PRESIDENCY UNIVERSITY

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PROGRAMME REGULATIONS & CURRICULUM

2024-27

PRESIDENCY SCHOOL OF INFORMATION SCIENCE

BACHELOR OF COMPUTER APPLICATIONS

(DATA SCIENCE)

PRESIDENCY UNIVERSITY

Presidency University Act, 2013 of the Karnataka Act No. 41 of 2013 | Established under Section 2(f) of UGC Act, 1956
Approved by AICTE, New Delhi

PRESIDENCY SCHOOL OF INFORMATION SCIENCE

Program Regulations and Curriculum

2024-2027

BACHELOR OF COMPUTER APPLICATIONS

(Data Science)

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

(As amended up to the 24th Meeting of the Academic Council held on 3rd August 2024. This document supersedes all previous guidelines)

Regulations No.: PU/AC-24.6/SOIS05/BCD/2024-2027

Resolution No.6 of the 24th Meeting of the Academic Council held on 3rd August 2024, and ratified by the Board of Management in its 24th Meeting held on 5th August 2024

AUGUST-2024

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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 2024-2027.
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 2024-202 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 2024-2025.

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 (DS) Degree Program Regulations and Curriculum, 2024-2027;

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 2024-2027 are subject to, and, pursuant to the Academic Regulations, 2021. These Program Regulations shall be applicable to the following ongoing Bachelor of Computer Applications Degree Programs of 2024-2027 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: [Data Analysis]: Demonstrate comprehensive knowledge using statistical and machine learning techniques to analyze data and derive meaningful insights and patterns.

PSO-2: [Design/ development of Solutions]: Identify, formulate and apply the knowledge of Machine learning algorithms, Deep Learning Algorithms and Big data technologies and tools for processing and analysing large datasets.

PSO-3: [Data Science Applications] Students should be able to apply data science techniques, and translate data insights into actionable recommendations in specific domains, such as finance, healthcare, or marketing, etc.,

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 2nd year (3rd 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	100%
	End Term Examination	0%
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.

PART B: PROGRAM STRUCTURE

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

The BCA Program Structure (2024-2027) 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.

Table 3: BCA 2024-2027: Summary of Mandatory Courses and Minimum Credit Contribution from various Baskets

Sl. No.	Baskets	Credit Contribution
1	Core Courses	50
2	Ability Enhancement Courses	8
3	Multi-Disciplinary Elective course	3
4	Value added Courses	6
5	Skill Enhancement courses	29
6	Discipline Specific Elective	24
	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 of 19.2.1 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.

PART C: CURRICULUM STRUCTURE

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

List of Courses Tabled – aligned to the Program Structure
(Course Code, Course Name, Credit Structure (LTPC), Contact Hours, Course Basket, Type of Skills etc., as applicable).

Table 3.1: Ability Enhancement Courses (AEC)						
S.No	**Code**	**Course Name**	**L**	**T**	**P**	**C**
1	ENG1003	Communicative English	2	0	0	2
2	PPS1001	Introduction to soft skills	0	0	2	1
3	ENG2005	Technical Written Communication	2	0	0	2
4	PPS1006	Employability for young professionals	0	0	2	1
5	PPS2002	Being Corporate Ready	0	0	2	1
6	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.	CSA1001	Problem Solving using C	2	0	4	4
2.	CSA1002	Web Design and Development	1	0	4	3
3.	CSA1004	Programming in Python	1	0	4	3
4.	CSA1504	Object Oriented Programming using Java	1	0	4	3
5.	CSA2511	Android Mobile Applications Development	0	0	6	3
6.	CSA2519	Database System Administrator Lab	0	0	4	2
7.	CSA2211	UI/UX Design	0	0	6	3
8.	CSA2212	Internet of Things	1	0	4	3
9.	CSA7000	Summer Internship	-	-	-	3
10.	CSA7300	Project	-	-	-	4
		Total No. of Credits				**31**

Table 3.3: Core Courses (CC)						
S.No	**Code**	**Course Name**	**L**	**T**	**P**	**C**
1	MAT2007	Applied Mathematics	3	0	0	3
2	ECE2009	Digital Computer Fundamentals	2	0	2	3
3	CSA1003	Fundamentals of Data Science	3	0	0	3
4	MAT1006	Statistical Methods and Techniques	3	0	0	3
5	CSA2101	Data Structures and Algorithms	3	0	0	3
6	CSA2100	Data Structures and Algorithms Lab	0	0	2	1
7	CSA2004	Computer Networks	3	0	0	3
8	CSA2002	Computer Organization	3	0	0	3
9	CSA2503	Relational Database Management Systems	3	0	0	3
10	CSA2504	Relational Database Management Systems Lab	0	0	2	1

11	CSA2515	Data Modelling and Visualization	1	0	4	3
12	CSA2505	Analysis of Algorithms	2	1	0	3
13	CSA2504	Operating Systems and Unix Programming	2	0	0	2
14	CSA2505	Operating Systems and Unix Programming Lab	0	0	2	1
15	CSA1202	Software Engineering	3	0	0	3
16	CSA2517	Machine Learning Algorithms	3	0	0	3
17	CSA2509	Data Management using Cloud	3	0	0	3
18	CSA2518	Machine Learning Algorithms Lab	0	0	2	1
19	CSA1703	Data Mining	3	0	0	3
20	CSA2516	Data Analysis using R Programming	0	0	4	2
		Total No. of Credits				**50**

Table 3.4 : Value Added Course (VAC)						
S.No	**Code**	**Course Name**	**L**	**T**	**P**	**C**
1	CHE7601	Environmental Studies	0	0	0	0
2	LAW1008	Indian Constitution	2	0	0	2
3	CSA1204	Design thinking and Innovation	2	0	0	2
		Total No. of Credits				**4**

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 fulfill 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 Handout.

18.1 Internship

A student may opt to undertake Internship for a duration of 10-12 weeks during the 6th semester, while concurrently completing the remaining registered courses for that semester. This 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.

18.2 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 18.3.2 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

Table 3.7 : Discipline Specific Elective – Minimum of 15 credits is to be earned by the student in a particular track and overall 24 credits.

Track 1 - Full Stack and Front End

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	CSA3424	Agile Structures and Frameworks	3	0	0	3
4	CSA3425	Introduction to Devops	3	0	0	3
5	CSA3426	Front-End Development using Java Script	1	0	4	3
6	CSA3427	Web Application Development	1	0	4	3

Track 2 – Data Science & AIML

S.No	Course Code	Course Name	L	T	P	C
1	CSA3803	AI in Finance and Business Accounting	1	0	4	3
2	CSA3415	Pattern Recognition	1	0	4	3
3	CSA3416	Predictive Analytics	1	0	4	3
4	CSA3417	Time Series Analysis	3	0	0	3
5	CSA3428	Ethical aspects of AI	3	0	0	3
6	CSA3418	Blockchain for Data Integrity and Verification	3	0	0	3

Track 3 – Cloud and Network

S.No	Course Code	Course Name	L	T	P	C
1	CSA3429	Cloud Computing for Data Analytics	3	0	0	3
2	CSA3421	Enterprise and Cloud computing	3	0	0	3
3	CSA3419	Enterprise Data Management and Strategy	3	0	0	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.

Table 3.8 Multi-Disciplinary Electives Courses Baskets: Minimum Credits to be earned from this Basket is 3						
Sl. 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 Behavior	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

Sl. 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									
			CREDIT STRUCTURE						
S. NO.	COURSE CODE	COURSE NAME	L	T	P	C	CONTACT HOURS	BASKET	TYPE OF SKILL
1	MAT2007	Applied Mathematics	3	0	0	3	3	CC	S
2	CSA1001	Problem Solving using C	2	0	4	4	6	SEC	S
3	ECE2009	Digital Computer Fundamentals	2	0	2	3	4	CC	S
4	CSA1002	Web Design and Development	1	0	4	3	5	SEC	S
5	ENG1003	Communicative English	2	0	0	2	2	AEC	S
6	PPS1001	Introduction to soft skills	0	0	2	1	2	AEC	S
		TOTAL	**10**	**0**	**12**	**16**	**22**	**-**	**-**

Semester 2									
			CREDIT STRUCTURE						
S. NO.	COURSE CODE	COURSE NAME	L	T	P	C	CONTACT HOURS	BASKET	TYPE OF SKILL
1	CSA1004	Programming in Python	1	0	4	3	5	SEC	S
2	MAT1006	Statistical Methods and Techniques	3	0	0	3	3	CC	S

3	CSA2101	Data Structures and Algorithms	3	0	0	3	3	CC	S
4	CSA2100	Data Structures and Algorithms Lab	0	0	2	1	2	CC	S
5	ENG2005	Technical Written Communication	2	0	0	2	2	AEC	S
6	CSA2004	Computer Networks	3	0	0	3	3	CC	S
7	CSA1003	Fundamentals of Data Science	3	0	0	3	3	CC	S
8	CSA2002	Computer Organization	3	0	0	3	3	CC	S
9	PPS1006	Employability for young professionals	0	0	2	1	2	AEC	S
		TOTAL	**18**	**0**	**8**	**22**	**26**	**-**	**-**

Semester 3									
			CREDIT STRUCTURE						
S. NO.	**COURSE CODE**	**COURSE NAME**	**L**	**T**	**P**	**C**	**CONTACT HOURS**	**BASKET**	**TYPE OF SKILL**
1	CSA2503	Relational Database Management Systems	3	0	0	3	3	CC	S
2	CSA2504	Relational Database Management Systems Lab	0	0	2	1	2	CC	S
3	CSA1504	Object Oriented Programming using Java	1	0	4	3	5	SEC	S
3	CSA2515	Data Modelling and Visualization	1	0	4	3	5	CC	S
5	CSA2505	Analysis of Algorithms	2	1	0	3	3	CC	S
6	CSA2506	Operating Systems and Unix Programming	2	0	2	2	4	CC	S
7	CSA2507	Operating Systems and Unix Programming Lab	0	0	2	1	2	CC	S
8	CSA1202	Software Engineering	3	0	0	3	3	CC	S
9	PPS2002	Being Corporate Ready	0	0	2	1	2	AEC	S
10	CHE7601	Environmental Studies	0	0	0	0	0	VAC	S
		TOTAL	**12**	**1**	**16**	**20**	**29**	**-**	**-**

Semester 4									
			CREDIT STRUCTURE						
S. NO.	**COURSE CODE**	**COURSE NAME**	**L**	**T**	**P**	**C**	**CONTACT HOURS**	**BASKET**	**TYPE OF SKILL**
1	CSA2517	Machine Learning Algorithms	3	0	0	3	3	CC	S
2	CSA2511	Android Mobile Application Development	0	0	6	3	6	SEC	S
3	CSA2509	Data Management using Cloud	3	0	0	3	3	CC	S
4	CSA2518	Machine Learning Algorithms Lab	0	0	2	1	2	CC	S
5	CSAXXXX	Discipline Specific Elective– I	3	0	0	3	3	DSE	EM
6	CSAXXXX	Discipline Specific Elective– II	3	0	0	3	3	DSE	EM
7	CSAXXXX	Discipline Specific Elective– III	3	0	0	3	3	DSE	EM
8	PPS3001	Problem Solving through Aptitude	0	0	2	1	2	AEC	S
9	LAW1008	Indian Constitution	2	0	0	2	2	VAC	S
		TOTAL	**17**	**0**	**10**	**22**	**27**	**-**	**-**

Semester 5									
			CREDIT STRUCTURE						
S. NO.	**COURSE CODE**	**COURSE NAME**	**L**	**T**	**P**	**C**	**CONTACT HOURS**	**BASKET**	**TYPE OF SKILL**
1	CSA1703	Data Mining	3	0	0	3	3	CC	S

2	CSA2516	Data Analysis using R Programming	0	0	4	2	4	CC	S
3	CSA2519	Database System Administrator Lab	0	0	4	2	4	SEC	S
4	CSAXXXX	Discipline Specific Elective– IV	3	0	0	3	3	DSE	EM
5	CSAXXXX	Discipline Specific Elective– V	3	0	0	3	3	DSE	EM
6	CSAXXXX	Discipline Specific Elective – VI	3	0	0	3	3	DSE	EM
7	CSA2212	Internet of Things	1	0	4	3	5	SEC	S
8	CSAXXXX	Multi-Disciplinary Elective – I	3	0	0	3	3	MDC	EN
9	CSA7000	Summer Internship	-	-	-	3	0	SEC	S
		TOTAL	**16**	**0**	**12**	**25**	**28**	**-**	**-**

Semester 6									
			CREDIT STRUCTURE						
S. NO.	**COURSE CODE**	**COURSE NAME**	**L**	**T**	**P**	**C**	**CONTACT HOURS**	**BASKET**	**TYPE OF SKILL**
1	CSA1204	Design thinking and Innovation	2	0	0	2	2	VAC	S
2	CSA2211	UI/UX Design	0	0	6	3	6	SEC	S
3	CSAXXXX	Discipline Specific Elective - VII	3	0	0	3	3	DSE	EM
4	CSAXXXX	Discipline Specific Elective - VIII	3	0	0	3	3	DSE	EM
5	CSA7300	Project	-	-	-	4	0	SEC	S
		TOTAL	**8**	**0**	**6**	**15**	**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)

ENG1003 Communicative English

Course Code: ENG 1003	Course Name: Communicative English Type of Course: Theory Course	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 course facilitates the holistic development of English language skills i.e., basic communication, Listening, Speaking, Reading and Writing. The course aims at developing the communicative competence of learners by participating in various narrate group activities and by enacting in role-plays pertaining to functional English. The course enables the learners to write various types of professional business letters. The course involves comprehension of business-related texts of topical relevance and drawing inferences from the given text.
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:** • Explain basic Communication Process. [Understand] • Apply speaking skills in various situations [Apply] • Demonstrate writing strategies in drafting business letters. [Understand] • Interpret the ideas of the author in the text [Understand]

Course Content:

Module 1	Art of Communication	Assignment	Art of Communication	7 Sessions

Topics:
1. Introduction: The Process of Communication, the communication cycle, noise, General and technical communication.
2. Language as a tool of communication, Characteristics of Language
3. Kinesics and proxemics, Paralinguistics and Chronomics

Module 2	Listen and Speak	Quiz/ Assignment	Listen and Speak	7 Sessions

Topics:
1.Narration – Rules
Motivational Stories –Role Play, Story Circle, Jigsaw Tale
2.Conversations
At the Bank
At the Airport
Life in Metropolis
Talking about Computers
At the Post office
Giving a Message on phone
Customer Service Situations
Talking about Weather and Temperature

Module 3	Business Writing	Assignment	Business Writing	7 Sessions

Topics:
1.Basic writing skills: Introduction to writing, Cohesion, Coherence, Steps of writing
2.Effective Business Writing: Tips and Techniques, Important elements of letter writing, Layout, Types of Business letters (Order Placement, Appointments, Claims, Inquiry, Sales, and Complaint Letters)

Module 4	Reading Skills	Assignment	Reading Skills	7 Sessions

Topics:
Importance of analytical reading, Different types of Reading, Reading Comprehension Tips & Tricks
Reading Comprehension Practice – Analyze Main Idea Questions, Analyze Contextual Questions, Analyze Inference Questions

Text Book

• Course Material by the Instructor. • PPT's and Videos and Worksheets provided by the instructor.
References • Hart, Steve. Nari, Aravind R. and Bhambhani, Veena. Embark: English for Undergraduates. New Delhi; Cambridge University Press, 2016. • 2. J. K. Gangal, A Practical course in Spoken English, PHL Learning Private Limited, Delhi-2014.
E-Resources 1. https://presiuniv.knimbus.com/user#/searchresult?searchId=Communication%20Skills 2. https://presiuniv.knimbus.com/user#/searchresult?searchId=Communicative%20English

