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

2023-2026

BACHELOR OF COMPUTER APPLICATIONS

(Artificial Intelligence and Machine Learning)

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

Regulation Number: PU/AC-21.6/SoIS2 /BCI/2023-2026

Resolution No. 6 of the 21th Meeting of the Academic Council held on 06th Sept 2023, and ratified by the Board of Management in its 22nd Meeting held on 02nd Nov 2023.

(As amended upto 26th Meeting of the Academic Council held on 25th July 2025, and ratified by the Board of Management in its 27th Meeting held on 28th July 2025)

September 2023

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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 2023-2026.
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 2023-2026 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 2023-2024.

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 (Artificial Intelligence and Machine Learning) Degree Program Regulations and Curriculum, 2023-2026;*

ff. *"Program" means the Bachelor of Computer Application (Artificial Intelligence and Machine Learning) 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;*

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 2023-2026 are subject to, and, pursuant to the Academic Regulations. These Program Regulations shall be applicable to the following ongoing Bachelor of Computer Applications Degree Programs of 2023-2026 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 BCI.

3. Bachelor of Computer Applications in Data Science, abbreviated as BCD.

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:

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 solid understanding of artificial intelligence and machine learning techniques, and be able to apply them to real-world problem-solving solutions.

PSO-3: [AI/ML Applications]: Students should be able implement AI algorithms for various applications, for various domains, such as healthcare, finance, agriculture or robotics, 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

Transfer of student(s) from another recognized University to the 2nd year (3rd Semester) of the BCA. Program of the University

10.1 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.

10.2 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.

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

10.4 The concerned student fulfils the criteria specified in Clauses 10.2 and 10.3.

10.5 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.

10.6 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.

11.2. 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.

11.3. 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.

11.4. 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.

11.5. 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.

11.6. The eligible student may be allowed a change in Branch, strictly in order of inter se merit, subject to the conditions 11.6 and 11.7:

11.7. 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,

11.8. 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.

11.9. 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 12.5) 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 8.10Error: Reference source not found) shall be awarded to a student based on her/his overall performance relative to the class performance distribution in the concerned Course. These Letter Grades not only indicate a qualitative assessment of the student’s performance but also carry a quantitative (numeric) equivalent called the Grade Point.

12.5 **Assessment Components and Weightage**

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

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

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

12.6 Minimum Performance Criteria:

12.6.1 Theory only Course and Lab/Practice Embedded Theory Course

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

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

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

12.6.2 **Lab/Practice only Course and Project Based Courses**

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

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

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

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

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

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

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

13.3.1 A student may complete SWAYAM/NPTEL/other approved MOOCs as mentioned in Clause 13.3 (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 13.3(As per the academic regulations) shall be approved by the concerned Board of Studies and placed (as Annexures) in the concerned PRC.

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

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

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

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

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

13.3.8 The credit equivalence of the SWAYAM/NPTEL/other approved MOOCs are based on Course durations and/or as recommended by the Course offering body/institute/university. The Credit Equivalence mapped to SWAYAM/ NPTEL approved Courses based on Course durations for transfer of credits is summarised in Table shown below. The Grade will be calculated from the marks received by the Absolute Grading Table 8. 11 in the Academic Regulations.

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

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

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

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

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

- S (Satisfactorily Completed): Awarded when the student successfully completes all prescribed course requirements.
- NC (Not Completed): Awarded when the student fails to meet the prescribed course requirements.

