# PRESIDENCY UNIVERSITY

# PROGRAMME REGULATIONS & CURRICULUM

2025-28

## PRESIDENCY SCHOOL OF INFORMATION SCIENCE

### BACHELOR OF COMPUTER APPLICATIONS

**PRESIDENCY SCHOOL OF INFORMATION SCIENCE**

# Program Regulations and Curriculum 2025-2028

## BACHELOR OF COMPUTER APPLICATIONS

**based on Choice Based Credit System (CBCS) and Outcome Based Education (OBE)**

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## PART A – PROGRAM REGULATIONS

1. **Vision & Mission of the University and the School / Department**

   *1.1 Vision of the University*

   To be a Value-driven Global University, excelling beyond peers and creating professionals of integrity and character, having concern and care for society.

   *1.2 Mission of the University*

   - Commit to be an innovative and inclusive institution by seeking excellence in teaching, research and knowledge-transfer.
   - Pursue Research and Development and its dissemination to the community, at large.
   - Create, sustain and apply learning in an interdisciplinary environment with consideration for ethical, ecological and economic aspects of nation building.
   - Provide knowledge-based technological support and services to the industry in its growth and development.
   - To impart globally-applicable skill-sets to students through flexible course offerings and support industry's requirement and inculcate a spirit of new-venture creation.

   *1.3 Vision of Presidency School of Information Science*

   To be a value based, practice-driven School of Information Science, committed to developing globally-competent Professionals, dedicated to applying Modern Information Science for Social Benefit

   *1.4 Mission of Presidency School of Information Science*

   - Cultivate a practice-driven environment with an Information-Technology-based pedagogy, integrating theory and practice.
   - Attract and nurture world-class faculty to excel in Teaching and Research, in the Information Science Domain.
   - Establish state-of-the-art facilities for effective Teaching and Learning experiences.
   - Promote Interdisciplinary Studies to nurture talent for global impact.
   - Instil Entrepreneurial and Leadership Skills to address Social, Environmental and Community-needs.

2. **Preamble to the Program Regulations and Curriculum**

   This is the subset of Academic Regulations and it is to be followed as a requirement for the award of BCA degree.

   The Curriculum is designed to take into the factors listed in the Choice Based Credit System (CBCS) with focus on Social Project Based Learning, Industrial Training, and Internship to enable the students to become eligible and fully equipped for employment in industries, choose higher studies or entrepreneurship.

   In exercise of the powers conferred by and in discharge of duties assigned under the relevant provision(s) of the Act, Statutes and Academic Regulations, of the University, the Academic Council hereby makes the following Regulations.

### 3. Short Title and Applicability

a. These Regulations shall be called the Bachelor of Computer Applications Degree Program Regulations and Curriculum 2025-2028.

b. These Regulations are subject to, and pursuant to the Academic Regulations.

c. These Regulations shall be applicable to the ongoing Bachelor of Computer Applications Degree Programs of the 2025-2028 batch, and to all other Bachelor of Computer Applications Degree Programs which may be introduced in future.

d. These Regulations shall supersede all the earlier Bachelor of Computer Applications Program Regulations and Curriculum, along with all the amendments thereto.

e. These Regulations shall come into force from the Academic Year 2025-2026.

### 4. Definitions

*In these Regulations, unless the context otherwise requires:*

a. *"Academic Calendar" means the schedule of academic and miscellaneous events as approved by the Vice Chancellor;*

b. *"Academic Council" means the Academic Council of the University;*

c. *"Academic Regulations" means the Academic Regulations, of the University;*

d. *"Academic Term" means a Semester or Summer Term;*

e. *"Act" means the Presidency University Act, 2013;*

f. *"AICTE" means All India Council for Technical Education;*

g. *"Basket" means a group of courses bundled together based on the nature/type of the course;*

h. *"BOE" means the Board of Examinations of the University;*

i. *"BOG" means the Board of Governors of the University;*

j. *"BOM" means the Board of Management of the University;*

k. *"BOS" means the Board of Studies of a particular Department/Program of Study of the University;*

l. *"CGPA" means Cumulative Grade Point Average as defined in the Academic Regulations;*

m. *"Clause" means the duly numbered Clause, with Sub-Clauses included, if any, of these Regulations;*

n. *"COE" means the Controller of Examinations of the University;*

o. *"Course In Charge" means the teacher/faculty member responsible for developing and organising the delivery of the Course;*

p. *"Course Instructor" means the teacher/faculty member responsible for teaching and evaluation of a Course;*

q. *"Course" means a specific subject usually identified by its Course-code and Course-title, with specified credits and syllabus/course-description, a set of references, taught by some teacher(s)/course-instructor(s) to a specific class (group of students) during a specific Academic Term;*

r. *"Curriculum Structure" means the Curriculum governing a specific Degree Program offered by the University, and, includes the set of Baskets of Courses along with minimum credit requirements to be earned under each basket for a degree/degree with specialization/minor/honours in addition to the relevant details of the Courses and Course catalogues (which describes the Course content and other important information about the*

*Course). Any specific requirements for a particular program may be brought into the Curriculum structure of the specific program and relevant approvals should be taken from the BOS and Academic Council at that time.*

s.  *"DAC" means the Departmental Academic Committee of a concerned Department/Program of Study of the University;*

t.  *"Dean" means the Dean of the concerned School;*

u.  *"Degree Program" includes all Degree Programs;*

v.  *"Department" means the Department offering the degree Program(s) / Course(s) / School offering the concerned Degree Programs / other Administrative Offices;*

w.  *"Discipline" means specialization or branch of BCA Degree Program;*

x.  *"HOD" means the Head of the concerned Department;*

y.  *"L-T-P-C" means Lecture-Tutorial-Practical-Credit – refers to the teaching – learning periods and the credit associated;*

z.  *"MOOC" means Massive Open Online Courses;*

aa. *"MOU" means the Memorandum of Understanding;*

bb. *"NPTEL" means National Program on Technology Enhanced Learning;*

cc. *"Parent Department" means the department that offers the Degree Program that a student undergoes;*

dd. *"Program Head" means the administrative head of a particular Degree Program/s;*

ee. *"Program Regulations" means the Bachelor of Computer Application Degree Program Regulations and Curriculum, 2025-2028;*

ff. *"Program" means the Bachelor of Computer Application (BCA) Degree Program;*

gg. *"PSIS" means the Presidency School of Information Science;*

hh. *"Registrar" means the Registrar of the University;*

ii. *"School" means a constituent institution of the University established for monitoring, supervising and guiding, teaching, training and research activities in broadly related fields of studies;*

jj. *"Section" means the duly numbered Section, with Clauses included in that Section, of these Regulations;*

kk. *"SGPA" means the Semester Grade Point Average as defined in the Academic Regulations, 2021;*

ll. *"Statutes" means the Statutes of Presidency University;*

mm.     *"Sub-Clause" means the duly numbered Sub-Clause of these Program Regulations;*

nn. *"Summer Term" means an additional Academic Term conducted during the summer break (typically in June-July) for a duration of about eight (08) calendar weeks, with a minimum of thirty (30) University teaching days;*

oo. *"SWAYAM" means Study Webs of Active Learning for Young Aspiring Minds.*

pp. *"UGC" means University Grant Commission;*

qq. *"University" means Presidency University, Bengaluru; and*

rr. *"Vice Chancellor" means the Vice Chancellor of the University.*

## 5. Program Description

The Bachelor of Computer Applications Program Regulations and Curriculum 2025-2028 are subject to, and, pursuant to the Academic Regulations. These Program Regulations shall be applicable to the following ongoing Bachelor of Computer Applications Degree Programs of 2025-2028 offered by the Presidency School of Information Science (PSIS):

1. Bachelor of Computer Applications abbreviated as BCA.

2. Bachelor of Computer Applications in Artificial Intelligence and Machine Learning, abbreviated as BCA. (Artificial Intelligence and Machine Learning).

3. Bachelor of Computer Applications in Data Science, abbreviated as BCA. (Data Science).

5.1 These Program Regulations shall be applicable to other similar programs, which may be introduced in future.

5.2 These Regulations may evolve and get amended or modified or changed through appropriate approvals from the Academic Council, from time to time, and shall be binding on all concerned.

5.3 The effect of periodic amendments or changes in the Program Regulations, on the students admitted in earlier years, shall be dealt with appropriately and carefully, so as to ensure that those students are not subjected to any unfair situation whatsoever, although they are required to conform to these revised Program Regulations, without any undue favour or considerations.

## 6. Minimum and Maximum Duration

6.1 Bachelor of Computer Applications Degree Program is a Three Year, Full-Time Semester based program. The minimum duration of the BCA Program is three (03) years and each year comprises of two academic Semesters (Odd and Even Semesters) and hence the duration of the BCA program is six (06) Semesters.

6.2 A student who for whatever reason is not able to complete the Program within the normal period or the minimum duration (number of years) prescribed for the Program, may be allowed a period of two years beyond the normal period to complete the mandatory minimum credits requirement as prescribed by the concerned Program Regulations and Curriculum. In general, the permissible maximum duration (number of years) for completion of Program is 'N' + 2 years, where 'N' stands for the normal or minimum duration (number of years) for completion of the concerned Program as prescribed by the concerned Program Regulations and Curriculum.

6.3 The time taken by the student to improve Grades/CGPA, and in case of temporary withdrawal/re-joining (Refer to Clause 16.1 of Academic Regulations), shall be counted in the permissible maximum duration for completion of a Program.

6.4 In exceptional circumstances, such as temporary withdrawal for medical exigencies where there is a prolonged hospitalization and/or treatment, as certified through hospital/medical records, women students requiring extended maternity break (certified by registered medical practitioner), and, outstanding sportspersons representing the University/State/India

requiring extended time to participate in National/International sports events, a further extension of one (01) year may be granted on the approval of the Academic Council.

6.5 The enrolment of the student who fails to complete the mandatory requirements for the award of the concerned Degree (refer Section 19.0 of Academic Regulations) in the prescribed maximum duration (Clauses 18.1 and 18.2 of Academic Regulations), shall stand terminated and no Degree shall be awarded.

# 7 Programme Educational Objectives (PEO)

After four years of successful completion of the program, the graduates shall be able to:

**PEO 01:** Demonstrate success as a computer professional with innovative skills, having moral and ethical values.

**PEO 02:** Engage in lifelong learning through software development.

**PEO 03:** Serve as a leader in the profession through consultancy, extension activities and/ or entrepreneurship.

# 8 Programme Outcomes (PO) and Programme Specific Outcomes (PSO)

## 8.1 Programme Outcomes (PO)

**On successful completion of the Program, the students shall be able to:**

**PO 1.** Application of Domain Knowledge: Apply the domain knowledge such as mathematics, science and software engineering fundamentals into the Computer Application related professions.

**PO 2:** Problem Solving & Analysis: Identify, Formulate, Analyse and Solve Complex Scenarios related to Computer Applications.

**PO 3:** Design/development of Activities: Conceive, Design and Develop various activities of Computer Applications.

**PO 4:** Conduct Investigations of Events: Carry out Investigation of an event and draw logical conclusions based on critical thinking and analytical reasoning.

**PO 5:** Modern Tool usage: Effectively apply relevant ICT Tools and digital tools to carry out Computer Application Attributes.

**PO 6:** Research: Identify suitable Research Methods and report the findings.

**PO 7:** Profession and Society: Apply the knowledge of the values and beliefs of multicultural society and a global perspective in the profession.

**PO 8:** Ethics: Identify ethical issues and embrace ethical values in conduct of Profession.

**PO 9:** Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**PO 10:** Communication: Express thoughts and ideas effectively in writing and oral communication

**PO 11:** Project Management and Finance: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion.

**PO 12:** Life-long Learning: Recognize the need for, and have the preparation and ability to

engage in independent and life-long learning in the broadest context of societal and technological change.

**8.2 Program Specific Outcomes (PSOs):**

On successful completion of the Program, the students shall be able to:

**PSO-1: [Disciplinary knowledge]:** Demontrate comprehensive knowledge and understanding of Computer Applications, Data Science and AI/ML techniques.

**PSO-2: [Problem Solving]:** Identify, formulate and apply appropriate techniques in the areas related to Software development, Big data, Network, Cloud computing technolgies and related domains of varying complexities in real-time applications.

**PSO-3: [Design/development of Applications]:** design, develop, and test full stack applications by applying principles of software engineering, addressing real-world requirements across various domains.

## 9 Admission Criteria (as per the concerned Statutory Body)

The University admissions shall be open to all persons irrespective of caste, class, creed, gender or nation. All admissions shall be made on the basis of merit in the qualifying examinations; provided that forty percent of the admissions in all Programs of the University shall be reserved for the students of Karnataka State and admissions shall be made through a Common Entrance Examination conducted by the State Government or its agency and seats shall be allotted as per the merit and reservation policy of the State Government from time to time. The admission criteria to the BCA Program is listed in the following Sub-Clauses:

9.1.    An applicant who has successfully completed Pre-University course or Senior Secondary School course (+2) or equivalent such as (11+1), 'A' level in Senior School Leaving Certificate Course from a recognized university of India or outside or from Senior Secondary Board or equivalent, constituted or recognized by the Union or by the State Government of that Country for the purpose of issue of qualifying certificate on successful completion of the course, may apply for and be admitted into the Program.

9.2.    Provided further A candidate seeking admission for BCA Program should have passed 10+2 or an equivalent examination from any recognized board with a minimum of 40 % marks in aggregate.

9.3.    Reservation for the SC / ST and other backward classes shall be made in accordance with the directives issued by the Government of Karnataka from time to time.

9.4.    Admissions are offered to Foreign Nationals and Indians living abroad in accordance with the rules applicable for such admission, issued from time to time, by the Government of India.

9.5.    Candidates must fulfil the medical standards required for admission as prescribed by the University.

9.6.    If, at any time after admission, it is found that a candidate had not in fact fulfilled all the requirements stipulated in the offer of admission, in any form whatsoever, including possible misinformation and any other falsification, the Registrar shall report the matter to the Board of Management (BOM), recommending revoking the admission of the candidate.

9.7.    The decision of the BOM regarding the admissions is final and binding.

### 10  Transfer Students requirements

**10.1. Transfer of student(s) from another recognized University to the 2<sup>nd</sup> year (3<sup>rd</sup> Semester) of the BCA. Program of the University**

10.1.1.   A student who has completed the 1st Year (i.e., passed in all the Courses / Subjects prescribed for the 1st Year) of the BCA Three-Year Degree Program from another recognized University, may be permitted to transfer to the 2nd Year (3rd Semester) of the BCA Program of the University as per the rules and guidelines prescribed in the following Sub-Clauses:

10.1.2.   The concerned student fulfils the criteria specified in Sub-Clauses 10.1.1, 10.1.2 and 10.1.3.

10.1.3.   The student shall submit the Application for Transfer along with a non-refundable Application Fee (as prescribed by the University from time to time) to the University no later than July 10 of the concerned year for admission to the 2nd Year (3rd Semester) BCA Program commencing on August 1 on the year concerned.

10.1.4.   The student shall submit copies of the respective Marks Cards / Grade Sheets / Certificates along with the Application for Transfer.

10.1.5.   The transfer may be provided on the condition that the Courses and Credits completed by the concerned student in the 1st Year of the BCA. three-year Degree Program from the concerned University, are declared equivalent and acceptable by the Equivalence Committee constituted by the Vice Chancellor for this purpose. Further, the Equivalence Committee may also prescribe the Courses and Credits the concerned students shall have to mandatorily complete, if admitted to the 2nd Year of the BCA Program of the University.

**10.1.6.**   The Branch / Discipline allotted to the student concerned shall be the decision of the University and binding on the student.

### 11 Change of Branch / Discipline / Specialization

A student admitted to a particular Branch of the BCA Program will normally continue studying in that Branch till the completion of the program. However, the University reserves the right to provide the option for a change of Branch, or not to provide the option for a change of Branch, at the end of 1st Year of the BCA Program to eligible students in accordance with the following rules and guidelines: framed by the University from time to time.

11.1. Normally, only those students, who have passed all the Courses prescribed for the 1st Year of the BCA Program and obtained a CGPA of not less than 6.50 at the end of the 2nd Semester, shall be eligible for consideration for a change of Branch.

11.2. Change of Branch, if provided, shall be made effective from the commencement of the 3rd Semester of the BCA Program. There shall be no provision for change of Branch thereafter under any circumstances whatsoever.

11.3. The student provided with the change of Branch shall fully adhere to and comply with the Program Regulations of the concerned Branch of the BCA Program, the Fee Policy pertaining to that Branch of the BCA Program, and, all other rules pertaining to the changed Branch existing at the time.

11.4. Change of Branch once made shall be final and binding on the student. No student shall be permitted, under any circumstances, to refuse the change of Branch offered.

11.5. The eligible student may be allowed a change in Branch, strictly in order of inter se merit, subject to the conditions given below:

11.6. The actual number of students in the 3rd Semester in any particular Branch to which the transfer is to be made, should not exceed the intake fixed by the University for the concerned Branch; and,

11.7. The actual number of students in any Branch from which transfer is being sought does not fall below 75% of the total intake fixed by the University for the concerned Branch.

11.8. The process of change of Branch shall be completed within the first five days of Registration for the 3rd Semester of the BCA Program.

**12. Specific Regulations regarding Assessment and Evaluation (including the Assessment Details of NTCC Courses, Weightages of Continuous Assessment and End Term Examination for various Course Categories)**

12.1. The academic performance evaluation of a student in a Course shall be according to the University Letter Grading System based on the class performance distribution in the Course.

12.2. Academic performance evaluation of every registered student in every Course registered by the student is carried out through various components of Assessments spread across the Semester. The nature of components of Continuous Assessments and the weightage given to each component of Continuous Assessments (refer Clause 8.8 of Academic Regulations) shall be clearly defined in the Course Plan for every Course, and approved by the DAC.

12.3.  Format of the End-Term examination shall be specified in the Course Plan.

12.4.  Grading is the process of rewarding the students for their overall performance in each Course. The University follows the system of Relative Grading with statistical approach to classify the students based on the relative performance of the students registered in the concerned Course except in the following cases:

- Non-Teaching Credit Courses (NTCC)

- Courses with a class strength less than 30

Absolute grading method may be adopted, where necessary with prior approval of concerned DAC.

Grading shall be done at the end of the Academic Term by considering the aggregate performance of the student in all components of Assessments prescribed for the Course. Letter Grades (Clause 8.10) shall be awarded to a student based on her/his overall performance relative to the class performance distribution in the concerned Course. These Letter Grades not only indicate a qualitative assessment of the student's performance but also carry a quantitative (numeric) equivalent called the Grade Point.

**12.5.  Assessment Components and Weightage**

| Table 1: Assessment Components and Weightage for different category of Courses | | |
|---|---|---|
| **Nature of Course and Structure** | **Evaluation Component** | **Weightage** |
| **Lecture-based Course** L component in the L-T-P Structure is predominant (more than 1) (Examples: 3-0-0; 3-0-2; 2-1-0; 2-0-2, 2-0-4 etc.) | Continuous Assessments | 50% |
| | End Term Examination | 50% |
| **Lab/Practice-based Course** P component in the L-T-P Structure is predominant (Examples: 0-0-4; 1-0-4; 1-0-2; etc.) | Continuous Assessments | 75% |
| | End Term Examination | 25% |
| **Skill based Courses** like Industry Internship, Capstone project, Research Dissertation, Integrative Studio, Interdisciplinary Project, Summer / Short Internship, Social Engagement / Field Projects, Portfolio, and such similar Non-Teaching Credit Courses, where the pedagogy does not lend itself to a typical L-T-P structure | Guidelines for the assessment components for the various types of Courses, with recommended weightages, shall be specified in the concerned Program Regulations and Curriculum / Course Plans, as applicable. | |

The exact weightages of Evaluation Components shall be clearly specified in the concerned PRC and respective Course Plan.

Normally, for Practice/Skill based Courses, without a defined credit structure (L–T–P) [NTCC], but with assigned Credits (as defined in Clause 5.2 of the Academic Regulations), the method of evaluation shall be based only on Continuous Assessments. The various components of Continuous Assessments, the distribution of weightage among such components, and the method of evaluation/assessment, shall be as decided and indicated in the Course Plan/PRC. The same shall be approved by the respective DAC.

12.6. **Minimum Performance Criteria:**

### 12.6.1.    Theory only Course and Lab/Practice Embedded Theory Course

A student shall satisfy the following minimum performance criteria to be eligible to earn the credits towards the concerned Course:

a. A student must obtain a minimum of 30% of the total marks/weightage assigned to the End Term Examinations in the concerned Course.

b. The student must obtain a minimum of 40% of the AGGREGATE of the marks/weightage of the components of Continuous Assessments, Mid Term Examinations and End Term Examinations in the concerned Course.

### 12.6.2.    Lab/Practice only Course and Project Based Courses

The student must obtain a minimum of 40% of the AGGREGATE of the marks/weightage of all assessment components in the concerned Course.

12.6.3.    A student who fails to meet the minimum performance criteria listed above in a Course shall be declared as "Fail" and given "F" Grade in the concerned Course. For theory Courses, the student shall have to re-appear in the "Make-Up Examinations" as scheduled by the University in any subsequent semester, or, re-appear in the End Term Examinations of the same Course when it is scheduled at the end of the following Semester or Summer Term, if offered. The marks obtained in the Continuous Assessments (other than the End Term Examination) shall be carried forward and be included in computing the final grade, if the student secures the minimum requirements (as per sub-clauses 8.9.1 and 8.9.2 of Academic Regulations) in the "Make-Up Examinations" of the concerned Course. Further, the student has an option to re-register for the Course and clear the same in the summer term/ subsequent semester if he/she wishes to do so, provided the Course is offered.

## 13. Additional clarifications - Rules and Guidelines for Transfer of Credits from MOOC, etc. – Note: These are covered in Academic Regulations

The University allows students to acquire credits from other Indian or foreign institutions and/or Massive Open Online Course (MOOC) platforms, subject to prior approval. These credits may be transferred and counted toward fulfilling the minimum credit requirements for the award of a degree. The process of transfer of credits is governed by the following rules and guidelines:

13.1.　The transfer of credits shall be examined and recommended by the Equivalence Committee (Refer Annexure B of Academic Regulations) and approved by the Dean - Academics.

13.2.　Students may earn credits from other Indian or foreign Universities/Institutions with which the University has an MOU, and that MOU shall have specific provisions, rules and guidelines for transfer of credits. These transferred credits shall be counted towards the minimum credit requirements for the award of the degree.

13.3.　Students may earn credits by registering for Online Courses offered by *Study Web of Active Learning by Young and Aspiring Minds* (SWAYAM) and *National Program on Technology Enhanced Learning* (NPTEL), or other such recognized Bodies/ Universities/Institutions as approved by the concerned BOS and Academic Council from time to time. The concerned School/Parent Department shall publish/include the approved list of Courses and the rules and guidelines governing such transfer of credits of the concerned Program from time to time. The Rules and Guidelines for the transfer of credits specifically from the Online Courses conducted by SWAYAM/ NPTEL/ other approved MOOCs are as stated in the following Sub-Clauses:

　13.3.1.　A student may complete SWAYAM/NPTEL/other approved MOOCs as mentioned in Clause 17.3(As per the academic regulations) and transfer equivalent credits to partially or fully complete the mandatory credit requirements of Discipline Elective Courses and/or the mandatory credit requirements of Open Elective Courses as prescribed in the concerned Curriculum Structure. However, it is the sole responsibility of the student to complete the mandatory credit requirements of the Discipline Elective Courses and the Open Elective Courses as prescribed by the Curriculum Structure of the concerned Program.

　13.3.2.　SWAYAM/NPTEL/ other approved MOOCs as mentioned in Clause 17.3(As per the academic regulations) shall be approved by the concerned Board of Studies and placed (as Annexures) in the concerned PRC.

　13.3.3.　Parent Departments may release a list of SWAYAM/NPTEL/other approved MOOCs for Pre-Registration as per schedule in the Academic Calendar or through University Notification to this effect.

　**13.3.4.**　Students may Pre-Register for the SWAYAM/NPTEL/other approved MOOCs in the respective Departments and register for the same Courses as per the schedule announced by respective Online Course Offering body/institute/ university.

　13.3.5.　A student shall request for transfer of credits only from such approved Courses as mentioned in Sub-Clause 13.3.2 above.

　13.3.6.　SWAYAM/NPTEL/other approved MOOCs Courses are considered for transfer of credits only if the concerned student has successfully completed the SWAYAM/NPTEL/other approved MOOCs and obtained a certificate of successful/satisfactory completion.

13.3.7. A student who has successfully completed the approved SWAYAM/NPTEL/ other approved MOOCs and wants to avail the provision of transfer of equivalent credits, must submit the original Certificate of Completion, or such similar authorized documents to the HOD concerned, with a written request for the transfer of the equivalent credits. On verification of the Certificates/Documents and approval by the HOD concerned, the Course(s) and equivalent Credits shall forwarded to the COE for processing of results of the concerned Academic Term.

13.3.8. The credit equivalence of the SWAYAM/NPTEL/other approved MOOCs are based on Course durations and/or as recommended by the Course offering body/institute/university. The Credit Equivalence mapped to SWAYAM/ NPTEL approved Courses based on Course durations for transfer of credits is summarised in Table shown below. The Grade will be calculated from the marks received by the Absolute Grading Table 8.11 in the Academic Regulations.

| Table 2: Durations and Credit Equivalence for Transfer of Credits from SWAYAM-NPTEL/ other approved MOOC Courses | | |
|---|---|---|
| Sl. No. | Course Duration | Credit Equivalence |
| 1 | 4 Weeks | 1 Credit |
| 2 | 8 Weeks | 2 Credits |
| 3 | 12 Weeks | 3 Credits |

13.3.9. The maximum permissible number of credits that a student may request for credit transfer from MOOCs shall not exceed 20% of the mandatory minimum credit requirements specified by the concerned Program Regulations and Curriculum for the award of the concerned Degree.

13.3.10. The University shall not reimburse any fees/expense; a student may incur for the SWAYAM/NPTEL/other approved MOOCs.

13.4 The maximum number of credits that can be transferred by a student shall be limited to forty percent (40%) of the mandatory minimum credit requirements specified by the concerned Program Regulations and Curriculum for the award of the concerned Degree. However, the grades obtained in the Courses transferred from other Institutions/MOOCs, as mentioned in this Section (13), shall not be included in the calculation of the CGPA.

13.5 Mandatory Non-Credit Course Completion Requirements: All mandatory non-credit courses shall be satisfactorily completed by the student as part of the degree requirements. These courses will be evaluated and awarded letter grades based on the following criteria:

• S (Satisfactorily Completed): Awarded when the student successfully completes all prescribed course requirements.

• NC (Not Completed): Awarded when the student fails to meet the prescribed course requirements.

A student receiving an NC grade must reappear for and complete the course in accordance with the guidelines prescribed by the University.

In the case of non-taught and non-credited mandatory courses—where students are advised to undertake learning through MOOC platforms—there shall be a clearly defined Course Catalogue and a corresponding Course Plan. The Course Plan shall outline the assessment components, which will form the basis for evaluation.

**14. Structure / Component with Credit Requirements Course Baskets & Minimum Basket wise Credit Requirements**

The BCA Program Structure (2025-2028) totalling 120 credits. Table 3 summarizes the type of baskets, number of courses under each basket and the associated credits that are mandatorily required for the completion of the Degree.

| Sl. No. | Baskets | Credit Contribution |
|---------|---------|---------------------|
| | **Table 3: BCA 2025-2028: Summary of Mandatory Courses and Minimum Credit Contribution from various Baskets** | |
| 1 | Core Courses | 53 |
| 2 | Ability Enhancement Courses | 8 |
| 3 | Multi-Disciplinary Elective course | 3 |
| 4 | Value added Courses | 2 |
| 5 | Skill Enhancement courses | 36 |
| 6 | Discipline Specific Elective | 18 |
| 7 | Mandatory Courses (MAC) | 0 |
| | Total Credits | 120 (Minimum) |

In the entire Program, the practical and skill-based course component contribute to an extent of approximately 62% out of the total credits of 120 for BCA program of three years' duration.

**15. Minimum Total Credit Requirements of Award of Degree**

As per the AICTE guidelines, a minimum of 120 credits is required for the award of a BCA degree.

**16. Other Specific Requirements for Award of Degree, if any, as prescribed by the Statutory Bodies,**

16.1    The award of the Degree shall be recommended by the Board of Examinations and approved by the Academic Council and Board of Management of the University.

16.2    A student shall be declared to be eligible for the award of the concerned Degree if she/he:

a.  Fulfilled the Minimum Credit Requirements and the Minimum Credits requirements under various baskets;

b.  Secure a minimum CGPA of 4.50 in the concerned Program at the end of the Semester/Academic Term in which she/he completes all the requirements for the award of the Degree as specified in Sub-Clause a of Academic Regulations;

c.  No dues to the University, Departments, Hostels, Library, and any other such Centers/ Departments of the University; and

d.  No disciplinary action is pending against her/him.

**17. Curriculum Structure – Basket Wise Course List (not Semester Wise)**

| | | Table 3.1 Ability Enhancement Courses (AEC) | | | | |
|---|---|---|---|---|---|---|
| S.No | Code | Course Name | L | T | P | C |
| 1 | ENG1902 | Foundations of English Communication | 3 | 0 | 0 | 3 |
| 2 | ENG1913 | Essentials of Writing Skills | 3 | 0 | 0 | 3 |
| 3 | PPS1001 | Introduction to soft skills | 0 | 0 | 2 | 1 |
| 4 | PPS3001 | Problem Solving through Aptitude | 0 | 0 | 2 | 1 |
| | | | | **Total No. of Credits** | | **8** |

| | | Table 3.2 Skill Enhancement Courses (SEC) | | | | |
|---|---|---|---|---|---|---|
| S.No | Code | Course Name | L | T | P | C |
| 1 | CSA1500 | Problem Solving using C | 2 | 0 | 0 | 2 |
| 2 | CSA1501 | Problem Solving using C Lab | 0 | 0 | 4 | 2 |
| 3 | CSA1502 | Web Design and Development | 1 | 0 | 4 | 3 |
| 4 | CSA1503 | Programming in Python | 1 | 0 | 4 | 3 |
| 5 | CSA1504 | Object Oriented Programming using Java | 1 | 0 | 4 | 3 |
| 6 | CSA2511 | Android Mobile Applications Development | 0 | 0 | 6 | 3 |
| 7 | CSA2519 | Database System Administration | 1 | 0 | 4 | 3 |
| 8 | CSA2211 | User Interface Design | 0 | 0 | 6 | 3 |
| 9 | CSA2212 | Internet of Things | 1 | 0 | 4 | 3 |
| 10 | CSA7000 | Summer Internship | - | - | - | 3 |
| 11 | CSA7300 | Project | - | - | - | 8 |
| | | | | **Total No. of Credits** | | **36** |

| | | Table 3.3 Core Courses (CC) | | | | |
|---|---|---|---|---|---|---|
| S.No | Code | Course Name | L | T | P | C |
| 1 | MAT1201 | Applied Mathematics | 3 | 0 | 0 | 3 |
| 2 | CSA1200 | Digital Computer Fundamentals | 3 | 0 | 0 | 3 |
| 3 | MAT1202 | Statistical Methods and Techniques | 3 | 0 | 0 | 3 |
| 4 | CSA2500 | Data Structures | 3 | 0 | 0 | 3 |
| 5 | CSA2501 | Data Structures Lab | 0 | 0 | 2 | 1 |
| 6 | CSA2502 | Computer Networks | 3 | 0 | 0 | 3 |
| 7 | CSA1201 | Computer Organization | 3 | 0 | 0 | 3 |
| 8 | CSA2503 | Relational Database Management Systems | 3 | 0 | 0 | 3 |
| 9 | CSA2504 | Relational Database Management Systems Lab | 0 | 0 | 2 | 1 |
| 10 | CSA1703 | Data Mining | 2 | 1 | 0 | 3 |
| 11 | CSA2505 | Analysis of Algorithms | 2 | 1 | 0 | 3 |
| 12 | CSA2506 | Operating Systems and Unix Programming | 2 | 0 | 0 | 2 |
| 13 | CSA2507 | Operating Systems and Unix Programming Lab | 0 | 0 | 2 | 1 |
| 14 | CSA1202 | Software Engineering | 3 | 0 | 0 | 3 |
| 15 | CSA1704 | Principles of Artificial Intelligence | 3 | 0 | 0 | 3 |
| 16 | CSA2508 | Software Testing | 2 | 0 | 2 | 3 |
| 17 | CSA1700 | Essentials of Cloud Computing | 3 | 0 | 0 | 3 |

| 18 | CSA1705 | Blockchain Technology | 3 | 0 | 0 | 3 |
| 19 | CSA2510 | Computer Network and Administration Lab | 0 | 0 | 6 | 3 |
| 20 | CSA2520 | Virtualization and Cloud Infrastructure | 1 | 0 | 4 | 3 |
| | | | | | **Total No. of Credits** | **53** |

| Table 3.4 Value Added Course (VAC) | | | | | | |
|---|---|---|---|---|---|---|
| **S.No** | **Code** | **Course Name** | **L** | **T** | **P** | **C** |
| 1 | CSA1204 | Design thinking and Innovation | 2 | 0 | 0 | 2 |
| | | | | | **Total No. of Credits** | **2** |

| Table 3.5 List of Mandatory Courses (MAC) | | | | | | |
|---|---|---|---|---|---|---|
| **S.No** | **Code** | **Course Name** | **L** | **T** | **P** | **C** |
| 1 | CHE7601 | Environmental Studies | - | - | - | - |
| 2 | LAW7601 | Indian Constitution | - | - | - | - |

## 18. Practical / Skill based Courses – Internships / Thesis / Dissertation / Capstone Project Work / Portfolio / Mini project

Practical / Skill based Courses like internship, project work, capstone project, research project / dissertation, and such similar courses, where the pedagogy does not lend itself to a typical L-T-P-C Structure as defined in Clause 5.1 of the Academic Regulations, 2021, are simply assigned the number of Credits based on the quantum of work / effort required to fulfil the learning objectives and outcomes prescribed for the concerned Courses. Such courses are referred to as Non-Teaching Credit Courses (NTCC). These Courses are designed to provide students with hands-on experience and skills essential for their professional development. These courses aim to equip students with abilities in problem identification, root cause analysis, problem-solving, innovation, and design thinking through industry exposure and project-based learning. The expected outcomes are first level proficiency in problem solving and design thinking skills to better equip BCA graduates for their professional careers. The method of evaluation and grading for the Practical / Skill based Courses shall be prescribed and approved by the concerned Departmental Academic Committee (refer Annexure A of the Academic Regulations, 2021). The same shall be prescribed in the Course plan.

### 18.1    Summer Internship

A student may opt to undertake Internship for a duration of 10-12 weeks during the summer break (Between 4th and 5th semester). A student may opt Mini project work shall be considered equivalent to an internship, subject to the following conditions:

> 18.1.1. The Internship shall be in conducted in accordance with the Internship Policy prescribed by the University from time to time.

> 18.1.2. The selection criteria (minimum CGPA, pass in all Courses as on date, and any other qualifying criteria) as applicable / stipulated by the concerned Industry / Company or academic / research institution for award of the Internship to a student;

18.1.3. The number of Internships available for the concerned Academic Term. Further, the available number of internships shall be awarded to the students by the University on the basis of merit using the CGPA secured by the student. Provided further, the student fulfils the criteria, as applicable, specified by the Industry / Company or academic / research institution providing the Internship, as stated in Sub-Clause 18.1.2 above.

