniques to a real-world dataset and presenting findings.

Textbooks / References:

- Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data (Data-Centric Systems and Applications) byBing Liu, Springer Publisher.
- Mining The Web: Discovering Knowledge From Hypertext Data by Chakrabarti Soumen, Elsevier Science
- Web Mining: Applications and Techniques, Anthony Scime (State University of New York at Brockport, USA)Release Date: August, 2004|Copyright: © 2005 |Pages: 442 ISBN13:
- "Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data" by Bing Liu
- "Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, GitHub, and More" by Matthew A. Russell
- "Introduction to Information Retrieval" by Christopher D. Manning, Prabhakar Raghavan, and Hinrich Schütze
- Research papers and online resources relevant to web mining and related topics.

Evaluation Pattern

Assessment	Weightage (%)
Midterm	20
Continuous Assessment (including lab)	50
End Semester Exam	30
Total Marks	100