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

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

PART B: PROGRAM STRUCTURE

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

The BCA (Artificial Intelligence and Machine Learning) Program Structure (2023-2026) 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 2023-2026: Summary of Mandatory Courses and Minimum Credit Contribution from various Baskets

Sl. No.	Baskets	Credit Contribution
1	School Core	30
2	Program Core	72
3	Discipline Elective	12
4	Open Elective	6
5	Mandatory Courses (MAC)*	0
	Total Credits	120 (Minimum)

In the entire Program, the practical and skill-based course component contribute to an extent of approximately 62% out of the total credits of 120 for BCA *(Artificial Intelligence and Machine Learning)* 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

Table 3.1 : School Core						
S.No	**Code**	**Course Name**	**L**	**T**	**P**	**C**
1.	CSA1004	Programming in Python	1	0	4	3
2.	CSA3001	Capstone Project	-	-	-	4
3.	MAT1006	Statistical Methods and Techniques	3	0	0	3
4.	MAT2007	Applied Mathematics	3	0	0	3
5.	CSA3008	Internship	-	-	-	8
English and Foreign Languages (Minimum credits to be earned-4)						
6.	ENG1003	Communicative English	2	0	0	2
7.	ENG2005	Technical Written Communication	2	0	0	2
Kannada (Minimum credits to be earned-1)						
8.	KAN1001	Kali Kannada	1	0	0	1
9.	KAN2001	Thili Kannada	1	0	0	1
Soft Skills Basket (Minimum credits to be earned-4)						
10.	PPS1012	Enhancing Personality through Soft skills	0	0	2	1
11.	PPS1006	Employability for Young Professionals	0	0	2	1
12.	PPS2002	Being Corporate Ready	0	0	2	1
13.	PPS3001	Problem Solving through Aptitude	0	0	2	1
Non-Credit Pass/Fail Type Courses(Mandatory course)						
14.	CHE1020	Environmental studies and Sustainable Development	2	0	0	0
		Minimum Credits to be Earned From basket				**30**

Table 3.2: Program Core						
S.No	**Code**	**Course Name**	**L**	**T**	**P**	**C**
1.	CSA2002	Computer Organization	3	0	0	3
2.	CSA1001	Problem Solving using C	2	0	4	4
3.	ECE2009	Digital Computer Fundamentals	2	0	2	3
4.	CSA1002	Web Design and Development	1	0	4	3
5.	CSA2001	Data Structures and Algorithms	3	0	2	4
6.	CSA2004	Computer Networks	3	0	0	3
7.	CSA1006	Operating Systems and Unix Programming	2	0	2	3
8.	CSA2003	Relational Database Management Systems	2	0	4	4
9.	CSA1005	Object Oriented Programming using Java	1	0	4	3
10.	MAT2028	Graph Theory	2	1	0	3
11.	CSA2005	Analysis of Algorithms	2	1	0	3
12.	CSA2020	Artificial Intelligence	3	0	0	3

13.	CSA3002	Machine Learning Algorithms	2	0	2	3
14.	CSA2006	Fundamentals of Software Engineering	3	0	0	3
15.	CSA2102	Information Retrieval	3	0	0	3
16.	CSA3071	Deep Learning	2	0	2	3
17.	CSA3014	Natural Language Processing	2	0	2	3
18.	CSA3003	Android Mobile Applications Development	1	0	4	3
19.	CSA3074	Reinforcement Learning	3	0	0	3
20.	CSA2008	Essentials of Cloud Computing	3	0	0	3
21.	CSA3005	Internet of Things	1	0	4	3
22.	CSA3075	Social Media Analytics	1	0	4	3
23.	CSA3052	Pattern Recognition	3	0	0	3
		Total No. of Credits				**72**

	Table 3.3: List of Mandatory Courses (MAC)					
S.No	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1	LAW7601	Indian Constitution	-	-	-	0

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 plan.

18.1 Internship

A student may undergo an Internship for a period of 10-12 weeks in an industry / company or academic / research institution during the Semester Break between 4th and 5th Semesters or 6th and 7th Semesters, 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, 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 2.6.2.1). 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 7th / 8th Semester as applicable, 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, subject to the following conditions:

18.3.2 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 6 credits is to be earned by the student in a particular track and overall 12 credits.