18.1.4. A student may opt for Internship in an Industry / Company or academic / research institution of her / his choice, subject to the condition that the concerned student takes the responsibility to arrange the Internship on her / his own. Provided further, that the Industry / Company or academic / research institution offering such Internship confirms to the University that the Internship shall be conducted in accordance with the Program Regulations and Internship Policy of the University.

18.1.5. A student selected for an Internship in an industry / company or academic / research institution shall adhere to all the rules and guidelines prescribed in the Internship Policy of the University.

18.1.6. A student may opt to do a Mini Project Work for a period of 10-12 weeks in an Industry / Company or academic / research institution or the University Department(s) as an equivalence of Summer Internship during the 5th Semester while concurrently completing the remaining registered courses for that semester.

### 18.2    Project Work

A student may opt to do a Project Work for a period of 10-12 weeks in an Industry / Company or academic / research institution or the University Department(s) as an equivalence of Internship during the 6th Semester as applicable, while concurrently completing the remaining registered courses for that semester. subject to the following conditions:

**18.2.1**   The Project Work shall be approved by the concerned HOD and be carried out under the guidance of a faculty member.

**18.2.2**     The student may do the project work in an Industry / Company or academic / research institution of her / his choice subject to the above mentioned condition (Sub-Clause 18.2.1). Provided further, that the Industry / Company or academic / research institution offering such project work confirms to the University that the project work will be conducted in accordance with the Program Regulations and requirements of the University.

### 18.3    Capstone Project

A student may undergo a Capstone Project for a period of 8-12 weeks in an industry / company or academic / research institution in the 4th Semester as applicable, while concurrently completing the remaining registered courses for that semester. subject to the following conditions:

**18.3.1** The Capstone Project shall be in conducted in accordance with the Capstone Project Policy prescribed by the University from time to time.

**18.3.2** The selection criteria (minimum CGPA, pass in all Courses as on date, and any other qualifying criteria) as applicable / stipulated by the concerned Industry / Company or academic / research institution for award of the Capstone Project to a student;

**18.3.3** The number of Capstone Project available for the concerned Academic Term. Further, the available number of Capstone Project shall be awarded to the students by the University on the basis of merit using the CGPA secured by the student. Provided further, the student fulfils the criteria, as applicable, specified by the Industry / Company or academic / research institution providing the Capstone Project, as stated in Sub-Clause 2.6.3.2 above.

**18.3.4** A student may opt for Capstone Project in an Industry / Company or academic / research institution of her / his choice, subject to the condition that the concerned student takes the responsibility to arrange the I Capstone Project on her / his own. Provided further, that the Industry / Company or academic / research institution offering such Capstone Project confirms to the University that the Capstone Project shall be conducted in accordance with the Program Regulations and Capstone Project Policy of the University.

**18.3.5** A student selected for a Capstone Project in an industry / company or academic / research institution shall adhere to all the rules and guidelines prescribed in the Capstone Project Policy of the University.

### 18.4    Research Project / Dissertation

A student may opt to do a Research Project / Dissertation for a period of 12-14 weeks in an Industry / Company or academic / research institution or the University Department(s) as an equivalence of Capstone Project/Internship/Project, subject to the following conditions:

18.4.1 The Research Project / Dissertation shall be approved by the concerned HOD and be carried out under the guidance of a faculty member.

The student may do the Research Project / Dissertation in an Industry / Company or academic / research institution of her / his choice subject to the above mentioned condition (Sub-Clause 2.6.4.1). Provided further, that the Industry / Company or academic / research institution offering such Research Project / Dissertation confirms to the University that the Research Project / Dissertation work will be conducted in accordance with the Program Regulations and requirements of the University.

**19. List of Elective Courses under various Specialisations / Stream Basket**

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Table 3.6 : Discipline Specific Elective – Minimum of 15 credits is to be earned by the student in a particular track and overall 18 credits.

---

| \multicolumn{7}{c}{Track 1 - Front End Development} |
|---|

| S.No | Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | CSA3422 | .Net Programming Using C# | 1 | 0 | 4 | 3 |
| 2 | CSA3423 | No SQL | 1 | 0 | 4 | 3 |
| 3 | CSA3426 | Front-End Development using Java Script | 1 | 0 | 4 | 3 |
| 4 | CSA3427 | Web Application Development | 1 | 0 | 4 | 3 |
| 5 | CSA3424 | Agile Structures and Frameworks | 3 | 0 | 0 | 3 |
| 6 | CSA3425 | Introduction to Devops | 3 | 0 | 0 | 3 |

| Track 2 - AIML and Data Science |
|---|

| S.No | Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | CSA3400 | Computational Data Modelling and Visualization | 1 | 0 | 4 | 3 |
| 2 | CSA3402 | Statistical Analysis using R Programming | 1 | 0 | 4 | 3 |
| 3 | CSA3430 | Bigdata Analytics | 1 | 0 | 4 | 3 |
| 4 | CSA3401 | Information Retrieval | 3 | 0 | 0 | 3 |
| 5 | CSA3403 | Natural Language Processing | 3 | 0 | 0 | 3 |
| 6 | CSA3428 | Ethical aspects of AI | 3 | 0 | 0 | 3 |

| Track 3 – Network and Multimedia |
|---|

| S.No | Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | CSA3409 | 2D Graphics Design | 1 | 0 | 4 | 3 |
| 2 | CSA3410 | Multimedia Data Compression and Storage | 1 | 0 | 4 | 3 |
| 3 | CSA3411 | Multimedia and Animation | 1 | 0 | 4 | 3 |
| 4 | CSA3406 | Cryptography and Network security | 3 | 0 | 0 | 3 |
| 5 | CSA3407 | Ethical Hacking | 3 | 0 | 0 | 3 |
| 6 | CSA3408 | Data Security and Privacy | 3 | 0 | 0 | 3 |

**20. List of Multi-Disciplinary Electives to be offered by the School / Department.**

| SI. No. | Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|---|
| | | | | | | |

**Table 3.6: Multi-Disciplinary Electives Courses Baskets: Minimum Credits to be earned from this Basket is 3**

| SI. No. | Course Code | Course Name | L | T | P | C |
|---|---|---|---|---|---|---|
| 1 | COM2001 | Introduction to Human Resource Management | 3 | 0 | 0 | 3 |
| 2 | COM2002 | Finance for non-finance | 3 | 0 | 0 | 3 |
| 3 | COM1021 | Introduction to Banking | 3 | 0 | 0 | 3 |
| 4 | BBA1025 | Fundamentals of Management | 3 | 0 | 0 | 3 |
| 5 | COM2007 | Basics of Accounting | 3 | 0 | 0 | 3 |
| 6 | CSE3116 | No Code AI | 2 | 0 | 2 | 3 |
| 7 | DSA2002 | Yoga for Health | 2 | 0 | 0 | 2 |
| 8 | DSA2003 | Stress Management and Well Being | 2 | 0 | 0 | 2 |
| 9 | MEC2003 | Supply Chain Management | 3 | 0 | 0 | 3 |
| 10 | MEC3201 | Industry 4.0 | 3 | 0 | 0 | 3 |
| 11 | MGT2002 | Organizational Behaviour | 3 | 0 | 0 | 3 |
| 12 | MGT2003 | Competitive Intelligence | 3 | 0 | 0 | 3 |
| 13 | MGT2004 | Development of Enterprises | 3 | 0 | 0 | 3 |
| 14 | MGT2011 | Personal Finance | 3 | 0 | 0 | 3 |
| 15 | MGT2022 | Customer Relationship Management | 3 | 0 | 0 | 3 |

**21. List of MOOC (NPTEL) Courses**

**21.1 NPTEL - Discipline Elective Courses for BCA**

| SI. No. | Course ID | Course Name | Duration |
|---|---|---|---|
| 1 | CSA7600 | Foundation of Cyber Physical System | 12 Weeks |
| 2 | CSA7601 | Affective Computing | 12 Weeks |
| 3 | CSA7602 | Getting Started with Competitive Programming | 12 Weeks |
| 4 | CSA7603 | The Joy of Computing using python | 12 Weeks |

**22. Recommended Semester Wise Course Structure / Flow including the Programme / Discipline Elective Paths / Options**

| Semester 1 | | | | |
|---|---|---|---|---|
| | | COURSE NAME | CREDIT STRUCTURE | BASKET |

| S. NO. | COURSE CODE | COURSE NAME | L | T | P | C | CONTACT HOURS | BASKET |
|--------|-------------|-------------|---|---|---|---|---------------|--------|
| 1 | MAT1201 | Applied Mathematics | 3 | 0 | 0 | 3 | 3 | CC |
| 2 | CSA1500 | Problem Solving using C | 2 | 0 | 0 | 2 | 2 | SEC |
| 3 | CSA1501 | Problem Solving using C Lab | 0 | 0 | 4 | 2 | 4 | SEC |
| 4 | CSA1200 | Digital Computer Fundamentals | 3 | 0 | 0 | 3 | 3 | CC |
| 5 | CSA1502 | Web Design and Development | 1 | 0 | 4 | 3 | 5 | SEC |
| 6 | ENG1902 | Foundations of English Communication | 3 | 0 | 0 | 3 | 3 | AEC |
| 7 | PPS1001 | Introduction to soft skills | 0 | 0 | 2 | 1 | 2 | AEC |
| | | **TOTAL** | **12** | **0** | **10** | **17** | **22** | **-** |

| Semester 2 | | | | | | | | |
|------------|---|---|---|---|---|---|---|---|
| | | | **CREDIT STRUCTURE** | | | | | |
| S. NO. | COURSE CODE | COURSE NAME | L | T | P | C | CONTACT HOURS | BASKET |
| 1 | CSA1503 | Programming in Python | 1 | 0 | 4 | 3 | 5 | SEC |
| 2 | MAT1202 | Statistical Methods and Techniques | 3 | 0 | 0 | 3 | 3 | CC |
| 3 | CSA2500 | Data Structures | 3 | 0 | 0 | 3 | 3 | CC |
| 4 | CSA2501 | Data Structures Lab | 0 | 0 | 2 | 1 | 2 | CC |
| 5 | ENG1913 | Essentials of Writing Skills | 3 | 0 | 0 | 3 | 3 | AEC |
| 6 | CSA2502 | Computer Networks | 3 | 0 | 0 | 3 | 3 | CC |
| 7 | CSA1201 | Computer Organization | 3 | 0 | 0 | 3 | 3 | CC |
| 8 | CSA1204 | Design thinking and Innovation | 2 | 0 | 0 | 2 | 2 | VAC |
| | | **TOTAL** | **18** | **0** | **6** | **21** | **24** | **-** |

| Semester 3 | | | | | | | | |
|------------|---|---|---|---|---|---|---|---|
| | | | **CREDIT STRUCTURE** | | | | | |
| S. NO. | COURSE CODE | COURSE NAME | L | T | P | C | CONTACT HOURS | BASKET |
| 1 | CSA2503 | Relational Database Management Systems | 3 | 0 | 0 | 3 | 3 | CC |
| 2 | CSA2504 | Relational Database Management Systems Lab | 0 | 0 | 2 | 1 | 2 | CC |
| 3 | CSA1504 | Object Oriented Programming using Java | 1 | 0 | 4 | 3 | 5 | SEC |
| 4 | CSA1703 | Data Mining | 2 | 1 | 0 | 3 | 3 | CC |
| 5 | CSA2505 | Analysis of Algorithms | 2 | 1 | 0 | 3 | 3 | CC |
| 6 | CSA2506 | Operating Systems and Unix Programming | 2 | 0 | 2 | 2 | 4 | CC |
| 7 | CSA2507 | Operating Systems and Unix Programming Lab | 0 | 0 | 2 | 1 | 2 | CC |
| 8 | CSA1202 | Software Engineering | 3 | 0 | 0 | 3 | 3 | CC |
| 9 | CHE7601 | Environmental Studies | - | - | - | - | 0 | MNC |
| | | **TOTAL** | **13** | **2** | **10** | **19** | **25** | **-** |

| Semester 4 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| S. NO. | COURSE CODE | COURSE NAME | CREDIT STRUCTURE | | | | | BASKET |
| | | | L | T | P | C | CONTACT HOURS | |
| 1 | CSA1704 | Principles of Artificial Intelligence | 3 | 0 | 0 | 3 | 3 | CC |
| 2 | CSA2511 | Android Mobile Application Development | 1 | 0 | 4 | 3 | 5 | SEC |
| 3 | CSA2508 | Software Testing | 2 | 0 | 2 | 3 | 4 | CC |
| 4 | CSA1700 | Essentials of Cloud Computing | 3 | 0 | 0 | 3 | 3 | CC |
| 5 | CSA2519 | Database System Administration | 1 | 0 | 4 | 3 | 5 | SEC |
| 6 | CSAXXXX | Discipline Specific Elective– I | 3 | 0 | 0 | 3 | 3 | DSE |
| 7 | CSAXXXX | Discipline Specific Elective– II | 3 | 0 | 0 | 3 | 3 | DSE |
| 8 | PPS3001 | Problem Solving through Aptitude | 0 | 0 | 2 | 1 | 2 | AEC |
| 9 | LAW7601 | Indian Constitution | - | - | - | - | 0 | MNC |
| | | TOTAL | 16 | 0 | 12 | 22 | 28 | - |

| Semester 5 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| S. NO. | COURSE CODE | COURSE NAME | CREDIT STRUCTURE | | | | | BASKET |
| | | | L | T | P | C | CONTACT HOURS | |
| 1 | CSA1705 | Blockchain Technology | 3 | 0 | 0 | 3 | 3 | CC |
| 2 | CSA2510 | Computer Network and Administration Lab | 0 | 0 | 6 | 3 | 6 | CC |
| 3 | CSAXXXX | Discipline Specific Elective– III | 3 | 0 | 0 | 3 | 3 | DSE |
| 4 | CSAXXXX | Discipline Specific Elective– IV | 3 | 0 | 0 | 3 | 3 | DSE |
| 5 | CSAXXXX | Discipline Specific Elective– V | 3 | 0 | 0 | 3 | 3 | DSE |
| 6 | CSA2212 | Internet of Things | 1 | 0 | 4 | 3 | 5 | SEC |
| 7 | CSAXXXX | Multi-Disciplinary Elective – I | 3 | 0 | 0 | 3 | 3 | MDC |
| 8 | CSA7000 | Summer Internship | - | - | - | 3 | 0 | SEC |
| | | TOTAL | 16 | 0 | 10 | 24 | 26 | - |

| Semester 6 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| S. NO. | COURSE CODE | COURSE NAME | CREDIT STRUCTURE | | | | | BASKET |
| | | | L | T | P | C | CONTACT HOURS | |
| 1 | CSA2520 | Virtualization and Cloud Infrastructure | 1 | 0 | 4 | 3 | 5 | CC |
| 2 | CSA2211 | User Interface Design | 0 | 0 | 6 | 3 | 6 | SEC |
| 3 | CSAXXXX | Discipline Specific Elective – VI | 3 | 0 | 0 | 3 | 3 | DSE |
| 4 | CSA7300 | Project | - | - | - | 8 | 0 | SEC |
| | | TOTAL | 4 | 0 | 10 | 17 | 14 | - |

**23. Course Catalogue**

Course Catalogue of all Courses Listed including the Courses Offered by other School / Department and Discipline / Programme Electives – Course Code, Course Name, Prerequisite, Anti-requisite, Course Description, Course Outcome, Course Content (with Blooms Level, CO, No. of Contact Hours), Reference Resources.

# Ability Enhancement Courses (AEC)

## ENG1902    Foundations of English Communication

| Course Code: ENG 1902 | Course Name:   Foundations Of English Communication<br>Type of Course: Theory Course /AEC | L- T-P- C | 2-0-0-2 |
|---|---|---|---|
| Version No. | 1 | | |
| Course Pre-requisites | PUC level basic English Language skills | | |
| Anti-requisites | NIL | | |
| Course Description | This foundational course is designed to develop core English communication skills in learners with beginner proficiency. centred around the LSRW approach—Listening, Speaking, Reading, and Writing—the course introduces students to practical and interactive methods for enhancing their confidence and fluency in English. Through real-life contexts, engaging activities, and multimedia resources, students will build essential skills needed for academic, professional, and everyday communication. The course also fosters collaboration, self-expression, and digital literacy through creative tasks and group exercises. | | |
| Course Objective | The objective of the course is skill development of student by using Participative Learning techniques | | |
| Course Out Comes | **On successful completion of the course the students shall be able to:**<br>• Identify the basics of English communication and gain confidence in using the language in both academic and social contexts. (Remember)<br>• Recognize active listening skills by engaging with different English accents, tones, and formats to better understand meaning and context. (Understand)<br>• Demonstrate speaking fluency, correct pronunciation, and clear expression through conversations, role plays, and public speaking. ( Understand )<br>• Classify vocabulary and reading comprehension skills by reading and analysing various texts such as stories, poems, and digital content. ( Understand )<br>• Develop effective writing skills for both academic and creative purposes through activities like writing paragraphs, and short stories. ( Understand ) | | |
| Course Content: | | | |

| Module 1 | Introduction to English Communication | Communication Skills | LSRW | 06 Sessions |
|---|---|---|---|---|

Topics:
- Importance of English in academics and career
- Basics of communication (verbal/non-verbal)
- Elements of effective communication
- Barriers to communication

Activity: Verbal and Nonverbal communication- charades.

| Module 2 | Active Listening | Quiz | Listening Skills | 9 Sessions |
|---|---|---|---|---|

Topics:
- Listening to conversations,
- Listening for gist and details
- Listening and Note-taking

Audio Sources: BBC Learning English, TEDx (simplified), Daily conversations

Activity:
- Listening quiz

| Module 3 | Better Speaking | Role Play | Speaking | 12Sessions |
|---|---|---|---|---|

Topics:
- Everyday conversations: shopping, college, travel
- Role plays and dialogues
- Describing people/places

Activity:
- Speech on "My Role Model"
- Extempore (guided)

| Module 4 | Reading for Understanding | Comprehension Skills | Reading Skills | 12 Sessions |
|---|---|---|---|---|

Topics:
- Reading simple paragraphs, short stories, and poetry
- Identifying main ideas and supporting details
- Skimming and scanning
- Reading digital content (tweets, podcasts, blogs)

Texts:
- The Eyes Are Not Here (Ruskin Bond)
- Leisure (W.H. Davies)

| Module 4 | Effective Writing | Writing Skills | | 6 Sessions |
|---|---|---|---|---|

Topics:
- Basics of sentence structure
- Paragraph writing: description, opinion
- Story and dialogue writing
- Using tools like Grammarly for editing

Activity:
- Picture-based story writing

Text Book
- Gairns, Ruth, and Stuart Redman. Oxford English for Academic Communication. Oxford UP, 2021.
- Flowerdew, John, and Lindsay Miller. The Routledge Handbook of English for Academic Purposes. 2nd ed., Routledge, 2022.

References
- Richards, Jack C. Key Issues in Language Teaching. 2nd ed., Cambridge UP, 2022.
- Nation, I. S. P., and Averil Coxhead. Teaching Vocabulary: A Vocabulary Research Manual. Routledge, 2022.
- Hyland, Ken. Second Language Writing. 3rd ed., Cambridge UP, 2021.
- Paltridge, Brian, and Sue Starfield. Getting Published in Academic Journals: Navigating the Publication Process. 2nd ed., University of Michigan Press, 2020.

E-Resources

**ENG1913        Essentials of Writing Skills**

| Course Code: ENG1913 | Course Name:   Essentials of Writing Skills<br>Type of Course: Theory Course /AEC | L- T-P- C | 3-0-0-3 |
|---|---|---|---|
| Version No. | 1 | | |
| Course Pre-requisites | NIL | | |
| Anti-requisites | NIL | | |
| Course Description | In any workplace, people use their computers and mobiles to help them research, compose, design, revise, and deliver information and documents. Networked computers and mobile devices are the central nervous system of the technical workplace, and the course helps students to practice technical communication. The course aims at initiating writing skills in the field of technical communication concentrating product descriptions, letters, emails, memos etc. New media and communication technologies are dramatically altering technical fields at an outstanding rate. Students are prone to work more efficiently, more globally and more visually. These changes are incorporated in the course giving importance to online communication, such as, blog and online content writing. | | |
| Course Objective | This course is designed to improve the learners' employability skills by using problem solving methodologies. | | |
| Course Out Comes | **On successful completion of the course the students shall be able to:**<br>CO1.   Apply strategies and techniques for organizing and drafting descriptions and specifications.  [Understand]<br>CO2.   Develop skills in writing sentences and paragraphs for content on websites and blogs.  [Understand]<br>CO3.   Write technical/professional emails, letters and memo  [Understand] | | |

Course Content:

| Module 1 | Technical Descriptions and specifiactions | Assignment | Technical Descriptions and specifiactions | 15  Sessions |
|---|---|---|---|---|

Topics:
• Technical ICT vocabulary errors/full forms of common ICT words
• Using proper punctuation
• ICT product descriptions
• Writing instructions
• User guides (step-by-step instructions, procedures, manuals)

| Module 2 | Informative summaries | Quiz/ Assignment | Informative summaries | 10  Sessions |
|---|---|---|---|---|

Topics:
1: Creating Infographics
2: Creating summary maps

| Module 3 | Technical Correspondence | Assignment | Technical Correspondence | 5  Sessions |
|---|---|---|---|---|

| Topics: | | | | |
|---|---|---|---|---|
| Business & Official Letters, Memos and Email | | | | |

**Text Book**

- Johnson, Richard. Technical Communication Today. Pearson, 2015.
- Felder, Lynda. Writing for the Web Creating Compelling Web Content Using Words, Pictures and Sound. Pearson, 2012.

**E-Resources**
1. https://www.cambridge.org/core/journals/publications-of-the-astronomical-society-of-australia/article/abs/3-lyman-technical-description/ACBC41A9A302D85C94AFF7CFFD9B0761
2. https://www.cambridge.org/core/books/abs/patent-intensity-and-economic-growth/clustering-procedure-technical-description/173050CAD2CCA6F62B597981B4DB9B0F
3. https://www-jstor-org-presiuniv.knimbus.com/stable/43748770?seq=2
4. •      Bridgeford, Tracy; Kitalong, Karla Saari; and Selfe, Richard, "Innovative Approaches to Teaching Technical Communication" (2004). All USU Press Publications. 147. https://digitalcommons.usu.edu/usupress_pubs/147

## PPS1001      Introduction to soft skills

| Course Code:<br>PPS1001 | Course Name:  Introduction to Soft Skills<br>Type of Course: Lab / Lab Integrated Course/AEC | | L- T-P- C | 0-0-2-1 |
|---|---|---|---|---|
| Version No. | 1 | | | |
| Course Pre-requisites | 1. Students are expected to understand basic English.  2. Students should have desire and enthusiasm to involve, participate and learn. | | | |
| Anti-requisites | NIL | | | |
| Course Description | This course is designed to enable students to understand the importance of soft skills and improve confidence, communication and professional skills to give the students a competitive advantage and increase chances of success in the professional world. The course will benefit learners in presenting themselves effectively through various activities and learning methodologies. | | | |
| Course Objective | The objective of the course is skill development of student by using participative & experiential learning techniques | | | |
| Course Out Comes | **On successful completion of the course the students shall be able to:**<br>**CO1**      Prepare professional social media profile                              [Understand]<br>**CO2**      Recognize the significance of Soft Skills                            [Understand]<br>**CO3**      List the techniques of unlearning poor habits and forming healthy    [Understand]<br>              habits<br>**CO4**      Demonstrate appropriate team behavior & people management            [Understand] | | | |
| Course Content: | | | | |
| Module 1 | Introduction to Soft Skills | Assignment | Introduction to Soft Skills | 4  Sessions |
| **Topics:**<br>Setting Expectations, Ice Breaker, Significance of soft skills. | | | | |
| Module 2 | Professional Brand Building | Assignment | Professional Brand Building | 4  Sessions |
| **Topics:**<br>Significance of a profile. Creating an online profile.<br>Networking - 100 connections, LinkedIn as a live resume, Create a dashboard. | | | | |
| Module 3 | Habit Formation | Assignment | Habit Formation | 4  Sessions |
| **Topics:**<br>Professional and personal ethics for success, Identity based habits, Domino effect, Habit Loop, Unlearning, standing up for what is right, New skills acquisition - 10,000 hours' rule for expertise. | | | | |

| Module 4 | Team Synergy & People Management, Adaptability, Effective communication | Assignment | Team Synergy & People Management, Adaptability, Effective communication | 4 , 6 , 4 Sessions |
|---|---|---|---|---|

**Topics:**

Importance of team, Get to know team needs (Maslow's Theory of needs), Trust and collaboration, Virtual Team building.

Change management: VUCA, adapting to changes, growth and fixed mindset, Continuous Learning

Different styles of communication, Difference between hearing and listening, Effective communication for success. Self-introduction framework.

Self-awareness, Empathy, Self-management, social awareness, and Relationship management

| Text Book |
|---|
| • The 7 Habits of Highly Effective People, first published in 1989, is a business and self-help book written by Stephen R. Covey – ( Module – Habit Formation) <br> • The Power of Habit: Why We Do What We Do in Life and Business is a book by Charles Duhigg ( Module – Habit Formation) |
| E-Resources |
| 1. How to Write a Blog on LinkedIn <br> 2. 7 steps for successful career planning (naukri.com) <br> Ted Talk: <br> • An introvert's guide to networking \| Rick Turoczy \| TEDxPortland - YouTube (Module: Professional Brand building) <br> • How to turn a group of strangers into a team \| Amy Edmondson - YouTube (Module: Team skills and People Management) <br> • How Adaptability Will Help You Deal With Change \| Jennifer Jones \| TEDxNantwich - YouTube (Module: Adaptability) |

## PPS3001     Problem Solving through Aptitude

| Course Code: PPS3001 | Course Name: Problem Solving through Aptitude <br> Type of Course: Lab / Lab Integrated Course/AEC | L- T-P- C | 0-0-2-1 |
|---|---|---|---|
| Version No. | 1 | | |
| Course Pre-requisites | Students should know the basic Mathematics & aptitude along with understanding of English | | |
| Anti-requisites | NIL | | |
| Course Description | The objective of this course is to prepare the trainees to tackle the questions on various topics and various difficulty levels based on Quantitative Ability, and Logical Reasoning asked during the placement drives. There will be sufficient focus on building the fundamentals of all the topics, as well as on solving the higher order thinking questions. The focus of this course is to teach the students to not only get to the correct answers, but to get there faster than ever before, which will improve their employability factor. | | |
| Course Objective | The objective of the course is to familiarize the learners with the concepts of Aptitude and attain Skill Development through Problem Solving techniques. | | |
| Course Out Comes | **On successful completion of the course the students shall be able to:** <br> CO1   Recall all the basic mathematical concepts they learnt in high school.   [Understand] <br> CO2   Identify the principle concept needed in a question.   [Understand] <br> CO3   Solve the quantitative and logical ability questions with the appropriate concept.   [Understand] <br> CO4   Analyze the data given in complex problems.   [Understand] | | |
| Course Content: | | | |

| Module 1 | Quantitative Ability | Assignment | Quantitative Ability | 10 Sessions |
|---|---|---|---|---|

**Topics:**

Introduction to Aptitude, working of Tables, Squares, Cubes, Number Series, Wrong number series, Letter series.

| Module 2 | Logical Reasoning | Assignment | Logical Reasoning | 20 Sessions |
|---|---|---|---|---|

**Topics:**
Linear & Circular Arrangement Puzzle, Coding & Decoding, Blood Relations, Directions,
Ordering and Ranking, Clocks and Calendars

Text Book
   T1.  Quantitative Aptitude by R S Aggarwal
   T2.  Verbal & Non-Verbal Reasoning by R S Aggarwal
E-Resources
1.      www.indiabix.com
2.      www.youtube.com/c/TheAptitudeGuy/videos
3.      Prepinsta.com

# Skill Enhancement Courses

## CSA1500      Problem solving using C

| Course Code: CSA1500 | Course Title: Problem solving using C<br>Type of Course: Program Core<br>Theory and Laboratory Integrated | | L-T-P-C | 2 | 0 | 0 | 2 |
|---|---|---|---|---|---|---|---|
| Version No. | 1.0 | | | | | | |
| Course Pre-requisites | Basic knowledge about the computer and its usage | | | | | | |
| Anti-requisites | NIL | | | | | | |
| Course Description | This Course will provide an introduction to foundational concepts of computer programming to students of BCA program. Topics covered in this Course are problem formulation and development of simple programs, Pseudo code, Flow Chart, Algorithms, data types, operators, decision making and branching, looping statements, arrays, functions, structures, Union, File handling and pointers. In the lab session students are required to solve problems based on the above concepts to illustrate the features of the structured programming | | | | | | |
| Course Objectives | The objective of the course is to familiarize the learners with the concepts of Problem-Solving Using C and attain Skill Development through Experiential Learning techniques. | | | | | | |
| Course Out Comes | On successful completion of the course the students shall be able to:<br>CO1: Identify the solution to the problem through programming [Knowledge]<br>CO2: Apply the basic concepts and control structures of programming to solve the problem. [Application]<br>CO3: Interpret the concepts of array and strings to represent data and its operations. [Application]<br>CO4: Demonstrate the concepts of functions, structures and unions in solving the related scenarios. [Application] | | | | | | |
| Course Content: | | | | | | | |
| Module 1 | Introduction to C Programming | Assignment | Case Studies | | | 12 Sessions | |
| Topics: Introduction to C: Background, Computer basics, Problem solving techniques, Tokens, Input/ Output statements, Structure of C program. | | | | | | | |
| Module 2 | Control statements in C | Assignment | Programming | | | 20 Sessions | |
| Topics: Type Casting, Expression Evaluation, Conditional and unconditional statement, Looping statements | | | | | | | |

| Module 3 | Arrays and Strings | Assignment | Mini Project | 21 Sessions |
|---|---|---|---|---|
| Topics: One dimensional Array, Array operations,2D Array, 2D Array operations, Strings and its operations, String manipulation functions. | | | | |
| Module 4 | Functions, Structures and Unions, Pointers | Assignment | Programming | 10 Sessions |
| Topics: Categories of functions, concept of modular programming, user defined datatypes, structures, union, pointers, file handling | | | | |
| Text Book E. Balaguruswamy, "Programming in ANSI C", Eighth Edition - Tata McGraw Hill. | | | | |
| References Books Behrouz A Forouzan, Richard F Gilberg, "Computer Science: A structured programming approach using C", Third Edition Cengage Learning. Brian W. Kernighan / Dennis Ritchie, "The C Programming Language ",Second Edition, Pearson YashavantKanetkar, "Let Us C", Eighteenth edition , BPB Publications Web Links: https://www.coursera.org/learn/introducton- to programming-in-c (Coursera) https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE _BASED&unique_id=DOAJ_1_02082022_1773 (E-Library Resource) https://onlinecourses.nptel.ac.in/noc22_cs32/preview (NPTEL) | | | | |

## CSA1501 Problem solving using C Lab

| Course Code CSA1501 | Course Title: Problem solving using C Type of Course: Program Core Theory and Laboratory Integrated | L-T-P-C | 2 | 0 | 0 | 2 |
|---|---|---|---|---|---|---|
| Version No. | 1.0 | | | | | |
| Course Pre-requisites | NIL | | | | | |
| Anti-requisites | NIL | | | | | |
| Course Description | This course introduces the fundamentals of C programming, including data types, control structures, arrays, and strings. Students will analyze problems, draw flowcharts, and implement solutions using modular programming techniques. The course also covers advanced topics such as functions, structures, unions, and pointers for efficient problem-solving. | | | | | |
| Course Objectives | The objective of the course is to familiarize the learners with the concepts of Problem-Solving Using C and attain Skill Development through Experiential Learning techniques. | | | | | |
| Course Out Comes | On successful completion of the course the students shall be able to: **CO1:** Apply branching, looping, arrays, and strings to solve problems using flowcharts and C programming. [Apply] **CO2:** Apply functions, structures, unions, and pointers to develop modular and efficient C programs. [Apply] | | | | | |
| Course Content: | | | | | | |
| Module 1 | Introduction to C Programming | Assignment | Case Studies | | | 12 Sessions |
| Topics: Introduction to C: Background, Computer basics, Problem solving techniques, Tokens, Input/ Output statements, Structure of C program. | | | | | | |
| Module 2 | Control statements in C | Assignment | Programming | | | 20 Sessions |

| Topics: Type Casting, Expression Evaluation, Conditional and unconditional statement, Looping statements |||||
|---|---|---|---|---|
| Module 3 | Arrays and Strings | Assignment | Mini Project | 21 Sessions |
| Topics: One dimensional Array, Array operations,2D Array, 2D Array operations, Strings and its operations, String manipulation functions. |||||
| Module 4 | Functions, Structures and Unions, Pointers | Assignment | Programming | 10 Sessions |
| Topics:  Categories of functions, concept of modular programming, user defined datatypes, structures, union, pointers, file handling |||||

**List of Laboratory Tasks:**
- Basics of C Programming To Analyze the problem and draw the flowchart, Selecting the suitable data type
- Develop the program, identifying errors and rectifying them
- Programs on Branching statements, Programs on Looping
- Analyze the problem and draw the flowchart and selecting the branching or looping construct
- Develop the program. Identifying errors and rectifying them
- Programs on Arrays and Strings Analyze the problem and draw the flowchart and selecting suitable data storage type.
- Develop the program Identifying errors and rectifying them
- Programs on Functions, Programs on Structures & unions, programs on Pointers
- Developing the solution using modular programming and usage of user defined datatype
- Develop solutions using pointers concepts and modular programming

Text Book
E. Balaguruswamy, "Programming in ANSI C", Eighth Edition - Tata McGraw Hill.

References  Books
Behrouz A Forouzan, Richard F Gilberg, "Computer Science:  A structured programming approach using C", Third Edition Cengage Learning.
Brian W. Kernighan / Dennis Ritchie, "The C Programming Language " ,Second Edition, Pearson
YashavantKanetkar, "Let Us C", Eighteenth edition , BPB Publications
Web Links:
https://www.coursera.org/learn/introducton- to programming-in-c (Coursera)
https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE
_BASED&unique_id=DOAJ_1_02082022_1773 (E-Library Resource)
https://onlinecourses.nptel.ac.in/noc22_cs32/preview (NPTEL)


## CSA1502      Web Design and Development


| Course Code: CSA1502 | Course Title: Web Design and Development<br>Type of Course:    Laboratory integrated | L-T-P-C | 1 | 0 | 4 | 3 |
|---|---|---|---|---|---|---|
| Version No. | 1.0 |||||||
| Course Pre-requisites | ||||||||
| Anti-requisites | NIL ||||||||
| Course Description | This course is designed to build the student's knowledge on web design and development to an intermediate level. Students will learn the fundamental languages and markups for front-end web programming and back-end languages. By the end of this course, students should be able to design, program and publish a working and atheistic website. Students will also go ||||||||

**CSA1503      Programming in Python**

| Course Code: CSA1503 | Course Title: Program of working in the client/server-side programming and learning skills which is necessary to successfully fulfil each role. The associated Theory & Integrated Laboratory to implement the various programming language to design web pages and enhance critical thinking and analytical skills. | | L-T-P-C | 0 | 4 | 3 |
|---|---|---|---|---|---|---|
| | Type of Course: Theory & Integrated Laboratory | | | | | |
| Version No. | 1.0 | | | | | |
| Course Pre-requisites | Nil | | | | | |
| Course Objectives | The objective of the course is to familiarize the learners with the concepts of Web Design and Development and attain Skill Development through | | | | | |
| Anti-requisites | Nil Experiential Learning techniques. | | | | | |
| Course Description | This course provides the opportunity for the students of Computer Science engineering to develop Python scripts using its powerful programming features like lists, sets, tuples, dictionaries and sets. Students will also be introduced to object oriented programming concepts and packages for data visualization. Topics include: Basics of Python programming, operators and expressions, decision statements, loop control statements, functions, strings, lists, list processing: searching and sorting, nested list, list comprehension, tuples and dictionaries, sets, file handling, exception handling, object oriented programming concepts, modules and packages for data visualization | | | | | |

**Course Out Comes**

On successful completion of this course the students shall be able to:
- Design static and dynamic web pages using HTML, CSS and Java Script. [Apply]
- Use JavaScript to write modern, reactive dynamic Websites (Client-side programming. [Apply]
- Understand PHP language and use them while applying the principles of object-oriented development. [Apply]

| Course Objective | The objective of the course is to familiarize the learners with the concepts of Problem Solving Using Python and attain ==Skill Development== through E==xperiential Learning== techniques. | | | | |
|---|---|---|---|---|---|
| Course Content | | | | | |
| Module 1 | Introduction to HTML and CSS(Application) | Assignment | Programming activity | 20 Sessions | |

**Course Out Comes** On successful completion of the course the students shall be able to:
1. Demonstrate problem solving through understanding the basics of python (Apply)
2. Manipulate functions and data structures. (Apply)
3. Apply Tuple, Dictionaries, File and Exception Handling concepts to solve real time problems (Apply)
4. Practice object-oriented programming (Apply)
5. Produce data visualization using modules and packages (Apply)

| Module 2 | Designing of simple pages (Application) | Assignment | Programming activity | 20 Sessions | |
|---|---|---|---|---|---|

**Topics:**
JavaScript: JavaScript basics, variables, string manipulation, mathematical functions, statements, operators, arrays and functions. Objects in JavaScript: Data and objects in JavaScript, regular expressions, exception handling, built-in objects, events; Dynamic HTML with JavaScript: Data validation, opening a new window, Rollover buttons, moving images, multiple pages in a single download, floating logos.