PPS1001 Introduction to soft skills

Course Code: PPS1001	Course Name: Introduction to Soft Skills Type of Course: Lab / Lab Integrated Course	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:** **CO1** Prepare professional social media profile [Understand] **CO2** Recognize the significance of Soft Skills [Understand] **CO3** List the techniques of unlearning poor habits and forming healthy habits [Understand] **CO4** Demonstrate appropriate team behavior & people management [Understand]		

Course Content:				
Module 1	Introduction to Soft Skills	Assignment	Introduction to Soft Skills	4 Sessions
Topics: Setting Expectations, Ice Breaker, Significance of soft skills.				
Module 2	Professional Brand Building	Assignment	Professional Brand Building	4 Sessions
Topics: Significance of a profile. Creating an online profile. Networking - 100 connections, LinkedIn as a live resume, Create a dashboard.				
Module 3	Habit Formation	Assignment	Habit Formation	4 Sessions
Topics: 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) • 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 2. 7 steps for successful career planning (naukri.com) Ted Talk: • An introvert's guide to networking | Rick Turoczy | TEDxPortland - YouTube (Module: Professional Brand building) • How to turn a group of strangers into a team | Amy Edmondson - YouTube (Module: Team skills and People Management) • How Adaptability Will Help You Deal With Change | Jennifer Jones | TEDxNantwich - YouTube (Module: Adaptability)

ENG2005 Technical Written Communication

Course Code: ENG2005	Course Name: Technical Written Communication Type of Course: Theory Course	L- T-P- C	2-0-0-2
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:** • Apply strategies and techniques for organizing and drafting descriptions and specifications. [Understand] • Develop skills in writing sentences and paragraphs for content on websites and blogs. [Understand] • 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

- 1. Johnson, Richard. Technical Communication Today. Pearson, 2015.
- 2. 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

PPS1006 Employability for young professionals

Course Code: PPS1006	Course Name: Employability for Young Professionals Type of Course: Lab / Lab Integrated Course	L- T-P- C	0-0-2-1
Version No.	1		
Course Pre-requisites	Students are expected to understand Basic English. Students should have desire and enthusiasm to involve, participate and learn.		
Anti-requisites	NIL		
Course Description	This course is designed to develop effective communication skills and boost confidence levels. The activity-based modules cover the art of Questioning, how to ask questions, goal setting with emphasis on time and stress management, creating the first impression and introducing one self and finally culminating with the etiquettes of email writing. The pedagogy used will be research, group discussions, flipped classrooms, continuous feedback, role-play and mentoring.		
Course Objective	NIL		
Course Out Comes	**On successful completion of the course the students shall be able to:** **CO1** Show effective communication skills through self-introduction [Understand] **CO2** Analyse information through questioning technique for better decision making [Understand] **CO3** Identify individual strengths and weaknesses for self-awareness and stress management [Understand] **CO4** Apply SMART technique to achieve goals and increase productivity [Understand]		

Course Content:				
Module 1	Art of Questioning	Assignment	Art of Questioning	4 Sessions
Topics: Note Taking, Framing Questions, Open-ended and Close-ended questions, Funnel technique, Probing questions, Leading questions, Rhetorical questions, 5W1H Technique				
Module 2	Goal Setting & Time management	Assignment	Goal Setting & Time management	8 Sessions
Topics: Goal Setting (SMART Goals), Time Management Matrix, Steps to managing time through outbound group activity, Making a schedule, Daily Plan and calendars (To Do List), Monitoring/charting daily activity				
Module 3	Self - Introduction and creating an Impression	Assignment	Self - Introduction and creating an Impression	8 Sessions
Topics: Body Language, Grooming guidelines for boys/girls, Common mistakes in Grooming at workplace and social gathering, Etiquettes at work place & social gathering, SWOT – Self-awareness analysis, Self-introduction template, evaluation of self-introduction in class				
Module 4	E-Mail Etiquette	Assignment	E-Mail Etiquette	6 Sessions
Topics: Dos and Don'ts of professional email etiquette, practice writing emails (activity)				

PPS2002 Being Corporate Ready

Course Code: PPS2002	Course Name: Being Corporate Ready Type of Course: Lab / Lab Integrated Course	L- T-P- C	0-0-2-1
Version No.	1		
Course Pre-requisites	Students are expected to understand Basic English. Students should have desire and enthusiasm to involve, participate and learn.		
Anti-requisites	NIL		
Course Description	The course is designed to enhance confidence level through effective communication, presentation and group discussion skills. The corporate etiquette module intends to provide an understanding of the culture and etiquettes to be followed in the corporate world. The pedagogy used will be research, group discussions, flipped classrooms, continuous feedback, role-play and mentoring.		
Course Objective	The objective of the course is to familiarize the learners with the concepts of "Being Corporate Ready" and attain SKILL DEVELOPMENT through PARTICIPATIVE LEARNING techniques.		
Course Out Comes	**On successful completion of the course the students shall be able to:** **CO1** Recognize the fundamental nuances of Corporate Etiquette [Understand] **CO2** Express thoughts/opinions in an acceptable manner in group discussions [Understand] **CO3** Demonstrate effective presentation skills [Understand]		

Course Content:

Module 1	Presentation skills – practice and evaluation of individual presentation	Assignment	Presentation skills – practice and evaluation of individual presentation	14 Sessions
Topics: Presentation Skills, Opening Body & Closing Body, Audibility, Speech Clarity, Fluency, Voice Modulation, Non-verbal Communication and Body Language, Talk by Industry Expert-Outbound activity. Activity: Individual presentations (10 hours)				
Module 2	Group Discussions – Practice and feedback	Assignment	Group Discussions – Practice and feedback	8 Sessions
Topics: Group Discussion techniques, Idea Generation, Mind Mapping, DEF, GOD, Action Plans for GD, Alumni Talk. Activity: Group Discussions				
Module 3	Corporate Etiquette	Assignment	Corporate Etiquette	2 Sessions
Topics: Do's and Don'ts in an Office Meeting, Handshake, Use of Business Card, Understanding Dress Code, Accessorizing Professionally, Telephone Etiquette, Interacting with Colleagues, Culture & Gender sensitization, Introduction to common tools at workplace for example CRM, POS, LMS, CANVA etc.				
Module 4	Recap, Revision & Feedback session	Assignment	Recap, Revision & Feedback session	2 Sessions
Topics: Revision of all the modules, overall feedback from the students about the syllabus.				

E-Resources
YouTube Links: https://youtu.be/z__jxoczNWc
TED Talks: https://youtu.be/xkq8dr_5ofs

PPS3001 Problem Solving through Aptitude

Course Code: PPS3001	Course Name: Problem Solving through Aptitude Type of Course: Lab / Lab Integrated Course	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:** **CO1** Recall all the basic mathematical concepts they learnt in high school. [Understand] **CO2** Identify the principle concept needed in a question. [Understand] **CO3** Solve the quantitative and logical ability questions with the appropriate concept. [Understand] **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

CSA1001 Problem solving using C

CSA1001	Course Title: Problem solving using C Type of Course: Program Core Theory and Laboratory Integrated	L-T-P-C	2	0	4	4
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: CO1: Identify the solution to the problem through programming [Understand] CO2: Apply the basic concepts and control structures of programming to solve the problem. [Apply] CO3: Interpret the concepts of array and strings to represent data and its operations. [Apply] CO4: Demonstrate the concepts of functions, structures and unions in solving the related scenarios. [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)

CSA1002 Web Design and Development

Course Code: CSA1002	Course Title: Web Design and Development 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 through the process of working in a client/server side programming and learning skills which 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 and analytical skills.					
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 Experiential Learning techniques.					
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. [Application] • Use JavaScript to write modern, reactive dynamic Websites (Client-side programming. [Application] • Understand PHP language and use them while applying the principles of object-oriented development. [Application] • Design server-side programming on the web using PHP. [Application]					
Course Content:						
Module 1	Introduction to HTML and CSS(Application)	Assignment	Programming activity	6 Hours		
Topics: Introduction to HTML: fundamentals of HTML elements, Document body, text, hyperlink, lists, tables, color and images, frames; Cascading Style Sheets: Introduction, defining your own styles, properties and values in styles, style sheets, formatting blocks, and layers.						
Module 2	Designing of simple pages (Application)	Assignment	Programming activity	6 Hours		
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.

Module 3	Server Side Development (Application)	Assignment	Programming activity	6 Hours

Topics:
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

Errors Handling:
Error Handling and Validation, What are errors and Exceptions?, PHP Error Reporting, PHP Error and Exceptions Handling

List of Laboratory Tasks:
Lab sheet -1 [2 Practical Sessions]
Experiment No 1:
Level 1 –Design a simple web page with head, body and footer, with heading tags, image tag.
Level 2 - Design a page to display the product information such as name, brand, price and etc with table tag.
Experiment No. 2:
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.
Lab sheet – 2 [2Practical Sessions]
Experiment No. 1:
Level 1 - Design a web page with nice formatting like background image, text colors and border for text using external CSS.
Level 2 -JavaScript to perform mathematical calculations such as addition, subtraction, multiplication, and division using form elements
Experiment No. 2:
Level 1- Design a web page to display timer in the left side of the web page using Java Script.
Level 2- Design a web page to capture the student details such as student number, name, age, marks using Java Script Object.
Lab sheet – 3 [2 Practical Sessions]
Experiment No. 1:
Level 1 – JavaScript that calculates the Squares and Cubes of numbers from 0 to 10.
Level 2 –Display the results in an HTML table format.
Experiment No. 2:
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 decreases to 10pt.
Lab sheet – 4 [2 Practical Sessions]
Experiment No. 1:
Level 1 - PHP program print the grade of student using marks
Level 2 -PHP program to print the date in ten different formats
Experiment No. 2:
Level 1 - PHP program to keep track of the number of visitors visiting the web page and to display 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:

Level 1 - PHP program to sort the student's records which are stored in the database using the SELECTION sort. Level 2 –Design an XML document to store information about a student in a college. The information must include USN, Name, Course name, Year of joining, and email id. Create a style sheet and use it to display document.
Targeted Application & Tools that can be used:
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course
Problem Solving: Choose appropriate web concepts to implement the web pages.
Text Book HTML and CSS: The Comprehensive Guide, Jürgen Wolf, SAP Press; New edition (30 June 2023) JAVASCRIPT THE DEFINITIVE GUIDE 7/ED, David Flanagan, Shroff/O'Reilly; Seventh edition (15 June 2020) 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)

CSA1004 Programming in Python

Course Code: **CSA1004**	**Course Title:** Programming In Python **Type of Course:** Theory & Integrated Laboratory	**L-T-P-C**	1	0	4	3
Version No.	1.0					
Course Pre-requisites	Nil					
Anti-requisites	NIL					
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 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 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)			
Course Content:				
Module 1	**Problem Solving Techniques and Basics of Python Programming**	assignments	Quizzes form basics of python	**15 Sessions**
Basics of problem solving techniques, Basics of Python programming, operators and expressions, decision statements, loop control statements.				
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				
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.				
Module 4	**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.				
List of Laboratory Tasks: Each Lab sheets experiments are prepared by level 0 and level 1 module wise.				
Targeted Application & Tools that can be used: **Any IDE –PyCharm, VS Code, Python IDE, Spyder, jupyter note book, Google Colab**				
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 GSRAHSSHLKSKKGQS TSRHK?

iii) What is the total molecular weight and number of aminoacids of the peptide YTSLIHSLIEESQNQQEKNE QELLELDKWASLWNWF?

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 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.		
Course Out Comes	**On successful completion of the course the students shall be able to:** **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	Introduction to OOP : 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	Arrays, Strings , Extending Class	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 3	Interface, Package and Exception Handling	Assignment	Interface, Package and Exception Handling	20 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	Collection & GUI Programming	15 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 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.		
Course Out Comes	**On successful completion of the course the students shall be able to:** **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	20 Sessions
Topics: Views, Layout, Menu, Intent and Fragments.				
Module 3	Components of Android	Assignment	Components of Android	20 Sessions
Topics: Activities, Services, Broadcast receivers, Content providers, User Navigation				

Module 4	Notifications and Data Persistence	Assignment	Notifications and Data Persistence	30 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

Course Code: CSA2519	Course Name: Database System Administrator Lab Type of Course: Lab / Lab Integrated Course	L- T-P- C	0-0-4-2
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.		
Course Out Comes	**On successful completion of the course the students shall be able to:** **CO1** Apply database installation and configuration procedures to set up and manage a secure DBMS environment. [Apply] **CO2** Implement backup, recovery, and user management operations for maintaining database integrity and availability. [Apply]		

Course Content:

Module 1	Database Setup, User Management & Security	Assignment	Authentication mechanisms and access control	20 Sessions

Topics:
Installation and configuration of DBMS - Creating and managing databases - Tablespace and storage structure 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

Module 2	Backup, Recovery, Performance & Automation	Assignment		20 Sessions

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

Module 3	Introduction to Cloud-Based Database Administration	Assignment	Design methodologies	20 Sessions

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

List of Laboratory Tasks

1. **Experiment 1:** Install and configure MySQL/PostgreSQL/Oracle Database
2. **Experiment 2:** Create a new database and manage tablespaces (MySQL/PostgreSQL)
3. **Experiment 3:** Create and manage database users and roles
4. **Experiment 4:** Implement user privileges and access control (GRANT, REVOKE)
5. **Experiment 5:** Perform basic security hardening of a DBMS
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 a database from backup and perform crash recovery
10. **Experiment 10:** Create and configure database replication (Master-Slave for MySQL/PostgreSQL)
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 slow queries using EXPLAIN PLAN and indexing strategies
15. **Experiment 15:** Analyze and tune system performance based on query execution plans

16. **Experiment 16:** Set up automated database maintenance tasks (index rebuilding, backups)
17. **Experiment 17:** Use Linux tools like iostat, vmstat, and top to monitor system resources
18. **Experiment 18:** Setup and configure a basic MySQL/PostgreSQL database cluster (if applicable)
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

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/
- **PostgreSQL Documentation**: https://www.postgresql.org/docs/
- **Oracle Database Documentation**: https://docs.oracle.com/en/database/
- **Microsoft SQL Server Documentation**: https://docs.microsoft.com/en-us/sql/sql-server/

CSA2211 UI/UX Design

Course Code: CSA2211	Course Name: UI/UX Design Type of Course: Lab / Lab Integrated Course	L- T-P- C	0-0-6-3
Version No.	1		
Course Pre-requisites	Nil		
Anti-requisites	Nil		
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 visual communications 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.		
Course 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.		
Course Out Comes	**On successful completion of the course the students shall be able to:** **CO1** CO1 : Explain the UX Design principles [Understand] [Understand] **CO2** CO2 : Summarize the ideal user experience. [Understand] [Understand] **CO3** CO3 : Develop wireframes using digital tools [Apply] [Apply] **CO4** CO4 : Construct personas and evaluate designs [Apply] [Apply]		

Course Content:

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.				
Module 2	Users and User Centered Design	Assignment	Users and User Centered Design	20 Sessions
Topics: Users and end users, 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				

Module 3	Design methodologies	Assignment	Design methodologies	20 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.				
Module 4	Personas, developing mockups using Figma	Assignment	Personas, developing mockups using Figma	30 Sessions
Topics: Basics of personas, creating personas, perspectives on personas. Gestalt principles of perception, Usability Testing, acceptance testing, creating mockups and prototypes in Figma.				