Track 1 - Computer Application Basket

S.No	Course Code	Course Name	L	T	P	C
1.	CSA3022	Advanced Java	1	0	4	3
2.	CSA3023	Advanced Data bases	2	0	2	3
3.	CSA3024	Advanced Python	1	0	4	3
4.	CSA3027	Cryptography and Network security	3	0	0	3
5.	CSA3028	Embedded Systems	2	0	2	3
6.	CSA3029	Storage Area Networks	3	0	0	3
7.	CSA3032	Semantic Web Technologies	3	0	0	3
8.	CSA3033	Robotic Process Automation	3	0	0	3
9.	CSA3034	Parallel Computing	3	0	0	3
10.	CSA3049	Software Metrics and Quality Management	3	0	0	3
11.	CSA3050	Ethical Hacking	3	0	0	3
12.	CSA3051	.Net Programming Using C#	1	0	4	3

Track 2 – Data Science and Big Data Basket

S.No	Course Code	Course Name	L	T	P	C
1.	CSA3006	Blockchain Technology	3	0	0	3
2.	CSA3004	Big Data Analytics	2	0	2	3
3.	CSA3089	Predictive Analytics	1	0	4	3
4.	CSA3070	Time Series Analysis	3	0	0	3

5.	MAT1008	Probability and Inferential Statistics	3	0	0	3
6.	MAT2033	Statistical Analysis using R	2	0	2	3
7.	CSA2018	Data Modeling and vizualization	2	0	2	3
8.	CSA3069	Data Management using Cloud	2	0	2	3
9.	MAT2038	Linear Programming	3	0	0	3
Track 3 Artificial Intelligence and Machine Learning Basket						
S.No	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1.	CSA2105	Optimization Techniques for Machine Learning	2	0	2	3
2.	CSA2106	Advanced Natural Language Processing	2	0	2	3
3.	CSA3072	Web Application Security	3	0	0	3
4.	CSA3048	Cloud Storage Applications	3	0	0	3
5.	CSA3020	Artificial Intelligence for Game Development	3	0	0	3
6.	CSA3017	Information Retrieval	3	0	0	3
7.	CSA2108	Machine Learning for Business	3	0	0	3
8.	CSA2109	AI in Healthcare	3	0	0	3

20. List of Open Electives to be offered by the School / Department (Separately for ODD and EVEN Semesters.

Table 3.8 : Open Elective Courses Baskets: Minimum Credits to be earned from this Basket is 6						
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

Sl. No.	Course Code	Course Name	L	T	P	Credits	Contact Hours	Type of course
Semester 1								
1	MAT2007	Applied Mathematics	3	0	0	3	3	School Core
2	CSA2002	Computer Organization	3	0	0	3	3	Program Core
3	CSA1001	Problem Solving using C	2	0	4	4	6	Program Core
4	ECE2009	Digital Computer Fundamentals	2	0	2	3	4	Program Core
5	CSA1002	Web Design and Development	1	0	4	3	5	Program Core
6	ENG1003	Communicative English	2	0	0	2	2	School Core
7	PPS1012	Enhancing Personality through Soft skills	0	0	2	1	2	School Core
8	KAN1001 / KAN2001	Kali Kannada/Thili Kannada	1	0	0	1	1	School Core
			14	0	12	20	26	
Semester 2								
1	CSA1004	Programming in Python	1	0	4	3	5	School Core
2	MAT1006	Statistical Methods and Techniques	3	0	0	3	3	School Core
3	CSA2001	Data Structures and Algorithms	3	0	2	4	5	Program Core
4	ENG1005	Technical Written Communication	2	0	0	2	2	School Core