**Course Content:**

| Module 1 | Problem Solving techniques and Basics of Python Programming (Application) | assignments | Quizzes form basics of python | 15 Sessions |
|---|---|---|---|---|
| Module 3 | Server-Side Development | Assignment | Programming activity | 35 Sessions |

Basics of problem solving techniques, Basics of Python programming, operators and expressions, decision statements, loop control statements.

Introduction to PHP, variables, control statements, loops, Arrays, string handling, PHP forms, Global variables in PHP, Regular expression and pattern matching, State management in web applications, cookies, Application and session state, Basic database concepts, connecting to a My SQL database, retrieving and displaying results, modifying, updating and deleting data

| Module 2 | Function, String and List | Quizzes and assignments | Comprehension based Quizzes and assignments | 20 Sessions |
|---|---|---|---|---|

Functions, strings, lists, list processing: searching and sorting, nested list, list comprehension

**Errors Handling:**
Error Handling and Validation, Exceptions, PHP Error Reporting, PHP Error and Exceptions Handling.

| Module 3 | Data Structures, File and Exception handling | Term paper/Assignment | Quizzes form advanced python | 20 Sessions |
|---|---|---|---|---|

Tuples and dictionaries, sets, file handling, exception handling.

**List of Laboratory Tasks:**
Lab sheet -1 [ 2 Practical Sessions]
Experiment No 1:

| | | | | | |
|---|---|---|---|---|---|
| **Module 4** | Level 1 –Design a web page with head, body and footer, with heading tags, image tag with table tag.<br>Level 2 - Design a web page and the product information such as name, brand, price and etc **Object Oriented Programming and Data Visualization** | | term paper/Assignment | Application on data visualization | **20 Sessions** |

Object oriented programming concepts, modules and packages for data visualization.

Level 1–Design a web site for book information, home page should contain books list, when particular book is clicked, information of the books should display in the next page.

Level 2 - Design a web page to capture the user information such as name, gender, mobile number, mail id, city, state, and country using form elements.

**List of Laboratory Tasks:**

Each Lab sheets experiments are prepared by level 0 and level 1 module wise.

Lab sheet – 2 [2Practical Sessions]

1. Write a Python program to perform basic arithmetic operations (addition, subtraction, multiplication, division) and print results.
   Level 1 - Design a web page with nice formatting like background image, text colors and border for text using external CSS.
2. Write a Python program that takes a number as input and checks whether it is positive, negative, or zero.
   Level 2 - JavaScript to perform mathematical calculations such as addition, subtraction, multiplication, and division using form elements
3. Implement a Python program to calculate the factorial of a given number using both for and while loops.
   Level 1- Design a web page to display timer in the left side of the web page using Java Script.
4. Write a Python program that checks if a number is prime.
   Level 2- Design a web page to capture the student details such as student number, name, age,
5. Develop a program to print different patterns using nested loops, such as:markdown
   marks using Java Script Object.
6. Write a function to generate the Fibonacci series up to n terms.
   Lab sheet – 3 [ 2 Practical Sessions]
7. Write a program to count vowels and consonants in a given string.
   Experiment No. 1:
8. Implement BubbleSort and calculate the Squares and Cubes of numbers from 0 to 10.
   Level 1 – JavaScript Bubble Search on a list of numbers.
9. Write a Python program to perform matrix addition using nested lists.
   Level 2 - Display the results in an HTML table format.
10. Use list comprehension to separate even and odd numbers from a given list.
    Experiment No. 2:
11. Create a dictionary to store student names and their marks, then perform add, update, and delete operations.
    Level 1 - JavaScript code that displays text "PRESIDENCY UNIVERSITY" with increasing font size in the interval of 200ms in a color.
    Level 2 –When font reaches to 100pt it displays "School of Engineering" in a color. Then font size
12. Implement union, intersection, and difference operations on sets.
    decreases to 10pt.
13. Write a Python program to read from a file and count word occurrences, then write the output to another file.
    Lab sheet – 4 [ 2 Practical Sessions]
    Experiment No. 1:
14. Implement a program that handles the ZeroDivisionError when dividing two numbers.
    Level 1 – PHP program print the grade of student using marks
15. Design a class BankAccount with methods to deposit, withdraw, and display balance.
    Level 2 - PHP program to print the date in ten different formats.
    Experiment No. 2:

**Targeted Application & Tools that can be used:**
Level 1- PHP program to keep track of the number of visitors visiting the web page and to display
**Any IDE –PyCharm, VS Code, Python IDLE, Spyder, jupyter note book, Google Colab**
this count of visitors, with proper headings.

Level 2 -PHP program to display a digital clock which display the current time of the server.

Lab sheet -5 [2 Practical Sessions]
Experiment No. 1:

**Assignment:**

1. Write a python program to input 5 subject marks and calculate total marks, percentage and grade based on following criteria
   i)percentage less than 50 (Grade C)
   ii)percentage equal to 50 and less than 80 (Grade B)
   iii)percentage equal to 80 and more than 80 (Grade A)
2. Write a python program to fetch only Email ID from text file which include following fields -:
   i)Name
   ii)Mobile Number
   iii)Roll Number
   iv)Email ID
3. Write a python script to answer the following questions:
   i) What is the average molecular weight of an aminoacids?
   ii) What is the total molecular weight and number of aminoacids of the P53 peptide GSRAHSSHL KSKKGQSTSRHK?
   iii) What is the total molecular weight and number of aminoacids of the peptide YTSLIHSLIEESQ NQQEKNEQELLELDKWASLWNWF?

PHP & MySQL: Server-side Web Development, Jon Duckett, Wiley; 1st edition (April 12, 2022)

References

Deitel, Deitel, Goldberg,"Internet& World Wide Web How to Program", Fifth Edition, Pearson Education, 2021.

HTML &CSSQuickStart Guide, David DuRocher, ClydeBankMedia,2021

JavaScript from Beginner to Professional, Laurence Svekis, Packt Publishing Limited (22 January 2021)

**Text Book**

T1. Ashok NamdevKamthane and Amit Ashok Kamthane, "Problem Solving and Python Programming", Tata

McGraw Hill Edition, 2018.

T2. Charles Dierbach, "Introduction to Computer Science Using Python", Wiley India Edition, 2015.

T3. ReemaThareja, "Python Programming Using Problem Solving Approach", Oxford University Press, 2017.

**References**

R1. Balagurusamy, "Introduction to Computing and Problem-Solving Using Python", Tata McGraw-Hill, 2016 R2. Y. Daniel Liang, "Introduction to Programming Using Python", Pearson, 2017

**E-Resources:**

W1. http://pythontutor.com/

W2. https://www.udemy.com/topic/python/

W3. https://in.coursera.org/courses?query=python

W4: https://puniversity.informaticsglobal.com/login

## CSA1504    Object Oriented Programming using Java

| Course Code: CSA1504 | Course Name: Object Oriented Programming using Java<br>Type of Course: Lab Course | L- T-P- C | 1-0-4-3 |
|---|---|---|---|
| Version No. | 1 | | |
| Course Pre-requisites | Nil | | |
| Anti-requisites | Nil | | |
| Course Description | The main objective is to learn the basic concept and techniques which form the object-oriented programming paradigm. Object-oriented programming is a new way of thinking about problem using models organized around real world concept. It investigates the software engineering principles of encapsulation, information hiding and code reuse, and discusses how these concepts are used to build abstract data types. The object oriented programming features of classes, inheritance, polymorphism and composition are studied, along with constructors and method overloading. Students implement Java programs incorporating features from the Java programming language. | | |
| Course Objective | The objective of the course is to familiarize the learners with the concepts of Object Oriented Programming Using Java and attain Skill Development through Experiential Learningtechniques. | | |

| | **On successful completion of the course the students shall be able to:** | | | |
|---|---|---|---|---|
| Course Out Comes | **CO1** | 1.       Discuss the OOP's concept and Apply the concepts to design, implement, compile, test and execute simple Java programs | [Apply] | |
| | **CO2** | Explain the concepts related to classes and Use built-in methods of String and String Buffer classes. | [Understand] | |
| | **CO3** | Implement concepts of Constructors, Polymorphism, Inheritance, Interfaces and Packages with programs | [Apply] | |
| | **CO4** | Design the GUI form using Applet and Swing components | [Apply] | |

**Course Content:**

| Module 1 | Introduction to OOP : Class and Object | Assignment | Class and Object | 20 Sessions |
|---|---|---|---|---|

**Topics:**
Defining an Array, Initializing & Accessing Array, Multi –Dimensional Array, Strings: Operation on String, Mutable & Immutable String, Creating Strings using String Buffer or StringBuilder. String Constant Pool, String Internal representation, String Application.  Tokenizing a String.
Inheritance and Polymorphism: Use and benefits of inheritance in OOP, Types of Inheritance, Method overriding, super keyword, Final, Polymorphism in inheritance, Abstract, this keyword.

| Module 2 | Arrays, Strings , Extending Class | Assignment | Extending Class | 15  Sessions |
|---|---|---|---|---|

**Topics:**
Defining an Array, Initializing & Accessing Array, Multi –Dimensional Array, Strings: Operation on String, Mutable & Immutable String, Creating Strings using String Buffer or StringBuilder. String Constant Pool, String Internal representation, String Application.  Tokenizing a String.
Inheritance and Polymorphism: Use and benefits of inheritance in OOP, Types of Inheritance, Method overriding, super keyword, Final, Polymorphism in inheritance, Abstract, this keyword.

| Module 3 | Interface, Package and Exception Handling | Assignment | Exception Handling | 15  Sessions |
|---|---|---|---|---|

**Topics:**
Introduction to threads, life cycle of a thread, Creating Threads, Extending the Thread Class, Implementing the Runnable interface, priority of a thread, synchronization, Inter communication of Threads.
JAVA File I/O - Byte Stream -  InputStream -  OutputStream -  FileInputStream -  FileOutputStream -  The Character Streams - Reader -  Writer -  FileReader -  FileWriter

| Module 4 | Collection & GUI Programming | Assignment | GUI Programming | 25 Sessions |
|---|---|---|---|---|

**Topics:**
The Collection Framework : Collections of Objects , Collection Types, Sets , Sequence, Map, Understanding Hashing, Use of ArrayList& Vector
Graphics Programming: Introduction, the abstract window toolkit (AWT), Layout managers, Frames, Panels, Drawing geometric figures, Keyboard Event and Mouse Event.
Creating User Interface: Introduction, describe various user interface Components: button, label, text field, text area, choice, list, check box.

**List of Laboratory Tasks**

List of Laboratory Tasks:
Lab sheet -1
Experiment No 1:
Level1 -Programs using Control statements☐ Methods with Parameters,  Methods with control statements
Level2 -  Demonstrations of Class, Object, Constructor, Static member, Encapsulation, Inner Class
Experiment No. 2:
Level 1 – Simple Program for Understanding Arrays and Strings.
Level2 - Programs to implement array of objects, passing and returning objects as arguments.
Lab sheet – 2
Experiment No. 1:
Level1 -  Programs to demonstrate concepts of constructors and destructors
Level2 - Write a program to create a database for a bank account contains Name, Account no, Account type, Balance, Including the following – any constructor, destructor and methods to set and get information for 10 people.

Experiment No. 2:
Level1 – Programs to implement methods of String and String Buffer Class.
Level2 - Programs to implement Inheritance and Polymorphism, Programs to implements Interface.
Lab sheet – 3
Level 1 - Programs to demonstrate Exceptions Handlers.
Level 2 - Programs to implements nested handlers, Checked and Unchecked Exception Handlers.
Lab sheet – 4
Level 1 - Programs to implement Thread class and Runnable Interface.
Level 2 - Programs to implement priority, inter thread communication.
Level 3 - Programs to implement file handling mechanism.
Lab sheet –5
Experiment No. 1:
Level 1 - Programs to implement Collections (List, Set, Map).
Level 2 - Programs to implement Comparable and Comparator Interface , Lambda Notation
Lab sheet 6
Experiment No. 1:
Level 1 – Programs to implement concepts of GUI.
Level 2 – Programs to create Registration form using Swing.

## Text Book
- Herbert Schildt, Java: The Complete Reference, Eleventh Edition (PROGRAMMING & WEB DEV - OMG), McGraw-Hill Education, 2019.
- E Balagurusamy, Programming with Java, 7th Edition, McGraw-Hill Education, 2020.

## References
- R. Nageswara Rao, Core Java: An Integrated Approach, New: Includes All Versions upto Java 8 2016.
- Brett McLaughlin, Head First Object-Oriented Analysis and Design: A Brain Friendly Guide to OOA&D, Dreamtech Press , 2016.

## E-Resources
"Head First Java" by Kathe Siera and Bert Bates, 2nd edition
https://www.rcsdk12.org/cms/lib/NY01001156/Centricity/Domain/4951/Head_First_Java_Second_Edition.pdf.

## CSA2511        Android Mobile Applications Development

| Course Code: CSA2511 | Course Name:  Android Mobile Application Development<br>Type of Course: Lab / Lab Integrated Course | L- T-P- C | 0-0-6-3 |
|---|---|---|---|
| Version No. | 1 | | |
| Course Pre-requisites | CSA1504 | | |
| Anti-requisites | NIL | | |
| Course Description | The course provides a basics of android platform and application life cycle. The goal of the course is to develop mobile applications with Android containing at least one of the following phone material components: GPS, accelerometer or phone camera, use simple GUI applications and work with database to store data locally or in a server.   Topics include user interface design; user interface building; input methods; data handling; network techniques and URL loading; GPS and motion sensing. Android application framework and deployment. Power management, Screen resolution, Touch interface, Store data on the device. | | |
| Course Objective | The objective of the course is to familiarize the learners with the concepts of Android Application Development and attain Skill Development through Experiential Learning techniques. | | |

| | On successful completion of the course the students shall be able to: | | | |
|---|---|---|---|---|
| **Course Out Comes** | **CO1** | Discuss the fundamentals of mobile application development and architecture. [Understand] | | [Understand] |
| | **CO2** | Illustrate mobile applications with appropriate android view. | | [Apply] |
| | **CO3** | Demonstrate the use of services, broadcast receiver, Notifications and content | | [Apply] |
| | **CO4** | Apply data persistence techniques, to perform CRUD operations. | | [Apply] |

**Course Content:**

| Module 1 | Introduction and Architecture of Android | Assignment | Introduction and Architecture of Android | 20 Sessions |
|---|---|---|---|---|

**Topics:**
Android: History and features, Architecture, Development Tools, Android Debug Bridge (ADB), and Life cycle.

| Module 2 | User Interfaces, Intent and Fragments | Assignment | User Interfaces, Intent and Fragments | 25 Sessions |
|---|---|---|---|---|

**Topics:**
Views, Layout, Menu, Intent and Fragments.

| Module 3 | Components of Android | Assignment | Components of Android | 25 Sessions |
|---|---|---|---|---|

**Topics:**
Activities, Services, Broadcast receivers, Content providers, User Navigation

| Module 4 | Notifications and Data Persistence | Assignment | Notifications and Data Persistence | 20 Sessions |
|---|---|---|---|---|

**Topics:**
Notification, Shared Preferences, SQLite database, Android Room with a View, Firebase

**List of Laboratory Tasks**

Graphics and Animation, Sensors, Performance, Location, Places, Mapping, Custom Views, Canvas.
List of Laboratory Tasks
1.a. Design an app to read user inputs using edit text and display the result of arithmetic operations using toast message.
1.b. Create an android app to calculate the current age of yourself, select your DOB using date picker.
2.a. Design an app to input your personal information. Use autocomplete text view to select your place of birth.
2.b. Design an app to select elective course using spinner view and on click of the display button, toast your ID and selected elective course.
3. Design a restaurant menu app to print the total amount of orders.
4. Develop an android app that uses intent to maintain the following scenario.
Check the eligibility criteria for voting. Input the Aadhar no., Name & age in the first activity. If the age is above 18, display the voter's detail in the second activity. Else, display, "You are not eligible to vote" in the second Activity.
5. Demonstrate the use of fragment with list of buttons representing various colors, and on click of these buttons, the appropriate color is filled in the next fragment.
Create an Android application to input the vitals of a person (temperature, BP). If the vitals are abnormal, give proper notification to the user.
6. Create an android app to for movie ticket booking. Save the user name of the customer using shared preferences. After completion of booking, retrieve the username from the shared preferences and print the ticket details.
7. Create an android application to manage the details of students' database using SQLite.Use necessary UI components, which perform the operations such as insertion, modification, removal and view.Presidency University needs an APP for Admission eligibility checking for students, for that you need to take the following information from the Student: registration ID, physics, chemistry and mathematics marks (PCM), fees is allotted as below criteria.

PCM (Total marks %)      Fee concession
90 above                         80 %
70 to 89                          60 %
Below 69 %                     no concession

On click on the button "Registration" details should be stored in the database using SQLite. Create button DISPLAY ALL (full students list) on click on the button it should display the students list per the fee concession.
8. A company need to design an app that plays soft music automatically in the background. Create an app to achieve this functionality.
9. Create an android application such that your view object in the Activity can be Animated with fade-in effect. Create an appropriate XML file named fade-in and write the application to perform the property animation.
10. Demonstrate how to send SMS and email.

| | | | |
|---|---|---|---|
| 11. Create an android application to transfer a file using WiFi. Create an android application "Where am I" with an Activity that uses the GPS Location provider to find the device's last known location. | | | |

**Text Book**
- T1. Dawn Griffiths, David Griffiths, "Head First Android Develoment", O'Reilly Media, 3rd edition, Nov 2021
- T2. Pradeep kothari "Android Application Development - Black Book", dreamtechpress

**References**
- Bill Phillips, Chris Stewart, and Kristin Marsicano (Author) "Android Programming" 3rd edition, 2017
- The Big Nerd Ranch Guide, Big Nerd Ranch LLC, 5. The Big Nerd Ranch Guide, by" Erik Hellman, "Android Programming – Pushing the Limits", 1st Edition, Wiley India Pvt Ltd, 2014.

**E-Resources**
https://developers.google.com/certification/associate-android-developer/study-guide/android-core
NPTEL course : https://onlinecourses.swayam2.ac.in/nou21_ge41/preview
https://www.coursera.org/specializations/android-app-development
https://www.coursera.org/learn/introduction-to-android-mobile-application-development

## CSA2519          Database System Administration

| Course Code:<br>CSA2519 | Course Name:   Database System Administration<br>Type of Course: Lab / Lab Integrated Course | L- T-P- C | 1-0-4-3 |
|---|---|---|---|
| Version No. | 1 | | |
| Course Pre-requisites | Relational Database Management Systems | | |
| Anti-requisites | Nil | | |
| Course Description | This lab-oriented course provides hands-on experience in the core functions of a Database Administrator (DBA). Students will gain practical skills in installing and configuring database systems, managing users and roles, implementing data security, performing backup and recovery, tuning system performance, and automating routine tasks. The course emphasizes real-world administrative scenarios to prepare students for roles in database management and enterprise system maintenance. By the end of the course, students will be able to manage a fully functioning database environment with a focus on security, efficiency, and reliability. | | |
| Course Objective | The objective of the course is to familiarize the learners with the concepts of  Database Administrator Lab and attain Employability Skills through Experiential Learning techniques. | | |

**CSA2211          UI/UX Design**

| | | On successful completion of the course the students shall be able to: | | | |
|---|---|---|---|---|---|
| Course Code: CSA2211 | Course Name: UI/UX Design | **CO1** Apply database installation and configuration procedures to set up and manage a secure DBMS environment. [Apply] | | L- T-P- C | 0-0-6-3 |
| | Type of Course: Lab / Lab Integrated Course | **CO2** Implement backup, recovery, and user management operations [Apply] | | | |
| Version No. | 1 | for maintaining database integrity and availability. | | | |
| Course Pre-requisites | Nil | | | | |
| Anti-requisites | Nil | | | | |
| Module 1 | Database Setup, User Management & Security | Assignment | Authentication mechanisms and access control | 25 Sessions | |

**Topics:**
Installation and configuration of DBMS - Creating and managing databases and Tablespace and storage perspective management - User creation, role assignment, and privilege management - Authentication mechanisms and access control - Database auditing and security best practices - Tools: Command-line utilities, pgAdmin/phpMyAdmin/SQL Developer

**Course Description**
The UI/UX Design brings a design-centric approach to user interface and user experience design, and offers practical, skill-based instruction centered on a communication perspective, rather than on one focused on marketing or programming alone. User interface and user experience design is a high-demand field, but the skills and knowledge you will learn in this Specialization are applicable to a wide variety of careers, from marketing to web design to human-computer interaction. The course is foundational and hands-on learning in using popular design tools such as Figma.

**Module Objective**
The objective of the course is to familiarize the learners with the concepts of UI/UX Design and attain Employability Skills through Experiential Learning techniques.

**Topics:**
Backup strategies: full, incremental, and differential - Database recovery and crash simulation - Query performance tuning and indexing strategies - Using EXPLAIN PLAN, slow query logs, and optimization tips - Scheduling tasks using cron jobs - DBMS automation of maintenance tasks (backup scripts, health checks) - Basic replication setup

**Course Out Comes**

| | On successful completion of the course the students shall be able to: | |
|---|---|---|
| **CO1** | Explain the UX Design principles | [Understand] |
| **CO2** | Summarize the ideal user experience | [Understand] |
| **CO3** | Develop wireframes using digital tools | [Apply] |
| **CO4** | Construct persona and evaluate designs | [Apply] |

| Module 3 | Introduction to Cloud-Based Database Administration | Assignment | Design methodologies | 25 Sessions |
|---|---|---|---|---|

**Course Content:**

**Topics:**
Introduction to Cloud Computing and Database as a Service (DBaaS) - Creating and Managing AWS RDS Instances - Provisioning and Configuring Azure SQL Databases - Security and Access Management in Cloud Databases - Backup and Restore Operations on Cloud Platforms - Connecting Cloud Databases from Local Clients and Tools

| Module 1 | Introduction to UI/UX | Assignment | Introduction to UI/UX | 20 Sessions |
|---|---|---|---|---|

**Topics:**
Introduction to User Experience, Importance of UX design, Different sub - disciplines within UX, job opportunities in UX field/domain. RoI, KPI, Stakeholders of UX team, trade-offs, UX Design definition. Basics of Interaction Design, User Research, Visual Design, Motion Design

**List of Laboratory Tasks**
1. **Experiment 1:** Install and configure MySQL/PostgreSQL/Oracle Database
2. **Experiment 2:** Create a new database and manage tables
3. **Experiment 3:** Create and manage database users and roles

| Module 2 | Users and User Centered Design | Assignment | Users and User Centered Design | 25 Sessions |
|---|---|---|---|---|

**Topics:**
Users and user research, user centered design framework, 7 principles of UX design, 4 stages of user centered design, 5-elements framework, Design thinking process, Lean UX, Double Diamond, designing for the next billion users, designing for multiple platforms, the four Cs of designing for multiple platform

4. **Experiment 4:** Implement user privileges and access control (GRANT, REVOKE)
5. **Experiment 5:** Perform database backup and recovery
6. **Experiment 6:** Implement database authentication mechanisms (password, SSL)
7. **Experiment 7:** Setup and configure database auditing and logging
8. **Experiment 8:** Manage database backups using mysqldump/pg_dump and Oracle RMAN
9. **Experiment 9:** Restore database from backup and perform crash recovery
10. **Experiment 10:** Create and configure database replication (Master-Slave for MySQL/PostgreSQL)

| Module 3 | Design methodologies | Assignment | Design methodologies | 25 Sessions |
|---|---|---|---|---|

**Topics:**
Universal design, 7 principles of universal design, inclusive design and accessible design, and equity-focused design. Equality and equity. Designing for accessibility, Lenses of Accessibility, assistive technology, design sprints. Wireframing, importance of wireframing, Compatibility with wearable devices.

11. **Experiment 11:** Perform full, incremental, and differential backups
12. **Experiment 12:** Set up and configure automated backup schedules using cron jobs (Linux)
13. **Experiment 13:** Monitor database health using performance views and logs
14. **Experiment 14:** Optimize queries using EXPLAIN PLAN and indexing strategies
15. **Experiment 15:** Analyze and tune system performance based on query execution plan
16. **Experiment 16:** Set up automated database maintenance tasks (index rebuilds, backups)

| Module 4 | Personas, developing mockups using Figma | Assignment | Personas, developing mockups using Figma | 20 Sessions |
|---|---|---|---|---|

**Topics:**
Basics of personas, creating personas, perspective, Persona - Gestalt principles of perception, Usability Testing, acceptance testing, creating mockups and prototypes in Figma.

17. **Experiment 17:** Use Linux tools like iostat, vmstat, and top to monitor system resources
18. **Experiment 18:** Setup connection pooling in MySQL/PostgreSQL databases (connection pooling)
19. **Experiment 19:** Implement database partitioning for performance optimization
20. **Experiment 20:** Perform database scaling on cloud platforms (AWS RDS / Azure SQL) and monitor performance

List of Laboratory Tasks:

Experiment No. 1: Installation and Interface of Balsamiq and/or Figma
Level 1: Ensure that both Balsamiq and Figma are up and running with user accounts.
Level 2: Download and import design files from internet to familiarize with them.

Experiment No. 2: Create wireframe of the login screen of a mobile app
Level 1: Make first wireframe of one login page
Level 2: Make two pages that are hyperlinked and critique the design

Experiment No. 3: Final wireframe experiment.
Level 1: Prepare the wireframe of all the pages of a selected website
Level 2: Change the wireframe to make the design changes to the website

**Text Book**
- **Harrington, J. L. (2022).** *Database design: A practical approach to relational database design* (5th ed.). Morgan Kaufmann
- **Thomas, R. (2021).** *SQL and relational theory: How to write accurate SQL code* (2nd ed.). O'Reilly Media.

**References**
- **MySQL Documentation**
  https://dev.mysql.com/doc/

Experiment No. 4: First Figma experiment.
Level 1: Figma interface, shortcuts and tools.
Level2: Create and move between frames.
Experiment No. 5: Design App Screen
Level 1: Create layout, layers, fill colours
Level 2: Set layer opacity, lock and unlock layers
Experiment No. 6: Logo and icon
Level 1: Boolean operations on shapes, pen tool
Level2: Make smiley face
Experiment No.7: Create an app face.
Level1: Insert image, design nav bar using logo and icons
Level 2: Duplicate frame
Experiment No.8: Create a prototype
Level1: Use designing and prototyping modes
Level 2: Create connections between frames and layers
Experiment No.9: Create prototype of food delivery app
Level1: Replicate inner pages of app
Level 2: Improve the inner page design
Experiment No.10: Create prototype of a desktop website
Level1: Replicate pages on desktop app
Level 2: Export files and share in LinkedIn

**Text Book**
- Chesnut D., Nichols K.P., 'UX for Dummies', Wiley Publications, 2021.
- Fabio Staiano, "Designing and Prototyping Interfaces with Figma: Learn essential UX/UI design principles", Packt Publishing,

**References**
- Nick de Voil, 'User Experience Foundations', The Chartered Institute for IT, 2020.
- Morris, Jason, 'Hands-On Android UI Development : Design and Develop Attractive User Interfaces for Android Applications', Packt Publishing, 2017.

## CSA2212        Internet of Things

| Course Code:<br>CSA2212 | Course Name: Internet of Things<br>Type of Course: Lab / Lab Integrated Course | L- T-P- C | 1-0-4-3 |
|---|---|---|---|
| Version No. | 1 | | |
| Course Pre-requisites | The IoT course requires basic knowledge of programming (Python, C, or Arduino), electronics (sensors, actuators, microcontrollers), and networking (IP addressing, communication protocols). Familiarity with cloud computing for data storage and processing is beneficial. Logical thinking and problem-solving skills are essential for designing and troubleshooting IoT systems. These prerequisites ensure a smooth learning experience and practical application of IoT concepts. | | |
| Anti-requisites | NIL | | |

**CSA7000        Summer Internship**

| Course Description Course Code: CSA7000 | The Internet of Things (IoT) course provides a comprehensive understanding of IoT concepts, architectures, and applications. It covers hardware and software components, communication protocols, data analytics, and security. Learners will gain hands-on experience in building and deploying IoT solutions. | | L-T-P-C | - - - 3 |
|---|---|---|---|---|
| Version No. Course Objective | To understand the fundamental concepts and architecture of IoT. To explore IoT communication protocols and networking technologies. To develop hands-on skills in sensor interfacing, data | | | |
| Course Description Course Out Comes | On successful completion of the course the students shall be able to: CO1 Explain IoT architecture, components, and communication [Understand] protocols. CO2 Implement IoT networks using different communication protocols. [Apply] CO3 Process and analyze IoT-generated data for decision-making. [Analyze] | | | |
| Course Objective Course Content: | | | | |
| Module 1 | Introduction to IoT | Assignment | Introduction to IoT | 15 Sessions |

**Topics:**
IoT Fundamentals and Architecture, IoT Components: Sensors, Actuators, and Microcontrollers,
IoT Communication Technologies (Wi-Fi, Bluetooth, LoRa, Zigbee), Hands-on: Setting up a Basic IoT System

| Module 2 | IoT Communication and Networking | Assignment | IoT Communication and Networking | 20 Sessions |
|---|---|---|---|---|

**Topics:**
IoT Networking Protocols: MQTT, CoAP, HTTP, Cloud Computing for IoT: AWS, Google Cloud, and Azure IoT, Edge Computing and Fog Computing in IoT, Hands-on: Implementing MQTT for IoT Data Transmission

| Module 3 | IoT Data Processing and Analytics | Assignment | IoT Data Processing and Analytics | 25 Sessions |
|---|---|---|---|---|

**Topics:**
IoT Data Collection and Storage Techniques, Real-time Data Analytics in IoT, AI and Machine Learning for IoT Applications, Hands-on: Building an IoT Dashboard for Data Visualization

| Module 4 | IoT Security and Applications | Assignment | IoT Security and Applications | 15 Sessions |
|---|---|---|---|---|

**Topics:**
Security Challenges in IoT: Authentication, Encryption, and Privacy, Case Studies in Smart Cities, Healthcare, and Industrial Automation, IoT System Optimization and Power Management, Hands-on: Securing an IoT Network with Encryption Techniques

**List of Laboratory Tasks**

Basic IoT Hardware Setup

1. Getting Started with Arduino/Raspberry Pi – Set up and run a simple LED blinking program.
2. Sensor Interfacing – Connect and read data from temperature, humidity, and motion sensors.
3. Actuator Control – Control a servo motor and buzzer based on sensor inputs.
4. Building a Smart Home Automation System – Control lights and fans using IoT-based relays.

IoT Communication and Networking

5. Connecting IoT Devices to Wi-Fi – Establish communication between a microcontroller and a Wi-Fi module.
6. Data Transmission using MQTT Protocol – Implement a publisher-subscriber model for IoT messaging.
7. HTTP and REST API Integration – Send sensor data to a cloud server and retrieve responses.
8. Bluetooth-based IoT Communication – Transfer data between IoT devices using Bluetooth.

Cloud Computing and Data Analytics

9. Storing IoT Data on the Cloud – Send real-time sensor data to Firebase/AWS IoT Core.
10. Visualizing IoT Data with Dashboards – Create live data graphs using ThingSpeak or Grafana.
11. Edge Computing for IoT – Process IoT data locally before sending it to the cloud

Security and Advanced Applications

12. Securing IoT Communication with Encryption – Implement AES or RSA encryption for IoT data transmission
13. Building a Smart Surveillance System – Stream live camera feed using Raspberry Pi and OpenCV.
14. Energy Optimization in IoT Devices – Implement sleep modes in IoT devices to save power.

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The Summer Internship program is designed to provide students with industry exposure and hands-on experience in real-world IT environments. It allows students to apply their theoretical knowledge to practical scenarios, develop technical and professional skills, and understand workplace dynamics. The internship helps bridge the gap between academic learning and industry expectations, preparing students for future employment or entrepreneurship.

The objective of the course is to familiarize the learners with the concepts of Summer Internship and attain Employability Skills through Experiential Learning techniques.

**On successful completion of the course the students shall be able to:**

CO1 Analyze industry requirements and understand workplace [Analyze] expectations.

CO2 Apply technical knowledge and development skills to real-world [Apply] projects.

CO3 Evaluate project challenges, propose solutions, and document [Evaluate] technical work effectively

CO4 Demonstrate professional ethics, teamwork, and communication [Apply] skills in an industry setting.

**Internship – Schedule**

| Week | Activity | Deliverable |
|---|---|---|
| Week 1 | Orientation & Onboarding | Internship Proposal & Work Plan Submission |
| Week 2-3 | Initial Project Research & Training | Daily Work Log |
| Week 4-5 | Mid-Term Review & Progress Update | Mid-Term Progress Report |
| Week 6-7 | Project Implementation & Problem Solving | Codebase/Prototype Development |
| Week 8 | Documentation & Final Review | Final Internship Report |
| Week 9 | Presentation & Viva | Internship Presentation & Evaluation |

**Rubrics:**

Component
Internship Proposal & Work Plan
Technical Contribution & Performance
Final Report & Documentation
Presentation & Viva

**Mini Project Schedule**

1. Title confirmation with the Project Supervisors
2. Project Titles Confirmation/Submission of Abstracts.
3. I - Review
4. Problem Statement and Module Design
5. II - Review
6. Application Development
7. III - Review
8. Complete Implementation Results/Demonstrations
9. Project Documentation Submission
10. Final Documentation submission/Review the Status of Research Paper
11. Final Review
12. Results and Project Document/Presentation

15.      Building a Complete IoT Project – Integrate sensors, communication protocols, and cloud storage into a real-world application like a smart agriculture or healthcare monitoring system.

**Text Book**
- A. Bahga and V. Madisetti, Internet of Things: A Hands-on Approach, Universities Press, 2014.
- D. Hanes, G. Salgueiro, P. Grossetete, R. Barton, and J. Henry, IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, Cisco Press, 2017.

**References**
- C. Pfister, Getting Started with the Internet of Things, O'Reilly Media, 2011.
- P. Raj and A. C. Raman, The Internet of Things: Enabling Technologies, Platforms, and Use Cases, CRC Press, 2017.