List of Laboratory Tasks

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
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

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

References

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

E-Resources
Nil

CSA2212 Internet of Things

Course Code: CSA2212	Course Name: Internet of Things 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		
Course Description	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.		
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 acquisition, and cloud integration. To implement security measure		
Course Out Comes	**On successful completion of the course the students shall be able to:** **CO1** Explain IoT architecture, components, and communication protocols. [Understand] **CO2** Implement IoT networks using different communication protocols. [Apply] **CO3** Process and analyze IoT-generated data for decision-making. [Analyze] **CO4** Secure IoT applications and optimize performance. [Create]		

Course Content:

Module 1	Introduction to IoT	Assignment	Introduction to IoT	19 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	19 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	19 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	18 Sessions
Topics: Security Challenges in IoT: Authentication, Encryption, and Privacy,Case Studies of IoT 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 and 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.
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

CSA7000 Summer Internship

Course Code: CSA7000	Course Name: Summer Internship Type of Course: NTCC	L-T-P-C	-	-	-	3
Version No.	1					
Course Description	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.					
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.					
Course Out Comes	**On successful completion of the course the students shall be able to:** **CO1** Analyze industry requirements and understand workplace expectations. [Analyze] **CO2** Apply programming, design, and development skills to real-world projects. [Apply] **CO3** Evaluate project challenges, propose solutions, and document technical work effectively [Evaluate] **CO4** Demonstrate professional ethics, teamwork, and communication skills in an industry setting [Apply]					

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

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

CSA7300 Project

Course Code: CSA7300	Course Name: Project Type of Course: NTCC	L-T-P-C	-	-	-	4
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.					

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

MAT2007 Applied Mathematics

Course Code: MAT2007	**Course Title:** Applied Mathematics **Type of Course:** School Core	**L- T-P-C**	3	0	0	3
Version No.	2.0					
Course Pre-requisites	Nil					
Anti-requisites	Nil					
Course Description	The course provides an overview of the fundamental ideas of trigonometry and analytical geometry keeping in mind the geometrical approach to solving real-world problems. The course provides insights into the deeper aspects of differential calculus and its applications. It also covers various methods of integration and their significance. In addition, the course highlights the importance of matrix techniques and their advantages.					
Course Objective	The objective of the course is to **familiarize the learners with the concepts of "Applied Mathematics" and attain Skill Development through Problem Solving techniques.**					
Course Outcomes	On successful completion of the course the students shall be able to: CO1: Understand the basic principles of trigonometry and analytical geometry and their applications. [Understand] CO2: Comprehend the concepts of differential calculus and its applications. [Understand] CO3: Explain various methods of integration and their advantages. [Understand] CO4: Apply matrix techniques to solve system of linear equations. [Apply]					
Course Content:						
Module 1	**Trigonometry and Analytical Geometry**			**10 classes**		
Introduction, trigonometric ratios, transformations, identities, inverse trigonometric functions (only elementary topics). Scalar product, vector product, angle between two vectors, shortest distance between two lines, conditions for two lines to intersect, point of intersection, collinearity of three points (self- study topics). Direction ratios, direction cosines of a line passing through two points, equation of a line in space, angle between two lines, shortest distance between two lines, plane, equation of a plane in normal form.						
Module 2	**Differential Calculus**			**12 classes**		
Limit, continuity, differentiability, Test of convergence, Rolle's Theorem, Mean value theorems (Cauchy's and Lagrange's), Power series expansions of functions in Taylor's and Maclaurin's forms; indeterminate forms and L'Hospital's rule.						
Module 3	**Integral**			**10 classes**		

	Calculus			
Integral as limit of sum, fundamental theorem of calculus, indefinite integrals, methods of Integration: substitution method, integration by parts and by partial fraction technique.				
Module 4	**Matrices**			**12 classes**
Matrices, types of matrices, elementary properties of matrices, inverse matrices, rank of a matrix, symmetric, skew symmetric and orthogonal matrices, system of linear equations, Gauss elimination method.				

Targeted Application & Tools that can be used:

Applied Mathematics provides the mathematical foundations for technological engineering, scientific computing, management science, operations research, statistics, actuarial science, mathematical economics and the like.
Tools used: Mathematica / Matlab / Maple

Project work/Assignment:

Assignment 1: Trigonometry and Analytical Geometry.
Assignment 2: Differential and Integral Calculus.
Assignment 3: Matrix Techniques.

Text Books:

1. Hugh Neill, Trigonometry: A complete Introduction, John Murray Learning, 2018.

2. George B. Thomas and Ross L. Finney, Calculus and Analytical Geometry, Addison-Wesley, 9thEdn, 1998.
3. Ron Larson, Elementary Linear Algebra, Brooks/Cole Cengage Learning, 7thEdn., 2015.

References

1. Erwin Kreyzig, Advanced Engineering Mathematics, John Wiley and sons, Inc.10th Edition.

2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2010.

3. David C. Lay, Linear Algebra and its Applications, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.
4. Gilbert Strang, Linear Algebra and its Applications, Thomson, 2007.

5. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, Linear Algebra, 4th Ed., Prentice Hall, 2020.

6. A.I. Kostrikin, Introduction to Algebra, Springer Verlag, 1984.
7. Richard Bronson, Theory and Problems of Matrix Operations, Tata McGraw Hill, 1989.

8. Ron Larson, Trigonometry, Brooks/Cole Cengage Learning, 11thEdn, 2020.

9. Robert E, Moyer, Trigonometry, Mc. Graw Hill, Addision-Wesely, 4th Edition, 2009.

Topics relevant to SKILL DEVELOPMENT: The course provides an overview of the fundamental ideas of trigonometry and analytical geometry keeping in mind the geometrical approach to solving real-world problems. The course provides insights into the deeper aspects of differential calculus and its applications for **Skill Development through Problem Solving methodologies.** This is attained through assessment component mentioned in course handout.

E-Resources (https://presiuniv.knimbus.com)

1. https://openFullText.html?DP=https://directory.doabooks.org/handle/20.500.12854/52889

2. https://openFullText.html?DP=https://open.umn.edu/opentextbooks/textbooks/92

3. https://openFullText.html?DP=https://open.umn.edu/opentextbooks/textbooks/178
Web Resources 1. https://www.pdfdrive.com/analytic-geometry-and-calculus-with-vectors-e18904408.html 2. https://www.pdfdrive.com/calculus-and-analytic-geometry-9th-edition-e184473689.html 3. https://www.pdfdrive.com/calculus-with-analytic-geometry-e35951356.html
Video Lectures 1. https://www.youtube.com/watch?v=k_MzQjLA9fA 2. https://www.youtube.com/watch?v=BzxvLSkrd90 3. https://www.youtube.com/watch?v=WsQQvHm4lSw 4. https://archive.nptel.ac.in/courses/111/106/111106146/

ECE2009 Digital Computer Fundamentals

Course Code: ECE2009	Course Title: Digital Computer Fundamentals Type of Course: Program Core& Theory& Integrated Laboratory	L-T-P-C	2	0	2	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. In this course we emphasize on analysis and design of digital electronic circuits. Additionally, this course will create a foundation for future courses includes Computer Architecture, Microprocessors, Microcontrollers, and Embedded Systems etc. The course also enhances the Design, Implementation and Programming abilities through laboratory tasks. The associated laboratory provides an opportunity to verify the theoretical knowledge.					
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	10 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	10 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	10 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.				

List of Laboratory Tasks:

Experiment No 1: Verifythe Logic Gates truth table
Level 1: Verify basic logic gates on Digital Logic simulator.
Level 2: Construct basic logic gates using universal gates and verify using Digital Logic Simulator

Experiment No. 2: Construct and verify 2-bit and 3-bit adder and subtractor logic circuits
Level 1: By using basic logic and XOR gates on Simulator
Level 2: By using Universal logic gates on Simulator

Experiment No. 3: Construct and verify the Multiplexer and Demultiplexer logic circuits
Level 1: By using basic logic and XOR gates on Simulator
Level 2: By using Universal logic gates on Simulator.

Experiment No. 4: Construct and verify the Encoder and Decoder logic circuits
Level 1: By using basic logic gates on Simulator
Level 2: Design and simulate Priority encoder.

Experiment No. 5: Construct and verify the combinational logic circuit for given specifications.
Level 1: Specifications given in the form of Truth table. Implement using basic gates.
Level 2: Specification should be extracted from the given scenario. Implement using universal gates only.

Experiment No. 6: Study of Flip flops
Level 1: Verify the operation of Flip-Flops on Digital Logic Simulator
Level 2: Conversion of one FF to another and verify on Digital Logic Simulator.

Experiment No. 7: Construct and verify the synchronous counter circuit.
Level 1: 3-Bit up counter using JK excitation table.
Level 2: Specification should be extracted from the given scenario and design.

Experiment No. 8: Construct and verify the Asynchronous counter circuit.
Level 1: 3-Bit up counter.

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.

Professionally Used Software: MultiSim Simulator

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.
{[PDF] Digital Design By M. Morris Mano, Michael D Ciletti Book Free Download (studymaterialz.in)
Jain, R. P., *"Modern Digital Electronics"*, 4th Edition, McGraw Hill Education (India).
Roth, Charles H., Jr and Kinney Larry L., *"Fundamentals of logic Design"*, 7th Edition, Cengage Learning.

Online Resources (e-books, notes, ppts, video lectures etc.):

NPTEL Course- "Digital Electronics Circuits" by Prof. GowthamSaha, Dept of ECE, IIT Kharagpur, NPTEL :: Electrical Engineering - NOC:Digital Electronic Circuits
Digital Logic Design Lectures PPT Slide 1 (iare.ac.in)
Digital Design Lab Tutorial Links: Multisim Tutorial for Digital Circuits - Bing video
CircuitVerse - Digital Circuit Simulator online
Learn Logisim ➠ Beginners Tutorial | Easy Explanation! - Bing video
Digital Design 5: LOGISIM Tutorial & Demo
Presidency university link- https://presiuniv.knimbus.com/user#/home

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

CSA1003 - Fundamentals Of Data Science

Course Code: CSA1003	Course Title: FUNDAMENTALS OF DATA SCIENCE Type of Course: Theory	L-T-P-C	3	0	0	3
Version No.	1					

Course Pre-requisites	No prerequisites			
Anti-requisites	Nil			
Course Description	The purpose of this course is to enable the students to learn the Fundamentals of Data Science-Data Analysis for effective data driven decisions and to develop the abilities of analyzing the Data. Data science is the science of analyzing raw data using statistics and machine learning techniques with the purpose of drawing conclusions about that information.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of Fundamentals of Data Science and attain Skill Development through Participative Learning techniques.			
Course Outcomes	On successful completion of the course the students shall be able to: 1] Define the data science process. [Remember] 2] Understand different types of data description for data science process. [Understand] 3] Gain knowledge on relationships between data. [Remember] 4] Identify the role of ML and Domain Expertise in Data Science. [Understand]			
Course Content:				
Module 1	Introduction to Data Science	Assignment	Data Science Process	10 Sessions
Data Science: Benefits and uses – facets of data - Data Science Process: Overview – Defining research goals – Retrieving data – cleaning, integrating, and transforming data -Data preparation - Exploratory Data analysis – build the model– presenting findings and building applications - Data Mining - Data Warehousing – Basic Statistical descriptions of Data				
Module 2	DESCRIBING DATA	Continuous Assessment		9 Sessions
Types of Data - Types of Variables -Describing Data with Tables and Graphs –Describing Data with Averages - Describing Variability - Normal Distributions and Standard (z) Scores				
Module 3	DESCRIBING RELATIONSHIPS	Continuous Assessment		11 Sessions
Correlation –Scatter plots –correlation coefficient for quantitative data –computational formula for correlation coefficient – Regression –regression line –least squares regression line – Standard error of estimate – interpretation of r2 –multiple regression equations –regression towards the mean				
Module 4	Introduction to Machine Learning and Domain Expertise.	Continuous Assessment		10 Sessions
Topic: Defining Machine Learning and its processes, Learning Styles Learning with supervised algorithms, Learning with unsupervised algorithms, Learning with reinforcement algorithms. KNN Algorithm and K-Means. Data Engineering, Map reduce, Word Frequency Problem,, Map Reduce Solution, Other Examples of Map Reduce, Pregel.				
Targeted Application & Tools that can be used MS- Excel, Databases, Python etc..,				
Project work/Assignment:				
Assignment 1: Find the Sum, Pass or fail, Average and ranking for the 10 students. Assignment 2: Types of Data Analysis.				
Text Book T1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016. T2. Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017. T3. Lillian Pierson, “Data Science for Dummies”, 2nd ed, John Wiley & Sons, Inc., 2017.				
References R1 John D. Kelleher and Brendan Tierney, Data science, The MIT Press Essential knowledge series, 2018. [Module 1].				

Web resources: https://presiuniv.knimbus.com/user#/searchresult?searchId=eBook&curPage=0&layout=grid&sorFieldId=none&topresult=false&content=*cloud* https://presiuniv.knimbus.com/user#/home https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=2706929&site=ehostlive

MAT1006 Statistical Methods and Techniques

Course Code: MAT1006	**Course Title:** Statistical Methods and Techniques **Type of Course:**	**L- T-P-C**	3	0	0	3
Version No.	2.0					
Course Pre-requisites	Nil					
Anti-requisites	**NIL**					
Course Description	To acquaint students with various statistical methods. To cultivate statistical thinking among students. To prepare students for future courses having quantitative components.					
Course Objective	The objective of the course is to **familiarize the learners with the concepts of "Statistical Methods and Techniques"**and attain **Skill Development Through Problem Solvingtechniques**.					
Course Outcomes	On successful completion of this course the students shall be able to: CO1: **Recognize** the different techniques of graphical representation of statistical data. [Remember] CO2: **Predict** the characteristics of statistical data with the help of measures of central tendency, dispersion, correlation and regression. [Understand] CO3: **Interpret** the symmetry of a data set with the help of measures of skewness and kurtosis. [Understand] CO4: **Employ** suitable formulae for solving problems pertaining to the basic probability, additive and multiplicative laws for both independent and dependent events. [Understand]					
Course Content:						
Module 1	**Data distribution and Concepts of Central Tendency and Dispersion**			15 classes		
Statistics, Importance of Statistics, Data: Primary and secondary data, Types of data: unclassified, ungrouped and grouped data, Visual Representation of data: Bar chart- simple, sub-divided, component, percentage, Histogram, Frequency polygon, Frequency curve, Cumulative Frequency Curve, Pie Chart – Interpretation and Examples. Introduction to Central Tendency, Mean – Arithmetic Mean, Positional averages: quartiles, deciles and percentiles, Mode for unclassified, grouped and ungrouped data- Interpretation and Examples. Introduction to Measures of Dispersion, Range, Quartile Deviation, Variance, Standard Deviation and Coefficient of variation – Interpretation and Examples.						

Module 2	**Skewness, moments and Kurtosis**			10 classes
Introduction to Skewness, absolute measure of skewness, Relative measures of skewness- Karl Pearson's Coefficient of skewness, Bowley's coefficient of skewness, Introduction to moments, moments about mean, moments about arbitrary point, moments about zero, relationship between central and non-central moments, Sheppard's correction of moments, Introduction to Kurtosis, measures of kurtosis - Interpretation and Examples.				
Module 3	**Correlation and Regression**			10 classes
Introduction to Covariance, Correlation, Rank Correlation, Karl Pearson's correlation coefficient, standard error of correlation coefficient, Regression Analysis – Examples.				
Module 4	**Probability**			10 classes
Introduction - Random Experiment, Sample space and events, Probability of an event, Properties, Addition principle, conditional probability, Multiplication law, Bayes theorem and problems.				

Targeted Application & Tools that can be used:

Organize, manage and present data.
Translate real-world problems into probability models.
Analyze Statistical data using MS-Excel/SPSS/R software

Project work/Assignment:

Assignment 1: Correlation and Regression.
Assignment 2: Bayes theorem problems.