**E-Resources**
https://www.coursera.org/specializations/internet-of-things?utm_source=chatgpt.com

**Rubrics:**
1. Project Scope, Planning And Task Definition
2. Literature Review And Problem identification
3. Preliminary Design Selection
4. Detailed System Design/Technical Details
5. End Term Viva
6. Project Report
7. *Supervisor
8. Publication/Certification

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**CSA7300      Project**

| Course Code: CSA7300 | Course Name: Project<br>Type of Course: NTCC | L-T-P-C | - | - | - | 8 |
|---|---|---|---|---|---|---|
| Version No. | 1 | | | | | |
| Course Description | The BCA Final Year Project is a capstone course designed to integrate knowledge and skills acquired throughout the BCA program. Students will work individually or in teams to develop a real-world software application, research-based project, or innovative solution using emerging technologies. The project encourages problem-solving, technical proficiency, and professional documentation, preparing students for careers in IT and software development. | | | | | |
| Course Objective | The objective of the course is to familiarize the learners with the concepts of Summer Internship and attain Employability Skills through Experiential Learning techniques. | | | | | |

**On successful completion of the course the students shall be able to:**

| Course Out Comes | CO1 | Analyze real-world problems and define a suitable problem statement for software development. | [ Analyze] |
|---|---|---|---|
| | CO2 | Design and develop an efficient software solution using appropriate methodologies and technologies | [ Create] |
| | CO3 | Document and present project reports, technical documentation, and findings effectively | [ Evaluate] |
| | CO4 | Demonstrate teamwork, ethical practices, and project management skills in software development. | [Apply] |

**Rubrics: Project Schedule**

1. Title confirmation with the Project Supervisors
2. Project Titles confirmation/Submission of Abstracts.
3. I - Review
4. Problem Statement and Module Design

5. II - Review
6. Application Development
7. III - Review
8. Complete Implementation Results/ Demonstrations
9. Project Documentation Submission
10. Final Documentation submission/ Review the Status of Research Paper
11. Final Review
12. Results and Project Document/Presentation

**Rubrics:**
1. Project Scope, Planning And Task Definition
2. Literature Review And Problem identification
3. Preliminary Design Selection
4. Detailed System Design/Technical Details
5. End Term Viva
6. Project Report
7. *Supervisor
8. Publication/Certification

# Core Courses

## MAT1201        Applied Mathematics

| Course Code: MAT1201 | Course Title: Applied Mathematics<br>Type of Course: 1] School Core | L-T- P- C | 3 | 0 | 0 | 3 |
|---|---|---|---|---|---|---|
| **Version No.** | 1.0 | | | | | |
| **Course Pre-requisites** | Knowledge of Basic Mathematics | | | | | |
| **Anti-requisites** | **NIL** | | | | | |
| **Course Description** | The course explores the study of mathematical structures that are fundamentally discrete, focusing on concepts like Logic, Set theory, Matrices, Determinants and Differential calculus with applications primarily in computer science fields like algorithms, software development, and cryptography; it covers topics such as basic logic gates, laws of Set theory, eigenvalue and eigenvectors, continuity of functions, Boolean algebra, and simplification of Boolean expressions, providing a foundation for analyzing discrete problems and structures within computer applications. | | | | | |
| **Course Objective** | The main objective of the course is students should learn a particular set of mathematical facts and how to apply them. It teaches students how to think logically and mathematically through five important themes: mathematical reasoning, combinatorial analysis, discrete structures, algorithmic thinking, and applications and modeling. A successful mathematical foundation course should carefully blend and balance all five themes. | | | | | |
| **Course Outcomes** | On successful completion of the course the students shall be able to:<br>CO1 - Comprehend the basic principles and laws of set theory. .<br>CO2 - Understand the fundamental concepts of matrices and solution of linear equations using matrix methods.<br>CO3 - Apply the principles of basic logic gates and simplify Boolean expressions using Boolean algebra.<br>CO4 - Apply the rules of differentiation to standard functions, compute partial derivatives and solve problems involving maxima and minima. | | | | | |
| **Course Content:** | | | | | | |

| Module 1 | Set Theory | | (09 Classes) |
|---|---|---|---|
| Introduction to Sets, Types of Sets (Finite, Infinite, Empty, Singleton, etc.), Operations on Sets (Union, Intersection, Difference, Complement), Venn Diagrams, Laws of Set Theory (De Morgan's Laws, Distributive Laws, etc.), Applications of Sets in Computer Science | | | |
| Module 2 | Logic and Boolean Algebra | | (9 Classes) |
| Basic Logic Gates (AND, OR, NOT, NAND, NOR, XOR), Truth Tables, Boolean Algebra, and Simplification of Boolean Expressions, Applications in Computer Science (Circuit Design, etc.). | | | |
| Module 3 | Matrices and Determinants | Assignment | (11 Classes) |
| Introduction to Matrices, Types of Matrices (Square, Diagonal, Identity, Symmetric, Skew-Symmetric, etc.), Matrix Operations (Addition, Subtraction, Multiplication, Transpose), Determinants and their Properties, Inverse of a Matrix.<br><br>System of Linear Equations: Solution using Matrices (Cramer's Rule, Gaussian Elimination, Gauss Jordan), Echelon form and Normal form, Characteristic Equation, Eigen Value and Eigen Vectors and Problems Applications of Matrices in Computer Science (Graphics, Cryptography, etc.). | | | |
| Module 4 | Differential Calculus | Assignment | (16 Classes) |
| Concept of Limits, Standard Limits, Continuity of Functions, Types of Discontinuities, Applications in Computer Science (Algorithm Analysis, etc.), Derivatives of Standard Functions (Polynomial, Exponential, Logarithmic, Trigonometric), Maxima & Minima, Partial derivatives, total derivatives. | | | |
| Targeted Application & Tools that can be used:<br>This course provides the mathematical foundations for many computer application courses, including data structures, algorithms, database theory, automata theory, formal languages, compiler theory, computer security, and operating systems. | | | |
| Assignment: | | | |
| Assignment 1: Applications of Sets in Computer Science. | | | |
| Assignment 2: Solution using Matrices. | | | |
| Assignment 3: Derivatives of Standard Functions. | | | |
| Text Book<br>Kenneth H. Rosen, "Discrete Mathematics and its Applications", McGraw-Hill, 8th Edition, 2019.<br>B. S. Grewal, Higher Engineering Mathematics by, 44th Edition, Khanna Publishers, 2017. | | | |
| References:<br>Arthur Gill, "Applied Algebra for Computer Science", Prentice Hall.<br>K.D. Joshi, "Discrete Mathematics", Wiley Eastern Ltd.<br>Ralph. P. Grimaldi., "Discrete and Combinatorial Mathematics: An Applied Introduction", 4th Edition, Pearson Education Asia.<br>E-resources/ Web links:<br>https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_375<br>https://www.math.hkust.edu.hk/~maqian/ma006_0607F.html<br>https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_54588 | | | |

# MAT1202  Statistical Methods and Techniques

| Course Code: MAT1202 | Course Title: Statistical Methods and Techniques<br>Type of Course: 1] School Core | L-T- P- C | 3 | 0 | 0 | 3 |
|---|---|---|---|---|---|---|
| Version No. | 1.0 | | | | | |
| Course Pre-requisites | Knowledge of Central Tendency and Measure of Dispersion | | | | | |
| Anti-requisites | **NIL** | | | | | |
| Course Description | The course introduces the concepts of probability theory and statistical analysis, covering how to collect, organize, interpret, and draw inferences from data using mathematical models to understand randomness and uncertainty, with applications across various fields like science, engineering, economics, and social sciences. | | | | | |
| Course Objective | The objective of the course is to equip students with the foundational knowledge of probability theory and statistical methods, enabling them to collect, analyze, interpret data, and make informed decisions based on the likelihood of events occurring in various situations, often applied across different fields like science, engineering, and business. | | | | | |
| Course Out Comes | On successful completion of the course the students shall be able to:<br>CO1 - compute conditional probabilities directly and using Bayes' theorem, and check for independence of events. [Understand]<br>CO2 - set up and work with discrete & continuous random variables; in particular, to understand the Bernoulli, binomial, geometric, Poisson distributions, uniform, normal, and exponential distributions. [Apply]<br>CO3 - Identifying different types of data relationships (linear, polynomial, exponential, logarithmic). [Understand]<br>CO4 - use specific significance tests, including z-test, t-test (one- and two-sample), and chi-squared test [Apply] | | | | | |
| Course Content: | | | | | | |

| Module 1 | Introduction to Statistics | | 11  Sessions |
|---|---|---|---|
| Definition and Scope of Statistics, Types of Data - Qualitative and Quantitative, Data Collection Methods, Presentation of Data - Tabular and Graphical Methods, Measures of Central Tendency -Mean, Median, Mode, Quartiles, Decile, and Percentile, Measures of Dispersion - Range, Quartile Deviation, Variance, Standard Deviation, Covariance. | | | |
| Module 2 | Probability, Random Variables, and Probability Distributions | Assignment | 11  Sessions |
| Basic Concepts of Probability, Sample Space and Events, Types of Probability (Classical, Empirical, Subjective), Rules of Probability - Addition Rule, Multiplication Rule, Conditional Probability, Bayes' Theorem, Independence of Events.<br>Definition of Random Variables (Discrete and Continuous), Probability Mass Function (PMF) and Probability Density Function (PDF), Cumulative Distribution Function (CDF), Expectation and Variance of a Random Variable, Common Probability Distributions: Discrete Probability Distributions: Binomial, Poisson, Continuous Probability Distributions: Normal, Exponential. | | | |
| Module 3 | Correlation and Regression | | 11  Sessions |
| Scatter Diagrams, Karl Pearson's Coefficient of Correlation, Spearman's Rank Correlation, Simple Linear Regression, Least Squares Method, Applications in Data Analysis. | | | |
| Module 4 | Sampling and Sampling Distributions | Assignment | 12  Sessions |
| Population vs Sample, Sampling Methods - Random, Stratified, Systematic, Cluster, Sampling Distribution of Mean and Proportion, Central Limit Theorem, Applications in Computer Science - Data Sampling, Algorithm Analysis. | | | |
| Targeted Application & Tools that can be used:<br>The contents of this course has direct applications in most of the core engineering courses for problem formulations, Problem Solution and system Design.<br>Tools Used: R software (Open Source) | | | |
| Assignment: | | | |

| Select any one simple differential equation pertaining to the respective branch of engineering, identify the dependent and independent variable – Obtain the solution and compare the solution sets by varying the values of the dependent variable. |
|---|
| **Text Book** |
| Ronald .E. Walpole, Raymond. H. Myers, Sharon. L Myers, and Keying E. Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education, Delhi-9th edition, 2012.<br>B. S. Grewal (2017), Higher Engineering Mathematics by, 44th Edition, Khanna Publishers. |
| **References:** |
| Miller and Freund, Probability and Statistics for Engineers, Pearson Education Ltd.<br>Erwin Kreyzig, Advanced Engineering Mathematics, John Wiley and sons, Inc.10th Edition.<br>Douglas C. Montgomery &  George Runger, Applied Statistics and Probability for Engineers, , Wiley Publications<br><br>**E-resources/ Web links:**<br>https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_10427<br>https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=EBSCO95_30102024_100198<br>https://nptel.ac.in/courses/109104124<br>https://nptel.ac.in/courses/111106051<br>https://nptel.ac.in/courses/111102137<br>https://www.math.hkust.edu.hk/~maqian/ma006_0607F.html<br>https://www.scu.edu.au/study-at-scu/units/math1005/2022/<br>Presidency University's Knimbus library URL is: presiuniv.knimbus.com |
| **Topics relevant to SKILL DEVELOPMENT:**   The course focuses on the concepts of Vector calculus and Linear Algebra with reference to specific engineering problems. The course is of both conceptual and analytical type in nature through Problem Solving**.** This is attained through the assessment component mentioned in the course handout. |

# CSA1200      Digital Computer Fundamentals

| Course Code:<br>CSA1200 | Course Title: Digital Computer Fundamentals<br>Type of Course: Theory | L-T-P-C | 3-0-0-3 |
|---|---|---|---|
| Version No. | 1.0 | | |
| Course Pre-requisites | Basic concepts of number representation, Boolean Algebra, Arithmetic and Logic Computation. | | |
| Anti-requisites | NIL | | |
| Course Description | The purpose of this course is to enable the students to appreciate the fundamentals of digital logic circuits and Boolean algebra focusing on both combinational and sequential logic circuits. This course is analytical in nature and needs a fundamental knowledge on logical computation with Boolean Algebra. The focus of the course will be to discuss the minimization techniques for making canonical and low-cost digital circuit implementations. | | |
| Course Objective | The objective of the course is to familiarize the learners with the concepts of Digital Computer Fundamentals and attain the SKILL DEVELOPMENT through EXPERIENTIAL LEARNING. | | |

| Course Outcomes | On successful completion of this course the students shall be able to: CO1. Apply minimization techniques to simplify Boolean expressions. [Apply] CO2. Demonstrate the Combinational circuits for a given logic. [Understand] CO3. Illustrate the Sequential logic circuits. [Understand] CO4. Implement various combinational logic circuits using gates. [Apply] | | | |
|---|---|---|---|---|
| Course Content: | | | | |
| Module 1 | Boolean function simplification | Assignment | Programming and Simulation task | 15 Session |
| Topics: Review of Number systems and logic gates, Number base conversions, Overview of Boolean functions and simplifications, two, three, four variable K-Maps- Don't care conditions- Both SOP and POS- Universal Gates (NAND & NOR) Implementations. | | | | |
| Module 2 | Combinational Logic circuits | Assignment | Programming and Simulation task | 15 Session |
| Topics: Introduction to Combinational circuits, Analysis, Design procedure, Binary Adder and Subtractor, Magnitude comparator, Parity generator and checker, Multiplexers-Demultiplexers, Decoders, Encoders and Priority Encoders. | | | | |
| Module 3 | Sequential and Programmable logic circuits | Assignment | Programming and Simulation task | 15 Session |
| Topics: Introduction to sequential circuits, Storage elements: latches and flip flops, Characteristic tables and equations, excitation table, Analysis of clocked sequential circuits, Mealy & Moore Models of finite state machines - Registers & Counters. | | | | |
| Targeted Application & Tools that can be used: Application Area includes all modern electronic devices (cellular phones, MP3 players, laptop computers, digital cameras, high-definition televisions, Home Automation, Communication systems). The students will be able to join a profession which involves basics to high level of digital circuit design and analysis.<br><br>Professionally Used Software:  MultiSim Simulator<br><br>Besides these software tools Digital IC Trainer kit and Integrated Circuits (ICs) can be used to perform circuit testing and analysis. | | | | |
| Text Book(s): Thomas L. Flyod, *"Digital Fundamentals"*, Eleventh Edition, Pearson Education.ISBN-10: 132737965. (2014) eBook-[PDF] DIGITAL LOGIC DESIGN FOURTH EDITION FLOYD | abri.engenderhealth.org. | | | | |
| Reference(s): Reference Book(s): Mano, M. Morris and Ciletti Michael D., *"Digital Design"*, 5th Edition, Pearson Education.<br>          {[PDF] Digital Design By M. Morris Mano, Michael D Ciletti Book Free Download (studymaterialz.in)<br>Jain, R. P., *"Modern Digital Electronics"*, 4th Edition, McGraw Hill Education (India).<br>Roth, Charles H., Jr and Kinney Larry L., *"Fundamentals of logic Design"*, 7th  Edition, Cengage Learning.<br>Online Resources (e-books, notes, ppts, video lectures etc.):<br><br>NPTEL Course- "Digital Electronics Circuits" by Prof. GowthamSaha, Dept of ECE, IIT Kharagpur,  NPTEL :: Electrical Engineering - NOC:Digital Electronic Circuits<br>Digital Logic Design Lectures PPT Slide 1 (iare.ac.in)<br>Digital Design Lab Tutorial Links:   Multisim Tutorial for Digital Circuits - Bing video<br>CircuitVerse - Digital Circuit Simulator online<br>Learn Logisim➡ Beginners Tutorial | Easy Explanation! - Bing video<br>Digital Design 5: LOGISIM Tutorial & Demo | | | | |

E-content:
1. Z. Xin-Li and W. Hong-Ying, "The Application of Digital Electronics in Networking Communication," 2016 Eighth International Conference on Measuring Technology and Mechatronics Automation (ICMTMA), 2016, pp. 684-687, doi: 10.1109/ICMTMA.2016.168.
https://www.researchgate.net/publication/339975715_Study_and_Evaluation_of_Digital_Circuit_Design_Using_Evolutionary_Algorithm
2. An encoding technique for design and optimization of combinational logic circuit DipayanBhadra;Tanvir Ahmed Tarique;Sultan Uddin Ahmed;Md. Shahjahan;Kazuyuki Murase2010 13th International Conference on Computer and Information Technology (ICCIT).
https://ieeexplore.ieee.org/document/5723860
3. A. Matrosova and V. Provkin, "Applying Incompletely Specified Boolean Functions for Patch Circuit Generation," 2021 IEEE East-West Design & Test Symposium (EWDTS), 2021, pp. 1-4, DOI: 10.1109/EWDTS52692.2021.9581029.
https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.951.2860&rep=rep1&type=pdf
4. https://presiuniv.knimbus.com/user#/home

## CSA 2500 Data Structures

| Course Code: CSA 2500 | Course Title: Data Structures Type of Course: Theory | L- T-P-C | 3 | 0 | 0 | 3 |
|---|---|---|---|---|---|---|
| Version No. | 1.0 | | | | | |
| Course Pre-requisites | Problem Solving Using C | | | | | |
| Anti-requisites | NIL | | | | | |
| Course Description | This course introduces the fundamental concepts of data structures and to emphasize the importance of choosing an appropriate data structure and technique for program development .This course has theory and lab component which emphasizes on understanding the implementation and applications of data structures using Java programming language .With a good knowledge in the fundamental concepts of data structures and practical experience in implementing them, the student can be an effective designer, developer for new software applications. | | | | | |

| Course Objective | The objective of the course is <mark>SKILL DEVELOPMENT</mark> of student by using <mark>EXPERIENTIAL LEARNING</mark> techniques |
|---|---|
| Course Out Comes | **On successful completion of the course the students shall be able to:**<br><br>CO1: Explain the concepts and operations of linear data structures. [Understand]<br>CO2: Describe the structure and applications of singly and circular linked lists, and understand recursive processes. [Understand]<br>CO3: Illustrate the basic concepts of trees and graphs along with their representations and traversals. [Understand]<br>CO4: Interpret the working of basic searching and sorting algorithms and analyze their time and space complexities. [Understand] |
| **Course Content:** | |

| Module 1 | Introduction to Data Structure and Linear Data Structure –Stacks and Queues | Assignment | Program activity | 11 Sessions |
|---|---|---|---|---|

**Introduction** –Introduction to Data Structures, Types and concept of Arrays .

**Stack** -Concepts and representation, Stack operations, stack implementation using array and Applications of Stack.

**Queues** -Representation of queue, Queue Operations, Queue implementation using array, Types of Queue and Applications of Queue.

| Module 2 | Linear Data Structure - Linked List | Assignment | Program activity | 11 Sessions |
|---|---|---|---|---|

**Topics: Linked List** - Singly Linked List, Operation on linear list using singly linked storage structures, Circular List, Applications of Linked list.

**Recursion** - Recursive Definition and Processes, Programming examples.

| Module 3 | Non-linear Data Structures - Trees and Graph | Assignment | Program activity | 11 Sessions |
|---|---|---|---|---|

**Topics: Trees** - Introduction to Trees, Binary tree :Terminology and Properties, Use of Doubly Linked List, Binary tree traversals :Pre-Order traversal, In-Order traversal, Post-Order traversal. **Graph** - Basic Concept of Graph Theory and its Properties, Representation of Graphs.

**CSA2501-Data Structures Lab**

| Course Code: CSA2501 | Course Title: Data Structures Lab | | | L- T-P- C | 0-0-2-1 |
| | Type of Course: Sorting Pure Lab | Assignment | Program activity | | 12 sessions |
| Version No. | 1.0 | Performance Analysis | | | |

**Module 4**

**Topic: Sorting & Searching** - Sequential and Binary Search, Sorting – Selection and Insertion sort.

**Performance Analysis** - Time and space analysis of algorithms – Average, best and worst case analysis.

**Assignment:** Students should complete the lab programs associated with each module by end of each practical session and module wise assignments before the deadline.

| Course Pre-requisites | Problem Solving Using C |
| Anti-requisites | NIL |

**Course Description**

This laboratory course provides hands-on experience in implementing fundamental data structures using a high-level programming language such as C. Students will design, implement, and test linear and non-linear data structures including arrays, stacks, queues, linked lists, trees, and graphs. Through guided lab activities, students will develop problem-solving skills by applying appropriate data structures to real-world scenarios and perform operations such as traversal, insertion, deletion, searching, and sorting. The course emphasizes code efficiency, memory management, and algorithmic thinking for structured software development.

**Course Objective**

The objective of the course is SKILL DEVELOPMENT of student by using EXPERIENTIAL LEARNING techniques

**Course Text Book**

**T1** NarasimhaKarumanchi" :*Data Structures and Algorithms Made Easy in Java",* 5th Edition. CareerMonk Publications, 2017.

**T2**. *Data Structures Using C* by Ashok N. Kamthane (Pearson India, May 2024)

**Course Reference Projects**

**R1** Mark Allen Weiss" :*Data Structures and Algorithm Analysis in Java",* 4th Edition, Pearson Educational Limited, 2014.

**R2** Michael T .Goodrich, Roberto Tamassia, Michael H .Goldwasser" :*Data Structures and Algorithms in Java",* 6th Edition, John Wiley& Sons, Inc., ISBN: 978-1-118-77133-4, 2014.

**R3** Thomas H .Cormen, Charles E .Leiserson, Ronald L .Rivest and Clifford Stein, 2017 " :*Introduction to Algorithms",* 3rd Edition PHI learning Private Limited.

**Web resources:**

**Course Outcomes**

**On successful completion of the course the students shall be able to:**

CO.1. Apply linear and non-linear data structures such as arrays, stacks, queues, linked lists, and trees to solve computational problems using C programming. [Apply]

CO.2. Apply recursion and sorting/searching algorithms to implement efficient problem-solving techniques in C.[Apply]

**Course Content:**
1. For theory :https://onlinecourses.nptel.ac.in/noc20_cs85/preview
2. https://www.geeksforgeeks.org/data-structures/

| Module 1 | Introduction to Data Structure and Linear Data Structure –Stacks and Queues | Assignment | Program activity | 8 Sessions |

**Introduction** –Introduction to Data Structures, Types and concept of Arrays .

**Stack** -Concepts and representation, Stack operations, stack implementation using array and Applications of Stack.

**Queues** -Representation of queue, Queue Operations, Queue implementation using array, Types of Queue and Applications of Queue.

| Module 2 | Linear Data Structure - Linked List | Assignment | Program activity | 8 Sessions |

**Topics: Linked List** - Singly Linked List, Operation on linear list using singly linked storage structures, Circular List, Applications of Linked list.

**Recursion** - Recursive Definition and Processes, Programming examples.

| Module 3 | Non-linear Data Structures - Trees and Graph | Assignment | Program activity | 8 Sessions |
|----------|----------------------------------------------|------------|------------------|------------|

**Topics: Trees** - Introduction to Trees, Binary tree :Terminology and Properties, Use of Doubly Linked List, Binary tree traversals :Pre-Order traversal, In-Order traversal, post-order traversal. **Graph** - Basic Concept of Graph Theory and its Properties, Representation of Graphs.

| Module 4 | Searching & Sorting Performance Analysis | Assignment | Program activity | 6 Sessions |
|----------|------------------------------------------|------------|------------------|------------|

**Topic: Sorting & Searching** - Sequential and Binary Search, Sorting – Selection and Insertion sort.

**Performance Analysis** - Time and space analysis of algorithms – Average, best and worst case analysis.

**List of Laboratory Tasks:**

**Module 1: Arrays, Stacks & Queues (4 Experiments)**
1. **Array Operations**: Implement insertion, deletion, and traversal on a one-dimensional array.
2. **Stack using Array**: Implement push, pop, peek, and display operations.
3. **Queue using Array**: Implement enqueue, dequeue, and display operations in a linear queue.
4. **Circular Queue using Array**: Implement circular queue operations and demonstrate wrap-around.

**Module 2: Linked Lists & Recursion (4 Experiments)**
5. **Singly Linked List**: Implement insert (beginning, middle, end), delete, and display operations.
6. **Circular Linked List**: Implement insert and delete operations in a circular singly linked list.
7. **Recursion - Factorial & Fibonacci**: Write recursive functions for factorial and Fibonacci series.
8. **Recursion - Towers of Hanoi**: Solve Towers of Hanoi problem using recursion.

**Module 3: Trees and Graphs (4 Experiments)**
9. **Binary Tree using Linked List**: Create a binary tree and perform insertions.
10. **Tree Traversals**: Implement In-order, Pre-order, and Post-order traversal of a binary tree.
11. **Graph Representation**: Represent a graph using an adjacency matrix and adjacency list.
12. **DFS & BFS**: Implement Depth First Search (DFS) and Breadth First Search (BFS) traversal.

**Module 4: Searching, Sorting & Performance Analysis (3 Experiments)**
13. **Linear and Binary Search**: Implement and compare linear and binary search algorithms.
14. **Selection Sort & Insertion Sort**: Implement selection and insertion sort and display stepwise results.
15. **Performance Analysis**: Measure and compare time complexity for search and sort algorithms (use clock() function in C for timing).

**Targeted Application & Tools that can be used**
Use of PowerPoint software for lecture slides and use of Ubuntu for lab programs to execute. Tool is Codetantra tool.

**Project work/Assignment:**

**Assignment:** Students should complete the lab programs by end of each practical session and module wise assignments before the deadline.

**Text Book**

**T1** NarasimhaKarumanchi" :*Data Structures and Algorithms Made Easy in Java",* 5th Edition, CareerMonk Publications, 2017.

**References**

**R1** Mark Allen Weiss" :*Data Structures and Algorithm Analysis in Java",* 4th Edition, Pearson Educational Limited, 2014.

**R2** Michael T .Goodrich, Roberto Tamassia, Michael H .Goldwasser" :*Data Structures and Algorithms in Java"*, 6th Edition, John Wiley & Sons, Inc., ISBN :978-1-118-77133-4, 2014.

**R3**Thomas H .Cormen, Charles E .Leiserson, Ronald L .Rivest and Clifford Stein, 2017" :*Introduction to Algorithms",* 3rd Edition, PHI Learning Private Limited.

**Web resources:**

3.  For theory :https://onlinecourses.nptel.ac.in/noc20_cs85/preview

### CSA2502- Computer Networks

| Course Code: CSA2502 | Course Title: Computer Networks  Type of Course: Program Core –Theory | L-T-P-C | 3 | 0 | 0 | 3 |
|---|---|---|---|---|---|---|
| Version No. | 1.0 | | | | | |
| Course Pre-requisites | Computer Organization | | | | | |
| Anti-requisites | NIL | | | | | |
| Course Description | This course gives a thorough introduction to all the layers of computer network following the top down approach. Application, Transport, Network, and Data link layer protocols are taught with analysis wherever applicable. All-important concepts required to take up advanced courses and to face placement tests by an undergraduate student will be covered in this course. This course can be followed up with an advanced computer networks by the student to get a complete understanding of this domain. | | | | | |
| Course Objective | The objective of the course is to familiarize the learners with the concepts of Computer Networks and attain Skill Development through Participative Learningtechniques. | | | | | |
| Course Out Comes | On successful completion of the course the students shall be able to:  **CO1:** Describe linear data structures like arrays, stacks, and queues. [Understand]  **CO2:** Explain linked lists and recursion concepts. [Understand]  **CO3:** Illustrate tree and graph structures with operations. [Understand]  **CO4:** Interpret basic searching, sorting, and performance analysis. [Understand] | | | | | |
| Course Content | | | | | | |

| Module 1 | Overview, Application, and Transport Layer | Assignment | Problem Solving | 12 Sessions |
|---|---|---|---|---|
| Introduction: Computer Networks, Topologies, OSI Reference Model, Functions of Each Layer, TCP/IP model. Principles of Network Applications, The Web and HTTP, DNS—The Internet's Directory Service, Socket Programming: Creating Network Applications<br><br>Introduction and Transport-Layer Services, Connectionless Transport: UDP, Principles of Reliable Data Transfer, Connection-Oriented Transport: TCP, Principles of Congestion Control, TCP Congestion Control. | | | | |
| Module 2 | Network Layer | Assignment | Problem Solving | 12 Sessions |
| Overview of Network Layer, Forwarding and Routing, The Data and Control Planes<br><br>The Internet Protocol (IP): IPv4 Addressing, IPv4 Datagram Format, Network Address Translation (NAT), IPv6 Introduction  Routing Algorithms: The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm, Intra-AS Routing in the Internet, OSPF Routing Among the ISPs: BGP, Introduction to BGP. ICMP: The Internet Control Message Protocol | | | | |
| Module 3 | Data Link Layer | Assignment | Problem Solving | 11 Sessions |
| Introduction to the Link Layer, The Services Provided by the Link Layer, Error-Detection and -Correction Techniques, Parity Checks, Check summing Methods, Cyclic Redundancy Check (CRC), *MAC Sub Layer, Frame Format, Frame Types;*<br><br>Switched Local Area Networks, Link-Layer Addressing and ARP, Ethernet, Link-Layer Switches, Virtual Local Area Networks (VLANs) | | | | |
| Module 4 | Wireless and Security in Computer Networks | Assignment | Problem Solving | 10 Sessions |
| Introduction, Wireless Links and Network Characteristics, Wi-Fi: 802.11 Wireless LANs, Cellular Networks: 4G and 5G.<br><br>Security in Computer Networks: Principles of Cryptography, End-Point Authentication, Securing E-Mail, Operational Security: Firewalls and Intrusion Detection Systems. | | | | |

| Targeted Application & Tools that can be used: Cisco Packet Tracer, Wireshark |
|---|
| Case Study/Assignment: Assignment proposed for this course in CO1-CO4<br><br>Assume that a computer sends a frame at the transport layer to another computer and the destination port address is not running. According to what you read from chapter 2, what will happen to that process?<br><br>Determine the possible bit rate and the number of levels over a channel for these cases? a. B = 2.4K Hz, noiseless channel with L = 16. b. B= 2.4K Hz, SNR = 20 dB. c. B = 3.0K Hz, SNR = 40 db.<br><br>Using CISCO Packet Tracer Configuring Static and Default Routes<br>Objectives<br>• Configure static routes on each router to allow communication between all clients.<br>• Test connectivity to ensure that each device can fully communicate with all other devices.<br><br>Getting familiar with Wireshark software by installing it I your system, and perform following task:<br>List out the packets which are having DNS protocols<br>List of IP address present in the cache along with its MAC addresses<br>Display all the packets which are having the DNS or HTTP protocol |
| Problem Solving: Choose and appropriate devices and implement various network concepts. |

| Text Book |
| --- |
| • James F. Kurose, Keith W. Ross, "*Computer Networking ATopdown Approach",* 8th Edition, Pearson, 2023. |
| • Computer Networks ,Tanenbaum , 5th Edition , Pearson Education Media, 2023 |
| • Behrouz A. Forouzan, "*Data Communications and Networking*", 5th Edition, Tata McGraw-Hill, 2017 |
| References |
| • CompTIA Network+  Certification All in one Exam Guide , Mike Meyers , 7th Edition , McGraw Hill, 2023 |
| • Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007. |
| • Web Based Resources and E-books: |
| • W1: Computer Networks:https://gaia.cs.umass.edu/kurose_ross/index.php |
| • W2:https://www.coursera.org/learn/computer-networking |

## CSA1201-Computer Organization

| Course Code: CSA1201 | Course Title:  Computer Organization | | L-T-P- C | 3 | 0 | 0 | 3 |
| --- | --- | --- | --- | --- | --- | --- | --- |
| | Type of Course: Program Core and Theory | | | | | | |
| Version No. | 1.0 | | | | | | |
| Course Pre-requisites | Nil | | | | | | |
| Anti-requisites | NIL | | | | | | |
| Course Description | Computer Organization is an introductory course that focuses on the fundamental principles and concepts behind the design and implementation of modern computer systems. The course explores the structure and functionality of computers at the hardware level, providing students with a solid foundation in understanding how computers work. | | | | | | |
| Course Objective | The objective of the course is to familiarize the learners with the concepts of Computer Organization and attain Skill Development through Participative Learning techniques. | | | | | | |
| Course Out Comes | CO1 : outline basic structure and operations of a computer.   [Understand] CO2 : categorize the arithmetic and logic unit and implementation of fixed-point and floating-point arithmetic unit. [Understand] CO3 : Describe the basics of pipelined execution. [Understand] CO4 : Explain parallelism and multi-core processors.  [Understand] | | | | | | |
| Course Content: | | | | | | | |
| Module 1 | Computer Organization & Instructions | Assignments | Quizzes form basics of CA | | 12 Sessions | | |
| Basics of a computer system: Evolution, Ideas, Technology, Performance, Power wall, Uniprocessors to Multiprocessors. Addressing and addressing modes. Instructions: Operations and Operands, Representing instructions, Logical operations, control operations. | | | | | | | |
| Module 2 | Arithmetic operations | Quizzes and assignments | Comprehension based Quizzes and assignments | | 10 Sessions | | |
| Fixed point Addition, Subtraction, Multiplication and Division. Floating Point arithmetic, High performance arithmetic, Subword parallelism | | | | | | | |
| Module 3 | Processor | Term paper/Assignment | Quizzes form advanced python | | 12 Sessions | | |

Introduction, Logic Design Conventions, Building a Datapath — A Simple Implementation scheme — An Overview of Pipelining — Pipelined Datapath and Control. Data Hazards: Forwarding versus Stalling, Control Hazards, Exceptions, Parallelism via Instructions.

| Module 4 | Memory And I/O Organization | Term paper/Assignment | Classification on Memory Organization | 11 Sessions |
|---|---|---|---|---|

Memory hierarchy, Memory Chip Organization, Cache memory, Virtual memory. Parallel Bus Architectures, Internal Communication Methodologies, Serial Bus Architectures, Mass storage, Input and Output Devices.

**Assignment:**

Assignments are given after completion of each module which the student need to submit within the stipulated deadline.

**Text Book**

1. Carl Hamacher, ZvonkoVranesic and SafwatZaky, "Computer Organization", Fifth Edition, Tata McGraw Hill, 2021.
2. Godse, A. P., &Godse, D. A. (2021). Computer Organization and Architecture. Technical Publications.

**References**

1. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software interface", Elsevier, 2019.

2. William Stallings, "Computer Organization and Architecture – Designing for Performance", Sixth Edition, Pearson Education, 2003.
3. John P. Hayes, "Computer Architecture and Organization", Third Edition, Tata McGraw Hill.