Text Books

1. S. C. Gupta, Fundamentals of Statistics, 7th Edition, Himalaya Publishing House

2. Schaum Series – Statistics and Probability, McGraw Hill Publications.

References

1. Berenson and Levine, Basic Business Statistics, New Jersey, 6th edition, Prentice- Hall India, 1996.

2. D.C. Montogomery and G. C. Runger, Applied Statistics and Probability for engineers, New Jersey, John Wiley and Sons, 3rd edition, 2003.

CSA2100 Data Structures and Algorithms Lab

Course Code: **CSA2100**	**Course Title:** Data Structures and Algorithms Lab **Type of Course:** **Pure Lab**	**L- T-P- C**	0-0-2-1
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 SKILL DEVELOPMENT of student by using EXPERIENTIAL LEARNING techniques			
Course Out Comes	**On successful completion of the course the students shall be able to:** **CO1:** Implement program for given problems using fundamentals of data structures. [Application] **CO2:** Apply an appropriate linear data structure for a given scenario. [Application] **CO3:** Apply an appropriate non-linear data structure for a given scenario. [Application] **CO4:** Explain the performance analysis of given searching and sorting algorithms. [Application]			
Course Content:				
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:

Lab sheet -1

Level 1: Program to Create, display, insert, and delete for elements in an array.

Level 2: Program to merge two sorted arrays into a single sorted array.

Lab sheet -2

Level 1: Program to demonstrate the working of stack using array.

Level 2: Program for Towers of Hanoi problem.

Lab sheet -3

Level 1: Program to convert infix arithmetic expression to post fix expression.

Level 2: Program to simulate the working of an ordinary queue using an array.

Lab sheet -4

Level 1: Program to simulate the working of Circular Queue using an array.

Level 2: Program to Insert and delete a node in a Singly Linked List

Lab sheet -5

Level 1: Program to find the GCD of two numbers using recursion.

Level 2: Program to find the Factorial of a Number using recursion

Lab sheet -6

Level 1: Program to calculate the sum of the first N natural numbers using recursion.

Level 2: Program to create and display a general Tree without traversal operations.

Lab sheet -7

Level 1: program to perform basic Operations on binary tree

a) Create a binary tree

b) Insertion

c) Deletion

Level 2: Program to perform In-order traversal operation.

Lab sheet -8

Level 1: Program to perform Pre-order traversal operation.

Level 2: Program to perform post-order traversal operation.

Lab sheet -9

Level 1: program to search an element using linear search.

Lab sheet -10

Level 1: program to search an element using Binary search. **Lab sheet -11** **Level 2:** Program to Sort the elements using Bubble sort technique. **Lab sheet -12** **Level 1:** Program to sort the elements using Insertion Sort. **Lab sheet -13** **Level 1:** Program to sort the elements using Selection Sort.
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:** 1. For theory: https://onlinecourses.nptel.ac.in/noc20_cs85/preview 2. For Lab : codetantra tool 3. https://puniversity.informaticsglobal.com/login

CSA 2101 Data Structures and Algorithms

Course Code: CSA 2101	**Course Title:** Data Structures and Algorithms **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 SKILL DEVELOPMENT of student by using EXPERIENTIAL LEARNING techniques			
Course Out Comes	**On successful completion of the course the students shall be able to:** **CO1:** Implement program for given problems using fundamentals of data structures.[Understand] **CO2:**Apply an appropriate linear data structure for a given scenarios. [Apply] **CO3:**Apply an appropriate non-linear data structure for a given scenarios. [Apply] **CO4:**Explain the performance analysis of given searching and sorting algorithms.[Apply]			
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.				
Module 4	**Searching & Sorting Performance Analysis**	Assignment	Program activity	**12 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.				
Assignment: Students should complete the lab programs associated with each module 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:** 4. For theory: https://onlinecourses.nptel.ac.in/noc20_cs85/preview 5. https://www.geeksforgeeks.org/data-structures/				

CSA2004 Computer Networks

Course Code: CSA2004	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	NIL					

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: 1] List the Basic Concepts of Computer Networks and Transport-Layer Services. (Remember) 2] Apply the Knowledge of IP Addressing and Routing Mechanism in Computer Networks. (Apply) 3] Develop the functionalities of Data Link Layer. (Apply) 4] Relate the working principles of wireless devices and security aspects of Networks. (Remember)			
Course Content				
Module 1	Overview, Application, and Transport Layer	Assignment	Problem Solving	12 Classes
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 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 Classes
Overview of Network Layer, Forwarding and Routing, The Data and Control Planes 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	08 Classes
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;* 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	08 Classes

Introduction, Wireless Links and Network Characteristics, Wi-Fi: 802.11 Wireless LANs, Cellular Networks: 4G and 5G. Security in Computer Networks: Principles of Cryptography, End-Point Authentication, Securing E-Mail, Operational Security: Firewalls and Intrusion Detection Systems.
TargetedApplication & Tools that can be used:Cisco Packet Tracer, Wireshark
Case Study/Assignment: Assignment proposed for this course in CO1-CO4 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? 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. Using CISCO Packet Tracer Configuring Static and Default Routes Objectives • Configure static routes on each router to allow communication between all clients. • Test connectivity to ensure that each device can fully communicate with all other devices. Getting familiar with Wireshark software by installing it I your system, and perform following task: List out the packets which are having DNS protocols List of IP address present in the cache along with its MAC addresses 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 R1: CompTIA Network+ Certification All in one Exam Guide , Mike Meyers , 7th Edition , McGraw Hill, 2023 R2: 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 W3: Presidency University -E Library (Knimbus) https://presiuniv.knimbus.com/user#/searchresult?searchId=eBook&curPage=0&layout=grid&sorFieldId=none&topresult=false&content=*cloud*

CSA2002 Computer Organization

Course Code: CSA2002	Course Title: Computer Organization Type of Course: Program Core and Theory	L-T-P- C	3	0	0	3
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. Throughout the course, students will delve into various topics related to computer organization, including processor architecture, memory systems, input/output (I/O) devices, and system buses. They will gain an understanding of the interplay between hardware and software and how they interact to execute programs and perform computations efficiently.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of Computer Organization and attain Skill Development through Participative Learningtechniques.			
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. CO3 : experiment the basics of pipelined execution. CO4 : explain parallelism and multi-core processors.			
Course Content:				
Module 1	COMPUTER ORGANIZATION & INSTRUCTIONS	Assignments	Quizzes form basics of CA	10 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	Quizzes and assignments	Comprehension based Quizzes and assignments	8 Sessions
Fixed point Addition, Subtraction, Multiplication and Division. Floating Point arithmetic, High performance arithmetic, Subword parallelism				
Module 3	THE PROCESSOR	Term paper/Assignment	Quizzes form advanced python	8 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	10 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.				
Module 5	ADVANCED COMPUTER ARCHITECTURE	Term paper/Assignment	CA	9 Sessions
Parallel processing architectures and challenges, Hardware multithreading, Multicore and shared memory multiprocessors, Introduction to Graphics Processing Units, Clusters and Warehouse scale computers — Introduction to Multiprocessor network topologies.				
List of Laboratory Tasks: Each Lab sheets experiments are prepared by level 0 and level 1 module wise.				
Targeted Application & Tools that can be used: NA				
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. 2. 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 Type of Course: Theory Course	L- T-P- C	3-0-0-3
Version No.	1		
Course Pre-requisites	Computer Organization & Data Structures and Algorithms		
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:** • Describe a database system using ER model and relational algebra. [Understand] • Apply Relational Algebra and Database Querying concepts in designing the database. [Apply] • Solve various normalization techniques for designing a robust database. [Apply]		

Course Content:

Module 1	Introduction to Database Modelling and Relational Algebra	Assignment	Introduction to Database Modelling and Relational Algebra	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 and Query Optimization	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	Designing and 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.				
Module 4	NA	Assignment	NA	NA Sessions
Topics: NA				
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 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:** **CO1** Describe a database system using ER model and relational algebra. [Understand] **CO2** Apply Relational Algebra and Database Querying concepts in designing the database. [Apply]		
Course Content:			

Module 1	Introduction to Database Modelling and Relational Algebra	Assignment	Introduction to Database Modelling and Relational Algebra	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 and Query Optimization	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	Designing and 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

Labsheet-1 [3 Practical Sessions]
Experiment No 1:
To study and implement the different language of Structured Query Language.
Level 1: Perform operations using Data Definition Language and Data Manipulation Language commands including different variants of SELECT on Student DB.
Level 2: Identify the given requirements; valid attributes and data types and Perform DDL and DML operations on a given scenario. [Banking Databases]
Experiment No. 2:
1. To study and implement the concept of integrity constraints in SQL.
Level 1: Create tables on Banking database using PRIMARY KEY, NOT NULL, UNIQUE, FOREIGN KEY and demonstrate the working of relational, logical, pattern matching, BETWEEN, IS NULL, IN and NOT IN Special Operators on Student Database.
Level 2: Enforce different types of data and referential integrity constraints. Then try queries with special operators based on the student database. [Banking Database].
Labsheet-2 [4 Practical Sessions]
Experiment No. 3:
2. Implement complex queries in SQL.
Level 1: Implement the conjugate of GROUP BY, ORDER BY and aggregate functions on Banking Database. Level 2: Implement MySQL DB queries on library database using appropriate clauses and aggregate functions. Also order the data either in ascending and descending order using corresponding clause. [Library databases].
Experiment No. 4:
3. To study and implement different types of Set and Join Operations
Level 1: Demonstrate different types of Set Operations (UNION, UNION ALL, INTERSECT, MINUS) and Join Operations (INNER JOINs, OUTER JOINS, CROSS JOIN, NATURAL JOIN) on two or more tables of Airline Database. Level 2: Use Set and Join operations to retrieve the data from two or more relations(tables) as per the given

scenario. [Airline Database] Labsheet-3 [3 Practical Sessions] Experiment No. 5: 5. To study and implement Views, and Procedures in MySQL DB. Level 1: Implement MySQL Views, and Procedures in ORACLE DB on Employee database. Level 2: Analyze the requirement and construct views, and Procedures on Mini Project Domain. [Banking Database] Labsheet-4 [2 Practical Sessions] Experiment No. 6: 6. To study and implement Functions, and Triggers in MySQL DB. Level 1: Implement Oracle Functions and Triggers in Oracle on Employee database. Level 2: Analyze the requirement and construct Functions and Triggers. [Supply chain Database] Labsheet-5 [2 Practical Sessions] Experiment No. 7: To implement the concept of forms and reports. Level 1: Implement the concept of forms and reports. Level 2: Analyze the schema relationship. Labsheet-6 [3 Practical Sessions] Experiment No. 8: Design a mini project based on the databases such as Inventory Management System, University Management System, Hospital Management System, etc. Level 1: Implement the real time database. Level 2: Analyze the working of database in real time.
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

CSA2515-Data Modelling and Visualization

Course Code: CSA2515	Course Name: Data Modelling and Visualization Type of Course: Lab / Lab Integrated Course	L- T-P- C	1-0-4-3
Version No.	1		
Course Pre-requisites	CSA1203		
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:** **CO1** Understand the various types of data, apply and evaluate the principles of data visualization. [Apply] **CO2** Acquire skills to apply visualization techniques to a problem and its associated dataset. [Apply] **CO3** Create interactive visualization for better insight using various visualization tools [Apply] **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 1. https://pythonprogramming.net/live-graphs-data-visualization-application-dash-python-tutorial/ 2. Google Data Analytics Professional Certificate | Coursera 3. Learning Python for Data Analysis and Visualization Ver 1 | Udemy 4. Data Science, Analytics and Visualization (DS) Courses | Chaminade University - PROD [Integrated] Catalog 5. Data Visualization Training and Certification Courses | Koenig Solutions (koenig-solutions.com)

CSA2505-Analysis of Algorithms

Course Code: CSA2505	Course Name: Analysis of Algorithms Type of Course: Theory Course	L- T-P- C	2-0-0-2
Version No.	1		
Course Pre-requisites	CSA2500		
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 Analysisof Algorithms and attain Skill Development through Problem Solving Methodologies.		
Course Out Comes	**On successful completion of the course the students shall be able to:** • Classify the types of asymptotic notations. [Apply] • Discuss the Brute Force Technique used for solving a problem. [Understand] • Explain divide and conquer technique for searching and sorting problems. [Understand] • Discuss the Dynamic Programming Algorithm used for solving a problem. & Discuss the Back tracking technique and limitations of Algorithms. [Understand]		

Course Content:				
Module 1	Introduction	Assignment	Introduction	9 Sessions
Topics: 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	9 Sessions
Topics: Selection Sort, sequential search, Uniqueness of Array, Exhaustive search Travelling Salesman, Knapsack Problem.				

Module 3	Divide-and-conquer	Assignment	Divide-and-conquer	9 Sessions
Topics: Master Theorem, Merge sort, Quick sort, Binary search.				
Module 4	Dynamic programming and greedy technique & Complexity Classes	Assignment	Dynamic programming and greedy technique & Complexity Classes	18 Sessions
Topics: Introduction, Coin changing problem, Multi stage graph – Optimal Binary Search Trees, warshall's, floyds,0/1 Knapsack, Prim's, Kruskal's, Dijkstra's Algorithm. Complexity Classes- P,NP- NP Hard and NP Complete - Boolean Satisfiability Problem (SAT). 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. •				
References • AnanyLevitin, "Introduction to the Design and Analysis of Algorithms", Pearson Education. • Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson.				
E-Resources https://onlinecourses.nptel.ac.in/noc19_cs47/preview				

CSA2506-Operating Systems and Unix Programming

Course Code: CSA2506	Course Name: Operating Systems and Unix Programming Type of Course: Theory Course	L- T-P- C	2-0-0-2
Version No.	1		
Course Pre-requisites	CSA1201		
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.		
Course Out Comes	**On successful completion of the course the students shall be able to:** **CO1** Recall OS types, services, structures, layers, and system calls. [Remember] **CO2** Explain IPC, deadlocks, synchronization, and memory management. [Understand] **CO3** Describe memory allocation, page replacement, and virtual memory. [Understand] **CO4** Summarize CPU scheduling, file management, and OS security. [Understand]		

Course Content:				
Module 1	Introduction to OS and System Structure	Assignment	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	Quiz/ Assignment	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	Assignment	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	Assignment	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 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

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

CSA2507- Operating Systems and Unix Programming Lab

Course Code: CSA2507	Course Name: Operating Systems and Unix Programming Lab Type of Course: Lab / Lab Integrated Course		L- T-P- C	0-0-2-1
Version No.	1			
Course Pre-requisites	CSA1201			
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.			
Course Out Comes	**On successful completion of the course the students shall be able to:** **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 Allocation concepts [Understand] **CO4** Design Virtual Memory and File Management with CPU scheduling algorithms. [Apply]			
Course Content:				
Module 1	Introduction to OS and System Structure	Assignment	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	Assignment	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	Assignment	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	Assignment	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				

List of Laboratory Tasks

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

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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 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:** • Understand the software engineering principles, ethics and process models. [Understand] • Identify the requirements and design appropriate models for a given application. [Understand] • Apply various types of testing methods and Quality Assurance techniques. [Remember] • 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	Introduction to Software Engineering & 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 and Design	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	Software Testing And Quality Assurance	Software Testing And Quality 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.				