# CSA2503-Relational Database Management Systems

| Course Code: CSA2503 | Course Name: Relational Database Management Systems<br>Type of Course: Theory Course | L- T-P-C | 3-0-0-3 |
|---|---|---|---|
| Version No. | 1 | | |
| Course Pre-requisites | Computer Organization | | |
| Anti-requisites | Nil | | |
| Course Description | This course introduces the core principles and techniques required in the design and implementation of database systems. It covers concepts of relational database systems (RDBMS). More emphasis is set on how to design, develop, organize, maintain and retrieve the information efficiently. It helps the students to learn and practice data modeling and database designs. | | |
| Course Objective | The objective of the course is to familiarize the learners with the concepts of Relational Database Managment Systems and attain Skill Development through Participative Learning techniques. | | |
| Course Out Comes | **On successful completion of the course the students shall be able to:**<br>• Describe a database system using ER model and relational algebra. [Understand]<br>• Apply Relational Algebra and Database Querying concepts in designing the database. [Apply]<br>• Solve various normalization techniques for designing a robust database. [Apply] | | |
| Course Content: | | | |

| Module 1 | Introduction to Database Modelling and Relational Algebra | Assignment | Database Modelling | 15 Sessions |
|---|---|---|---|---|
| Topics: | | | | |

Introduction to Database: Schema, Instance, 3-shema architecture, physical and logical data independence, Data isolation problem in traditional file system, advantages of database over traditional file systems. Entity Relationship (ER) Model, ER Model to Relational Model, Examples on ER model.

Relational Algebra with selection, projection, rename, set operations, Cartesian product, joins (inner and outer joins), and division operator. Examples on Relational Algebra Operations.

| Module 2 | Fundamentals of SQL and Query Optimization | Quiz/ Assignment | Fundamentals of SQL | 15 Sessions |
|----------|---------|---------|---------|---------|

Topics:

Database Querying: DDL, DML, Constraints, Operators- BETWEEN, IN, LIKE, where clause, order by command, Set Operators, Aggregate Functions, having, group by clauses, Views, Procedures, Cursors and Triggers.

Query Optimization: Purpose, transformation of relational expressions, estimating cost and statistics of expression, choosing evaluation plans, linear and bushy plans, dynamic programming algorithms.

| Module 3 | Designing and Refining Database Schema | Assignment | Refining Database Schema | 15 Sessions |
|----------|---------|---------|---------|---------|

Topics:

Schema Design: Problems in schema design, redundancy and anomalies. Schema refinement: Functional Dependencies, Normalization and forms - First, Second, Third, Dependency Preservation – Boyce/Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. Fundamentals of Transaction: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties (ACID) of Transactions.

Text Book
- Elmasri R and Navathe S B, "Fundamentals of Database System", Pearson Publication, 7th Edition, 2018.
- RamaKrishna & Gehrke, "Database Management Systems" 3rd Edition, 2018, McGraw-Hill Education.

References
- W. Lemahieu, S. vanden Broucke and B. Baesens, "Principles of Database Management: Practical Guide to Storing, Managing and Analyzing Big and Small Data", Cambridge University Press, 2018.
- Avi Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", McGraw-Hill ,7th Edition, 2019.

E-Resources
NA

# CSA2504-Relational Database Management Systems Lab

| Course Code: CSA2504 | Course Name: Relational Database Management Systems Lab<br>Type of Course: Lab / Lab Integrated Course | L- T-P- C | 0-0-2-1 |
|----------|---------|---------|---------|
| Version No. | 1 | | |
| Course Pre-requisites | CSA2103 – Relational Database Management Systems (Basics of Database) | | |
| Anti-requisites | NIL | | |

| Course Description | This course is designed to implement various databases using MySQL DATABASE in information technology applications. All the exercises will focus on the fundamentals for creating, populating, sophisticated, interactive way of querying, and simultaneous execution of the transactions of database. |
|---|---|
| Course Objective | The objective of the course is to familiarize the learners with the concepts of Relational Database Managment Systems and attain Skill Development through Experiential Learning techniques. |
| Course Out Comes | **On successful completion of the course the students shall be able to:**<br>**CO1** Describe a database system using ER model and relational [Understand] algebra.<br>**CO2** Apply Relational Algebra and Database Querying concepts in [Apply] designing the database. |

**Course Content:**

| Module 1 | Introduction to Database Modelling and Relational Algebra | Assignme nt | Database Modelling | 15 Sessions |
|---|---|---|---|---|

Topics:

Introduction to Database: Schema, Instance, 3-shema architecture, physical and logical data independence, Data isolation problem in traditional file system, advantages of database over traditional file systems. Entity Relationship (ER) Model, ER Model to Relational Model, Examples on ER model.

Relational Algebra with selection, projection, rename, set operations, Cartesian product, joins (inner and outer joins), and division operator. Examples on Relational Algebra Operations.

| Module 2 | Fundamentals of SQL and Query Optimization | Quiz/ Assignme nt | Fundamentals of SQL | 15 Sessions |
|---|---|---|---|---|

Topics:

Database Querying:  DDL, DML, Constraints, Operators- BETWEEN, IN, LIKE, where clause, order by command, Set Operators, Aggregate Functions, having, group by clauses, Views, Procedures, Cursors and Triggers.

Query Optimization: Purpose, transformation of relational expressions, estimating cost and statistics of expression, choosing evaluation plans, linear and bushy plans, dynamic programming algorithms.

| Module 3 | Designing and Refining Database Schema | Assignme nt | Refining Database Schema | 15 Sessions |
|---|---|---|---|---|

Topics:

Schema Design:  Problems in schema design, redundancy and anomalies. Schema refinement: Functional Dependencies, Normalization and forms - First, Second, Third, Dependency Preservation – Boyce/Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. Fundamentals of Transaction: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties (ACID) of Transactions.

**List of Laboratory Tasks**
1. Create a Student database using DDL commands.
2. Insert records into a Student table using DML.
3. Update and delete student records.
4. Use SELECT with WHERE to retrieve specific student records.
5. Use SELECT with ORDER BY to sort students by marks.
6. Use SELECT with multiple conditions (AND/OR).
7. Create a Banking database and define tables with appropriate data types.
8. Insert sample bank account data using DML commands.
9. Use SELECT with arithmetic and aliasing expressions.
10. Use aggregate functions: COUNT, MAX, MIN, AVG, SUM on bank accounts.
11. Create tables with PRIMARY KEY, UNIQUE, NOT NULL constraints.
12. Add FOREIGN KEY constraint between Customer and Account tables.

13. Use BETWEEN and IN operators on Student database queries.
14. Use LIKE and NOT LIKE for pattern matching.
15. Use IS NULL and NOT NULL queries on missing entries.
16. Use GROUP BY with aggregate functions (e.g., group by department).
17. Use HAVING to filter grouped results.
18. Combine GROUP BY and ORDER BY on banking or library data.
19. Perform nested subqueries (e.g., students with marks above average).
20. Write queries using CASE statements (e.g., assign grade based on score).

Text Book
- Elmasri R and Navathe S B, "Fundamentals of Database System", Pearson Publication, 7th Edition, 2018.
- RamaKrishna & Gehrke, "Database Management Systems" 3rd Edition, 2018, McGraw-Hill Education.

References
- W. Lemahieu, S. vanden Broucke and B. Baesens, "Principles of Database Management: Practical Guide to Storing, Managing and Analyzing Big and Small Data", Cambridge University Press, 2018.
- Avi Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", McGraw-Hill ,7th Edition, 2019.

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# CSA2505-Analysis of Algorithms

| Course Code: CSA2505 | Course Name:  Analysis of Algorithms<br>Type of Course: Theory Course | L- T-P- C | 2-1-0-3 |
|---|---|---|---|
| Version No. | 1 | | |
| Course Pre-requisites | Data Structures and Algorithms | | |
| Anti-requisites | NIL | | |
| Course Description | This Course introduces techniques for the design and analysis of efficient algorithms and methods of applications. Deals with analyzing time and space complexity of algorithms, and to evaluate trade-offs between different algorithms. | | |
| Course Objective | The objective of the course is to familiarize the learners with the concepts of Analysis of Algorithms and attain Skill Development through Problem Solving Methodologies. | | |
| Course Out Comes | **On successful completion of the course the students shall be able to:**<br>• Classify the types of asymptotic notations.  [Apply]<br>• Discuss the Brute Force Technique used for solving a problem.  [Understand]<br>• Explain divide and conquer technique for searching and sorting problems. [Understand]<br>• Discuss the Dynamic Programming Algorithm used for solving a problem  [Understand] | | |

Course Content:

| Module 1 | Introduction | Assignment | Introduction | 10  Sessions |
|---|---|---|---|---|
| Topics:<br>Important Problem types, Asymptotic Notations and its properties, Mathematical analysis for Recursive and Non-recursive algorithms. | | | | |
| Module 2 | Algorithm design techniques-Brute force | Quiz/ Assignment | Algorithm design techniques-Brute force | 10  Sessions |

| Topics: | | | | |
|---|---|---|---|---|
| Selection Sort, sequential search, Uniqueness of Array, Exhaustive search Travelling Salesman, Knapsack Problem. | | | | |
| Module 3 | Divide-and-conquer | Assignment | Divide-and-conquer | 10 Sessions |
| Topics: | | | | |
| Master Theorem, Merge sort, Quick sort, Binary search. | | | | |
| Module 4 | Dynamic programming and greedy technique | Assignment | Dynamic programming and greedy technique | 15 Sessions |
| Topics: | | | | |
| Introduction, Coin changing problem, Multi stage graph – Optimal Binary Search Trees,  warshall's, floyds,0/1 Knapsack, Prim's, Kruskal's. Hamiltonian Path Problem, M Coloring Problem. Backtracking, - Backtracking – n-Queens problem. | | | | |

| Text Book |
|---|
| • Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", PHI Learning Private Limited(2021)<br>• Levitin, A. (2011). Introduction to the design and analysis of algorithms (3rd ed.). Pearson |

| References |
|---|
| • AnanyLevitin, "Introduction to the Design and Analysis of Algorithms", Pearson Education.<br>• Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson. |

| E-Resources |
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| https://onlinecourses.nptel.ac.in/noc19_cs47/preview |

## CSA2506-Operating Systems and Unix Programming

| Course Code: CSA2506 | Course Name:  Operating Systems and Unix Programming<br>Type of Course: Theory Course | L- T-P- C | 2-0-0-2 |
|---|---|---|---|
| Version No. | 1 | | |
| Course Pre-requisites | Data Structures and Computer Organization | | |
| Anti-requisites | NIL | | |
| Course Description | The main objective of this course is to cover basic concepts of operating systems. Operating Systems functions, Basic Concepts, Notion of a process, Concurrent processes, Problem of mutual exclusion, Deadlock, Process Scheduling, Memory management, Multiprogramming, File systems; time sharing systems and their design consideration. This course will prepare students to develop software in and for Linux/UNIX environments.  Also this course helps the students in UNIX operating system and their effective use for problem solving. | | |
| Course Objective | The objective of the course is to familiarize the learners with the concepts of Operating Systems and Unix Programming and attain Skill Development through Experiential Learning techniques. | | |

## CSA2507- Operating Systems and Unix Programming Lab

| Course Code: CSA2507 | Course Name:  Operating Systems and Unix Programming Lab<br>Type of Course: Lab / Lab Integrated Course | L- T-P- C | 0-0-2-1 |
|---|---|---|---|
| Version No. | 1 | | |

| | |
|---|---|
| Course Pre-requisites | Data Structures and Computer Organization |
| Anti-requisites | Nil |
| Course Description | The main objective of this course is to cover basic concepts of operating systems. Operating Systems functions, Basic Concepts, Notion of a process, Concurrent processes, Problem of mutual exclusion, Deadlock, Process Scheduling, Memory management, Multiprogramming, File systems; time sharing systems and their design considerations. This course will prepare students to develop software in and for Linux/UNIX environments. Also this course helps the students in UNIX operating system and their effective use for problem solving. |
| Course Objective | The objective of the course is to familiarize the learners with the concepts of Operating Systems and Unix Programming and attain Skill Development through Experiential Learning techniques. |

**On successful completion of the course the students shall be able to:**

| | | |
|---|---|---|
| Course Out Comes | CO1 | Describe the different stages of process states. [Understand] |
| | CO2 | Explore the algorithms related to main memory and virtual memory techniques. [Understand] |
| | CO3 | Understand the Memory Management and its concepts [Understand] |
| | CO4 | Design Process, Process State Transitions, Process with CPU [Apply] scheduling algorithms. |

**Course Content:**

| Module 1 | Introduction to OS and System Structure | | 8 Sessions |
|---|---|---|---|

**Topics:**

Introduction: Concept of Operating Systems (OS), Generations of OS, Types of OS, OS Services, Interrupt handling and System Calls, Basic architectural concepts of an OS, Concept of Virtual Machine, Resource Manager view, process view and hierarchical view of an OS, Processes Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching. Process Scheduling: Scheduling algorithms:, Multiprocessor scheduling: Real Time scheduling:

| Module 2 | IPC and Deadlocks | | 7 Sessions |
|---|---|---|---|

**Topics:**

Inter-process Communication: Concurrent processes, precedence Graphs, Critical Section, Race Conditions, Mutual Exclusion, Deadlocks – prevention, avoidance, detection and recovery. Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads.
Banker's algorithm, Deadlock detection and Recovery

| Module 3 | Memory Management | | 8 Sessions |
|---|---|---|---|

**Topics:**

Memory Management: Logical and Physical address maps, Memory allocation, Contiguous Memory allocation – Fixed and variable partition – Internal and External fragmentation and Compaction.

| Module 4 | Virtual Memory and File Management | | 7 Sessions |
|---|---|---|---|

**Topics:**

Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page allocation, Partitioning, Paging, Page fault, Working Set, Segmentation, Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU) File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods , Free-space management, directory implementation , efficiency and performance

| Text Book | |
|---|---|

- Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Concepts, Wiley, 10th Edition, 2019.

| References | |
|---|---|

- Tanenbaum. Andrew S. Andrew S. Woodhull, Operating system: Design and implementation. Vol. 68. Englewood Cliffs: Prentice Hall, 1997.

**List of Laboratory Tasks**

- The Unix Programming Environment by Brain W. Kernighan & Rob Pike, Pearson.
- Introduction to Unix Shell Programming by M.G.Venkateshmurthy, Pearson

Experiment 1

Level 1 : To study of Basic UNIX Commands and various UNIX editors such as vi

| E-Resources | |
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1. https://nptel.ac.in/courses/106108101

2. https://nptel.ac.in/courses/106106144
3. https://nptel.ac.in/courses/117106113
4. https://www.udemy.com/course/unix-getting-started/
5. https://www.coursera.org/learn/unix

Level 2 :   To study the File manipulation Commands

Experiment 2

Level 1 :  Programs using the following system calls of UNIX operating system  fork, exec, getpid, exit,wait

Level 2 :  Programs using the following system calls of UNIX operating system  close, stat, opendir, readdir

Experiment 3

Level 1 : PROGRAM FOR SIMULATION OF LS UNIX COMMANDS

Level 2 : PROGRAM FOR SIMULATION OF GREP UNIX COMMANDS

Experiment 4

Level 1 : Write a Shell program to check the given number is even or odd

Level 2 : Write a Shell program to check the given year is leap year or not

Experiment 5

Level 1 : Write a Shell program to find the factorial of a number

Level 2 : Write a Shell program to swap the two integers

Experiment 6

Level 1 : Implementation of Priority scheduling algorithms. With total and average waiting time

Level 2 : Implementation of Priority scheduling algorithms. With total and average turnaround time

Experiment 7

Level 1 :   Write a Shell program to display a given Message

Level 2 :  Write a Shell Program to find the roots of the quadratic equation.

Experiment 8

Level 1 :  Write a shell program to find the smallest digit of a value

Level 2 :  Write a shell script to perform integer arithmetic operations

Experiment 9

Level 1 :  Write a shell program to reverse a number.

Level 2 :  Write a shell program to find the sum of even and odd numbers in an array

Experiment 10

Level 1 :  Write a Simple Shell script to print the sum of n natural numbers

Level 2 :  Write a shell program to count the number of digits of a value.

**Text Book**
- Abraham Silberschatz, Peter B. Galvin, Greg Gagne-Operating System Concepts, Wiley, 10th Edition, 2019.
- Tanenbaum, Andrew S., and Albert S. Woodhull. Operating systems: design and implementation. Vol. 68. Englewood Cliffs: Prentice Hall, 1997

**References**
- The Unix programming Environment by Brain W. Kernighan & Rob Pike, Pearson.
- Introduction to Unix Shell Programming by M.G.Venkateshmurthy, Pearson

**E-Resources**
https://nptel.ac.in/courses/106108101
https://nptel.ac.in/courses/106106144
https://nptel.ac.in/courses/117106113
https://www.udemy.com/course/unix-getting-started/
https://www.coursera.org/learn/unix

## CSA1202- Software Engineering

| Course Code: CSA1202 | Course Name:  Software Engineering<br>Type of Course: Theory Course | L- T-P- C | 3-0-0-3 |
|---|---|---|---|
| Version No. | 1 | | |
| Course Pre-requisites | NIL | | |

| Anti-requisites | NIL |
|---|---|
| Course Description | This course aims to equip students with a comprehensive understanding of the software development process and software project management principles. It covers key aspects such as software process models, requirement engineering, system analysis, design, implementation, and testing. Additionally, students will explore project evaluation, planning, effort estimation, and risk management, essential for effective software project execution. Through this course, students will gain the skills necessary to develop reliable software systems while managing project constraints effectively. |
| Course Objective | The objective of the course is to familiarize the learners with the concepts of Fundamentals of Software Engineering and attain Skill Development through Participative Learning techniques. |
| Course Out Comes | **On successful completion of the course the students shall be able to:**<br>• Understand the software engineering principles, ethics and process models. [Understand]<br>• Identify the requirements and design appropriate models for a given application. [Understand]<br>• Apply various types of testing methods and Quality Assurance techniques. [Remember]<br>• Apply project planning, scheduling, evaluation and risk management principles for a given project. [Apply] |

Course Content:

| Module 1 | Introduction to Software Engineering & Process Models | Assignment | Process Models | 11 Sessions |
|---|---|---|---|---|

Topics:
Software and Software Engineering: Nature of Software, Software Engineering Practice, Software Myths, SDLC and Software Processes: Generic Model, Prescriptive Process Model, Unified Process Model, Agile Development: Extreme Programming, SCRUM

| Module 2 | Software Requirements and Design | Quiz/ Assignment | Software Requirements | 10 Sessions |
|---|---|---|---|---|

Topics:
Requirements Engineering: Eliciting requirements, Functional and non- Functional requirements, SRS, Requirements modeling : Developing Use Cases, Developing Activity diagram and Swimlane diagram, Design: Design concepts, Architectural design, Component based design, User interface design

| Module 3 | Software Testing And Quality Assurance | Assignment | Testing And Quality Assurance | 11 Sessions |
|---|---|---|---|---|

Topics:
Introduction to Software Testing: verification and validation, Test Strategies for conventional Software, Validation Testing, Whitebox Testing: Basis path testing, Blackbox Testing. Software Quality Assurance: Elements of software quality assurance, SQA Tasks, Goals and Metrics, Software configuration management: SCM process.

| Module 4 | Software Project Management | Assignment | Software Project Management | 13 Sessions |
|---|---|---|---|---|

Topics:
Project Management Concepts, Project Planning, Overview of metrics, Estimation for Software projects, Project Scheduling, Risk Management, Maintenance and Reengineering, Software Process Improvement (SPI): CMM Levels.

**Text Book**
- Roger S. Pressman, "Software Engineering: A Practitioner's Approach", Seventh Edition, McGraw Hill International edition, 2009.
- BobHughes,MikeCotterell,RajibMall,"Software ProjectManagement",VIEdition,McGraw-Hill, 2018

**References**
- Ian Sommerville, "Software Engineering, Ninth Edition", Pearson Education, 2008.
- RajibMall,"FundamentalsofSoftwareEngineering",VIEdition,PHIlearningprivatelimited,2014.

# CSA2520 – Virtualization and Cloud Infrastructure

| Course Code: CSA2520 | Course Name: Virtualization and Cloud Infrastructure<br>Type of Course: Theory Course | L- T-P- C | 2-0-2-3 |
| --- | --- | --- | --- |
| Version No. | 1 | | |
| Course Pre-requisites | Computer Networks | | |
| Anti-requisites | NIL | | |
| Course Description | This course provides a comprehensive introduction to the principles and practices of virtualization and cloud computing infrastructure. It covers the fundamental concepts, technologies, and architectures of virtualization, including hypervisors, virtual machines, containers, and virtual networks. The course also explores the architecture and service models of cloud computing—Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS)—along with deployment models such as public, private, hybrid, and community clouds.<br><br>Students will gain practical experience in configuring and managing virtualization environments using tools such as VMware, VirtualBox, and KVM, and in deploying applications on cloud platforms like AWS, Microsoft Azure, and Google Cloud Platform. The course also addresses key issues such as resource management, scalability, security, cloud storage, orchestration, and cloud-native technologies like Docker and Kubernetes. | | |
| Course Objective | The objective of the course is to familiarize the learners with the concepts of Virtualization and Cloud Infrastructure and attain Skill Development through Participative Learning techniques. | | |
| Course Out Comes | **On successful completion of the course the students shall be able to:**<br>• Explain the core concepts and benefits of virtualization and cloud infrastructure. **(Understand)**<br>• Compare the performance and security challenges in virtualized and cloud environments and recommend best practices. (Understand)<br>• Configure and manage virtual machines and containers using popular virtualization tools. (**Apply**)<br>• Analyze different cloud service models (IaaS, PaaS, SaaS) and deployment models (public, private, hybrid). (**Analyze**) | | |
| Course Content: | | | |
| Module 1 | Introduction to Virtualization | Assignment | Introduction to Cloud | 15 Sessions |
| Topics: | | | | |

Concepts and benefits of virtualization, Types of virtualization: hardware, software, network, storage, Hypervisors: Type 1 vs Type 2, Virtual Machines and their architecture

| Module 2 | Virtualization Tools and Technologies | Quiz/ Assignment | Virtualization Fundamentals | 15 Sessions |
|---|---|---|---|---|

Topics:
Installation and configuration of virtualization platforms (e.g., VMware, VirtualBox, KVM), Containerization concepts and tools (Docker basics), Managing virtual networks and storage in virtual environments

| Module 3 | Advanced Cloud Computing Architectures and Services | Assignment | Cloud Services | 15 Sessions |
|---|---|---|---|---|

Topics:
Serverless computing and Function as a Service (FaaS), Multi-cloud and hybrid cloud architectures- Virtual networking in the cloud (VPCs, subnets, gateways, load balancers) - Cloud storage options (object, block, file storage) and data lifecycle management - Introduction to microservices and container orchestration (Kubernetes architecture and components)

| Module 4 | Performance, Security, and Best Practices | Assignment | Software Security Fundamentals | 15 Sessions |
|---|---|---|---|---|

Topics:
Performance metrics and monitoring in virtual/cloud environments - Security challenges and solutions in virtualization and cloud - Scalability and resource management - Best practices for deployment and management of virtualized/cloud infrastructure

**Lab Experiments :**

Lab Experiments
Module 1: Virtualization Basics
1. Install and Configure VirtualBox / VMware Workstation
   o Create and manage virtual machines with different OSes.
2. Hypervisor Comparison
   o Install Type 1 (e.g., KVM, ESXi) and Type 2 (VirtualBox/VMware) hypervisors and compare performance.
3. Snapshot Management
   o Create, manage, and revert virtual machine snapshots.
4. Network Configuration in Virtual Machines
   o Set up NAT, Bridged, and Host-only networking in a virtualized environment.
Module 2: Containers and Advanced Virtualization
5. Docker Installation and Basic Commands
   o Install Docker, run containers, and explore Docker Hub.
6. Create Custom Docker Images
   o Write a Dockerfile and build a custom image.
7. Docker Compose for Multi-Container Applications
   o Deploy a web application with a front-end and database using Docker Compose.
8. Container Networking and Volumes
   o Set up persistent volumes and custom networks for containers.
Module 3: Cloud Computing Fundamentals
9. Explore IaaS with AWS EC2
   o Launch an EC2 instance, connect via SSH, and install a web server.
10. Set Up and Configure S3 Storage
   • Create an S3 bucket, upload/download files, and set access policies.
11. Deploy an Application on PaaS (e.g., Heroku or Google App Engine)
   • Deploy a sample app using CLI tools and configure environment variables.
12. Create and Manage Virtual Private Cloud (VPC)
   • Design subnets, route tables, and security groups in AWS VPC.
Module 4: Cloud Orchestration, Security, and Automation
13. Infrastructure as Code using Terraform
   • Write basic Terraform scripts to launch cloud resources.

14. Kubernetes Basics
   - Set up a local Kubernetes cluster using Minikube and deploy a sample pod/service.
15. Cloud Monitoring and Security Audit
   - Use tools like AWS CloudWatch or Azure Monitor to track resource usage and perform a basic audit.

Text Book
   - D. C. Marinescu, *Cloud Computing: Theory and Practice*, 3rd ed., Amsterdam, Netherlands: Elsevier, 2022.
   - T. Erl, R. Puttini, and Z. Mahmood, *Cloud Computing: Concepts, Technology & Architecture*, 2nd ed., Upper Saddle River, NJ, USA: Prentice Hall, 2013.

References
   - C. Marinescu, Cloud Computing: Theory and Practice, 2nd ed. Burlington, MA, USA: Morgan Kaufmann, 2017.
   - B. Sosinsky, Cloud Computing Bible, 1st ed. Hoboken, NJ, USA: Wiley, 2011.

E-Resources
   1. https://www.redhat.com/en/topics/cloud-computing/cloud-vs-virtualization
   2. https://aws.amazon.com/what-is/virtualization/

# CSA1704-Principles of Artificial Intelligence

| Course Code: CSA1704 | Course Name: Principles of Artificial Intelligence<br>Type of Course: Theory Course | | L- T-P- C | 3-0-0-3 |
|---|---|---|---|---|
| Version No. | 1 | | | |
| Course Pre-requisites | Mathematics: Logic, Algebra, Probability | | | |
| Anti-requisites | Nil | | | |
| Course Description | This Course will introduce the basic principles in artificial intelligence. It will cover representation schemes, problem solving paradigms, search strategies, knowledge representation and Probabilistic Reasoning. Topics include: AI methodology and fundamentals, intelligent agents, search algorithms, game playing, supervised and unsupervised learning, uncertainty and probability theory, probabilistic reasoning in AI and Bayesian networks | | | |
| Course Objective | This course is designed to improve the learners' EMPLOYABILITY SKILLS by using PROBLEM SOLVING Methodologies. | | | |
| Course Out Comes | **On successful completion of the course the students shall be able to:**<br>• Explain the basic concepts of Artificial Intelligence and application of AI in several domains such as business and governance domains.  [Understand]<br>• Demonstrate knowledge of reasoning and knowledge representation for solving real world problems [Apply]<br>• Analyze and illustrate how informed and uninformed search algorithms play vital role in problem solving.  [Apply]<br>• Explain learning probabilistic reasoning in AI.  [Understand] | | | |
| Course Content: | | | | |
| Module 1 | Introduction to Artificial Intelligence | Assignment | Introduction to Artificial Intelligence | 06  Sessions |
| Topics: | | | | |

| Introduction to Artificial Intelligence, Definitions, foundation, History and Applications; Agents: Types of Agents, Structure of Intelligent agent and its functions, Agents and Environment. Case Studies: Agricultural Domain, Business and Marketing, Automatic Car Parking System. | | | | |
|---|---|---|---|---|
| Module 2 | Knowledge Representation | Quiz/ Assignment | Reasoning | 07  Sessions |
| Topics: Introduction to Knowledge representation, Knowledge-based Agents, Knowledge-Based Systems; Frame Structures, Propositional Logic, First order Logic, Inference in First Order Logic (FOL), Introduction to Reasoning, types of reasoning. | | | | |
| Module 3 | Problem Solving by searching | Assignment | Problem Solving by searching | 09  Sessions |
| Topics: Problem space and search, State space search techniques solving problems by searching: Classical Search, Adversarial Search, and Constraint Satisfaction Problem, Adversarial Search Methods. | | | | |
| Module 4 | Applications of AI | Assignment | Applications | 16  Sessions |
| Topics: Healthcare, Finance, Autonomous Vehicles, Robotics , AI in Everyday Applications - Smart Assistants, Recommendation Systems, AI in Manufacturing | | | | |
| Text Book <ul><li>Stuart J. Russell and Peter Norvig, "Artificial intelligence: A Modern Approach", 4th edition, Upper Saddle River, Prentice Hall, 2020</li><li>David L. Poole and Alan K. Mackworth,"Artificial Intelligence: Foundations of Computational Agents", 2nd edition, Cambridge University Press, 2020</li></ul> | | | | |
| References <ul><li>John Paul Mueller, Luca Massaron, "Artificial Intelligence for dummies", 2nd edition, Wiley, 2021.</li><li>Daeyeol Lee, "Birth of Intelligence: From RNA to Artificial Intelligence", 1st edition, Oxford University Press, 2020.</li></ul> | | | | |
| E-Resources https://www.researchgate.net/file.PostFileLoader.html?id=5440e3bdd5a3f298288b45fe&assetKey=AS%3A273625985290242%401442248926315 | | | | |

# CSA2508-Software Testing

| Course Code: CSA2508 | Course Name:  Software Testing<br>Type of Course: Theory Course | L- T-P- C | 3-0-0-3 |
|---|---|---|---|
| Version No. | 1 | | |
| Course Pre-requisites | Software Engineering | | |
| Anti-requisites | NIL | | |
| Course Description | This course will examine fundamental software testing and related program analysis techniques. In particular, the important phases of testing will be reviewed, emphasizing the significance of each phase when testing different types of software. The course will also include concepts such as test generation, test oracles, test coverage, regression testing, mutation testing, program analysis (e.g., program-flow and data-flow analysis), and test prioritization. | | |
| Course Objective | The objective of the course is to familiarize the learners with the concepts of Software Testing and attain Employability  through Experiential learning. | | |

## CSA1703- Data Mining

| | **On successful completion of the course the students shall be able to:** | | | |
|---|---|---|---|---|
| Course Out Comes | • Describe the fundamentals of software testing for Quality assurance. [Understand] | | | |
| Course Code: | Course Name: Test data Mining test Applications / Software's [Apply] | | L T P C | |
| CSA1703 | • Write Bug reports found in Testing Applications / Software's. [Apply] | | 3 0 1 0 2 | |
| Version No. | Type of Course: Theory Course | | | |

**Course Content:**

| Version No. | 1 | | | |
|---|---|---|---|---|
| Module 1 | Fundamentals of Software Testing | Assignment | Fundamentals of Software Testing | 15 Sessions |

Course Pre-requisites

Topics:
Relational Database Management Systems

Phases of Software Project – Quality assurance and Quality Control – Software Development Life Cycle (SDLC) Models – Software Testing and Its Types Software Testing Life Cycle (STLC).

| Module 2 | Test Case Development and Execution | Quiz/ Assignment | Test Case Development and Execution | 15 Sessions |
|---|---|---|---|---|

Course Description

The purpose of the Course is to introduce the students to issues in data mining, data pre-processing techniques, data mining tasks, association rules, advanced association rules, classification, and different approaches for classification, clustering, and outlier detection.

Topics:
Test Cases – Identification of Test case Scenarios – Test Case Template – Writing Test cases for Problems – Test Case Execution.

Topics include: Association rule mining, classification, clustering and outlier detection.

Course Objective

The objective of the course is to familiarize the learners with the concepts of Data Mining and attain Skill Development through Participative Learning techniques.

| Module 3 | Bug Reporting and Automation Testing | Assignment | Bug Reporting and Automation Testing | 15 Sessions |
|---|---|---|---|---|

Topics:
Defect Life Cycle, Bug Reporting – Template and Examples for Lab Exercises – Basics of Software Test Automation – Software Testing Metrics.

**On successful completion of the course the students shall be able to:**

• Explain the basic concepts and issues involved in Data Mining. [Remember]

Text Book

Course Out Comes

• Discuss different preprocessing techniques on Data Analysis. [Understand]

• Ralf Bierig, Stephen Brown, Edgar Galvan, Joe Timoney, "Essentials of Software Testing", Cambridge University Press, 2021

• Discover frequent item sets by using Association rule algorithms. [Apply]

• Srinivasan Desikan and Gopalaswamy Ramesh, "Software Testing – Principles and Practices", Pearson Education, 2016

• Apply different Classification and Clustering techniques used in data mining. [Apply]

References

• Cem Kaner, Jack Falk, Hung Q. Nguyen, "Testing Computer Software", Second edition, Wiley 2015

• Aditya P. Mathur, "Foundations of Software Testing _ Fundamental Algorithms and Techniques", Pearson Education, 2015

**Course Content:**

| Module 1 | Introduction to Data mining | Assignment | Introduction to Data mining | 11 Sessions |
|---|---|---|---|---|

E-Resources

Topics:
https://www.pdfdrive.com/testing-computer-software-d8618500.html

Introduction to Data mining – Data Mining Goals– Stages of the Data Mining Process–Data Mining Techniques– Applications.

| Module 2 | Types of data | Quiz/ Assignment | Types of data | 10 Sessions |
|---|---|---|---|---|

Topics:

Types of data – Data Quality – Data Preprocessing Techniques – Similarity and Dissimilarity measures.

| Module 3 | Motivation and terminology | Assignment | Motivation and terminology | 12 Sessions |
|---|---|---|---|---|

Topics:

Motivation and terminology – Basic idea: item sets – Generating frequent item sets and rules efficiently – Apriori Algorithm– FP Growth.

| Module 4 | Decision tree Induction | Assignment | Decision tree Induction | 12 Sessions |
|---|---|---|---|---|

Topics:

Decision tree Induction – Bayesian classification – Rule based classification – Classification by Back Propagation - Lazy learners – Modern evaluation and selection techniques to improve classification accuracy. Clustering Analysis – portioning method – Hierarchical methods –Basics of Density based method – Grid based methods. Anomaly detection preliminaries - Different Outlier detection techniques-Web mining-Text mining- Data mining software Application.

Text Book

- Tan P. N., Steinbach M & Kumar V. "Introduction to Data Mining", Pearson Education, 2016.

- Han J & Kamber M, "Data Mining: Concepts and Techniques", Elsevier, Second Edition, 2006

References

- G K Gupta, "Introduction to Data Mining with Case Studies", PHI, Third Edition, 2014

- Alex Berson and Stephen J. Smith, "Data Warehousing, Data Mining and OLAP", Tata McGraw – Hill.

E-Resources

https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=2233842&site=ehost-live

https://nptel.ac.in/courses/105106053

# CSA1700-Essentials of Cloud Computing

| Course Code: CSA1700 | Course Name: Essentials of Cloud Computing<br>Type of Course: Theory Course | L- T-P- C | 3-0-0-3 |
|---|---|---|---|
| Version No. | 1 | | |
| Course Pre-requisites | Computer Networks | | |
| Anti-requisites | NIL | | |
| Course Description | This course aims to introduce the core concepts of cloud computing to gain the foundational knowledge required for understanding cloud computing from a business perspective as also for becoming a cloud practitioner. From the course student will understand the definition and essential characteristics of cloud computing, its history, the business case for cloud computing, and emerging technology use cases enabled by cloud. This course covers on various cloud service models (IaaS, PaaS, SaaS), deployment models (Public, Private, Hybrid), the key components of a cloud infrastructure (VMs, Networking, Storage - File, Block, Object) and security issues in the cloud | | |
| Course Objective | The objective of the course is to familiarize the learners with the concepts of Essentials of Cloud Computing and attain Skill Development through Participative Learning techniques. | | |

# CSA1705-Blockchain Technology

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50 YEARS

| | |
|---|---|
| **Course Code:** CSA1705 | **On successful completion of the course the students shall be able to:** |
| **Course Out Comes** | • Understand the significance of Cloud computing technologies. [Understand] |
| **Version No.** 1 | • Identify appropriate Virtualization techniques to virtualize infrastructures. [Understand] |
| | • Demonstrate the different services provided by cloud [Apply] |
| **Course Pre-requisites** Nil | • Analyze cloud security issues in cloud computing. [Analyze] |
| **Anti-requisites:** Nil | |
| **Course Content:** Nil | |

**Course Name:** Blockchain Technology
**Type of Course:** Theory Course
**L-T-P-C** 3-0-0-3

**Module 1**
Topics:
**Course Description**
Cloud computing basics - Cloud computing components - Infrastructure - services - storage applications -
database services - Deployment models of Cloud - Services offered by Cloud - Benefits and Limitations of
Cloud Computing

The purpose of the course is to provide an introduction to Blockchain technology with
specific focus on industrial applications like Blockchain in Financial system, trade/supply
chains, manufacturing industry, Healthcare sectors and Insurance systems. With
the knowledge of blockchain technology. Students will learn how these systems are built,
how to interact with them.