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https://www.studocu.com/row/document/lead-city-university/software-engineering/software-engineering-lecture-note/10888094 https://www.youtube.com/watch?v=WxkP5KR_Emk https://www.youtube.com/watch?v=OVZYOItkUUs https://unimelb.libguides.com/c.php?g=931690&p=6734359 https://presiuniv.knimbus.com/user#/home https://nptel.ac.in/courses/

CSA2517 Machine Learning Algorithms

Course Code: CSA2517	Course Title: MACHINE LEARNING ALGORITHMS Type of Course: Integrated	L-T-P-C	3-0-0-3
Version No.	2.0		
Course Pre-requisites	Programming in Python & CSA2505		
Anti-requisites	Nil		
Course Description	A machine learning algorithm is a mathematical or computational procedure that is designed to learn patterns and relationships from data, and use that knowledge to make predictions, classifications, or decisions. These algorithms form the core building blocks of machine learning systems and enable computers to automatically learn from and analyze large amounts of data. The development and implementation of machine learning algorithms require careful consideration of factors such as data quality, feature engineering, model selection, hyperparameter tuning, and evaluation techniques to ensure reliable and accurate results.		
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Machine Learning Algorithms and attain Skill Development through Experiential Learningtechniques.		
Course Outcomes	Knowledge of training and testing the datasets using machine Learning techniques. Apply optimization andparameter tuning techniques for machine Learning algorithms. Apply a machine learning model to solve various problems using machine learning algorithms. Designa models through machine learning algorithm.		
Course Content:			

Module 1	Introduction to Machine Learning Algorithms	Assignment		15 Sessions
Topics: Introduction: History and Concept of machine learning, chronological overview of machine learning algorithms, Machine learning methods example: Supervised Learning-Linear Regression, Unsupervised Learning- Principal Component Analysis (PCA), Ensemble Methods- Bagging using Random Fores.				
Module 2	Introduction to machine learning techniques	Assignment		15 Sessions

Topics: Machine learning techniques example: Feature Selection/Extraction Techniques-Principal Component Analysis (PCA), Regularization Techniques- L1 Regularization (Lasso), Sampling Techniques-Oversampling(Synthetic Minority Over-sampling Technique (SMOTE)), Hyperparameter Optimization Techniques- Bayesian Optimization, Text Processing Techniques - Tokenization, Data Augmentation Techniques- Image Augmentation.				
Module 3	Knowledge management	Case Study		10 Sessions
Topics: Building machine learning models - Recognizing handwritten digits in image classification tasks, Identifying frequently co-occurring items in market basket analysis, and Image classification, object detection, and recognition tasks.				
Module 4	Capestone project	Case Study and Project		15 Sessions
Topics: Image Classification:Apply a model that can accurately classify images into different categories, such as identifying different species of flowers, recognizing handwritten digits, or detecting objects in images, Recommendation System:Apply a recommendation system that suggests relevant items to users based on their preferences, such as building a movie recommendation system, suggesting products to online shoppers, or recommending personalized news articles.				
Targeted Application & Tools that can be used: Linux / Vi Editor				
Project work/Assignment:				
Text Books Manaranjan Pradhan, U Dinesh Kumar, “Machine Learning Using Python” Wiley, First Edition 2019. "Pattern Recognition and Machine Learning" by Christopher Bishop: This book provides a comprehensive introduction to machine learning, covering both classical and modern techniques. It covers topics such as Bayesian methods, support vector machines, neural networks, and deep learning.				
Reference Books "Machine Learning" by Tom Mitchell: This book covers the foundations of machine learning and explores various algorithms and methods. It provides a balanced mix of theory and practical applications and is often used as a textbook in introductory machine learning courses. "The Elements of Statistical Learning" by Trevor Hastie, Robert Tibshirani, and Jerome Friedman: This book focuses on statistical learning methods and covers a broad range of techniques, including linear regression, classification, tree-based methods, and ensemble methods. It provides a theoretical foundation along with practical insights. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville: This book offers an in-depth exploration of deep learning methods, including deep neural networks, convolutional neural networks (CNNs), recurrent neural networks (RNNs), and generative models. It covers both theory and implementation details. "Pattern Classification" by Richard O. Duda, Peter E. Hart, and David G. Stork: This classic textbook covers the fundamentals of pattern classification and machine learning algorithms. It provides a solid foundation in pattern recognition concepts and techniques and includes practical examples and applications. "Understanding Machine Learning: From Theory to Algorithms" by Shai Shalev-Shwartz and Shai Ben-David: This book focuses on the theoretical aspects of machine learning, including formalism, generalization				

bounds, and algorithm design principles. It presents key machine learning concepts in a rigorous yet accessible manner.
Web References https://nptel.ac.in/courses/ https://www.udemy.com/course/ https://www.coursera.org/learn/
Topics relevant to "SKILL DEVELOPMENT": Exploratory Data Analysis and Regression Analysis for Skill development through Experiential Learning techniques. This is attained through the assessment component mentioned in the course handout.

CSA2509-Data Management using Cloud

Course Code: CSA2509	Course Name: Data Management using Cloud Type of Course: Theory Course	L- T-P- C	3-0-0-3
Version No.	1		
Course Pre-requisites	CSA2503		
Anti-requisites	NIL		
Course Description	This Course is designed to introduce the concepts of Cloud Computing as a new computing paradigm. Cloud Computing has emerged in recent years as a new paradigm for hosting and delivering services over the Internet. The students can explore various Cloud Computing terminology, principles and applications. Understanding different views of the Cloud Computing such as theoretical, technical and commercial aspects.		
Course Objective	The objective of the course is to familiarize the learners with the concepts of Data management Using Cloud Computing attain Employability through Experiential Learning techniques		
Course Out Comes	**On successful completion of the course the students shall be able to:** • Describe fundamentals of cloud computing, virtualization and cloud computing services. [Understand] • Discuss high-throughput and data-intensive computing. [Understand] • Explain security and standards in cloud computing. [Understand] • Demonstrate the installation and configuration of virtual machine. [Apply]		
Course Content:			

Module 1	Introduction to Cloud and Virtualization	Assignment	Introduction to Cloud and Virtualization	12 Sessions
Topics: Cloud Computing at a Glance, Historical Developments, Building Cloud Computing Environments, Computing Platforms and Technologies, Virtualization, Characteristics of Virtualized Environments Taxonomy of Virtualization Techniques, Virtualization and Cloud Computing, Technology Examples, Cloud Computing Architecture, IaaS, PaaS, SaaS, Types of Clouds, Economics of Cloud.				
Module 2	High Throughput and Data Intensive Computing	Quiz/ Assignment	High Throughput and Data Intensive Computing	12 Sessions
Topics: Task computing, MPI applications, Task based programming, Introduction to DIC, Technologies for DIC, Aneka Map Reduce Programming.				
Module 3	Cloud Security and Standards	Assignment	Cloud Security and Standards	12 Sessions
Topics: Cloud Security Challenges, Software-as-a-Service Security, Application standards, Client standards, Infrastructure and Service standards.				
Module 4	Cloud Platforms: Amazon Web Services	Assignment	Cloud Platforms: Amazon Web Services	9 Sessions
Topics: Communication Services, Additional Services, Google App Engine: Architecture and Core Concepts, Application Life-Cycle, Cost Model, Observations, Microsoft Azure: Core Concepts, SQL Azure, Windows Azure Platform Appliance, Observations. Demonstration of VM setup and configuration				
Text Book • John Rittinghouse and James Ransome, "Cloud Computing, Implementation, Management and Security", CRC Press. • Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, "Mastering Cloud Computing", McGraw Hill Education.				
References • David E.Y. Sarna, "Implementing and Developing Cloud Applications", CRC Press. • Anthony T Velte, Toby J Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", Tata McGraw-Hill.				
E-Resources IEEE Transactions on Cloud Computing- https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=6245519				

CSA2518 Machine Learning Algorithms Lab

Course Code: CSA2518	Course Name: MACHINE LEARNING ALGORITHMS LAB Type of Course: Lab / Lab Integrated Course	L- T-P- C	0-0-2-1
Version No.	1		
Course Pre-requisites	CSA1503		
Anti-requisites	NIL		

Course Description	A machine learning algorithm is a mathematical or computational procedure that is designed to learn patterns and relationships from data, and use that knowledge to make predictions, classifications, or decisions. These algorithms form the core building blocks of machine learning systems and enable computers to automatically learn from and analyze large amounts of data. The development and implementation of machine learning algorithms require careful consideration of factors such as data quality, feature engineering, model selection, hyperparameter tuning, and evaluation techniques to ensure reliable and accurate results.
Course Objective	The objective of the course is to familiarize the learners with the concepts of Machine Learning Algorithms Lab and attain Skill Development through Experiential Learning techniques.
Course Out Comes	**On successful completion of the course the students shall be able to:** **CO1** Explain the process of training and testing datasets in the context of machine learning techniques. [Understand] **CO2** Apply optimization and parameter tuning techniques for machine Learning algorithms [Apply] **CO3** Apply a machine learning model to solve various problems using machine learning algorithms [Apply] **CO4** Design a model through machine learning algorithm [Create]

Course Content:

Module 1	Introduction to Machine Learning Algorithms	Assignment	Introduction to Machine Learning Algorithms	8 Sessions

Topics:
Introduction: History and Concept of machine learning, chronological overview of machine learning algorithms, Machine learning methods example: Supervised Learning-Linear Regression, Unsupervised Learning- Principal Component Analysis (PCA), Ensemble Methods- Bagging using Random Fores.

Module 2	Introduction to machine learning techniques	Assignment	Introduction to machine learning techniques	7 Sessions

Topics:
Machine learning techniques example: Feature Selection/Extraction Techniques-Principal Component Analysis (PCA), Regularization Techniques- L1 Regularization (Lasso), Sampling Techniques-Oversampling(Synthetic Minority Over-sampling Technique (SMOTE)), Hyperparameter Optimization Techniques- Bayesian Optimization, Text Processing Techniques - Tokenization, Data Augmentation Techniques- Image Augmentation

Module 3	Knowledge Management	Assignment	Knowledge Management	8 Sessions

Topics:
Building machine learning models - Recognizing handwritten digits in image classification tasks, Identifying frequently co-occurring items in market basket analysis, and Image classification, object detection, and recognition tasks.

Module 4	Capstone Project	Assignment	Capstone Project	7 Sessions

Topics:
Image Classification:Apply a model that can accurately classify images into different categories, such as identifying different species of flowers, recognizing handwritten digits, or detecting objects in images, Recommendation System:Apply a recommendation system that suggests relevant items to users based on their preferences, such as building a movie recommendation system, suggesting products to online shoppers, or recommending personalized news articles.

List of Laboratory Tasks

Lab Experiments: Use UCI repository and Kaggle dataset for each experiments. Exp1:
(Two Session)
Level1: Introduction to Python Stack for Data Science, Core Python Libraries for data analysis, Anaconda platform and its installation, Executing programs on Jupiter IDE.
Level2: Write a Python program that utilizes expressions, types, statements, and variables to work with a simple dataset.
Experiment 2(Two Session)
Linear Regression: Implement linear regression to predict a continuous target variable based on input features.
Experiment 3 (Two Session)
Level1: Logistic Regression: Build a logistic regression model for binary classification problems. Level2: Logistic Regression: Build a logistic regression model for Multi classification problems.
Experiment 4 (Two Session)
Principal Component Analysis (PCA): Implement PCA to reduce the dimensionality of data by projecting it onto a lower-dimensional space.
Experiment 5 (Two Session)
Neural Networks: Implement a basic neural network model using libraries like TensorFlow or Keras for tasks like image classification.

Experiment 6 (Two Session) Level1: Implement a basic ANN model using TensorFlow or Keras for image classification tasks.Train the model on a labeled image dataset (e.g., MNIST or CIFAR-10) and evaluate its performance. Level2: Use a dataset containing user-item ratings and build a model to recommend items based on user preferences
Text Book • Manaranjan Pradhan, U Dinesh Kumar, "Machine Learning Using Python" Wiley, First Edition 2019. • Pattern Recognition and Machine Learning" by Christopher Bishop: This book provides a comprehensive introduction to machine learning, covering both classical and modern techniques. It covers topics such as Bayesian methods, support vector machines, neural networks, and deep learning
References • Stuart J. Russell, Peter Norvig, "Artificial Intelligence: A Modern Approach," Pearson, Fourth Edition 2020 • Ethem Alpaydin, "Machine Learning: The New AI," MIT Press, First Edition 2016.
E-Resources https://nptel.ac.in/courses/ https://www.udemy.com/course/ https://www.coursera.org/learn/

CSA1703 Data Mining

Course Code: CSA1703	Course Name: Data Mining Type of Course: Theory Course	L- T-P- C	2-0-0-2
Version No.	1		
Course Pre-requisites	CSA2503		
Anti-requisites	Nil		
Course Description	The purpose of this 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 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.		
Course Out Comes	**On successful completion of the course the students shall be able to:** • Explain the basic concepts and issues involved in Data Mining. [Remember] • Discuss different preprocessing techniques on Data Analysis. [Understand] • Discover frequent item sets by using Association rule algorithms. [Apply] • Apply different Classification and Clustering techniques used in data mining. [Apply]		
Course Content:			

Module 1	Introduction to Data mining	Assignment	Introduction to Data mining	05 Sessions
Topics: 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	09 Sessions
Topics: Types of data – Data Quality – Data Preprocessing Techniques – Similarity and Dissimilarity measures.				
Module 3	Motivation and terminology	Assignment	Motivation and terminology	07 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	17 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				

CSA2516 Data Analysis using R Programming

Course Code: CSA2516	Course Name: Data Analysis using R Programming Type of Course: Lab / Lab Integrated Course	L- T-P- C	0-0-4-2

Version No.	1
Course Pre-requisites	CSA1203
Anti-requisites	Nil
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.
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** Interpret data using appropriate statistical methods [Apply] **CO3** Demonstrate the decision trees concept with the given dataset. [Apply] **CO4** Demonstrate the Mining concepts for both Data and Text. [Apply]

Course Content:

Module 1	Introduction	Assignment	Introduction	15 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	15 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/

Discipline Specific Electives

CSA3422 .Net Programming Using C#

Course Code: CSA3422	Course Name: .Net Programming Using C# 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:** **CO1** Use OOPS concepts in C# for solutions to real-world problems [Apply] **CO2** Design and implement robust console-based and desktop applications using C# and the .NET framework. [Create] **CO3** Create interactive GUI-based applications in C# to enhance user experience. [Create] **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: 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.			
Module 2	C# Language Basics	Assignment	C# Language Basics	15 Sessions
Topics: 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 Services			
Module 3	Object oriented with C#	Assignment	Object oriented with C#	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 modifies: private, pubic, protected, internal, protected internal, new, Abstract classes, Sealed classes, Creating Interfaces, Implementing Interface inheritance.			
Module 4	Database Programming Using ADO.NET	Assignment	Database Programming Using ADO.NET	20 Sessions

Topics:

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

Experiment No. 1:
Level 1: Install Visual Studio, a robust IDE for developing .NET applications on Windows.
Level 2: Identify the Components of Integrated Development Environments.
Experiment No. 2:
Level 1: 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
Experiment No. 3:
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.
Level 2: Design a Windows application to calculate the Simple Interest (SI) by providing Principal (p), Rate(r) and Time (t).
Hint: S.I= (p × r × t)/100
Experiment No. 5:
Level 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 and add each digit of the number.
Display the final sum of the digits.
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
Experiment No. 6:
Level 1: Create a C# Program to implement Vowels Program using Select Case.
Level 2: Create a C# program to Print Fibonacci Series for the given input
Experiment No 7:
Level 1: Define a class 'student' with data members stno, stname and age. Also include following: Default Constructor and parameterized constructor. Display method to show all details.
Level 2: Design a class to represent a bank account. Include the following members: Data Members: - Name of the depositor, Account Number, Type of Account, Balance amount in the account and methods : To assign initial values, To deposit an amount, To withdraw an amount after checking balance, To display name and the balance. Write a c# program to demonstrate the working of the various class members
Experiment No. 8:
Level 1: Design a class to represent a bank account. Include the following members: Data Members: - Name of the depositor, Account Number, Type of Account, Balance amount in the account and methods : To assign initial values, To deposit an amount, To withdraw an amount after checking balance, To display name and the balance. Write a c# program to demonstrate the working of the various class members.
Level 2: Write a C# Program to find out the area of the triangle, square, and rectangle using method overloading.
Experiment No. 9:
Level 1: Write a C# program where the Student class inherits from the Person class. The Person class contains Name and Age properties, and the Student class adds the Course property. Display the information of a student by calling both the Person and Student methods.
Level 2: Write a C# program where the Teacher class inherits from the Person class. Override the DisplayInfo method in the Teacher class to show both the teacher's personal information and their subject.
Experiment No. 10:
Level 1: Create a Class called Rectangle and store length, width using constructor. Calculate the area using that. Create tabletop using rectangle class and calculate the cost of painting that table top. (Use single inheritance)