**Course Objective**
The objective of the course is to familiarize the learners with the concepts of Blockchain
Technology and Applications and attain Skill Development through Problem solving
methodologies.

**Module 2**
Topics:
Virtualization – Enabling technology for cloud computing- Types of Virtualization- Server Virtualization-
Desktop Virtualization- Memory Virtualization- Application Virtualization- Virtualization Tools and Products
available for Virtualization.

**On successful completion of the course the students shall be able to:**
• Understand the concepts of Blockchain technology [Remember]
• Explain the methods for verification and validation of Bitcoin transactions [Understand]

**Course Out Comes**

**Module 3**
Topics:
Cloud Services (SAAS, PAAS, IAAS)
• Explain the use the Ethereum programming [Apply]
• Illustrate the role of blockchain in various domain [Understand]

Getting started with SaaS - Understanding the multitenant nature of SaaS solutions- Understanding Open
SaaS Solutions- Understanding Service Oriented Architecture PaaS- Benefits and Limitations of PaaS,
Security as a Service, Understanding IaaS- Improving performance through Load balancing- Server Types
within IaaS solutions- Cloud based NAS devices - Understanding Cloud based data storage- Cloud
based database solutions- Cloud based block storage

**Course Content:**

| Module | | Assessment | | Sessions |
|---|---|---|---|---|
| Module 1 | Introduction to Blockchain | Assignment | Introduction to Blockchain | 15 Sessions |
| Module 2 | Bitcoin | Quiz/Assignment | Bitcoin | 10 Sessions |
| Module 3 | Ethereum | Assignment | Ethereum | 10 Sessions |
| Module 4 | Blockchains in Business | Assignment | Blockchains in Business | 10 Sessions |

**Module 1**
Topics:
Incentives and proof of work, Simple Local Storage, Hot and Cold Storage, Online Wallets and Exchanges,
Payment Services, Transaction Fees, Cryptographic Hash Functions, Hash Pointers and Data Structures,
Digital Signatures.

Cloud Computing Software Security Fundamentals

**Module 2**
Topics:
Bitcoin Mechanics: Bitcoin transactions, Bitcoin Scripts, Applications of Bitcoin scripts, Bitcoin blocks, The
Bitcoin network, Limitations and improvements. Bitcoin mining: The task of Bitcoin miners, Mining
Hardware, Energy consumption, Mining pools, Mining incentives and strategies.

Cloud Information Security Objectives, Cloud Security Services, Authentication, Authorization, Auditing,
Accountability, Secure Cloud Software Requirements, Secure Development Practices, Approaches to Cloud
Software Requirements Engineering.
Problem Solving: Design and implement dynamic resource allocation for virtual machine using cloud
computing environment.

**Module 3**
Topics:
The Ethereum Network – Components of Ethereum Ecosystem – Ethereum Programming Languages-
Runtime Byte Code, Blocks and Blockchain, Fee Schedule – Supporting Protocols – Solidity Language.

**Text Book**
• R. Buyya, C. Vecchiola, S.T. Selvi, Mastering Cloud Computing, McGraw Hill (India) Pvt Ltd. 2013.
• Ronald L Krutz, Russell vines, Cloud Security: A Comprehensive Guide to Secure Cloud
Computing, Wiley Publishing Inc., 2010

**Module 4**
Topics:
Blockchain in Supply Chain - Blockchain in Manufacturing - Blockchain in Automobiles - Blockchain in
Healthcare- Blockchain in Financial Industry

**References**
• Douglas E. Comer, "The Cloud Computing Book: The Future of Computing Explained", Chapman
and Hall/CRC; 1st edition, July 2021
• Kris Jamsa; Cloud Computing: SaaS, PaaS, IaaS, "Virtualization, Business Models, Mobile,
Security and more, Jones & Bartlett Learning Company, 2013

**Text Book**
• Bellaj Badr, Richard Horrocks, Xun (Brian) Wu, "Blockchain By Example: A developer's guide to
creating decentralized applications using Bitcoin, Ethereum and Hyperledger", Packt Publishing
limited 2020.

**E-Resources**
https://onlinecourses.nptel.ac.in/noc19_cs63/preview?...text=Cloud%20Computing%20is%20a%20scalable,
etc.%20over%20the%20Internet.

# CSA2510-Computer Network and Administration Lab

| | • Bashir, I. (2023). *Mastering blockchain: Unlocking the power of cryptocurrencies, smart contracts, and decentralized applications* (4th ed.). Packt Publishing. | | | |
|---|---|---|---|---|
| References: Course Code: CSA2510 Imran Bashir "Mastering Blockchain: Distributed Ledger Technology, decentralization, and smart contracts explained", 2nd Edition, Packt Publishing Ltd, March 2018. | Course Name: Computer Network and Administration Lab Type of course: Lab Lab Integrated Course Ledger Technology, decentralization, and smart | | L-T-P-C | 0-0-6-3 |
| Version No. 1 | • Drescher, D. (2022). Blockchain basics: A non-technical introduction in 25 steps (2nd ed.). Apress. | | | |
| Course Pre-Requisites E-Resources | Computer Networks | | | |
| | https://www.udemy.com/course/build-your-blockchain-az/ | | | |
| Anti-requisites | Nil | | | |
| Course Description | The Computer Network and Administration Lab provides hands-on experience in configuring, managing, and troubleshooting computer networks. Students learn network protocols, IP addressing, subnetting, and routing using simulation tools and real hardware. The course covers network security, firewall configuration, and VPN setup. Practical exercises include server administration, network monitoring, and performance analysis. By the end, students gain skills in network setup, maintenance, and troubleshooting. | | | |
| Course Objective | The objective of the course is to familiarize the learners with the concepts of Computer Network and Administration and attain Skill Development through Experiential Learning techniques. | | | |
| Course Out Comes | **On successful completion of the course the students shall be able to:** CO1 Apply networking concepts by configuring IP addressing, subnetting, and routing in a simulated environment. (Apply) [Apply] CO2 Analyze network traffic and performance using monitoring tools to identify issues and optimize efficiency. (Analyze) [Analyze] CO3 Evaluate security threats and implement firewall and VPN configurations to protect network resources. (Evaluate) [Evaluate] CO4 Troubleshoot network connectivity and administration issues using diagnostic tools and systematic approaches. (Apply) [Apply] | | | |
| Course Content: | | | | |
| Module 1 | Basic Network Configuration | Assignment | Basic Network Configuration | 15 Sessions |
| **Topics:** Introduction to Networking and OSI Model -IP Addressing, Subnetting, and VLAN Configuration Configuring and Managing Switches & Routers- Network Simulation using Packet Tracer or GNS3 | | | | |
| Module 2 | Network Services and Administration | Assignment | Network Services and Administration | 15 Sessions |
| **Topics:** DHCP, DNS, and Web Server Configuration- File Sharing and Remote Access (FTP, SSH, Telnet) Firewall and NAT Configuration for Security- Virtual Private Network (VPN) Setup | | | | |
| Module 3 | Network Security and Troubleshooting | Assignment | Network Security and Troubleshooting | 15 Sessions |
| **Topics:** Network Traffic Monitoring and Packet Analysis (Wireshark)- Intrusion Detection and Prevention Systems (IDS/IPS)- Troubleshooting Network Connectivity Issues- Performance Optimization and Load Balancing | | | | |
| **List of Laboratory Tasks** 1. Study of Networking Devices and Topologies – Identify and understand different network devices (switches, routers, hubs) and topologies. 2. IP Addressing and Subnetting – Configure IPv4/IPv6 addressing and subnet networks for efficient allocation. 3. Configuring Basic Switch and Router Settings – Set up hostname, passwords, and basic commands for network devices. 4. VLAN Configuration and Inter-VLAN Routing – Implement VLANs and establish communication between them. 5. Static and Dynamic Routing (RIP, OSPF, EIGRP) – Configure and analyze routing protocols using Packet Tracer or GNS3. 6. Network Address Translation (NAT) and Port Forwarding – Set up NAT to allow internal network access to the internet. 7. Configuring DHCP Server – Set up and test dynamic IP allocation using a DHCP server. 8. Configuring DNS Server – Implement a DNS server for domain name resolution. 9. Setting Up Web Server (Apache/IIS) – Deploy and host a simple website on a web server. 10. File Transfer Protocol (FTP) Server Setup – Configure and test FTP file transfer. 11. Secure Shell (SSH) and Telnet Implementation – Establish remote access using SSH and Telnet. 12. Virtual Private Network (VPN) Configuration – Create and test a secure VPN connection. | | | | |

13. Packet Sniffing and Network Traffic Analysis – Use Wireshark to capture and analyze network packets.
14. Intrusion Detection System (IDS) Setup – Install and test Snort IDS for network security.
15. Configuring Firewalls (iptables/PFsense) – Set up and test firewall rules for securing networks.
16. Denial-of-Service (DoS) Attack Simulation and Mitigation – Simulate and defend against DoS attacks.
17. Wireless Network Security and Encryption (WPA, WPA2, WEP) – Configure and analyze wireless security settings.
18. Network Performance Analysis using Ping, Traceroute, and Netstat – Diagnose network issues using command-line tools.
19. Load Balancing and Redundancy (HAProxy, VRRP) – Implement high availability and redundancy in networks.
20. Troubleshooting Network Issues using Simulation Tools – Diagnose and fix network problems using Packet Tracer/GNS3.

| Text Book |
| --- |
| • Kurose, J. F., & Ross, K. W. (2021). Computer networking: A top-down approach (8th ed.). Pearson Education. <br> • Forouzan, B. A. (2017). Data communications and networking (5th ed.). McGraw Hill |
| References |
| • Donahue, G. A. (2011). Network warrior (2nd ed.). O'Reilly Media <br> • Ratan, A. (2017). Practical network automation: Deploying and managing Cisco networks. Packt Publishing. |
| E-Resources |
| NA |

# Discipline Specific Electives

# Track 1 - Full Stack and Front End

## CSA3422      .Net Programming Using C#

| Course Code: CSA3422 | Course Name: .Net Programming Using C# <br> Type of Course: Lab / Lab Integrated Course | L- T-P- C | 1-0-4-3 |
| --- | --- | --- | --- |
| Version No. | 1 | | |
| Course Pre-requisites | Familiarity with any programming language such as C, C++, Java, or Python including Basic knowledge of OOP concepts, including classes, objects, inheritance, polymorphism, and encapsulation | | |
| Anti-requisites | Nil | | |
| Course Description | This course provides an in-depth exploration of .NET programming using C#, enabling students to design and develop modern applications efficiently. The students will gain a solid foundation in the .NET framework and C# programming language, focusing on object-oriented principles, graphical user interface development, web and desktop application creation, and integration with databases. The course also emphasizes best practices and design patterns, ensuring the development of robust, scalable, and secure applications. | | |
| Course Objective | The objective of the course .NET programming using C# is to familiarize the learners with the concepts of .Net Framework architectures, C# Programming language and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques | | |
| Course Out Comes | **On successful completion of the course the students shall be able to:** <br> **CO1**  Use OOPS concepts in C# for solutions to real-world problems  [Apply] <br> **CO2**  Design and implement robust console-based and desktop applications using C# and the .NET framework.  [Create] <br> **CO3**  Create interactive GUI-based applications in C# to enhance user experience.  [Create] <br> **CO4**  Develop database-driven applications using ADO.NET for efficient data management  [Create] | | |
| Course Content: | | | |
| Module 1 | Introduction to .NET Framework | Assignment | Introduction to .NET Framework | 15 Sessions |
| **Topics:** | | | | |

## CSA3423      No SQL

Understanding .NET Framework: An overview of the .NET, Key benefits of .NET Platform, Introduction to .NET framework and .NET, Architecture-.Net Framework Class Libraries-CLR- Name Space, Assemblies, MSIL, Understanding Common Type Systems (CTS), Common Language Specifications, Introduction to Visual Studio.Net, Languages supported by .NET, Different Applications of .NET.

| Course Code: CSA0420 | Course Name: No SQL  Type of Course: Lab / Lab Integrated Course | | L- T-P- C | 1-0-4-3 |
|---|---|---|---|---|
| Module No. Version No. | C# Language Basics | Assignment | C# Language Basics | 15  Sessions |
| Course Pre-requisites  Anti-requisites | Basic understanding of database concepts. Familiarity with SQL and relational database management systems. | | | |

The C# Language: Working with system Data Types and C# Keywords, Literals, and Variables, Operators, Type Conversion and Casting, Program Control Statements, Looping Statements, Understanding Arrays and Strings, Methods and Classes. Collections. Collections. Introduction to Windows Forms- The System Windows.Forms Namespace, Windows Forms Development, Windows Forms and Web Forms.

| Module 3  Course Description | This course develops an understanding of NoSQL databases, their architecture, and their applications in modern data-driven environments. Students will explore the key concepts, types, and use cases of NoSQL databases, focusing on their scalability, flexibility, and performance advantages over traditional relational databases. The course covers various NoSQL database models, including Key-Value, Document-Oriented, Column-Family, and Graph Databases with practical examples and hands-on experience. Students will gain the skills to design, implement, and manage NoSQL databases for real-world applications such as Big Data, IoT, and E-commerce systems. | | | 25  Sessions |

Topics:
The architecture of a class in C#, instance, Class & Reference variables, Access Modifier, Abstract Classes, Constructors, Destructors, Inheritance in C#, Method Overloading, Method Overriding, Operator Overloading, Method Hiding, Access modifiers, Sealed Classes and Methods, Partial Classes and Methods, Abstract Classes, Creating Interfaces.

| Course Objective | The course No SQL aims to equip BCA students with foundational knowledge and practical skills in NoSQL databases, focusing on their architecture, types, and applications. Students will learn to design, implement, and manage scalable, distributed systems using NoSQL database. | | | |
| Module 4 | Database Programming Using ADO.NET | Assignment | Database Programming Using ADO.NET | 20 Sessions |

**On successful completion of the course the students shall be able to:**

| Topics:  Course Outcomes | **CO1** | Understand NoSQL Fundamentals | [Understand] |
| | **CO2** | Perform Practical NoSQL Operations | [Apply] |
| | **CO3** | Design Scalable Systems | [Create] |
| | **CO4** | Apply NoSQL in Real-World Scenarios | [Apply] |

Database Programming using ADO.NET: Introduction and Evolution of ADO.NET, Understanding the Role of Managed Provider and ADO.NET Objects, Connecting to Database and Connection Pooling, Performing Insert, Update and Delete Operations, Fetching Data from the database, Executing Select Statements.

**List of Laboratory Tasks**

Course Content:

| Module 1 | Experiment No. 1:  Introduction to NoSQL Databases  Level 1: Install Visual Studio, a robust IDE for developing .NET applications on Windows.  Level 2: Identify the Components of Integrated Development Environments. | Assignment | Introduction to NoSQL Databases | 15  Sessions |

Topics:
Overview of NoSQL and its importance, Differences between SQL and NoSQL databases, Installation and setup of NoSQL databases (MongoDB, Cassandra, Redis, Neo4j), Introduction to basic NoSQL commands.

Level 3: Identify the Types of Projects supported by the .NET Framework.
Level 2: Identify the controls that are available for Windows Form Applications. List any 10 Common Controls and their basic Properties.

| Module 2 | Experiment No. 3:  Document-Oriented and Key-Value Databases | Assignment | Document-Oriented and Key-Value Databases | 15  Sessions |

Topics:
Understanding document-oriented databases (MongoDB), CRUD operations in MongoDB, Data modeling and schema design in MongoDB, Introduction to key-value stores (Redis), Working with Redis data  structures (strings, lists, sets, and hashes).

Level 1: Create a console application in C# that performs basic arithmetic operations (addition, subtraction, multiplication, and division)
Level 2: Create a console application in C# for Simple Interest and Compound Interest
Experiment No 4:
Level 1: University wants to store the student details. Get the student details such as Roll number, fname, lname, Semester, Specialization and display all details. Design a windows application form to accept user input.

| Module 3 | Column-Family Databases (Cassandra) | Assignment | Column-Family Databases (Cassandra) | 20  Sessions |

Level 2: Design a Windows application to calculate the Simple Interest (S.I) by providing Principal (p), Rate(r)

Topics: and Time (t). Hint: S.I= (p × r × t)/100
Introduction to column-family databases and their architecture, Basics of Apache Cassandra and its use cases , Creating keyspaces and tables in Cassandra, Performing CRUD operations using Cassandra Query Language, Data partitioning, replication, and consistency in Cassandra.

Experiment No 1: Write a C# program that calculates the sum of the digits of a given positive integer using the while loop. The program should:
Take a positive integer as input from the user.
Use a while loop to extract each digit of the number.

| Module 4 | Graph Databases (Neo4j) | Assignment | Graph Databases (Neo4j) | 25  Sessions |

Display the final sum of the digits.

Topics:
Introduction to graph databases and their applications Nodes, relationships, and properties in Neo4j ,Querying graph databases using Cypher, Real-world use cases of graph databases, Indexing, aggregation, and performance optimization in MongoDB, Sharding and replication in NoSQL databases, Security and access control in NoSQL databases.

Level 2: Write a C# program that takes the marks of a student as input and calculates their grade based on the following criteria:
Marks >= 90: Grade A
Marks >= 80 and < 90: Grade B
Marks >= 70 and < 80: Grade C
Marks >= 60 and < 70: Grade D
Marks >= 50 and < 60: Grade E
Marks < 50: Fail

List of Laboratory Tasks
Module 1: Introduction to NoSQL Databases (MongoDB, Cassandra, Redis, Neo4j)
(6 Experiments)
1. Install MongoDB locally and connect using Mongo Shell.
2. Install Cassandra and verify cluster setup.
3. Install Redis and perform basic commands (SET, GET).
4. Install Neo4j Desktop and explore Neo4j Browser.

Experiment No 6:
Level 1: Create a C# Program to implement Vowels Program using Select Case.

Experiment No 7:
Level 2: Create a C# program to Print Fibonacci Series for the given input

5. Compare SQL vs NoSQL data models using simple examples. Also include following: Default

6. Execute basic commands (create database, Display records) in NoSQL databases.

Level 2: Design a class to represent a bank account. Include the following members: Data Members: - Name

Module 2: Document-Oriented and Key-Value Databases (MongoDB, Redis) of the depositor, Account number, Balance amount in the account and methods : To assign

(8 Experiments) initial values, To deposit an amount, To withdraw an amount after checking balance, To display name and the

7. Create a MongoDB collection and insert data and demonstrate the working of the various class members.

8. Perform CRUD operations on MongoDB documents.

9. Design a Design a class to represent a advance account (the following members): Data Members: - Name

10. Perform indexing And MongoDB filter, Type of Account, Balance amount in the account and methods : To assign

11. Insert and store different data types (strings, lists, sets, hashes) in Redis balance, To display name and the

12. balance. Write a program to demonstrate the working of the various class members.

13. Simulate a simple C# Program using the Socket of States triangle, square, and rectangle using method

14. Overloading session store system using Redis (e.g., for login sessions).

Module 3: Column-Family Databases (Apache Cassandra)

(8 Experiments) Level 1: Write a C# program where the Student class inherits from the Person class. The Person class

15. Create a Keyspace and table in Cassandra the StudentCQL class adds the Course property. Display the information of

16. Insert and retrieve data using Cassandra Query Language (CQL).

17. Level 2: Write a C# program where the Teacher class inherits the Person class. Override the DisplayInfo

18. Demonstrate Partitioning by storing data with different partition keys information and their subject.

19. Experiment with Replication by setting replication factor in Cassandra.

20. Query 1: Create a Class Called Rectangle class with width using constructor. Calculate the area using

21. Simulate a table updating using class and multiple Class and cost of designing (if the table code is single).

22. Analyze Consistency Level settings (ONE, QUORUM, ALL) in Cassandra queries.

Level 2: Admin executive of the university is entering the university name for the students. If he enters the

Module 4: Graph Databases (Neo4j) name wrongly, an error should be raised.

(8 Experiments)

**Text Book** 23. Create nodes and relationships in Neo4j (e.g., Students-Friends, Company-Employee).

24. Andrew Troelsen Perform basic Cypher queries: MATCH, CREATE, RETURN. "C# 10 with .NET 6 – Foundational Principles and Practices

25. in Programming", Design a Movie Recommendation Graph. Apress Publishers, USA, 2022

26. Herbert Schildt, "C# 4.0: The Complete Reference", Use Neo4j to model a social network (likes follows comments). Tata McGraw-Hill Publishers, 4th Edition, 2017

**References** 27. Execute aggregation queries in Neo4j (e.g., count relationships).

28. Thuan L. Thai Perform indexing and constraint creation in Neo4j for optimization. ".Net Framework Essentials: Introducing the .net Framework", O'reilly Media Inc 2004, [ISBN:

29. 978-0-59-000305-4] Create complex Cypher queries: optional matches, patterns, subqueries.

30. Analyze real-world case study: Supply Chain Management graph using Neo4j. Mark J. Price, "C# 12 and .NET 8 – Modern Cross-Platform Development Fundamentals", 8th Edition, Packt

Publishing, 2023 [ISBN 978-1-83763-587-0].

**Text Book**
NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence by Pramod J. Sadalage and Martin Fowler.
• MongoDB: The Definitive Guide by Kristina Chodorow.

**E-Resources**
https://www.codecademy.com/learn/learn-c-sharp
https://docs.microsoft.com/en-us/learn/csharp

**References**
https://www.learncs.org/
https://www.codecademy.com/learn/courses/c-sharp Cassandra documentation: https://cassandra.apache.org/doc/latest/.
https://csharp-station.com Adam Fowler "NoSQL For Dummies", Wiley, 2015.

**E-Resources**
https://www.mongodb.com/resources/basics/databases/nosql-explained

## CSA3426    Front-End Development using Java Script

| Course Code: CSA3426 | Course Name: Front-End Development using Java Script<br>Type of Course: Lab / Lab Integrated Course | L- T-P- C | 1-0-4-3 |
|---|---|---|---|
| Version No. | 1 | | |

## CSA3427-Web Application Development

| Course Pre-requisites | NIL | | |
|---|---|---|---|
| Course Code: CSA3427 Anti-requisites | Course Name: Web Application Development Type of Course: Lab / Lab Integrated Course NIL | L- T-P- C | 1-0-4-3 |
| Version No. Course Pre-requisites | 1 This intermediate course enables students to perform front-end development using Javascript, with emphasis on employability skills. The course covers key technologies and architectures that enables the student to design and implement front-end. On successful completion of this course, the student shall be able to pursue a career in front end development. The students shall develop strong problem-solving skills as part of this course. NIL | | |
| Anti-requisites Course Objective | NIL The objective of the course is to familiarize the learners with the concepts of Front-end Development This course is designed to build the student's knowledge, experimental design and development to an | | |
| Course Description Course Out Comes | On successful completion of the course the students shall be able to markups for front-end web programming. Design and develop static web pages using HTML5 see, students should [Apply] able to design, program and publish a working and atheistic website. Students will also go through the process of working in a developers group using agine CSS, skills a script is necessary to successfully fulfill each role. The associated laboratory provides a platform to implement the various programming language to design web pages and enhance critical thinking to develop analytical skills[Apply] | | |
| Course Objective | The objective of the course is to familiarize the learners with the concepts of Web Application and attain Skill Development through Participative Learning techniques.:-end. [Apply] | | |
| Course Content: | On successful completion of the course the students shall be able to: | | |
| Module 1 Course Out Comes | CO1 Understand and briefly explained the semantics and syntax of [Apply] Introduction to Front-End Development HTML and CSS. | Introduction to Front End Development | 20 Sessions |
| Topics: Web development basics, Introduction to HTML5 structure, Semantic elements, Forms and inputs, Introduction to CSS3 styling, Selectors and properties, Box model, Flexbox and Grid, Introduction to JavaScript, Variables, Data types, Operators, Conditional statements, Loops, Functions. | CO2 Design and develop client side scripts and web pages using [Apply] HTML, CSS and Java script CO3 Understand PHP language and use them while applying the [Apply] principles of object oriented development CO4 Develop dynamic and interactive web applications by integrating [Apply] front-end and back-end technologies | | |
| Module 2 Course Content: | Advanced JavaScript & Interactive Web Elements | Advanced JavaScript & Interactive Web Elements | 25 Sessions |
| Module 1 Topics: | Web Development Basics | Web Development Basics | 15 Sessions |
| Topics: JavaScript Events, DOM Manipulation, Form validation, Local and session storage, ES6 concepts (Arrow functions, Spread/Rest Operators, Destructuring). Introduction to Bootstrap, Grid system, Forms, Navigation bars, Buttons, Cards, Tables, Modal windows. Introduction to web development, HTML Introduction, head, body, footer, text formatting, images, including, hyperlinks, tables, forms, CSS styling, inline vs external CSS, CSS box model, tables & lists, basic layout design. | | | |
| Module 3 | AJAX, jQuery & Responsive Web Design JavaScript & Client-Side Scripting | AJAX, jQuery & Responsive Web Design JavaScript & Client-Side Scripting | 25 Sessions 15 Sessions |
| Topics: Introduction to JavaScript, variables, operators, functions, events, form validation, loops, DOM manipulation, timers, JavaScript objects, JavaScript math operations, event handling, HTML-CSS-JS integration. Understanding AJAX and asynchronous JavaScript, Fetch API vs XMLHTTPRequest, Handling JSON data, jQuery basics, Selectors, Effects (Hide, Show, Toggle, Fade, Slide), Event handling in jQuery, Animations, Creating a dynamic content loader with AJAX & jQuery. | | | |
| Module 3 | Introduction to PHP, | Introduction to PHP, | 15 Sessions |
| Module 4 Topics: Introduction to PHP, syntax, variables, operators, conditional statements, loops, arrays, functions, handling user input, form validation, sessions and cookies, file handling in PHP, PHP and database connectivity using MySQL. | AngularJS & Django Integration | AngularJS & Django Integration | 15 Sessions |
| Topics: Introduction to AngularJS, Directives, Controllers, Data binding, Routing, Creating Angular components, Fetching API data with Angular, Introduction to Django, Creating views and templates, Static files and media, Connecting Django with Angular for dynamic web applications. | | | |
| Module 4 | XML & Web Application Development | XML & Web Application Development | 20 Sessions |
| Topics: Introduction to XML, XML structure and syntax, XML with CSS & XSLT, data storage, integrating XML with PHP, designing dynamic web applications, Practical-Server communication, validations, security considerations. | | | |
| List of Laboratory Tasks | Laboratory Tasks | | |

**List of Laboratory Tasks**

Experiment No. 1 [4 + 1 Practical Sessions]
Level 1: Familiarization of HTML and CSS basics.
Level 2: Create an HTML webpage showcasing biodata with CSS styling.

Lab Sheet - 1
Experiment No. 2: [4 + 1 Practical Sessions]
Level 1: Design an interactive web page for a new restaurant using CSS3 features, tags and an image.
Level 2: Create a simple web form to gather user information

Level 1: Design a simple web page with head, body, and footer, including heading tags and an image.
Level 2: Design a product information page displaying product name, brand, price, etc., using a table.

Experiment No. 2
Experiment No. 3 [5 + 1 Practical Sessions]
Level 1: Create a book information website with a homepage listing books. Clicking a book should open its details page.
Level 1: Practice basic JavaScript exercises, including creating a canvas drawing application.
Level 2: Implement JavaScript exercises for form validation, gender, mobile number, email, city, state, and
Level 2: Design a user information form with fields like name, gender, mobile number, email, city, state, and country.

Experiment No. 4 [5 + 1 Practical Sessions]

Lab Sheet 2 Create a student registration form using JavaScript.
Experiment 2: Design an RSVP form using Bootstrap form controls.
Sheet 1: Design a web page with background images, text colors, and borders using external CSS.
Experiment No. 5 [4+1 Practical Sessions] for addition, subtraction, multiplication, and division.
Experiment No. 2 Create a responsive image grid using Bootstrap 5.
Level 2: Create a JavaScript program using AJAX to dynamically load content and implement jQuery effects like fading.
Level 2: Capture student details (ID, name, age, marks) using JavaScript objects.
Lab Sheet No. 6 [5 + 1 Practical Sessions]
Experiment No. Create an AngularJS application module and controller in app.js.
Level 2: Design a JavaScript Smart System that are squared data visualizations from 0 to 10.
Experiment 2: Display the results in a HTML table format.
Experiment No. 2 Develop a simple Django app that displays an unordered list of fruits and ordered list of selected students. Develop a JavaScript effect to display the text "PRESIDENCY-UNIVERSITY" with an increasing font size. Develop a layout.html with a suitable header (containing navigation menu) and footer with copyright and developer information, displaying School of Engineering, the pages include to About Us and Home page of any website.

| | |
|---|---|
| Text Book | Experiment No. 1 |

- Level 1: Write a PHP program to find the sum of digits 2018 given number.
- Northwood, Chris, "The Full End Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer", APress, 2018

| | |
|---|---|
| References | Level 1: Write a PHP script to track and display the number of visitors to a web page. |

- Flanagan D'S, "Javascript: The Definitive Guide 7th Edition 7th ed. O'Reilly Media; 2020.
- Alex Libby, Gaurav Gupta, and Asoj Talesra. "Responsive Web Design with HTML5 and CSS3 Essentials", Packt Publishing, 2016

Level 1: Write a PHP program to sort student records stored in a database using selection sort.
Level 2: Design an XML document to store student details (USN, Name, Course, Year, Email) and use a stylesheet to display the data

| | |
|---|---|
| E-Resources | Lab Sheet 6 |

Mozilla Developer Network (MDN): https://developer.mozilla.org/en-US/
W3Schools - HTML, CSS & JavaScript: https://www.w3schools.com/
CSS Tricks: https://css-tricks.com/
JavaScript.info (Advanced JS Concepts): https://javascript.info/
Bootstrap 5 Documentation: https://getbootstrap.com/docs/5.0/getting-started/introduction/
jQuery Documentation: https://api.jquery.com/
AngularJS Guide: https://angularjs.org/
Django Official Documentation: https://docs.djangoproject.com/en/stable/

Level 1: Write a PHP script to validate phone numbers and display a message if incorrect.
Level 2: Write a regular expression in PHP to match email addresses and validate input.

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|---|---|
| Text Book | |

- Robert. W. Sebesta, "Programming the World Wide Web", Pearson Education, 9th Edition, 2016.
- Paul Deitel, Harvey Deitel, Abbey Deital "Internet & World Wide Web How to Program", Fifth Edition, Pearson Education, 2021.

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| References | |

- Randy Connolly, Ricardo Hoar,"Fundamentals of Web Development", Pearson Education India,1st. Edition.2016.
- Randy Connolly, Ricardo Hoar,"Fundamentals of Web Development", Pearson Education India,1st. Edition. 2016.

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|---|---|
| E-Resources | |

Mozilla Developer Network (MDN): https://developer.mozilla.org/en-US/
W3Schools - Web Technologies: https://www.w3schools.com/
PHP Manual: https://www.php.net/manual/en/
Bootstrap 5 Documentation: https://getbootstrap.com/docs/5.0/getting-started/introduction/
jQuery Documentation: https://api.jquery.com/

## CSA3424    Agile Structures and Frameworks

| Course Code:<br>CSA3424 | Course Name: Agile Structures and Frameworks<br>Type of Course: Theory Course | L- T-P- C | 3-0-0-3 |
|---|---|---|---|
| Version No. | 1 | | |
| Course Pre-requisites | Software Engineering | | |

| Anti-requisites | Nil |
| --- | --- |
| Course Description | This course imparts knowledge to students in the basic concepts of Agile Software Process, methodology and its development   The objective of this course is to provide the fundamentals concepts of Agile and its Significance.   This course covers the Agile and its methodologies.   The objective of the course is to understand the Agility and Assurance. |
| Course Objective | The objective of the course Agile Structures and Frameworks is EMPLOYBILITY of student by using PARTICIPATIVE LEARNING techniques |
| Course Out Comes | **On successful completion of the course the students shall be able to:**<br>• Understand the basic concepts of Agile Software Process  [Understand]<br>• Comprehend the various Agile Methodologies  [Understand]<br>• Design Agile Software Process [Apply]<br>• Apply principles of Agile Testing  [Apply] |

Course Content:

| Module 1 | Introduction | Assignment | Introduction | 10  Sessions |
| --- | --- | --- | --- | --- |

Topics:
Introduction to Agile technology, Iterative and Evolutionary Methods,  Agile – Agile Development. Agile Values, Agile Principles, Compare and Contrast the agile with traditional methods. Agile Benefits. Agile Estimation Techniques. Case Study

| Module 2 | Agile and Its Significance | Quiz/ Assignment | Agile and Its Significance | 12  Sessions |
| --- | --- | --- | --- | --- |

Topics:
Agile Story : Evolutionary delivery ,Scrum Demo, Planning game, Sprint back log, adaptive planning. Agile Motivation – Problems With The Waterfall - Research Evidence. Scrum : Method Overview ,Life cycle phases and Work product roles and practices.

| Module 3 | Agile methodology | Assignment | Agile methodology | 13  Sessions |
| --- | --- | --- | --- | --- |

Topics:
Extreme Programming: Method Overview ,Life cycle phases and Work product roles and practices.  Unified process : Method Overview ,Life cycle phases and Work product roles and practices. EVO : Method Overview ,Life cycle phases and Work product roles and practices. Case Study.

| Module 4 | Agility and Quality Assurance | Assignment | Agility and Quality Assurance | 10  Sessions |
| --- | --- | --- | --- | --- |

Topics:
Agile product development – Agile Metrics – Feature Driven Development (FDD). Agile approach to Quality Assurance. Test Driven Development – Agile approach in Global Software Development. Agile Technology Tools.