Level 2: Admin executive of the university is entering the university name for the students. If he enters the name wrongly, exception should be raised.
Text Book • Andrew Troelsen Philip Japikse, "Pro C# 10 with .NET 6 Foundational Principles and Practices in Programming", 11th Edition, Apress Publishers, USA, 2022 • Herbert Schildt, "C# 4.0: The Complete Reference", Tata McGraw-Hill Publishers, 4th Edition, 2017
References • Thuan L. Thai ".Net Framework Essentials: Introducing the .net Framework", O'reilly Media Inc 2004, [ISBN: 978-0-59-600505-4] • Mark J. Price, "C# 12 and .NET 8 – Modern Cross-Platform Development Fundamentals", 8th Edition, Packt Publishing, 2023 [ISBN 978-1-83763-587-0].
E-Resources https://www.codecademy.com/learn/learn-c-sharp https://dotnet.microsoft.com/en-us/learn/csharp https://www.learncs.org/ https://www.codechef.com/learn/course/c-sharp https://csharp-station.com/

CSA3423 No SQL

Course Code: CSA3423	Course Name: No SQL Type of Course: Lab / Lab Integrated Course	L- T-P- C	1-0-4-3
Version No.	1		
Course Pre-requisites	Basic understanding of database concepts. Familiarity with SQL and relational database management systems.		
Anti-requisites	Nil		
Course Description	This course provides an in-depth 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.		
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 u		
Course Out Comes	**On successful completion of the course the students shall be able to:** **CO1** Understand NoSQL Fundamentals [Understand] **CO2** Perform Practical NoSQL Operations [Apply] **CO3** Design Scalable Systems [Create] **CO4** Apply NoSQL in Real-World Scenarios [Apply]		

Course Content:				
Module 1	Introduction to NoSQL Databases	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.				
Module 2	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).				
Module 3	Column-Family Databases (Cassandra)	Assignment	Column-Family Databases (Cassandra)	20 Sessions
Topics: 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 CQL (Cassandra Query Language) , Data partitioning, replication, and consistency in Cassandra.				
Module 4	Graph Databases (Neo4j)	Assignment	Graph Databases (Neo4j)	25 Sessions
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				
List of Laboratory Tasks Experiment 1: Introduction and types of NoSQL Databases Experiment 2: Introduction and Installation of MongoDB Experiment 3: Basic CRUD Operations with MongoDB Experiment 4: Introduction and Setup of Cassandra Experiment 5: Data Modeling and Simple Queries with Cassandra Experiment 6: Introduction to Neo4j Graph Databases Experiment 7: Basic Graph Queries and Implementations with Neo4j Experiment 8: Redis Basics: Introduction and Key-Value Operations Experiment 9: Final Project				
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.				
References • Cassandra documentation: https://cassandra.apache.org/doc/latest/. • Adam Fowler, “NoSQL For Dummies”, Wiley, 2015.				
E-Resources https://www.mongodb.com/resources/basics/databases/nosql-explained				

CSA3424 Agile Structures and Frameworks

Course Code: CSA3424	Course Name: Agile Structures and Frameworks 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:** • Understand the basic concepts of Agile Software Process [Understand] • Comprehend the various Agile Methodologies [Understand] • Develop Agile Software Process [Create] • 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 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:** • Apply the features and common Git workflow [Apply] • Practice the Docker container and Saving Changes To A Docker Container [Apply] • Practice the filters and plugins to populate, manipulate, and manage data used by Ansible Playbooks. [Apply] • 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	25 Sessions
Topics: 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	20 Sessions
Topics: 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	25 Sessions
Topics: 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	20 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.

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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

CSA3426 Front-End Development using Java Script

CSA3426-Front-End Development using Java Script

Course Code: CSA3426	Course Name: Front-End Development using Java Script 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 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.		
Course Objective	The objective of the course is to familiarize the learners with the concepts of Front-end Development using Javascripts and attain Employability Skills through Experiential Learning techniques.		
Course Out Comes	**On successful completion of the course the students shall be able to:** **CO1** Design and develop static web pages using HTML5 elements and CSS3 [Apply] **CO2** Develop responsive web pages using CSS, JavaScript and bootstrap. [Apply] **CO3** Demonstrate the concepts of Angular.js to develop a web front-end. [Apply] **CO4** Illustrate the concepts of React.js to develop a web front-end. [Apply]		
Course Content:			
Module 1	Introduction to Front-End Development	Assignment	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.			
Module 2	Advanced JavaScript & Interactive Web Elements	Assignment	Advanced JavaScript & Interactive Web Elements	25 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.			
Module 3	AJAX, jQuery & Responsive Web Design	Assignment	AJAX, jQuery & Responsive Web Design	15 Sessions
Topics: 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 4	AngularJS & Django Integration	Assignment	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.

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.
Shape
Experiment No. 2: [4 + 1 Practical Sessions]
Level 1: Design an interactive web page for a new restaurant using CSS3 features.
Level 2: Create a simple web form to gather user information.
Shape
Experiment No. 3: [5 + 1 Practical Sessions]
Level 1: Practice basic JavaScript exercises, including creating a canvas drawing application.
Level 2: Implement JavaScript exercises for form validation.
Shape
Experiment No. 4 [5 + 1 Practical Sessions]
Level 1: Create a student registration form using JavaScript.
Level 2: Design an RSVP form using Bootstrap form controls.
Shape
Experiment No. 5 [4 + 1 Practical Sessions]
Level 1: Create a responsive image grid using Bootstrap 5.
Level 2: Write a JavaScript program using AJAX to dynamically load content and implement jQuery effects like fading.
Experiment No. 6 [5 + 1 Practical Sessions]
Level 1: Create an AngularJS application module and controller in app.js.
Level 2: Design an "AngularJS Solar System Explorer" for planet data visualization.
Experiment No. 7 [5 + 1 Practical Sessions]
Level 1 : Develop a simple Django app that displays an unordered list of fruits and ordered list of selected students for an event
Level 2: Develop a layout.html with a suitable header (containing navigation menu) and footer with copyright and developer information. Inherit this layout.html and create 3 additional pages: contact us, About Us and Home page of any website.

Text Book

- Fender, Young, “Front-end Fundamentals”,Leanpub, 2015
- Northwood, Chris, “The Front End Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer”,APress, 2018

References

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

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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/

CSA3427-Web Application Development

Course Code: CSA3427	Course Name: Web Application Development 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 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 through the process of working in a client/server side programming and learning skills which 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 and analytical skills.			
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.			
Course Out Comes	**On successful completion of the course the students shall be able to:** **CO1** Understand and briefly explained the semantics and syntax of HTML and CSS. [Apply] **CO2** Design and develop client side scripts and web pages using HTML, CSS and Java script [Apply] **CO3** Understand PHP language and use them while applying the principles of object oriented development [Apply] **CO4** Develop dynamic and interactive web applications by integrating front-end and back-end technologies. [Apply]			
Course Content:				
Module 1	Web Development Basics	Assignment	Web Development Basics	15 Sessions
Topics: Introduction to web development, HTML structure, head, body, footer, text formatting, image embedding, hyperlinks, tables, forms, CSS styling, inline vs external CSS, CSS box model, tables & lists, basic layout design.				
Module 2	JavaScript & Client-Side Scripting	Assignment	JavaScript & Client-Side Scripting	25 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.				
Module 3	Introduction to PHP,	Assignment	Introduction to PHP,	15 Sessions
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.				
Module 4	XML & Web Application Development	Assignment	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, client-server communication, validations, security considerations.				
List of Laboratory Tasks Lab Sheet - 1 Experiment No. 1 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 Level 1: Create a book information website with a homepage listing books. Clicking a book should open its details page. Level 2: Design a user information form with fields like name, gender, mobile number, email, city, state, and country. Lab Sheet - 2 Experiment No. 1 Level 1: Design a web page with background images, text colors, and borders using external CSS.				

Level 2: Implement a JavaScript calculator for addition, subtraction, multiplication, and division.
Experiment No. 2
Level 1: Create a JavaScript timer on the left side of a webpage.
Level 2: Capture student details (ID, name, age, marks) using JavaScript objects.
Lab Sheet - 3
Experiment No. 1
Level 1: Write a JavaScript program to calculate the squares and cubes of numbers from 0 to 10.
Level 2: Display the results in an HTML table format.
Experiment No. 2
Level 1: Develop a JavaScript effect to display the text "PRESIDENCY-UNIVERSITY" with an increasing font size every 200ms.
Level 2: When the font reaches 100pt, display "School of Engineering", then shrink back to 10pt.
Lab Sheet - 4
Experiment No. 1
Level 1: Write a PHP program to find the sum of digits of a given number.
Level 2: Write a PHP program to print the multiplication table of a number.
Experiment No. 2
Level 1: Write a PHP script to track and display the number of visitors to a web page.
Level 2: Write a PHP program to display a real-time digital clock using server time.
Lab Sheet - 5
Experiment No. 1
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.
Lab Sheet - 6
Experiment No. 1
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.

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.

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.

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/

CSA3803 AI in Finance and Business Accounting

Course Code: CSA3803	Course Name: AI in Finance and Business Accounting 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 provides a hands-on introduction to the application of Artificial Intelligence (AI) in finance and business accounting. Through lab-based sessions, students will explore how AI technologies, such as machine learning, natural language processing, and predictive analytics, are used in financial decision-making, risk management, and accounting processes. The course emphasizes practical skills, with students working on real-world financial datasets, building AI models, and using AI tools for tasks such as fraud detection, financial forecasting, and automated accounting. Ethical considerations and challenges in AI-driven finance are also discussed.
Course Objective	The objective of this course is to equip students with practical skills in applying AI techniques to finance and accounting. By the end of the course, students will be able to use AI tools for financial analysis, build predictive models, and understand th
Course Out Comes	**On successful completion of the course the students shall be able to:** **CO1** Demonstrate the use of AI tools for financial data analysis [Apply] **CO2** Develop AI models for financial forecasting and risk assessment. [Create] **CO3** Implement AI techniques for fraud detection and automated accounting. [Apply] **CO4** Evaluate ethical challenges in AI-driven finance and accounting. [Evaluate]

Course Content:

Module 1	Introduction to AI in Finance and Accounting	Assignment	Introduction to AI in Finance and Accounting	15 Sessions
Topics: Overview of AI technologies, Applications of AI in finance and accounting, Ethical considerations in AI, Case studies of AI in financial decision-making.				
Module 2	AI Techniques for Financial Modeling	Assignment	AI Techniques for Financial Modeling	20 Sessions
Topics: Machine learning for financial forecasting, Predictive analytics, Time-series analysis, AI-driven financial modeling tools.				
Module 3	AI in Fraud Detection and Risk Management	Assignment	AI in Fraud Detection	20 Sessions
Topics: Fraud detection using AI, Risk assessment models, Anomaly detection, AI in regulatory compliance				
Module 4	Automated Accounting Systems	Assignment	Automated Accounting Systems	20 Sessions
Topics: AI in bookkeeping, Automated invoice processing, AI-driven auditing, Blockchain and AI in accounting.				

List of Laboratory Tasks

List of Laboratory Tasks:
Each lab sheet will include experiments and hands-on activities related to AI tools and techniques used in finance and accounting. Lab tasks will be prepared based on Level 0 and Level 1 module-wise.

Lab 1: Introduction to AI Tools and Financial Datasets
Scenario:
You are given a dataset of monthly sales for a small retail store. Using Python and Pandas, load the dataset, display the first 10 rows, and create a simple line graph to visualize the sales trend over time.
Shape
Lab 2: Data Cleaning for Financial Data
Scenario:
A dataset of customer transactions has missing values and some incorrect entries (e.g., negative amounts). Use Python to clean the dataset by filling missing values with the average and removing rows with negative amounts.
Shape
Lab 3: Simple Financial Forecasting
Scenario:
Using a dataset of monthly electricity bills, predict the bill for the next month using a simple linear regression model in Python. Plot the actual vs. predicted values to see how well the model performs.
Shape
Lab 4: Stock Price Prediction (Basic)
Scenario:
You are given a dataset of daily closing prices for a stock. Use Python to calculate the average price over the last 7 days and predict the next day's price using this average.
Shape
Lab 5: Fraud Detection (Basic)

Scenario:
A dataset of credit card transactions includes a column labeled "fraud" (1 for fraud, 0 for normal). Use Python to count how many transactions are fraudulent and create a bar chart to show the comparison between fraudulent and normal transactions.
Shape
Lab 6: Risk Assessment (Basic)
Scenario:
A dataset of loan applicants includes columns like age, income, and loan amount. Use Python to calculate the average income of applicants and identify applicants with income below the average as "high risk."
Shape
Lab 7: Automated Invoice Processing (Basic)
Scenario:
You are given a CSV file containing invoice data (invoice number, date, amount). Use Python to filter invoices with amounts greater than $1000 and save them to a new CSV file.
Shape
Lab 8: AI-Driven Auditing (Basic)
Scenario:
A dataset of financial transactions includes a column for "amount." Use Python to identify transactions where the amount is unusually high (e.g., more than 3 times the average) and flag them for review.
Shape
Lab 9: Blockchain Simulation (Basic)
Scenario:
Simulate a simple blockchain for recording transactions. Use Python to create a list of transactions (e.g., "Alice pays Bob $50") and display the list as a "blockchain."
Shape
Lab 10: Ethical Implications of AI (Basic)
Scenario:
A dataset of loan applicants includes a column for gender. Use Python to count how many male and female applicants are in the dataset and discuss whether the dataset is balanced or biased.
Shape
Lab 11: Portfolio Optimization (Basic)
Scenario:
You are given a dataset of monthly returns for two stocks. Use Python to calculate the average return for each stock and suggest which stock is better for investment based on the higher average return.
Shape
Lab 12: Final Project – Simple AI-Driven Financial System
Scenario:
Combine the skills learned in previous labs to create a simple financial system. For example:
Load a dataset of sales data.
Clean the data by removing missing values.
Predict next month's sales using a simple average.
Identify unusually high sales for review.
Save the results in a new file.

Text Book

- "Artificial Intelligence in Finance: A Python-Based Guide" by Yves Hilpisch, O'Reilly Media, 2020.
- "AI for Finance and Accounting" by David Kuo Chuen Lee, Wiley, 2021

References

- "Machine Learning for Asset Managers" by Marcos López de Prado, Cambridge University Press, 2020.
- "AI in Accounting: Practical Applications" by Robotic Process Automation (RPA) and AI in Accounting, Springer, 2022.

E-Resources
https://www.upwork.com/resources/ai-in-accounting

CSA3415-Pattern Recognition

Course Code: CSA3415	Course Name: Pattern Recognition Type of Course: Lab / Lab Integrated Course	L- T-P- C	1-0-4-3
Version No.	1		

Course Pre-requisites	• Basic knowledge of mathematics (linear algebra, probability, and statistics). • Understanding of data structures and algorithms. • Familiarity with programming languages like Python, MATLAB, or C++. • Basic concepts of machine learning and image processing (preferred but not mandatory).
Anti-requisites	NIL
Course Description	This course introduces the fundamental concepts of pattern recognition, including feature extraction, classification, clustering, and machine learning techniques. Students will explore various algorithms used in image processing, speech recognition, and biometric authentication. The course provides hands-on experience in developing pattern recognition models using real-world datasets.
Course Objective	This course aims to equip BCA students with foundational knowledge and practical skills by providing hands-on experience in implementing pattern recognition techniques using programming languages like Python or MATLAB, To develop practical skills in featu
Course Out Comes	**On successful completion of the course the students shall be able to:** **CO1** To understand the fundamentals of pattern recognition and its applications [Understand] **CO2** To learn different classification and clustering techniques [Remember] **CO3** To develop skills in feature extraction and dimensionality reduction. [Evaluate] **CO4** To implement machine learning algorithms for pattern [Apply]

Course Content:

Module 1	Introduction to Pattern Recognition	Assignment	Introduction to Pattern Recognition	15 Sessions

Topics:
Definition and Scope of Pattern Recognition, Applications in Image Processing, Speech Recognition, and Biometrics, Statistical vs. Syntactic Pattern Recognition, Supervised, Unsupervised, and Semi-supervised Learning.

Module 2	Feature Extraction and Selection	Assignment	Feature Extraction and Selection	20 Sessions

Topics:
Feature Types: Numeric, Categorical, and Text-based Features, Feature Engineering Techniques, Principal Component Analysis (PCA) and Linear Discriminant Analysis (LDA), Feature Normalization and Selection. Methods

Module 3	Classification and Clustering Techniques	Assignment	Classification and Clustering Techniques	20 Sessions

Topics:
C Bayesian Decision Theory, k-Nearest Neighbors (k-NN), Support Vector Machines (SVM) , Neural Networks and Deep Learning for Classification , Clustering Algorithms: k-Means, Hierarchical, DBSCAN

Module 4	Advanced Topics and Applications	Assignment	Advanced Topics and Applications	20 Sessions

Topics:
Hidden Markov Models (HMM) and Gaussian Mixture Models (GMM) , Deep Learning for Pattern Recognition (CNN, RNN) , Real-World Case Studies in Biometric Authentication and Object Detection
Ethical Considerations in Pattern Recognition.

List of Laboratory Tasks

Experiment 1: Assuming a set of images that need to be classified, read the images and calculate basic statistics such as mean, mode, standard deviation, etc.,
Experiment 2: Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
Experiment 3: Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients.
Experiment 4: Introduction and Setup of Cassandra
Experiment 5 Write a program to perform Data Analysis on a given Dataset.
Experiment 6: Write a program to implement KNN on an image dataset.
Experiment 7: Write a program to implement K-Means Clustering.
Experiment 8: Write a program to implement PCA (Principle Component Analysis).
Experiment 9: Final Project

Text Book

- "Pattern Recognition and Machine Learning" – Christopher M. Bishop
- "Pattern Classification" – Richard O. Duda, Peter E. Hart, David G. Stork.

References
• "Machine Learning" – Tom M. Mitchell • "Introduction to Statistical Learning" – Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani
E-Resources https://www.engineeringvideolectures.com › course

CSA3416-Predictive Analytics

Course Code: CSA3416	Course Name: Predictive Analytics Type of Course: Lab / Lab Integrated Course	L- T-P- C	1-0-4-3
Version No.	1		
Course Pre-requisites	Basic Communication General Knowledge about Descriptive Analytics		
Anti-requisites	NIL		
Course Description	Predictive Analytics subject is conceptual in nature. The students will be benefited in this course to know about modern data analytic concepts and develop the skills for analyzing and synthesizing data sets for decision making in the firms.		
Course Objective	The objective of the course is to familiarize the learners with the concepts of Predictive Analytics and attain Employability Skills through Experiential Learning techniques.		
Course Out Comes	**On successful completion of the course the students shall be able to:** **CO1** Define the nature of analytics and its applications the concepts of predictive analytics and data mining [Remember] **CO2** Compute the analytical tools in business scenarios to achieve competitive advantage [Understand] **CO3** Recognize the real-world insights in decision trees and time series analysis methods in dynamic business environment [Understand] **CO4** Determine the importance of big data in predictive analytics [Evaluate]		

Course Content:

Module 1	Introduction to Predictive Analytics	Assignment	Introduction to Predictive Analytics	15 Sessions
Topics: Analytics- Definition, importance, Analytics in decision making, Applications, Challenges, Experts perception on analytics; Popularity in Analytics; Predictive analytics in business Scenarios- case studies				
Module 2	Predictive Analytics & Data Mining	Assignment	Predictive Analytics & Data Mining	15 Sessions
Topics: Predictive Analytics- Definition, Importance and application; Predictive Analytics – Marketing, Health care & other industries; Skills and roles in Predictive Analytics; Tools & Software; Data Mining – Page 2 of 4 Definition, applications, kinds of pattern data mining can discover, data mining tools & dark side of data mining				
Module 3	Data, Methods & Algorithms for Predictive Analytics	Assignment	Data, Methods & Algorithms for Predictive Analytics	20 Sessions
Topics: Nature; Pre-processing of data for analytics; Data Mining methods; Prediction; Classification- Decision tress; Cluster analysis, K means clustering, Association; Predictive analytics misconception; Algorithms - Naïve Bays, nearest neighbour; Regression - Simple linear regression (SLR) using OLS method, Multiple linear regression (MLR); Violation of Ordinary least squares (OLS) method - Auto correlation, Heteroscedasticity , multicollinearity				
Module 4	Business Forecasting & Decisions Trees with Big Data in Predictive Analytics	Assignment	Business Forecasting & Decisions Trees with Big Data in Predictive Analytics	25 Sessions

Topics:
Business Forecasting; Time Series Data and Time Series Analysis- based Forecasting, Forecasting Accuracy, Auto-regressive and Moving average model; Decision Trees : Introduction to decision trees; Analysis – unstructured data . Fundamental concepts of Big data; Challenges and problems in data analytics; Big data technologies; Big data & stream analytics; Expert views on analytics; Simulation – A/B Testing Data preparation, cleaning, and exploratory analysis using data visualization and descriptive statistics; applications of multiple regression for numeric prediction

List of Laboratory Tasks

1.Predicting buying behavior
- analytics to identify buying habits based on previous purchase history.
- predict customer purchase patterns.

2.Fraud detection

a. To identify anomalies in the system and detect unusual behavior to determine threats.

b. experts can feed historical data of cyberattacks and threats to the system. When the predictive analytics algorithm identifies something similar, it will send a notification to the respective personnel.

3.Healthcare diagnosis
- understanding the disease by providing an accurate diagnosis based on past data.
- predictive analytics help doctors reach the root cause of diseases.

4.Card abandonment
- predict how likely a customer is to abandon the cart.
- It will also provide companies with details about each customer about whether they will purchase or abandon the cart based on the previous visits to the store.

5.Content recommendation
- entertainment companies can predict what users want to watch based on their history.
- use analytics for predicting the user's behavior.

6. Equipment maintenance
the machinery would alert the personnel and the maintenance can be done to avoid unscheduled and accidental breakdowns.

Text Book
- T1 : Predictive Analytics Delen, D. (2020). Predictive Analytics: Data Mining, Machine Learning and Data Science for Practitioners. Upper Saddle River, NJ, USA: FT Press. (Pearson Publication)
- NA

References
- R1 Dinesh Kumar, U. (2021). Business Analytics: The Science of data-Driven Decision Making.
- R2 Business Analytics - Data Analysis & Decision Making", S. Christian Albright and Wayne L. Winston, Cengage Publication, 5th Edition, 2012

E-Resources
W1.https://www.sas.com/en_in/insights/analytics/predictive-analytics.html
W2. https://www.techtarget.com/searchbusinessanalytics/definition/predictive-analytics
W3. https://www.cio.com/article/228901/what-is-predictive-analytics-transforming-data- intofuture-insights.html
W4. https://www.simplilearn.com/what-is-predictive-analytics-article
W5. https://www.northeastern.edu/graduate/blog/predictive-analytics/

CSA3417-Time Series Analysis

Course Code: CSA3417	Course Name: Time Series Analysis Type of Course: Theory Course	L- T-P- C	3-0-0-3
Version No.	1		
Course Pre-requisites	R , Calculus, Linear Algebra, Probability and Statistics		

Anti-requisites	NIL
Course Description	The course will provide a basic introduction to time series analysis. This theory based course covers topics in time series analysis and some statistical techniques on forecasting. Time series regression, exploratory data analysis, AR models, Seasonal Models, GARCH Models and Box-Jenkins approach are the major topics covering in this course. R and RStudio will be required for this class.
Course Objective	The objective of the course is to familiarize the learners with the concepts of Time Series Analysis attain Employability through Experiential Learning techniques
Course Out Comes	**On successful completion of the course the students shall be able to:** • List the appropriate model, to fit parameter values and make concise decisions based on forecasts obtained [Remember] • Demonstrate an understanding of the principles behind modern forecasting techniques [Apply] • Apply concepts to real time series data using packages [Apply]

Course Content:

Module 1	Introduction	Assignment	Introduction	9 Sessions
Topics: Examples of Time Series, Objectives of Time Series Analysis, Characteristics of Time Series, Approaches used for time series forecasting, ETS (Error, Trend, Seasonality) models to make forecasts, Decomposition method, Irregularity concept in decomposition method, Case study on decomposition method, Model forecast theory, Model forecast hands-on, stochastic process.				
Module 2	Time Series Regression and Exploratory Data Analysis	Quiz/ Assignment	Time Series Regression and Exploratory Data Analysis	12 Sessions
Topics: Classical Regression in the Time Series Context, Exploratory Data Analysis, Stationary Models and the Autocorrelation Function, Detrending and De-seasonalizing Smoothing, Fundamental Statistical Concepts, Introduction to Time Series Analysis with R				
Module 3	AR models	Assignment	AR models	12 Sessions
Topics: Models for Stationary Time Series, Models for Non-Stationary Time Series, Identification, Forecasting, ARIMA (Autoregressive, Integrated, Moving Average) models, ARMA models				
Module 4	Additional models, Spectral Analysis and packages	Assignment	Additional models, Spectral Analysis and packages	12 Sessions
Topics: Seasonal Models, Time Series Regression Models, GARCH Models, Box-Jenkins approach, Introduction to Spectral Analysis, Estimating the Spectrum, Preparing model using ITSM, Time series using astsa, ARIMA models is to use sarima from astsa				

Text Book

- T1. Montgomery DC, Jennings CL, Kulahci M. Introduction to time series analysis and forecasting. John Wiley & Sons; 2015 Apr 21.
- T2.Brockwell & Davis (2016) Introduction to Time Series and Forecasting, 3rd edition, Springer.

References

- R1.Box GE, Jenkins GM, Reinsel GC, Ljung GM (2015) Time series analysis: forecasting and control. John Wiley & Sons
- R2.Cryer & Chan (2008) Time Series Analysis with Applications in R, Springer

E-Resources

W1.https://www.coursera.org/courses?query=time%20series%20analysis

W2. https://www.tableau.com/learn/articles/time-series-forecasting W3.https://presiuniv.knimbus.com/user#/home

CSA3428 Ethical aspects of AI

Course Code: CSA3428	Course Name: Ethical aspects of AI 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:** • Understand the fundamental concepts of Natural Language Processing. [[Understand] • Read corpora and train models for different NLP tasks [Apply] • Use word embeddings for solving an NLP Application [Apply] • Understand sequence to sequence modeling as used in machine translation. [Apply]		
Course Content:			
Module 1	Introduction to AI Ethics	Assignment	Key Ethical Principles	7 Sessions
Topics: 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	8 Sessions
Topics: 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	12 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	9 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 • "Artificial Intelligence: A Guide for Thinking Humans" – Melanie Mitchell
References • Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy – Cathy O'Neil • Ethics of Artificial Intelligence and Robotics – Vincent C. Müller (Editor)
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

CSA3418 Blockchain for Data Integrity and Verification

Course Code: CSA3418	Course Name: Blockchain for Data Integrity and Verification 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:** • Explain the fundamentals of blockchain technology, its evolution, and types. (Understanding) • Apply decentralization methods and smart contracts in blockchain-based systems. (Applying) • Implement symmetric cryptography techniques for securing blockchain data. (Applying) • Demonstrate the use of asymmetric cryptography for encryption, decryption, and data integrity. (Applying)		

Course Content:				
Module 1	Introduction to Blockchain	Quiz	Assignment	10 Sessions
Topics: Introduction to the Course: - The growth of blockchain technology, Distributed systems, The history of blockchain and Bitcoin, Types of blockchain, Consenus, CAP theorem and blockchain.				
Module 2	Decentralization using blockchain	Quiz	Assignment	10 Sessions
Topics: Methods of decentralization, Routes to decentralization, Blockchain and full ecosystem decentralization, Smart contracts, Decentralized Organizations, Platform for decentralization.				

Module 3	Symmetric Cryptography	Quiz	Assignment	12 Sessions
Topics: Mathematics: Set, Group, Field, A finite field, Order, An abelian group, Prime fields, Ring, A cyclic group, Modular arithmetic, Cryptography, Confidentiality, Integrity, Authentication, Entity authentication, Data origin authentication, Non-repudiation, Accountability. Cryptographic primitives: Symmetric cryptography, Stream and Block ciphers, Block encryption mode, Electronic Code Book, Data Encryption Standard, Advanced Encryption Standard.				
Module 4	Asymmetric Cryptography	Quiz	Assignment	8 Sessions
Topics: Encryption and decryption using RSA, Elliptic curve cryptography, Hash functions, Message Digest, Secure Hash Algorithms.				
Text Book • **"Blockchain Basics: A Non-Technical Introduction in 25 Steps"** – Daniel Drescher • **"Cryptography and Network Security: Principles and Practice"** – William Stallings				
References • **"Mastering Blockchain"** – Imran Bashir • **"Blockchain Revolution: How the Technology Behind Bitcoin is Changing Money, Business, and the World"** – Don Tapscott & Alex Tapscott				
E-Resources • **NIST Blockchain Research** – National Institute of Standards and Technology (NIST) research on blockchain and cryptography				

CSA3429 Cloud Computing for Data Analytics

Course Code: CSA3429	Course Name: Cloud Computing for Data Analytics Type of Course: Theory Course	L- T-P- C	3-0-0-3
Version No.	1		
Course Pre-requisites	Essentials of Cloud Computing		
Anti-requisites	NIL		
Course Description	This course provides an in-depth understanding of cloud computing concepts and their applications in data analytics. It covers cloud service models, distributed computing, big data analytics frameworks, and security considerations in cloud environments. Students will gain hands-on experience in deploying data analytics solutions on cloud platforms.		
Course Objective	The objective of the course is to familiarize the learners with the concepts of : Cloud Computing for Data Analytics and attain Skill Development through Participative Learning techniques.		
Course Out Comes	**On successful completion of the course the students shall be able to:** • Explain cloud computing fundamentals and service models. (Understanding) • Apply cloud-based data storage and processing techniques for analytics. (Applying) • Implement big data analytics frameworks on cloud platforms. (Applying) • Analyze security and privacy challenges in cloud-based data analytics. (Analyzing)		
Course Content:			