Text Book
- Craig Larman, "Agile and Iterative Development – A Manager's Guide", Pearson Education – 2006
- Edward Scatter "Brilliant Agile Project Management: A Practical Guide to Using Agile, Scrum and Kanban, 2015

References
- Chetankumar Patel, Muthu Ramachandran, Story Card Maturity Model (SMM): A Process Improvement Framework for Agile Requirements Engineering Practices, Journal of Software, Academy Publishers, Vol 4, No 5 (2009), 422-435, Jul 2009.
- Hazza& Dubinsky, Agile Software Engineering, Series: Undergraduate Topics in Computer Science, Springer 2009

E-Resources
https://presiuniv.knimbus.com/user#/home

## CSA3425        Introduction to Devops

| Course Code: CSA3425 | Course Name:  Introduction to Devops<br>Type of Course: Theory Course | L- T-P- C | 3-0-0-3 |
|---|---|---|---|
| Version No. | 1 | | |
| Course Pre-requisites | Agile frameworks | | |
| Anti-requisites | Nil | | |
| Course Description | The course Introduction to DevOps is designed to offer profound perceptions and knowledge in various tools like Git, Ansible, Jekins. With the proficient learning of DevOps course, a student will be able to work in all the above tools and become a trained practitioner in the integration and monitoring of software. DevOps Tool is an application that helps the software development process to industrialize. It mainly focuses on communication and collaboration between product management, software development, and operations professionals. The objective of this course is to discuss and implement the various tools usage and internals practically. | | |
| Course Objective | The objective of the course Introduction to DevOps is SKILL DEVELOPMENT of student by using PARTICIPATIVE LEARNING techniques | | |
| Course Out Comes | **On successful completion of the course the students shall be able to:**<br>• Apply the features and common Git workflow  [Apply]<br>• Practice  the Docker container and Saving Changes To A Docker Container  [Apply]<br>• Practice the filters and plugins to populate, manipulate, and manage data used by Ansible  Playbooks.  [Apply]<br>• Interpret the installation and features of Jenkins and build jobs.  [Apply] | | |
| Course Content: | | | |

| Module 1 | Introduction to DEVOPS and GIT Operations | Assignment | Introduction to DEVOPS and GIT Operations | 12  Sessions |
|---|---|---|---|---|
| Topics:<br>Basic Linux Commands, Software Development Lifecycle, Waterfall Model, Agile Model, Lean Methodology, Waterfall Vs Agile Vs Lean,Devops and its tools. Version Control With Git, Introduction to Git, Features of Git, Benefits, Workflow, Git vs GitHub, Installation of Git on Windows/Linux and Environment set up, All Git Commands-Working with local and remote repositories, Running first Git command, Fundamentals of Repository structure and file status life cycle, Working locally with staging, unstaging and commit. | | | | |
| Module 2 | Containerization Using Docker | Quiz/ Assignment | Containerization Using Docker | 10  Sessions |
| Topics:<br>Docker Life Cycle,Docker Installation, Docker Operations,Docker Concepts - Registry, Repository, Tag, Image and Containers, Create A Docker Hub Account, Docker Images and Containers, Pushing Docker To Container Hub, Docker File. | | | | |
| Module 3 | Ansible | Assignment | Ansible | 10  Sessions |
| Topics:<br>Ansible Workflow, Architecture, Installation in Linux/Windows, ad-hoc Commands, Playbooks, Tower, Roles, Variables open link, Tags, Galaxy, Commands Cheat Sheets, Modules, Shell, Templates, YAML, | | | | |

| Inventory, Debug, Apt, Lineinfile, Copy, Command, File, Vault, Windows, Yum, AWX, Unarchive, Ansible Pip | | | | |
|---|---|---|---|---|
| Module 4 | Jenkins | Assignment | Jenkins | 13 Sessions |

**Topics:**
Introduction To Continuous Integration, Jenkins Architecture, Managing Nodes On Jenkins, Jenkins Master Node Connection, Jenkins Integration With Devops Tools, Understanding CI/CD Pipelines, Creating A CI/CD Pipeline

**Text Book**
- Craig Berg, "DevOps For Beginners: A Complete Guide to DevOps Best Practices (Including How You Can Create World-Class Agility, Reliability, And Security In Technology Organizations With DevOps) (Code tutorials)", Paperback – June 12, 2020.
- Ferdinando Santacroce, "Git Essentials", Packt Publishing, April 2015

**References**
- Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans", Leanpub, August 5, 2020
- Gaurav Agarwal, "Modern DevOps Practices: Implement and secure DevOps in the public cloud with cutting-edge tools, tips, tricks, and techniques", July 2021.

**E-Resources**
Tutorials on GIT https://www.simplilearn.com/tutorials/git-tutorial/git-tutorial-for-beginner
Basics of Ansible https://www.javatpoint.com/ansible
Jenkin plugin informations https://www.tutorialspoint.com/jenkins/jenkins_managing_plugins.htm

# Track 2 - AIML and Data Science

### CSA3400      Computational Data Modelling and Visualization

| Course Code: CSA3400 | Course Name: Computational Data Modelling and Visualization<br>Type of Course: Lab / Lab Integrated Course | | L- T-P- C | 1-0-4-3 |
|---|---|---|---|---|
| Version No. | 1 | | | |
| Course Pre-requisites | Python Programming | | | |
| Anti-requisites | NIL | | | |
| Course Description | The purpose of the course is to install a strong foundation of scientific process orientation that is the cornerstone of effective data handling, and creative design thinking appended with strong programming skills to create meaningful visualizations of data. The student should have prior knowledge of python programming and basic knowledge of data concepts. The associated laboratory provides an opportunity to strengthen student's skillset in the arena of Data Preprocessing and Visualization. With a good knowledge in the fundamental concepts of the various libraries for handling and visualizing data the student can gain a stronghold in Data Science enabling the student to be an effective analyst for prospective employers. | | | |
| Course Objective | The objective of the course is to familiarize the learners with the concepts of Data Analysis and Visualization and attain EMPLOYABILITY through Experiential Learning techniques. | | | |
| Course Out Comes | **On successful completion of the course the students shall be able to:**<br>CO1   Understand the various types of data, apply and evaluate the principles of data visualization.   [Apply]<br>CO2   Acquire skills to apply visualization techniques to a problem and its associated dataset.   [Apply]<br>CO3   Create interactive visualization for better insight using various visualization tools   [Apply]<br>CO4   Implement the visualization concepts practically using Python   [Apply] | | | |
| Course Content: | | | | |
| Module 1 | Introduction to Data Modelling (Python Basics & EDA) | Assignment | Introduction to Data Modelling (Python Basics & EDA) | 20 Sessions |

| Topics: |
|---|
| Introduction to Data Science & Python, Overview of Data Modeling & Statistical Analysis, Python Libraries: NumPy, Pandas, Matplotlib, Seaborn, Data Importing & Preprocessing, Handling Missing Values & Outliers, Feature Engineering & Feature Selection,Exploratory Data Analysis (EDA) |

| Module 2 | Statistical Data Modelling & Machine Learning | Assignment | Statistical Data Modelling & Machine Learning | 25 Sessions |
|---|---|---|---|---|

| Topics: |
|---|
| Probability Distributions: Normal, Binomial, Poisson, Hypothesis Testing (t-test, ANOVA, Chi-Square), Correlation and Regression Analysis (Linear, Multiple, Polynomial), Principal Component Analysis (PCA) & Linear Discriminant Analysis (LDA), Time Series Analysis & Forecasting, Market Basket Analysis (Association Rule Mining). |

| Module 3 | Data Visualization Techniques | Assignment | Data Visualization Techniques | 15 Sessions |
|---|---|---|---|---|

| Topics: |
|---|
| Introduction to Data Visualization, Visualization Libraries in Python (Matplotlib, Seaborn, Plotly), Basic Plots (Bar, Line, Scatter, Histogram, Pie), Advanced Plots (Heatmaps, Boxplots, Violin Plots), Time Series Visualization, Geographic & Financial Data Visualization, Dashboard Development with Plotly Dash. |

| Module 4 | Big Data Handling in Python | Assignment | Big Data Handling in Python | 15 Sessions |
|---|---|---|---|---|

| Topics: |
|---|
| Big Data Handling in Python (Dask, Spark), Clustering Techniques (K-Means, Hierarchical Clustering), Deep Learning for Data Analysis (Introduction to TensorFlow/PyTorch), Streaming Data Visualization (Real-time data analysis), Financial Data Analysis & Visualization, Final Project: End-to-End Data Science Pipeline. |

**List of Laboratory Tasks**

Labsheet -1
Working with Numpy Functions
Labsheet -2
 Pandas functions
Labsheet -3
Acquiring and plotting data.
Labsheet -4
Practicals based on Data Cleaning and Preparation
Labsheet -5
Practicals based on Data Wrangling
Labsheet -6
Statistical Analysis – such as Multivariate Analysis, PCA, LDA, Correlation regression and analysis of variance
Labsheet – 7
Practicals based on Data Visualization using matplotlib
Labsheet -8 & 9
Visualization of various massive dataset - Finance - Healthcare - Census
Labsheet – 4 10
Practical based on Time Series Data Analysis-stock market
Labsheet -11
Market-Basket Data analysis-visualization
Labsheet -12
Text visualization using web analytics
Labsheet -13 & 14
Financial analysis using Clustering, Histogram and HeatMap
Labsheet -15
Visualization on Streaming dataset (Stock market dataset, weather forecasting)

**Text Book**
- Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016.
- McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy and IPython. 2nd edition. O'Reilly Media. W.(2017)

**References**
- Dr.Chun-hauh Chen, W.K.Hardle, A.Unwin, Handbook of Data Visualization, Springer publication, 2016.
- Christian Toninski, Heidrun Schumann, Interactive Visual Data Analysis, CRC press publication,2020 3. Alexandru C. Telea, Data Visualization: Principles and Practice, AK Peters, 2014.

**E-Resources**

## CSA3401-Information Retrieval

| Course Code:<br>CSA3401 | Course Name: Information Retrieval<br>Type of Course: Theory Course | L- T-P- C | 3-0-0-3 |
|---|---|---|---|
| Version No. | 1 | | |
| Course Pre-requisites | ML USING PYTHON    Basics of Data mining such as classification and clustering techniques | | |
| Anti-requisites | NIL | | |
| Course Description | The course is an intermediary course and aims to provide students with an in-depth understanding of design and implementation of data warehousing and data mining. The course will help students to enhance their understanding of various classification, clustering and outlier analysis methods. An interest to understand the concepts of data warehousing, data mining and a desire to be a successful data scientist are key to enable students to complete the course successfully.   Topics include: Data Model for Data Warehouses, data extraction, cleansing, transformation and loading, data cube computation, materialized view selection, OLAP query processing. Data mining-Fundamentals. Mining Techniques and Application: Classification, Clustering, Outlier analysis. | | |
| Course Objective | The objective of the course is SKILL DEVELOPMENT of student by using PARTICIPATIVE LEARNING techniques | | |
| Course Out Comes | **On successful completion of the course the students shall be able to:**<br>• Define basic concepts of information Retrieval  [Remember]<br>• Calculate the effectiveness and efficiency of different information retrieval methods [Apply]<br>• Calculate the effectiveness and efficiency of different information retrieval methods [Apply]<br>• Classify different recommended system and its aspect.  [Understand] | | |
| Course Content: | | | |
| Module 1 | Introduction to Information Retrieval | Assignment | Introduction to Information Retrieval | 10  Sessions |

Topics:
Information Retrieval: Web Search, Other IR Applications, Information Retrieval Systems: The Software Architecture, Documents and Update, Performance Evaluation, Open Source IR Systems: Lucene, Indri, Wumpus, Basic Techniques: Inverted Indices, Retrieval and Ranking, Evaluation.

| Module 2 | Indexing     Assignment Case studies / Case let   12 Sessions | Quiz/ Assignment | Indexing Assignment  Case studies / Case let   12 Sessions | 10  Sessions |

Topics:
Static Inverted Indices: Index Components and Index Life Cycle, The Dictionary, Postings Lists, Interleaving Dictionary and Postings Lists, Index Construction, Other Types of Indices, Query Processing: Query Processing for Ranked Retrieval, Lightweight Structure, Index Compression: General-Purpose Data Compression, Symbol-wise Data Compression, Compressing Postings Lists, Compressing the Dictionary, Dynamic Inverted Indices: Batch Updates, Incremental Index Updates, Document Deletions, Document Modifications.

## CSA3402-Statistical Analysis using R Programming

| Module 3 | Retrieval and Ranking | Assignment | Retrieval and Ranking | 12  Sessions |

Topics:
Probabilistic Retrieval: Modeling Relevance, The Binary Independence Model, The Robertson/Sparck Jones Weighting Formula, Document Length - BM25, Field Weights – BM25F, Language Modeling and Related Methods: Generating Queries from Documents, Language Models and Smoothing, Ranking with Language Models, Kullback-Leibler Divergence, Divergence from Randomness, Passage Retrieval and Ranking, Categorization and Filtering: Classification, Probabilistic Classifiers, Linear Classifiers, Similarity-Based Classifiers.

| Course Code: CSA3402 | Course Name: Statistical Analysis using R Programming | | | L  T  P  C |
| | Type of Course: Lab / Lab Integrated Course | | | 1 0 4 3 |
| Version No. | 1 | | | |
| Course Pre-requisites | Nil | | | |

| Module 4 | Evaluation | Assignment | Evaluation | 8  Sessions |

Topics:
Measuring Effectiveness: Traditional Effectiveness Measures, The Text Retrieval Conference, Using Statistics in Evaluation, Minimizing Adjudication Effort, Nontraditional Effectiveness Measures, Measuring Efficiency: Efficiency Criteria, Queuing Theory, Query Scheduling, Caching.

| Course Description | This course introduces fundamental and advanced statistical techniques using R Programming for data analysis. Students will learn data manipulation, visualization, hypothesis testing, regression analysis, and machine learning techniques in R. The course covers both descriptive and inferential statistics, enabling students to interpret real-world datasets effectively. Hands-on sessions with R packages like ggplot2, dplyr, and caret will enhance analytical skills. By the end of the course, students will be able to apply statistical methods to solve complex data-driven problems. |

| Course Objective | The objective of the course is to familiarize the learners with the concepts of Statistical Analysis using R Programming attain Employability Skills through Experiential Learning techniques. |

**Text Book**
- Stefan Buttcher, Charles L. A. Clarke, Gordon V. Cormack, "Information Retrieval im odern Information Retrieval: The Concepts and Technology behind Search", 2nd Edition, ACM Press Books, 2016.
- Ricci. F. Rokach, L. Shapira, B. Kantor, "Recommender Systems Handbook", 4th Edition, 2018.

| Course Out Comes | On successful completion of the course the students shall be able to: | | | |
| | CO1 | Apply basic R functions pertaining to fundamental data analysis. | | [Apply] |
| | CO2 | Make data representation using R. | | [Apply] |
| | CO3 | Demonstrate the decision trees concept with the given dataset. | | [Apply] |
| | CO4 | Demonstrate the Mining concept for both Data and Text. | | [Apply] |

**References**
- Stefan Buettcher, Charles A. Clarke and Gordon V. Cormack, "Information Retrieval: Implementing and Evaluating Search Engines", The MIT Press, 2017.
- Jian-Yun Nie Morgan, Claypool, "Cross-Language Information Retrieval", Publisher series 2011

**E-Resources**
1. https://www.coursera.org/learn/information-retrieval
2. https://www.edx.org/course/web-search-and-information-retrieval

**Course Content:**

| Module 1 | Introduction | Assignment | Introduction | 25 Sessions |

Topics:
Introduction to R, Overview of data analysis, Working with directory in R, Loading and handling data in R, Data Visualization with ggplot2, Data Transformation with dplyr.

| Module 2 | Exploratory Data Analysis | Assignment | Exploratory Data Analysis | 15  Sessions |

**Topics:**
Exploring a new dataset, Anomalies in numerical data, Visualizing relations between variables, Assumptions of Linear Regression, Validating Linear Assumption, Missing Values, Covariation, Patterns and Models, gglot2 Calls.

| Module 3 | Regression Analysis | Assignment | Regression Analysis | 20  Sessions |

**Topics:**
Introduction, Types of Regression Analysis Models, Linear Regression, Simple Linear Regression, Non-Linear Regression, Regression Analysis with Multiple Variables, Cross Validation, Principal Component Analysis, Factor Analysis.

| Module 4 | Classification | Assignment | Classification | 15 Sessions |

**Topics:**
Introduction, Different types of Classification, Logistic Regression, Support Vector Machines, K-Neatest Neighbors, Naïve Bayes Classifier, Decision Tree Classification, Random Forest Classification, Evaluation.

**List of Laboratory Tasks**

1. Using with and without R objects on console
2. Using mathematical functions on console
3. Write an R script, to create R objects for calculator
4. Write an R script to find basic descriptive statistics using summary, str, quartile function on mtcars & cars datasets.
5. Reading different types of data sets (.txt, .csv) from Web and disk and writing in file in specific disk location.
b. Reading Excel data sheet in R
6. Find the data distributions using box and scatter plot.
7. Find the outliers using plot.
8. Plot the histogram, bar chart and pie chart on sample data
9. Find the correlation matrix.

10. Plot the correlation plot on dataset and visualize giving an overview of relationships among data on iris data

11.Create a regression model for a given dataset

12.Install relevant package for classification.

13. Choose classifier for classification problem. c. Evaluate the performance of classifier.

14.Install relevant package for classification.

15. Choose classifier for classification problem. c. Evaluate the performance of classifier.

| Text Book |
| --- |
| • Hadley Wickham and Garrett Grolemund, "R for Data Science", O'reilly, 2017. |
| • Tilman M. Davies, "The Book of R: A First Course in Programming and Statistics", No Starch Press, 2016. |

| References |
| --- |
| • Dr.BharatiMotwani, "Data Analytics using R", Wiley, 2019. |
| • Jared P. Lander, "R for Everyone: Advanced Analytics and Graphics", Addison-Wesley, 2017 |

| E-Resources |
| --- |
| https://www.geeksforgeeks.org/r-programming-for-data-science/ |
| https://r4ds.had.co.nz/ |

# CSA3403-Natural Language Processing

| Course Code:<br>CSA3403 | Course Name: NATURAL LANGUAGE PROCESSING<br>Type of Course: Theory Course | L- T-P- C | 3-0-0-3 |
| --- | --- | --- | --- |
| Version No. | 1 | | |
| Course Pre-requisites | Artificial Intelligence and Machine Learning | | |
| Anti-requisites | NIL | | |
| Course Description | The purpose of this course is to introduce students to the science of natural language processing (NLP). NLP is the science of extracting information from unstructured text. It is basically how we can teach machines to understand human languages and extract meaning from text. In addition to regular theory, the course also involves:   Programming Assignments   Regular Quiz Tests (once a week and once after every module) | | |
| Course Objective | The objective of the course is to familiarize the learners with the concepts of Natural Language Processing attain Skill development through Experiential Learning techniques | | |
| Course Out Comes | **On successful completion of the course the students shall be able to:**<br>• Understand the fundamental concepts of Natural Language Processing. [ [Understand]<br>• Read corpora and train models for different NLP tasks  [Apply]<br>• Use word embeddings for solving an NLP Application  [Apply]<br>• Understand sequence to sequence modeling as used in machine translation.  [Apply] | | |
| Course Content: | | | | |

| Module 1 | Introduction | Assignment | Introduction | 12  Sessions |
| --- | --- | --- | --- | --- |
| Topics:<br>Topics:<br>Introduction. History. Text Analytics. Various tasks in NLP. Sentence boundary Detection. Edit distance.<br>Introduction to word embeddings, PoS tagging, chunking, parsing, machine translation. | | | | |
| Module 2 | Word and Text Representations | Quiz/ Assignment | Word and Text Representations | 12  Sessions |
| Topics:<br>Topics: | | | | |

Logistic Regression and Naïve Bayes classification. Vector semantics and embeddings. Neural Networks and Neural Language Models. Text representations and classification. Deep learning architectures for sequence processing (CNN and LSTM).

| Module 3 | oS Tagging, NER   Tagging and Parsing | Assignment | oS Tagging, NER Tagging and Parsing | 10  Sessions |
|---|---|---|---|---|
| Topics: | | | | |

Topics:

Part-of-Speech Tagging – using NLTK and spacy. Building a PoS Tagger using existing data and Hidden Markov Model. Named Entity Recognition. Relationship between NER tagging and PoS tagging. Constituency

Parsing.

| Module 4 | NLP Applications | Assignment | NLP Applications | 11  Sessions |
|---|---|---|---|---|
| Topics: | | | | |

Topics:

Lexical Resource Creation. Sentiment Analysis. Machine Translation. Word Sense Disambiguation and WordNet. Question Answering.

**Text Book**
- Daniel Jurafsky, and James Martin."Speech and Language Processing" (3rd edition,   2022)

**References**
- Chris Manning and HinrichSchutze, "Foundations of Statistical Natural Language Processing", 1st Edition, MIT Press. 2020.

**E-Resources**
E-Book Link for R2: https://drive.google.com/file/d/10nbwAJd-dv6htOOZVBgAvLd1WscI0RqC/view Web resources:https://web.stanford.edu/~jurafsky/slp3/
NPTEL Course: https://onlinecourses.nptel.ac.in/noc22_cs98/course

## CSA3430 - Data Analytics and Business Intelligence

| Course Code: CSA3430 | Course Title:  Data Analytics and Business Intelligence<br>       Type of Course: DE | L-T-P-C | 1-0-4-3 |
|---|---|---|---|
| Version No. | 1.1 | | |
| Course Pre-requisites | Basics of Python Programming and simple database concepts. | | |
| Anti-requisites | **NIL** | | |
| Course Description | This is an introductory course to data science and it covers the mathematical foundations of data science, techniques for data collection, pre-processing and visualizing data. Concepts discussed in this course will be supplemented with hands on data science tools in Data Science Lab course.This course also enables students to learn and understand the fundamentals of Business Intelligence and also Describes how Data Integration is achieved using SSIS. | | |
| Course Objective | The objective of the course is to familiarize the learners with the concepts of **Data Analytics and Business Intelligence** and attain **Skill Development** through **Experiential Learning** techniques.<br><br>. | | |

| Course Out Comes | On successful completion of the course the students shall be able to:<br><br>CO1: Describe the fundamentals of Data Analysis and Business Intelligence Technologies. (Understand)<br>CO2: Implement data visualization techniques to analyze Datasets. (Apply)<br>CO3: Apply ETL tools to integrate data in a warehouse. (Apply) | | | |
|---|---|---|---|---|
| **Course Content:** | | | | |
| **Module 1** | Introduction to Data Analysis and Visualization | Assignment | Programming Task | **20 Sessions** |

**Topics:**

Introduction to Data Analysis – Python Libraries for Data analysis – Data-types of variables – Continuous and Discrete variables – Data sampling – Pandas Data Structures – Data Visualization – Matplotlib Histograms – Line charts – Pie charts – Multiple bar graphs – Box plots – Scatter plots – Sea born plots – Bokeh plots.

| **Module 2** | Data collection | Assignment | | **20 Sessions** |
|---|---|---|---|---|

**Topics:**

Data Collection – Data Cleaning – Data munging – Web Scrapping – Rescaling and Dimensionality Reduction – Feature Selection – Feature Extraction – Principal Component Analysis.

| **Module 3** | Introduction to Business Intelligence | Assignment | | **20 Sessions** |
|---|---|---|---|---|

**Topics:**

Types of digital data – Introduction to OLTP – OLAP and Data Mining. BI Definitions & Concepts – Business Applications of BI – BI Framework – Role of Data Warehousing in BI.

| **Module 4** | Classification and clustering | Assignment | | **15 Sessions** |
|---|---|---|---|---|

Decision tree Induction – Bayesian classification – Model evaluation and selection techniques to improve classification accuracy. Clustering Analysis – portioning method – Hierarchical methods

**Targeted Application & Tools that can be used:**

Applications in Systems containing Multi-Force Members, Frames, Trusses, Machines, Cable Bridges etc.
**Professionally used softwa**re – Staad Pro/ETABS

**Project work/Assignment:**

To understand the application of the forces on rigid bodies, the students should draw the free body diagrams and calculate the magnitudes and directions of forces acting on the body.
Assignment: 1] Determine the resultants for the Problems using MATLAB functions
Assignment: 2] Determine the support reactions for the beams using MS Excel based on the given data.

**Text Book**

  T1. 1. Wes Mckinney. *"Python for Data analysis",* Second Edition, O'Reilly USA, 2017.
  T2. 2. RN Prasad and Seema Acharya, *"Fundamentals of Business Analytics"*, First Edition, Wiley India 2016.

https://presiuniv.knimbus.com/user#/home

 https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=2706929&site=ehostlive

**References**

R1. Roger Peng, *"Exploratory Data Analysis"*, Lean Publications, 2015.

R2. Soraya Sedkaoui, Mounia Khelfaoui, *"Sharing Economy and Big Data Analytics"*, First Edition, 2020.

R3. Rick Sherman , *"Business Intelligence Guidebook: From Data Integration to Analytics",2014*

# CSA3428     Ethical aspects of AI

| Course Code: CSA3428 | Course Name:  Ethical aspects of AI<br>Type of Course: Theory Course | | L- T-P- C | 3-0-0-3 |
|---|---|---|---|---|
| Version No. | 1 | | | |
| Course Pre-requisites | Nil | | | |
| Anti-requisites | NIL | | | |
| Course Description | Students will develop fluency reading material drawn from a variety of fields, including computer science, philosophy, legal and media studies. Students will practice ethical and critical thinking skills, such as weighing the rights of different stakeholders, and thinking through the consequences of technological innovations. | | | |
| Course Objective | The objective of the course is to familiarize the learners with the concepts of  Ethical aspects of AI attain Skill development through Participative Learning techniques | | | |
| Course Out Comes | **On successful completion of the course the students shall be able to:**<br>• Understand the fundamental concepts of Natural Language Processing. [ [Understand]<br>• Read corpora and train models for different NLP tasks  [Apply]<br>• Use word embeddings for solving an NLP Application  [Apply]<br>• Understand sequence to sequence modeling as used in machine translation.  [Apply] | | | |

Course Content:

| Module 1 | Introduction to AI Ethics | Assignment | Key Ethical Principles | 10  Sessions |
|---|---|---|---|---|
| Topics:<br>Definition and Importance of Ethics in AI, Ethical Theories and AI, Key Ethical Principles: Transparency, Fairness, Accountability, and Privacy, Ethical Dilemmas in AI,  Case Studies: AI Bias and Discrimination | | | | |
| Module 2 | AI and Society | Quiz/ Assignment | AI and Society | 12  Sessions |
| Topics:<br>AI's Impact on Employment and Economy,  Ethical Considerations in Autonomous , AI in Healthcare: Ethical Challenges and Solutions, Misinformation and Deepfakes- Case Studies: Social Media Algorithms and Their Ethical Impact | | | | |
| Module 3 | Regulatory and Legal Frameworks | Assignment | Legal Frameworks | 13  Sessions |
| Topics: | | | | |

Topics:

AI Governance and Policies, Global AI Ethics Guidelines, Data Protection Laws (GDPR, CCPA) and AI, Intellectual Property Rights and AI, Ethical AI Development Practices in Industry

| Module 4 | Future of Ethical AI | Assignment | Explainable AI | 10 Sessions |
|---|---|---|---|---|

Topics:

AI and Human Rights,  Explainable AI (XAI) and Ethical AI Design, AI in Warfare: Autonomous Weapons and Ethical Challenges, Sustainability and AI's Environmental Impact, Case Studies: Ethical AI Practices in Leading Companies

Text Book
- "The Ethics of Artificial Intelligence" – Mark Coeckelbergh, 2021
- "Artificial Intelligence: A Guide for Thinking Humans" – Melanie Mitchell, 2020

References
- Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy – Cathy O'Neil, 2020.
- Ethics of Artificial Intelligence and Robotics – Vincent C. Müller (Editor), 2021.

E-Resources
- https://standards.ieee.org/industry-connections/activities/ieee-global-initiative/
- https://www.microsoft.com/en-us/ai/responsible-ai-learn-overview
- https://www.coursera.org/learn/ai-for-everyone

## Track 3 – Cyber Security and Multimedia

### CSA3406        Cryptography and Network security

| Course Code: CSA3406 | Course Title:    Cryptography and Network Security. Type of Course: Discipline Elective | L- T- P- C | 3-0-0-3 |
|---|---|---|---|
| Version No. | 1 | | |
| Course Pre-requisites | Nil | | |
| Anti-requisites | Nil | | |
| Course Description | The Course covers the principles and practice of cryptography and network security, focusing in particular on the security aspects of the web and Internet. | | |
| Course Objective | The objective of the course is to familiarize the learners with the concepts of **Cryptography and Network Security.** and attain **Employability Skill** through **Participative Learning** techniques. | | |
| Course Out Comes | **On successful completion of the course the students shall be able to:** **CO1:** Identifies the basic concept of Cryptography **(Remember)** **CO2:** Express the different types of Cryptographic Algorithms **(Understand)** **CO3:** Recognize the Public key Cryptographic Techniques for various applications. **(Understand)** **CO4:** Apply the network security concepts during their implementation of network security application developments. **(Apply)** | | |

| **Course Content:** | | | | |
|---|---|---|---|---|
| **Module 1** | **Introduction to Cryptography and types of Ciphers** | Assignment | Data Collection/Interpretation | **10 Sessions** |
| **Topics:** Introduction to Cryptography, Model of Network Security, OSI Security architecture, Security Attacks: active attacks, passive attacks, services: Authentication, Access Control, Data Confidentiality, Data Integrity, Nonrepudiation, Substitution Ciphers : Caesar, Mono alphabetic, Polyalphabetic, Play-fair and Hill Cipher, Introduction to Block Cipher and Stream Cipher, Feistel Structure. | | | | |
| **Module 2** | **Private Key Cryptography and Number Theory** | Case studies / Case let | Case studies / Case let | **11 Sessions** |
| **Topics:** Symmetric Encryption Algorithms : Data Encryption Standard, Introduction to Galois Field, Advanced Encryption Standard, Modular Arithmetic, Prime numbers, Fermat's little theorem, brief about primality testing and factorization, Discrete Logarithmic Problem, Euclidean and Extended Euclidean Algorithm, Euler Totient Function, Chinese Remainder Theorem. | | | | |
| **Module 3** | **Public Key Cryptography and its Applications** | Quiz | Case studies / Case let | **10 Sessions** |
| **Topics:** Overview of Public Key Cryptography, RSA, Diffie - Helman Key exchange, Man in the middle attack, Cryptographic Hash functions, Secure Hash Algorithm, Message Authentication Codes – HMAC, Digital Signature, Discussion on real time practices of Cryptography. | | | | |
| **Module 4** | **Network Security** | Quiz | Case studies / Case let | **14 Sessions** |
| **Topics:** Network Security fundamentals, Network Security applications: Authentication: Kerberos, PKI, Network Security applications: e-mail security  y: PGP, MIME, Network Security applications: IP Security: IP Sec architecture, Network Security applications: Web Security. | | | | |
| **Targeted Application & Tools that can be used:** Kali Linux | | | | |
| **Project work/Assignment:** | | | | |
| **Project:** Malware detections, IDS and IPS for IOT devices using wire shark, NMAP etc. <br> **Assignment:** Review on types of attacks in networks, Article review, quiz, written assignments | | | | |
| **Text Book** <br> **T1** William Stallings, *"Cryptography and Network Security - Principles and Practices"*, Prentice Hall, 8th Edition, 2019. <br> **T2**. Wade Trappe and Lawrence C Washington, *"Introduction to Cryptography with Coding Theory"*, Pearson, 2020. | | | | |

**CSA3407        Ethical Hacking**

**References**

**R1**. Behrouz A Forouzan, Debdeep Mukhopadhyay, "*Cryptography and Network Security*", McGraw Hill, third edition, 2010

**R2**. R.Rajaram, "*Network Security and Cryptography*" SciTech Publication.3rd Edition, 2014

**R3**. AtulKahate, "*Cryptography and Network Security*", Tata McGraw-Hill, 2nd Edition, 2019

**R4**. BruceSchneier, "*Applied Cryptography*", John Wiley and Sons Inc. Second Edition, 2015.

**E book link T1:** http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=10133&query_desc=kw%2Cwrdl%3A%20Cryptography%20and%20Network%20Security

**Web resources:**

1. https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=fBYckQKJvP3a/8Vd3L08tQ
2. https://onlinecourses.nptel.ac.in/noc22_cs90/preview

| Course Code: CSA3407 | Course Title: Ethical Hacking<br>Type of Course: Discipline Elective | L- T- P- C | 3-0-0-3 |
|---|---|---|---|
| **Version No.** | 1.0 | | |
| **Course Pre-requisites** | basic networking tools knowledge and Cryptography & Network Security | | |
| **Anti-requisites** | NIL | | |
| **Course Description** | This course introduces students to a wide range of topics related to ethical hacking. It also provides an in-depth understanding of how to effectively protect computer networks. These topics cover some of the tools and penetration testing methodologies used by ethical hackers and provide a thorough discussion of what and who an ethical hacker is and how important they are in protecting corporate and government data from cyber-attacks. | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of **Ethical Hacking** attain **Employability** through **Experiential Learning** techniques. | | |
| **Course Outcomes** | On successful completion of this course the students shall be able to:<br>1] Illustrate the importance of ethical hacking [Understand]<br>2] Categorize the various techniques for performing reconnaissance. [Understand]<br>3] Demonstrate various types of system scanners and their functions. [Understand]<br>4] Demonstrate the function of sniffers on a network. [Understand] | | |
| **Course Content:** | | | |

| Module 1 | **Introduction to Hacking**<br>(Knowledge, Application) | Assignment | Programming activity | **12 Hours** |
|---|---|---|---|---|

Topics:
Introduction to Hacking-Important Terminologies - Asset - Vulnerability - Penetration Test - Vulnerability Assessments versus Penetration Test - Penetration Testing Methodologies - Categories of Penetration Test.
**Assignment:** Different phase methodologies on penetration testing

| Module 2 | **Linux Basics** | Assignment | Programming activity | **10 Hours** |
|---|---|---|---|---|

Topics:
Major Linux Operating Systems - File Structure inside of Linux - BackTrack - Changing the Default Screen Resolution - Some Unforgettable Basics.
**Assignment:** Penetration testing distribution

| Module 3 | **Information Gathering Techniques** | Assignment | Programming activity | **11 Hours** |
|---|---|---|---|---|

Topics:
Sources of Information Gathering - Copying Websites Locally - NeoTrace - Xcode Exploit Scanner - Interacting with DNS Servers - DNS Cache Snooping - DNS Lookup with Fierce - SNMP - SMTP.
**Assignment:**Domain internet groper

| Module 4 | **Target Enumeration and Port Scanning Techniques** | Assignment | Programming activity | **13 Hours** |
|---|---|---|---|---|

Topics:
Target Enumeration and Port Scanning Techniques - Host Discovery - Scanning for Open Ports and Services - Types of Port Scanning - Vulnerability Assessment.
**Assignment:** Demonstrations for port scanning

**Targeted Application & Tools that can be used:** Application Software and open source tools

**Project work/Assignment: Mention the Type of Project /Assignment proposed for this course**

Any appropriate tool can be given to demonstrate i.e Sql injections.

**Text Book**
1]    Rafay Baloch, 2014: "Ethical Hacking and Penetration Testing Guide" Apple Academic Press Inc**.**

**References**
2]    Gary Hall, Rrin Watson, 2016: "Hacking: Computer Hacking, Security Testing,Penetration Testing, and Basic Security".
3]    James Corley, Kent Backman, Michael Simpson, 2010: "Hands-On Ethical Hacking and Network Defense", 2nd Edition, Cengage Learning.

| Course Code: CSA3408 | Course Title:   Data Security and Privacy<br>Type of Course: Theory | | **L- T- P- C** | 3-0-0-3 |
|---|---|---|---|---|
| **Version No.** | 1.0 | | | |
| **Course Pre-requisites** | | | | |
| **Anti-requisites** | **NIL** | | | |
| **Course Description** | The purpose of this course is to sensitize security in Big Data environments. This course will discover cryptographic principles, mechanisms to manage access controls in Big Data system. This course teaches the principles and practices of big data for improving the privacy and the security of computing systems. Big data is being applied in areas where there is great commercial advantage to be had, and consequently, attacks and failures have become a serious concern. It delves into a set of techniques for defending big data techniques against breaching of big data (the privacy aspect) and against malicious attacks (the security aspect). | | | |
| **Course Objective** | The objective of the course is to familiarize the learners with the concepts of **B**IG DATA SECURITY AND PRIVACY and attain **Skill Development** through **Participative Learning** techniques. | | | |
| **Course Outcomes** | **On successful completion of this course the students shall be able to:**<br>i.     Define cryptographic principles and mechanisms to manage access controls in Big Data system.[Knowledge]<br>ii.    Explain security risks and challenges for Big Data system.[Knowledge]<br>iii.   Recognize all security related issues in big data systems .[Comprehension]<br>iv.   Apply Kerberos configuration for Hadoop ecosystem components.[Application] | | | |
| **Course Content:** | | | | |
| **Module 1** | Big Data Privacy, Ethics And Security | Assignment/Quiz | Big data security-organizational security | **12 classes** |
| **Topics:**<br>Privacy – Reidentification of Anonymous People – Why Big Data Privacy is self regulating? – Ethics – Ownership – Ethical Guidelines – Big Data Security – Organizational Security.<br>Assignment: Big data security-organizational security | | | | |
| **Module 2** | Security,        Compliance, Auditing, And Protection | Assignment | communication protocols for each of the Hadoop ecosystem components | **10 classes** |
| **Topics:**<br>Steps to secure big data – Classifying Data – Protecting – Big Data Compliance – Intellectual Property Challenge – Research Questions in Cloud Security – Open Problems.<br>Assignment: communication protocols for each of the Hadoop ecosystem components | | | | |
| **Module 3** | Hadoop Security Design, Hadoop Ecosystem Security | Case study | Kerberos configuration for ecosystem tools | **12 classes** |
| **Topics:** | | | | |

| Kerberos – Default Hadoop Model without security - Hadoop Kerberos Security Implementation & Configuration. Configuring Kerberos for Hadoop ecosystem components – Pig, Hive, Oozie, Flume, HBase, Sqoop. Assignment: Kerberos configuration for Hadoop ecosystem tools | | | | |
|---|---|---|---|---|
| **Module 4** | Data Security & Event Logging | Case study | Event monitoring in Hadoop cluster | **11 classes** |

**Topics:**
Integrating Hadoop with Enterprise Security Systems - Securing Sensitive Data in Hadoop – SIEM system – Setting up audit logging in hadoop cluster
Assignment: Event monitoring in Hadoop cluster

**Assignment:**

1.  Book/Article review: At the end of each module a book reference or an article topic will be given to an individual or a group of students. They need to refer the library resources and write a report on their understanding about the assigned article in appropriate format. Presidency University Library Link .