Module 1	Introduction to Cloud Computing	Assignment	Introduction to Cloud	10 Sessions
Topics: Basics of Cloud Computing- Cloud Service Models: IaaS, PaaS, SaaS-Cloud Deployment Models: Public, Private, Hybrid, Community - Virtualization and Containerization- Cloud Computing Platforms: AWS, Azure, Google Cloud				
Module 2	Cloud Storage and Data Processing	Quiz/ Assignment	Virtualization Fundamentals	10 Sessions
Topics: Cloud Storage Technologies: Object Storage, Block Storage, File Storage- Data Management and Storage Services (Amazon S3, Google Cloud Storage)- Distributed Data Processing: MapReduce, Apache Hadoop- Cloud-based Data Warehousing (BigQuery, Snowflake, Redshift) - Serverless Computing for Data Analytics				
Module 3	Big Data Analytics on Cloud	Assignment	Cloud Services(SAAS, PAAS,IAAS)	13 Sessions
Topics: Introduction to Big Data and Cloud Integration- Cloud-Based Big Data Platforms: Apache Spark, Databricks - Real-Time Analytics with Kafka and Flink - Machine Learning on Cloud (Google AI, AWS SageMaker, Azure ML) - Case Studies on Cloud-Based Data Analytics				
Module 4	Security and Privacy in Cloud Data Analytics	Assignment	Cloud Computing Software Security Fundamentals	12 Sessions
Topics: Security Challenges in Cloud Computing - Data Encryption and Secure Storage in Cloud - Identity and Access Management (IAM) in Cloud Platforms - Compliance and Regulatory Aspects (GDPR, HIPAA) - Risk Assessment and Mitigation Strategies				
Text Book • **"Cloud Computing: Concepts, Technology & Architecture"** – Thomas Erl, Ricardo Puttini, and Zaigham Mahmood • **"Data Science on the Google Cloud Platform"** – Valliappa Lakshmanan				
References • **"Mastering Cloud Computing"** – Rajkumar Buyya, Christian Vecchiola, and S. Thamarai Selvi • **"Big Data Analytics: Systems, Algorithms, Applications"** – C. Philip Chen, Kai Hwang, Min Chen				
E-Resources **AWS Cloud Data Analytics** – Amazon's guide on cloud-based big data analytics				

CSA3421-Enterprise and Cloud computing

Course Code: CSA3421	Course Name: Enterprise And Cloud Computing Type of Course: Theory Course	L- T-P- C	3-0-0-3
Version No.	1		
Course Pre-requisites	The prerequisites for this course are Basics of cloud technologies.		
Anti-requisites	NIL		
Course Description	The main objective of this course is to streamline computing resources, deploy enterprise applications, improve user access and system reliability, and utilize advanced computing capabilities. Foundation concepts include virtualization, multi-tenant architecture, and software		

	defined networking. Examines the full range of services available to organizations along with deployment strategies, evaluation criteria, economic justification, and manageability
Course Objective	The objective of the course is to familiarize the learners with the concepts of ENTERPRISE AND CLOUD COMPUTING and attain Skill Development through Experiential Learning techniques.
Course Out Comes	**On successful completion of the course the students shall be able to:** 1. Understand how cloud computing and enterprise applications can advance the mission of an organization and achieve organizational goals [Understand] 2. Identify and describe the variety of mechanisms, technologies, and architectures used in cloud computing systems [Evaluate] 3. Utilize cloud services, applications, and providers to solve a wide variety of problems and challenges faced by IT managers and organizations [Apply] 4. Justify and adopt cloud technologies, applications, and services and effectively manage their transition into the IT function [Evaluate]

Course Content:

Module 1	Introduction to Enterprise Computing	Assignment	Introduction to Enterprise Computing	8 Sessions

Topics:
Definition and Concepts of Enterprise Systems-Characteristics of enterprise systems,Types of enterprise applications (ERP, CRM, SCM),Enterprise Architecture-Components of enterprise architecture,Enterprise integration,Enterprise Software Development,Software development methodologies (Agile, Waterfall, etc.),Custom vs. packaged enterprise applications

Module 2	Cloud Computing Fundamentals	Quiz/ Assignment	Cloud Computing Fundamentals	8 Sessions

Topics:
Cloud Computing Overview,Definition, characteristics, and service models (IaaS, PaaS, SaaS)-Cloud deployment models (Private, Public, Hybrid, Community)-Cloud Computing Technologies-Virtualization, distributed computing-Cloud storage, network, and database-Cloud platforms (AWS, Google Cloud, Microsoft Azure, etc.)-Security concerns and challenges

Module 3	Enterprise Cloud Integration	Assignment	Enterprise Cloud Integration	8 Sessions

Topics:
Enterprise Cloud Adoption and Transformation,Cloud strategy, migration challenges,Change management in enterprise cloud adoption,Enterprise Cloud Integration Architectures,Integration of legacy systems with cloud-based solutions,Cloud API s, micro-services, and middleware,Interoperability and Cloud Standards Ensuring compatibility between cloud providers and enterprise

Module 4	Cloud Services Management	Assignment	Cloud Services Management	7 Sessions

Topics:
Cloud Service Life-cycle -Service design, provisioning, monitoring, and decommissioning-Service Level Agreements (SLAs) and Performance-Slaps in cloud environments-Metrics for performance management-. Case Studies and Applications-Real-world Enterprise Cloud Computing Case Studies-Analysis of companies adopting cloud technologies-Success stories and challenges

Text Book

- 1. Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, S.Thamarai Selvi from TMH 2013.
- 2. George Reese Cloud Application Architectures, First Edition, O"Reilly Media 2009.

References

- 1. Cloud Computing and SOA Convergence in Your Enterprise A Step-by-Step Guide by David S. Linthicum from Pearson 2010.
- 2. Cloud Computing 2nd Edition by Dr. Kumar Saurabh from Wiley India 2012.

E-Resources

1.	https://nptel.ac.in/Cloud Computing - Course

CSA3419 Enterprise Data Management and Strategy

Course Code: CSA3419	Course Name: Enterprise Data Management and Strategy Type of Course: Theory Course	L- T-P- C	3-0-0-3
Version No.	1		
Course Pre-requisites	The prerequisites for this course are Basics of cloud technologies.		
Anti-requisites	NIL		
Course Description	With the advent of big data systems, organizations have turned to enterprise data management frameworks to manage and gain insights from the vast amount of data collected. While storage costs themselves are relatively affordable, the bigger challenge has been finding an appropriate mechanism to manage the data as many technologies (e.g., relational databases, data warehouses) have limitations on the amount of data that can be stored. This course focuses on realizing the business advantage and business potential of operational, reconciled, and big data systems as well as data assets in supporting enterprise data management strategies and enterprise data analytics.		
Course Objective	The objective of the course is to familiarize the learners with the concepts of Enterprise Data Management and Strategy and attain Skill Development through Participative Learning techniques.		
Course Out Comes	**On successful completion of the course the students shall be able to:** • Explain the fundamentals of Hadoop, Hive, and Pig for big data processing. *(Understand)* • Apply SQL to query relational databases effectively. *(Apply)* • Analyze the principles of data profiling, data integration, and master data management. *(Analyze)* • Compare and evaluate big data approaches with relational database approaches. *(Evaluate)*		
Course Content:			
Module 1	Fundamentals of Enterprise Data Management	Assignment	Introduction to Enterprise Computing	8 Sessions
Topics: Introduction to Enterprise Data Management (EDM)- Data Lifecycle Management and Data Stewardship- Data Quality Management and Best Practices- Metadata Management and Master Data Management (MDM)- Regulatory Compliance (GDPR, HIPAA, and Industry Standards)				
Module 2	Data Strategy and Governance	Quiz/ Assignment	Cloud Computing Fundamentals	8 Sessions
Topics: Importance of Data Strategy in Business Decision-Making- Data Governance Frameworks and Policiesn- Roles and Responsibilities in Data Governance-Risk Management and Compliance in Data Handling-Data Monetization and Ethical Considerations				
Module 3	Data Architecture and Integration	Assignment	Enterprise Cloud Integration	8 Sessions
Topics: Enterprise Data Architecture and its Components-Database Management Systems (DBMS) and Data Warehousing-Data Lakes, Data Marts, and Cloud-Based Data Storage-Extract, Transform, Load (ETL) Processes and Tools-Data Integration Challenges and Best Practices				

Module 4	Data Analytics and Business Intelligence	Assignment	Cloud Services Management	7 Sessions
Topics: Fundamentals of Business Intelligence (BI) and Data Analytics- Data Visualization and Reporting Tools- Machine Learning and AI in Enterprise Data Analysis- Real-Time Analytics and Big Data Processing- Case Studies on Data-Driven Decision-Making				
Text Book • Dreibelbis, A. (2008). Enterprise Data Management: Managing Data as a Corporate Asset. IBM Press. • Loshin, D. (2013). Master Data Management. Morgan Kaufmann.				
References • McGilvray, D. (2008). Executing Data Quality Projects: Ten Steps to Quality Data and Trusted Information. Morgan Kaufmann. • Redman, T. C. (2016). Data Driven: Profiting from Your Most Important Business Asset. Harvard Business Review Press.				
E-Resources 1. https://www.dama.org 2. **MIT Sloan Management Review – Data & Analytics:** https://sloanreview.mit.edu/data-analytics/				

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. **Assignment:** Review on types of attacks in networks, Article review, quiz, written assignments				
Text Book **T1** William Stallings, *"Cryptography and Network Security - Principles and Practices"*, Prentice Hall, 8th Edition, 2019. **T2**. Wade Trappe and Lawrence C Washington, *"Introduction to Cryptography with Coding Theory"*, Pearson, 2020.				

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

CSA3407 Ethical Hacking

Course Code: CSA3407	**Course Title:** Ethical Hacking **Type of Course:** Discipline Elective	**L- P- C**	**3**	**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: 1] Illustrate the importance of ethical hacking 2] Categorize the various techniques for performing reconnaissance. 3] Demonstrate various types of system scanners and their functions 4] Demonstrate the function of sniffers on a network				
Course Content:					

Module 1	**Introduction to Hacking** (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.				

CSA3408 Data Security and Privacy

Course Code: CSA3408	**Course Title:** **Data Security and Privacy** **Type of Course:** **Theory**	**L- P- C**	3	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:** i. Define cryptographic principles and mechanisms to manage access controls in Big Data system.[Knowledge] ii. Explain security risks and challenges for Big Data system.[Knowledge] iii. Recognize all security related issues in big data systems .[Comprehension] 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	**08 classes**
Topics: Privacy – Reidentification of Anonymous People – Why Big Data Privacy is self regulating? – Ethics – Ownership – Ethical Guidelines – Big Data Security – Organizational Security. Assignment: Big data security-organizational security				
Module 2	Security, Compliance, Auditing, And Protection	Assignment	communication protocols for each of the Hadoop ecosystem components	**08 classes**
Topics: Steps to secure big data – Classifying Data – Protecting – Big Data Compliance – Intellectual Property Challenge – Research Questions in Cloud Security – Open Problems. 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	**08 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	**08 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, 2013.
2. Ben Spivey, Joey Echeverria, "Hadoop Security Protecting Your Big Data Problem", O'Reilly Media, 2015.

Reference(s):

Reference Book(s):

1. Mark Van Rijmenam, "Think Bigger: Developing a Successful Big Data Strategy for Your Business", Amazon, 1 edition, 2014.
2. Frank Ohlhorst John Wiley & Sons, "Big Data Analytics: Turning Big Data into Big Money", John Wiley & Sons, 2013.
3. Sherif Sakr, "Large Scale and Big Data: Processing and Management", CRC Press, 2014.

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

Value Added Courses

CHE7601 Environmental Studies

Course Code: CHE7601	**Environmental Studies** **Type of Course: MOOC course**	**L- T- P- C**	**0**	**0**	**0**	**0**
		Contact hours	**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: 1. Describe the basic environmental concepts and issues relevant to the business and management field. 2. Recognize the interdependence between environmental processes and socio-economic dynamics. 3. Explain the role of business decisions, policies, and actions in minimizing environmental degradation. 4. Identify possible solutions to curb environmental problems caused by managerial actions. 5. 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).

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

1. G. Tyler Miller and Scott Spoolman (2020), Living in the Environment, 20th Edition, Cengage Learning, USA
2. Poonia, M.P. Environmental Studies (3rd ed.), Khanna Book Publishing Co.
3. Bharucha, E. Textbook of Environmental Studies (3rd ed.) Orient Blackswan Private Ltd.
4. Dave, D., & Katewa, S. S. Text Book of Environmental Studies. Cengage Learning India Pvt Ltd.
5. Rajagopalan, R. Environmental studies: from crisis to cure (4th ed.). Oxford University Press.
6. Basu, M., & Xavier Savarimuthu, S. J. Fundamentals of environmental studies. Cambridge University Press.
7. Roy, M. G. Sustainable Development: Environment, Energy and Water Resources. Ane Books.
8. Pritwani, K. Sustainability of business in the context of environmental management. CRC Press.
9. 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.

LAW1008 Indian Constitution

Course Code: **LAW1008**	**Course Title: Indian Constitution** **Type of Course: Value Added Course**	**L-T-P-C**	**2**	**0**	**0**	**2**
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: CO1. To analyse the history, Preamble, Fundamental Rights, and basic structure of the Indian Constitution. CO2. To describe the roles of the President, Prime Minister, and legislative bodies (Lok Sabha and Rajya Sabha).					

	CO3. To examine the powers and functions of the Governor, Chief Minister, and State Secretariat CO4.Toassess the functioning of local government bodies like District Administration, Municipal Corporations, and Zila Panchayats. CO5. Toanalyse 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

CSA1204 Design thinking and Innovation

Course Code: CSA1204	**Course Title:** **Design thinking and Innovation** **Type of Course:** **Theory**	**L- P- C**	3	0	3
Version No.	1.0				
Course Pre-requisites					
Anti-requisites	**NIL**				
Course Description	This course introduces the principles and processes of **Design Thinking** as a human-centered, iterative approach to problem-solving and innovation. Students will explore how to identify user needs, redefine problems, and create innovative solutions using ideation, prototyping, and testing. Through real-world case studies and project-based learning, the course nurtures creativity, collaboration, empathy, and critical thinking.				
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:** • **CO1:** Recall the principles and phases of Design Thinking. *(Remember)* • **CO2:** Understand the role of empathy and user research in innovation. *(Understand)* • **CO3:** Explain the iterative nature of design and how prototyping aids in innovation. *(Understand)* • **CO4:** Recognize how design thinking leads to innovative product and service ideas. *(Remember)*			
Course Content:				
Module 1	Introduction to Design Thinking	Assignment/Quiz		**15 classes**
Topics: Origins and Evolution of Design Thinking- Principles: Human-Centered Design, Empathy, Iteration - Design Thinking vs. Traditional Problem-Solving - Stanford d.school and IDEO Approaches - User Research Methods: Interviews, Observation, Persona Creation - Empathy Mapping - Problem Framing and Redefining - Crafting Problem Statements				
Module 2	Ideate, Prototype and Test	Assignment		**08 classes**
Topics: Ideation Techniques: Brainstorming, SCAMPER, Mind Mapping - Low- and High-Fidelity Prototypes - Testing and User Feedback - Iterative Refinement and Feedback Loops				
Module 3	Innovation, Implementation & Case Studies	Case study		**08 classes**
Topics: Innovation vs. Invention - Implementing Innovative Ideas - Design Thinking in Startups, Social Innovation, and Tech Products - Case Studies from Apple, IDEO, Google, etc.				
Text Book(s): • T. Brown, *Change by Design: How Design Thinking Creates New Alternatives for Business and Society*, Harvard Business Press, 2020. • D. Kelley and T. Kelley, *Creative Confidence: Unleashing the Creative Potential Within Us All*, Crown Business, 2019.				
Reference(s): **Reference Book(s):** • N. Cross, *Design Thinking: Understanding How Designers Think and Work*, Bloomsbury Publishing, 2021. • J. Liedtka and T. Ogilvie, *Designing for Growth: A Design Thinking Tool Kit for Managers*, Columbia Business School Publishing, 2020. Weblinks: **IDEO Design Thinking Toolkit** – https://designthinking.ideo.com **Stanford d. School Resources** – https://dschool.stanford.edu/resources **Interaction Design Foundation – Design Thinking** – https://www.interaction-design.org/literature/topics/design-thinking **Coursera – Design Thinking for Innovation (University of Virginia)** – https://www.coursera.org/learn/uva-darden-design-thinking-innovation				

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