2. Presentation: Group presentation, where the students will be given a topic. They will have to explain/demonstrate the working and discuss the applications for the same.

**Text Book(s):**
1.  Sudeesh Narayanan, "Securing Hadoop", Packt Publishing, 2021.
2.  Ben Spivey, Joey Echeverria, "Hadoop Security Protecting Your Big Data Problem", O'Reilly Media, 2019.

**Reference(s):**
**Reference Book(s):**
     1. Mark Van Rijmenam, "Think Bigger: Developing a Successful Big Data Strategy for Your Business", Amazon, 1 edition, 2021.
     2. Frank Ohlhorst John Wiley & Sons, "Big Data Analytics: Turning Big Data into Big Money", John Wiley & Sons, 2018.
      3. Sherif Sakr, "Large Scale and Big Data: Processing and Management", CRC Press, 2021.
**Online Resources (e-books, notes, ppts, video lectures etc.):**
1.  Top Tips for Securing Big Data Environments:
    e-book (http://www.ibmbigdatahub.com/whitepaper/top-tips-securing-big-data-environments-ebook)
2.  http://www.dataguise.com/?q=securing-hadoop-discovering-and-securing-sensitive-datahadoop-data-stores
3.  Gazzang for Hadoop
    http://www.cloudera.com/content/cloudera/en/solutions/enterprisesolutions/security-for-hadoop.html
4.  eCryptfs for Hadoop https://launchpad.net/ecryptfs.
5.  Project Rhino - https://github.com/intel-hadoop/project-rhino .

Weblinks:

https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=1223875&site=ehost-live&ebv=EB&ppid=pp_xiii


https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=2706929&site=ehost-live

# CSA3409-2D Graphics Design

# PRESIDENCY UNIVERSITY

**CSA3410-Multimedia Data Compression and Storage**

| Course Code: CSA3409 | Course Name: 2D Graphics Design<br>Type of Course: Lab / Lab Integrated Course | L- T-P- C | 1-0-4-3 |
|---|---|---|---|
| Course Code: CSA3410 | Course Name: Multimedia Data Compression and Storage<br>Type of Course: Lab / Lab Integrated Course | L - T-P- C | 1-0-4-3 |
| Version No. | 1 | | |
| Course Pre-requisites | NIL | | |
| Anti-requisites | NIL | | |

**Course Description**

This course introduces students to the principles, tools, and techniques of 2D graphic design. Participants will learn how to create visually compelling designs for print, web, and digital media using industry-standard software. The course covers essential topics such as color theory, typography, layout design, vector and raster graphics, and visual storytelling. Through hands-on projects, students will develop the skills to design logos, posters, brochures, digital illustrations, and more. Whether you're a beginner or looking to enhance your design portfolio, this course provides a solid foundation in 2D design concepts and creative problem-solving.

This laboratory-based course provides a practical understanding of multimedia data compression and storage techniques. Students will explore various methods for efficiently encoding, storing, and transmitting multimedia content, including images, audio, and video. The course covers lossless and lossy compression algorithms, entropy coding, transform coding, and predictive coding techniques. Hands-on experiments with industry-standard tools and programming exercises will allow students to implement and evaluate compression methods such as JPEG, PNG, MP3, AAC, and H.264. Additionally, students will learn about storage architectures, file formats, and data retrieval strategies. By the end of the course, students will be equipped with the skills to optimize multimedia storage and transmission for real-world applications.

**Course Objective**

The objective of the course is to familiarize the learners with the concepts of 2D Graphics Design and attain Employability Skills through Experiential Learning techniques.

The objective of the course is to familiarize the learners with the concepts of Multimedia Data Compression and Storage and attain Employability Skills through Experiential Learning techniques.

**Course Outcome**

On successful completion of the course the students shall be able to:

| | | |
|---|---|---|
| CO1 | Summarize fundamentals of 2D graphics design | [Understand] |
| CO2 | Explain the principles of multimedia compression | [Understand] |
| CO3 | Develop pictures using digital tools | [Apply] |
| CO4 | Construct portfolio designs using digital tools | [Apply] |
| CO1 | Explain the principles of multimedia compression | [Understand] |
| CO2 | Explain image and audio compression methods | [Understand] |
| CO3 | Develop storage and transmission strategies for multimedia content | [Apply] |
| CO4 | Develop algorithms optimize multimedia data storage and retrieval | [Apply] |

**Course Content:**

| Module 1 | 2D Graphics and Design Fundamentals | Assignment | 2D Graphics and Design Fundamentals | 15 Sessions |
|---|---|---|---|---|

**Topics:**
Overview of 2D graphic design and its applications. Grids, Golden Ratio, Modular Grids, Warm vs. Cool Colors, Retouching, Rule of Thirds, Visual Flow, White Space. Understanding design principles: balance, contrast, alignment, repetition, and proximity. Basics of color theory and its psychological impact. Introduction to file formats: vector vs. raster graphics

| Module 1 | Fundamentals of Multimedia Compression | Assignment | Fundamentals of Multimedia Compression | 20 Sessions |
|---|---|---|---|---|

**Topics:**
Introduction to multimedia data types (text, images, audio, video). Compression Performance Evaluation, Peak Signal-to-Noise Ratio (PSNR) and Structural Similarity Index (SSIM), Need for compression: storage and transmission efficiency. Basics of lossless vs. lossy compression. Introduction to entropy coding (Huffman coding, arithmetic coding).

| Module 2 | Typography and Layout Design | Assignment | Typography and Layout Design | 15 Sessions |
|---|---|---|---|---|

**Topics:**
Exploring typography: fonts, typefaces, Visual Hierarchy in Layout Design. Composition and Proportion, User Experience (UX) and Layout Design and hierarchies. Principles of effective text placement and readability. Creating balanced layouts using grids and alignment. Designing for print and digital platforms.

| Module 2 | Image and Audio Compression Techniques | Assignment | Image and Audio Compression | 20 Sessions |
|---|---|---|---|---|

| Module 3 | Mastering Tools and Techniques | Assignment | Mastering Tools and Techniques | 20 Sessions |
|---|---|---|---|---|

**Topics:**
Lossless image compression: Run-Length Encoding (RLE), Huffman Coding, Arithmetic Coding, Lempel-Ziv-Welch (LZW), Lossy Image Compression Methods: Transform Coding (e.g., Discrete Cosine Transform - DCT in JPEG), Vector Quantization, Fractal Compression, Wavelet Transform (e.g., JPEG2000) PNG, Gif, and TIFF formats. Lossy image compression: JPEG, WebP, and their encoding principles. Audio compression basics: PCM, ADPCM, and psychoacoustic models. Lossy audio compression: MP3, AAC, and Ogg Vorbis.

**Topics:**
Introduction to industry-standard software (e.g., Adobe Illustrator, Photoshop, or equivalent), Data Analysis Tools, Audio and Video Editing Tools, Business and Productivity Tools, Cloud Computing Tools and Techniques. Working with layers, shapes, and paths. Designing with vector and raster tools: logos, icons, and illustrations. Image editing and enhancement: cropping, masking, and retouching.

| Module 3 | Video Compression and Storage Systems | Assignment | Video Compression and Storage Systems | 20 Sessions |
|---|---|---|---|---|

**Topics:**
Basics of video representation and frame structures (I, P, and B frames). MPEG (MPEG-1, MPEG-2, MPEG-4), H.264/AVC (Advanced Video Coding), H.265/HEVC (High Efficiency Video Coding), Motion Estimation and Compensation, Quantization and Entropy Coding, Rate-Distortion Optimization, AV1 and VP9 (Modern Open-Source Codecs) Popular video compression standards: H.264, H.265, VP9. Motion estimation and predictive coding in video compression. Storage architectures: file formats (MP4, AVI, MKV), metadata, and streaming considerations.

| Module 4 | Projects and Portfolio Development | Assignment | Projects and Portfolio Development | 25 Sessions |
|---|---|---|---|---|

**Topics:**
Creating a GitHub Portfolio for Developers, Project Portfolio for Architects and Engineers Concept development and storyboarding for design projects. Designing promotional materials: posters, flyers, and social media content. Branding and identity design: creating logos and business cards. Assembling a professional portfolio for future opportunities

**List of Laboratory Tasks**

Experiment No. 1: Create a simple design applying balance, contrast, and alignment.
Level 1: Use Adobe Photoshop to create a simple design
Level 2: Make design with multiple layers

| Module 4 | Optimization of Compression Algorithms | Assignment | Optimization of Compression Algorithms | 15 Sessions |
|---|---|---|---|---|

Experiment No. 2: Color Theory Exercise

**Topics:** Level 1: Develop a color palette

Hands-on Level 2: apply to a basic design algorithms using programming tools. Parallelization and GPU Acceleration of Compression Algorithms, Web Optimization (Brotli, Zstandard), Cloud Storage and Data Deduplication, Real-Time Streaming and Low-Latency Compression, Hardware-Based Compression Optimization (ASIC, FPGA), Trade-offs Between Speed and Compression Ratio Comparative analysis of compression techniques based on quality and efficiency. Data retrieval, storage optimization, and cloud-based multimedia storage solutions. Case studies and real-world applications of multimedia compression in streaming, gaming, and broadcasting.

Experiment No. 3: Convert an image between raster and vector formats Level 1: Convert an image between raster and vector formats
Level 2: analyze the differences

Experiment No. 4: Typography Exploration using different fonts, weights, and styles.

**List of Laboratory Tasks** Level 1: Design a simple typographic poster.

    Level2: Design a complex typographic poster with template
    Experiment No. 1: Implementation of Huffman Coding.
    Experiment No. 5: Text Layout Exercise Encode a given text using Huffman coding
    Level 1: Arrange a given text using left to any coding
    Level 2: Set proper hierarchy and alignment
    Experiment No. 2: Arithmetic Coding Experiment
    Experiment No. 6: Grid-Based Design for data compression
    Level 1: Analyze efficiency of compression grid system
    Level2: Create complex structured design
    Experiment No. 3: Comparison of Lossless and Lossy Compression
    Experiment No. 7: Logo Design on sample data
    Level 1: Analyze the differences of the logo using pen and paper
    Level 2: Design a simple vector-based logo using digital tools
    Experiment No. 4: Lossless Image Compression
    Experiment No. 8: Digital Illustration techniques
    Level2: Compare results of PNG compression paths and layers
    Level 2: Create an original vector illustration using paths and layers
    Experiment No. 5: JPEG Compression
    Experiment No. 9: Photo Editing and Retouching Apply JPEG compression to images
    Level 1: Evaluate quality vs file size digital image
    Level 2: Enhance and manipulate a digital image using all retouching tools
    Experiment No. 6: Audio Compression
    Experiment No. 10: Clipping Mask Exercise Convert audio using different Masks
    Level 2: Use masking compression effects blend images
    Level 2: create unique compositions
    Experiment No.7: Wavelet-Based Image Compression
    Experiment No. 11: Social Media Graphics Apply wavelet transform for image compression
    Level 1: Analyze performance of compression technique post for social media platform
    Level 2: Design a banner or post for a social media platform
    Experiment No.8: Spectral Analysis of Audio Compression
    Experiment No. 12: Business Card Design audio signals before and after compression
    Level 1: Compare changes in different audio compression handling elements
    Level 2: Create a professional business card incorporating branding elements
    Experiment No.9: Frame-Based Video Compression Analysis
    Experiment No. 13: Promotional Poster H.264 compressed video
    Level 1: Examine a visually appealing event H.264 compressed video typography and imagery
    Level 2: Develop a visually appealing event poster using typography and imagery
    Experiment No.10: Motion Estimation in Video Compression
    Experiment No. 14: Brand Identity Project Block matching algorithms for motion estimation
    Level 2: Duplicate a block-matching and packaging concept for a brand
    Level 2: Design a logo, letterhead, and packaging concept for a brand
    Experiment No.11: Bitrate and Quality Trade-Offs in Video Compression
    Experiment No. 15: Portfolio Compilation Encode video to different bitrate
    Level 2: Organize completed works into a digital portfolio for presentation
    Level 2: Incorporate brand identity into a digital portfolio for presentation

**Text Book** Experiment No.12: Multimedia Storage Formats Exploration

- New Graphic Design School: A Foundation Course in Principles and Practice by John Wiley and Sons Ltd Level 1: Study storage efficiency of MP4/AVI formats
- Christian Müller-Roterberg, 'Design Thinking for Dummies', Wiley Publications, 2021 Level 2: Study and compare storage efficiency of MP4, AVI, MKV formats

**References**
- Stephen Laskevitch, 'Adobe Photoshop: A Complete Course and Compendium of Features', Rocky Nook, 2020 Experiment No.13: Implementation of Run-Length Encoding Level 1: Develop an RLE-based compressor
- Morris, Jason, 'Hands-On Android UI Development: Design and Develop Attractive User Interfaces for Android Applications', Packt Publishing, 2017 Level 2: Test an RLE-based compressor on image data

Experiment No.14: Transform Coding using Discrete Cosine Transform

**E-Resources** Level 1: Implement DCT for image compression

| | Level 2: Analyze efficiency of DCT for image compression |
|---|---|
| | Experiment No.15: Cloud-Based Multimedia Storage Optimization<br>Level1: Experiment with cloud storage compression techniques<br>Level 2: Study retrieval speeds for different techniques |

**Text Book**
- Digital Compression For Multimedia: Principles And Standards by Jerry D. Gibson (Author), Toby Berger (Author), Tom Lookabaugh (Author), Rich Baker (Author),
- Compression for Multimedia :  Cambridge University Press

**References**
- GUIDE TO DATA COMPRESSION METHODS (SPRINGER PROFESSIONAL COMPUTING) by David Salomon (Author)
- Jerry D. Gibson, 'Digital Compression for Multimedia: Principles and Standards', Morgan Kaufmann Publications, 1998.

**E-Resources**
https://puniversity.informaticsglobal.com/login

# CSA3411-Multimedia and Animation

| Course Code: CSA3411 | Course Name:  Multimedia and Animation<br>Type of Course: Lab / Lab Integrated Course | | L- T-P- C | 1-0-4-3 |
|---|---|---|---|---|
| Version No. | 1 | | | |
| Course Pre-requisites | Nil | | | |
| Anti-requisites | Nil | | | |
| Course Description | This laboratory-based course provides hands-on experience in multimedia production and animation techniques. Students will work with industry-standard software to create and manipulate various multimedia elements, including text, images, audio, video, and interactive content. The course covers essential animation principles, such as keyframing, motion graphics, and character animation, in both 2D and 3D environments. Through practical exercises and projects, students will develop skills in digital storytelling, video editing, and interactive media design. By the end of the course, students will have a portfolio of multimedia and animation projects, preparing them for careers in digital media, entertainment, and advertising industries. | | | |
| Course Objective | The objective of the course is to familiarize the learners with the concepts of Multimedia and Animation and attain Employability Skills through Experiential Learning techniques. | | | |
| Course Out Comes | **On successful completion of the course the students shall be able to:**<br>**CO1** Summarize multimedia editing techniques  [Understand]<br>**CO2** Explain principles of 2D animations and motion  [Understand]<br>**CO3** Develop 3D models with texturing, lighting, and rendering techniques [Apply]<br>**CO4** Create interactive multimedia applications  [Apply] | | | |
| Course Content: | | | | |
| Module 1 | Fundamentals of Multimedia Production | Assignment | Fundamentals of Multimedia Production | 20 Sessions |
| **Topics:**<br>Introduction to multimedia elements: text, images, audio, video, and animation. Image editing and optimization using tools like Adobe Photoshop or GIMP. Emerging Technologies in Multimedia, Animation & Motion Graphics, Audio editing and enhancement using software like Audacity or Adobe Audition. Video editing basics with Adobe Premiere Pro or DaVinci Resolve | | | | |
| Module 2 | 2D Animation and Motion Graphics | Assignment | 2D Animation and Motion Graphics | 20  Sessions |

| **Topics:** | | | | |
|---|---|---|---|---|
| Principles of 2D animation: keyframes, tweening, and frame-by-frame animation. Creating animated characters and objects using Adobe Animate or Krita. Motion graphics and kinetic typography using After Effects. Interactive animations for web and multimedia applications. | | | | |
| Module 3 | 3D Animation and Modeling | Assignment | 3D Animation and Modeling | 20 Sessions |
| **Topics:** | | | | |
| Introduction to 3D modeling and texturing with Blender or Autodesk Maya. Rigging and character animation fundamentals. Lighting, rendering, and camera animation for realistic effects. Simulation of physics-based animation (e.g., cloth, particles, and fluids). | | | | |
| Module 4 | Interactive Multimedia and Project Development | Assignment | Interactive Multimedia and Project Development | 15 Sessions |
| **Topics:** | | | | |
| Designing interactive multimedia applications using Adobe XD or Unity. Game asset creation and animation for interactive environments. Final project: Creating an animated short film or interactive multimedia presentation. Portfolio compilation and project presentation. | | | | |

**List of Laboratory Tasks**

Experiment No. 1: Image Editing and Manipulation
Level 1: Edit images
Level 2: Optimize images for streaming requirements

Experiment No. 2: Audio Editing and Mixing
Level 1: Edit audio clips
Level 2: Enhance audio clips

Experiment No. 3: Video Editing Basics
Level 1: Cut, merge, and apply effects to video clips
Level 2: Optimize video for streaming

Experiment No. 4: Multimedia Integration
Level 1: Combine images, audio, and video to a multimedia file
Level2: Optimize multimedia file for streaming

Experiment No. 5: Frame-by-Frame Animation
Level 1: Duplicate a simple frame-by-frame animation
Level 2: Create an original frame-by-frame animation

Experiment No. 6: Tweening and Keyframe Animation
Level 1: Duplicate keyframe techniques to animate an object's motion
Level2: Create an original animation using keyframes

Experiment No.7: Kinetic Typography
Level1: Design an animated text-based motion graphic
Level 2: Design an animated text-based motion graphic with audio

Experiment No.8: Character Animation
Level1: Animate a 2D character
Level 2: Animate jumping action for 2D character

Experiment No.9: 3D Object Modeling
Level1: Create a basic 3D object
Level 2: Create a basic 3D object with proper texture and animation

Experiment No.10: Texturing and Lighting
Level1: Apply textures and lighting effects to a 3D model
Level 2: Apply external textures to 3D model

Experiment No.11: Rigging and Bone Animation
Level1: Set up a character rig
Level 2: Create a simple animation sequence

| | |
|---|---|
| Experiment No.12: Physics-Based Animation<br>Level1: Duplicate real-world physics of falling objects<br>Level 2: Duplicate real-world physics of water<br><br>Experiment No.13: Interactive Multimedia Design<br>Level1: Duplicate an interactive multimedia interface<br>Level 2: Create original interactive multimedia interface<br><br>Experiment No.14: Game Asset Creation<br>Level1: Duplicate simple 3D game asset<br>Level 2: Create 3D game asset for interactive interface<br><br>Experiment No.15: Animated Short Film<br>Level1: Develop a short animation<br>Level 2: Develop a short interactive game | |
| **Text Book**<br>&bull; Atul. P. Godse, 'Multimedia and Animation', Technical Publications, 2021.<br>&bull; Computer Multimedia and Animation by L. Sasikala, S. Rajendira Kumar | |
| **References**<br>&bull; V.K. Jain, 'Multimedia and Animation', Khanna Publishing House, 2023.<br>&bull; Shilpa S Jadimath, 'Computer Multimedia & Animation', Insta Publications, 2023. | |
| **E-Resources**<br>https://puniversity.informaticsglobal.com/login | |

# Value Added Courses

## CSA1204    Design thinking and Innovation

| **Course Code:** CSA1204 | **Course Title:** Design thinking and Innovation<br>**Type of Course:** Theory | **L-T-P- C** | 2-0-0-2 |
|---|---|---|---|
| **Version No.** | 1.0 | | |
| **Course Pre-requisites** | NIL | | |
| **Anti-requisites** | NIL | | |
| **Course Description** | The course aims to introduce students to the fundamental principles and processes of Design Thinking and will learn to apply Design Thinking methodologies to real-world challenges. The course emphasizes empathy, creativity, and collaboration, equipping students with essential skills for successful engineering practice. | | |
| **Course Objective** | This course is designed to develop and familiarize the learners with the concepts of Design thinking and Innovation and attain Skill Development by using Participative Learning techniques. | | |
| **Course Outcomes** | On successful completion of the course the students shall be able to:<br>1) Understand the concept and importance of Design Thinking. [Understand]<br>2) Differentiate between traditional problem-solving and Design Thinking. [Understand]<br>3) Identify the core stages of the Design Thinking process. [Understand] | | |

| Course Content: | | | | |
|---|---|---|---|---|
| **Module 1** | Introduction to Design Thinking | Assignment | Importance of Design Thinking | **3 hours** |
| Topic<br>  1) Definition and Introduction to Design Thinking<br>  2) Understand the Design Thinking Process | | | | |
| **Module 2** | Design Thinking in Action | Assignment | use cases of Design thinking | **12 hours** |
| Topics:<br>  1) Introduction to the steps of Design Thinking Process<br>  2) Understand use cases of Design thinking<br>  3) Design Thinking and Research Tools pertaining to Consumer Tech. ,  Home Tech. , Personal Tech. , Auto Tech. or Extended Reality. | | | | |
| **Targeted Application & Tools that can be used:**<br>  1) Design ideation tools like Miro , SCAMPER etc.<br>  2) Research Tools for Human Centric Design using forecasting tools like WGSN<br>  3) Feedback tools like Google Forms , etc.<br>  4) Expert Lectures | | | | |
| **Text Book**<br>  5) Thinking Design by S Balaram. New Delhi [India]: Sage Publications Pvt. Ltd. 2010. eBook., Database: eBook Collection (EBSCOhost)<br>https://puniversity.informaticsglobal.com:2284/ehost/detail/detail?vid=6&sid=18ab1f43-1f92-4d02-ae2e-a9c06dc06d8c%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=354920&db=nlebk | | | | |

# Mandatory Courses (MAC)

## CHE7601 - Environmental Studies

| **Course Code:**<br>**CHE7601** | **Environmental Studies**<br><br>**Type of Course:** MOOC course | **L- T- P- C** | 0 | 0 | 0 | 0 |
|---|---|---|---|---|---|---|
| **Course Pre-requisites** | NIL | | | | | |
| **Anti-requisites** | **NIL** | | | | | |

| Course Description | This course aims to familiarize students with fundamental environmental concepts and their relevance to business operations, preparing them to address forthcoming sustainability challenges. It is designed to equip students with the knowledge and skills needed to make decisions that account for environmental consequences, fostering environmentally sensitive and responsible future managers. **This course is designed to cater to Environment and Sustainability** | | | |
|---|---|---|---|---|
| Course Objective | The objective of the course is **'SKILL DEVELOPMENT'** of the student by using **'PARTICIPATIVE LEARNING'** techniques | | | |
| Course Outcomes | On successful completion of this course the students shall be able to: <br>• Describe the basic environmental concepts and issues relevant to the business and management field. <br>• Recognize the interdependence between environmental processes and socio-economic dynamics. <br>• Explain the role of business decisions, policies, and actions in minimizing environmental degradation. <br>• Identify possible solutions to curb environmental problems caused by managerial actions. <br>• Convert skills to address immediate environmental concerns through changes in business operations, policies, and decisions. | | | |
| Course Content: | | | | |
| Module 1 | **Understanding Environment, Natural Resources, and Sustainability** | | | |

**Topics:**
Classification of natural resources, issues related to Population growth and their overutilization, and strategies for their conservation. Water, air, soil, mineral, energy and food source.  Effect of human activities on natural resources.
Concept of sustainability- Sustainable Development Goals (SDGs)- targets and indicators, challenges and strategies for SDGs; Sustainable practices in managing resources, including deforestation, water conservation, Desalination – types, energy security, and food security issues, Life Cycle thinking and Circular Economy.

| Module 2 | **Ecosystems, Biodiversity, and Sustainable Practices** | | | |
|---|---|---|---|---|

**Topics:**
**Ecosystems and ecosystem services:** Various natural ecosystems, Major ecosystem types in India and their basic characteristics; forests, wetlands, grasslands, agriculture, coastal and marine; Ecosystem services- classification and their significance.
The importance of biodiversity, Biodiversity and Climate Change, the threats it faces, hotspots, and the methods used for its conservation. Strategies for in situ and ex situ conservation, nature reserves, and the significance of India as a mega diverse nation.

| Module 3 | **Environmental Pollution, Waste Management, and Sustainable Development** | | | |
|---|---|---|---|---|

**Topics:**
Types of pollution- Chemical, - Biological, Biomedical, noise, air, water, soil, thermal, radioactive and marine pollution, and their impacts on society.  Urbanization and Urban environmental problems; effects, and mitigation.
Causes of pollution, such as global climate change, ozone layer depletion, the greenhouse effect, and acid rain, with a particular focus on pollution episodes in India. Importance of adopting cleaner technologies; Solid waste management;

**Sustainable Materials and Technologies:** Biodegradable and compostable materials, Recycled and reclaimed materials (E-waste management), Sustainable manufacturing processes.

| Module 4 | **Social Issues, Legislation, and Practical Applications** | | | |
|---|---|---|---|---|

**Topics:**
Overview of key environmental legislation and the judiciary's role in environmental protection, including the Water (Prevention and Control of Pollution) Act of 1974, the Environment (Protection) Act of 1986, and the Air (Prevention and

Control of Pollution) Act of 1981. Environmental management system: ISO 14001. National Biodiversity Action Plan (NBAP), Environmental Impact Assessment (EIA): Objectives of EIA, Environmental Impact Statement (EIS), Life cycle Assessment (LCA) and application.

**Major International Environmental Agreements:** Convention on Biological Diversity (CBD), United Nations Framework Convention on Climate Change (UNFCCC); Kyoto Protocol; Paris Agreement.

**Major International organisations and initiatives:** United Nations Environment Programme (UNEP), United Nations Educational, Scientific and Cultural Organization (UNESCO), Intergovernmental Panel on Climate Change (IPCC).

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**Targeted Application & Tools that can be used:**
Application areas are Energy, Environment and sustainability
**Tools:** Online Tools – NPTEL and Swayam.

**Project work/Assignment:**

**Assessment Type**
- Online end term exam will be conducted by the department of Chemistry

**NPTEL/SWAYAM Link*:**
1) https://nptel.ac.in/courses/109105203, NPTEL course: Environmental Science, Lecture by Dr. Samik Chowdhury, Dr. Sudha Goel, 2024.
2) https://onlinecourses.swayam2.ac.in/ini25_bt02/preview, Swayam-NPTEL course: Biodiversity Conservation, Lecture by Prof. Kaleem Ahmed, Prof. Ahmad Masood Khan 2025.

* Other source links are available in below Resources link.

**Text Book**
- G. Tyler Miller and Scott Spoolman (2020), Living in the Environment, 20th Edition, Cengage Learning, USA
- Poonia, M.P. Environmental Studies (3rd ed.), Khanna Book Publishing Co.
- Bharucha, E. Textbook of Environmental Studies (3rd ed.) Orient Blackswan Private Ltd.
- Dave, D., & Katewa, S. S. Text Book of Environmental Studies. Cengage Learning India Pvt Ltd.
- Rajagopalan, R. Environmental studies: from crisis to cure (4th ed.). Oxford University Press.
- Basu, M., & Xavier Savarimuthu, S. J. Fundamentals of environmental studies. Cambridge University Press.
- Roy, M. G. Sustainable Development: Environment, Energy and Water Resources. Ane Books.
- Pritwani, K. Sustainability of business in the context of environmental management. CRC Press.
- Wright, R.T. & Boorse, D.F. Environmental Science: Toward A Sustainable Future (13th ed,). Pearson.

**Reference Books**
1. Varghese, Anita, Oommen, Meera Anna, Paul, Mridula Mary, Nath, Snehlata (Editors) (2022), Conservation through Sustainable Use: Lessons from India. Routledge.
2. William P. Cunningham and Mary Ann Cunningham (2020), Principles of Environmental Science: Inquiry & Applications, 9th Edition, McGraw-Hill Education, USA.
3. Richard A. Marcantonio, Marc Lame (2022). Environmental Management: Concepts and Practical Skills. Cambridge University Press.
4. Manahan, S.E. (2022). Environmental Chemistry (11th ed.). CRC Press. https://doi.org/10.1201/9781003096238
5. Theodore, M. K. and Theodore, Louis (2021) Introduction to Environmental Management, 2nd Edition. CRC Press

**Resources:**
1. **https://nptel.ac.in/courses/109105203**
2. **https://archive.nptel.ac.in/courses/120/108/120108004/**
3. **https://nptel.ac.in/courses/127105018**
4. **https://onlinecourses.nptel.ac.in/noc23_lw06/preview**
5. **https://nptel.ac.in/courses/129105008**
6. **https://archive.nptel.ac.in/courses/120/108/120108002/**
7. **https://onlinecourses.swayam2.ac.in/ini25_bt02/preview**
8. **https://nptel.ac.in/courses/102104088**
9. **https://nptel.ac.in/courses/124107165**
10. **https://nptel.ac.in/courses/109106200**
11. **https://archive.nptel.ac.in/content/storage2/courses/120108004/module1/lecture1.pdf**
12. **https://onlinecourses.swayam2.ac.in/nou25_ge19/preview**
13. **https://onlinecourses.swayam2.ac.in/ini25_hs01/preview**
14. **http://kcl.digimat.in/nptel/courses/video/105105184/L32.html**

| 15. https://nptel.ac.in/courses/105105169 |
|---|

**Topics relevant to Skill Development:**
1. An attitude of enquiry.
2. Write reports

**The topics related to Environment and Sustainability :**
All topics in theory component are relevant to Environment and Sustainability.


**LAW7601        Indian Constitution**

| Course Code: LAW7601 | Course Title:Indian Constitution<br><br>Type of Course: MOOC | L-T-P-C | - | - | - | - |
|---|---|---|---|---|---|---|
| **Course Pre-requisites** | NIL | | | | | |
| **Anti-requisites** | NIL | | | | | |
| **Course Description** | This course provides a comprehensive understanding of the Indian Constitution and its foundational elements. It begins with a critical analysis of the historical background, the Preamble, Fundamental Rights, and the basic structure doctrine, enabling students to appreciate the constitutional vision of justice, liberty, equality, and fraternity. The course then delves into the framework of governance at both the central and state levels, highlighting the roles, responsibilities, and interplay between key institutions such as the President, Prime Minister, Parliament, Governors, Chief Ministers, and State Secretariats. Additionally, the course offers insights into the structure and functioning of local self-governments, including District Administration, Municipal Corporations, and Zila Panchayats, thus fostering an understanding of grassroots democracy. Finally, the course assesses the pivotal role of the Election Commission in safeguarding democratic values through the conduct of free and fair elections. | | | | | |
| **Course Objective** | This course is designed to improve the learners' **Employability Skills** by using **Participatory Learning techniques**. | | | | | |
| **Course Outcomes** | On successful completion of the course, the students shall be able to:<br><br>**CO1.** To analyse the history, Preamble, Fundamental Rights, and basic structure of the Indian Constitution.<br>**CO2.** To describe the roles of the President, Prime Minister, and legislative bodies (Lok Sabha and Rajya Sabha).<br>**CO3.** To examine the powers and functions of the Governor, Chief Minister, and State Secretariat<br>**CO4.**Toassess the functioning of local government bodies like District Administration, Municipal Corporations, and Zila Panchayats.<br>**CO5.** To analyse the role of the Election Commission in conducting free and fair elections. | | | | | |
| **Course Content:** | | | | | | |

| Module 1 | The Constitution - Introduction | CO1 | Lectures & Discussion | 08 Sessions |
|----------|--------------------------------|-----|----------------------|-------------|

History of the Making of the Indian Constitution, Preamble and Basic Structure, and its interpretation, Fundamental Rights and Duties and their interpretation, State Policy Principles.

| Module 2 | Union Government | CO2 | Case Study/Group Discussion | 08 Sessions |
|----------|------------------|-----|----------------------------|-------------|

Structure of the Indian Union, President – Role and Power, Prime Minister and Council of Ministers, Lok Sabha and Rajya Sabha.

| Module 3 | State Government | CO3 | Research paper | 06 Sessions |
|----------|------------------|-----|----------------|-------------|

Governor – Role and Power, Chief Minister and Council of Ministers, State Secretariat.

| Module 4 | Local Administration | CO4 | Presentation | 04 Sessions |
|----------|---------------------|-----|--------------|-------------|

District Administration, Municipal Corporation Zila Panchayat.

| Module 5 | Election Commission | C05 | | 04 Sessions |
|----------|---------------------|-----|--|-------------|

Role and Functioning, Chief Election Commissioner, State Election Commission.

**Targeted Application & Tools that can be used:** NIL

**Project work/Assignment:**

**Group Assignment**
**Details:**
1. Presentations and Discussions

**Research Project**
**Details:**
1. Research Paper Writing

2. Case Analysis on leading cases

**Test Books**

1. Ethics and Politics of the Indian Constitution – Rajeev Bhargava, Oxford University Press, New Delhi, 2008
2. The Constitution of India – B.L. Fadia, Sahitya Bhawan, 2017 (New Edition)
3. Introduction to the Constitution of India – D.D. Basu, Lexis Nexis, 2018 (Twenty-Third Edition)

**Case Laws**

1. Rustom Cavasjee Cooper v. Union of India (1970) 1 SCC 248
2. State of Rajasthan v. Mohan Lal Vyas, AIR 1971 SC 2068
3. Mithilesh Garg v. Union of India (1992) 1 SCC 168
4. Chintamanrao v. The State of Madhya Pradesh, AIR 1951 SC 118
5. Cooverjee B. Bharucha v. Excise Commissioner, Ajmer, AIR 1954 SC 220
6. Automobile Transport (Rajasthan) Ltd. Vs State of Rajasthan, AIR 1962 SC 1406
   (And more as listed)

**Reference:**

1. Indian Constitution
2. Legislative Department of India
3. Supreme Court of India
4. Toppr Guide: The Indian Constitution

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