5	CSA2004	Computer Networks	3	0	0	3	3	Program Core
6	CSA1006	Operating Systems and Unix Programming	2	0	2	3	4	Program Core
7	PPS1006	Employability for young professionals	0	0	2	1	2	School Core
			14	0	10	19	24	
Semester 3								
1	CSA2003	Relational Database Management Systems	2	0	4	4	6	Program Core
2	CSA1005	Object Oriented Programming using Java	1	0	4	3	5	Program Core
3	MAT2028	Graph Theory	2	1	0	3	3	Program Core
4	CSA2005	Analysis of Algorithms	2	1	0	3	3	Program Core
5	CSA2020	Artificial Intelligence	3	0	0	3	3	Program Core
6	CSA3002	Machine Learning Algorithms	2	0	2	3	4	Program Core
7	PPS2002	Being Corporate Ready	0	0	2	1	2	School Core
8	CHE1020	Environmental Studies and Sustainable Development	2	0	0	0	2	School Core
			14	2	12	20	28	
Semester 4								
1	CSA2006	Fundamentals of Software Engineering	3	0	0	3	3	Program Core
2	CSA2102	Information Retrieval	3	0	0	3	3	Program Core
3	CSA3071	Deep Learning	2	0	2	3	4	Program Core
4	CSAXXXX	Discipline Elective 1	1	0	4	3	5	Discipline Elective
5	CSAXXXX	Discipline Elective 2	1	0	4	3	5	Discipline Elective
6	PPS3001	Problem Solving through Aptitude	0	0	2	1	2	School Core
7	CSA3001	Capstone Project	--	0	--	4	0	School Core
			10	0	12	20	22	
Semester 5								
1	CSA3014	Natural Language Processing	2	0	2	3	5	Program Core
2	CSA3003	Android Mobile Applications Development	1	0	4	3	5	Program Core
3	CSA3074	Reinforcement Learning	3	0	0	3	3	Program Core
4	CSA2008	Essentials of Cloud Computing	3	0	0	3	3	Program Core
5	CSAXXXX	Discipline Elective 3	1	0	4	3	5	Discipline

								Elective
6	CSA3005	Internet of Things	1	0	4	3	5	Program Core
7	XXXXXXX	Open Elective 1	3	0	0	3	3	Open Elective
8	LAW7601	Indian Constitution	-	-	-	0	0	MAC
			13	0	16	21	29	
Semester 6								
1	CSAXXXX	Discipline Elective 4	3	0	0	3	3	Discipline Elective
2	CSA3075	Social Media Analytics	1	0	4	3	5	Program Core
3	CSA3052	Pattern Recognition	3	0	0	3	3	Program Core
4	XXX XXX	Open Elective 2	3	0	0	3	3	Open Elective
5	CSA3008	Internship	- -	- -	- -	8	-	School Core
			10	0	4	20	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.

SCHOOL CORE

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 Programming in 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**	Term paper/Assignment	Application on data visualization	**20 Sessions**

	Visualization			

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.

1. Write a Python program to perform basic arithmetic operations (addition, subtraction, multiplication, division) and print results.
2. Write a Python program that takes a number as input and checks whether it is positive, negative, or zero.
3. Implement a Python program to calculate the factorial of a given number using both for and while loops.
4. Write a Python program that checks if a number is prime.
5. Develop a program to print different patterns using nested loops, such as:markdown
6. Write a function to generate the Fibonacci series up to n terms.
7. Write a program to count vowels and consonants in a given string.
8. Implement Bubble Sort and Binary Search on a list of numbers.
9. Write a Python program to perform matrix addition using nested lists.
10. Use list comprehension to separate even and odd numbers from a given list.
11. Create a dictionary to store student names and their marks, then perform add, update, and delete operations.
12. Implement union, intersection, and difference operations on sets.
13. Write a Python program to read from a file and count word occurrences, then write the output to another file.
14. Implement a program that handles the ZeroDivisionError when dividing two numbers.
15. Design a class BankAccount with methods to deposit, withdraw, and display balance.
16. Plot a bar chart or line graph using Matplotlib for student marks data.

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 GSRAHSSHLKSKKGQSTSRHK?

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

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
Topics relevant to “Skill Development”: Concepts of problem solving techniques, Functions, Object oriented programming and data visualization **for Skill Development** through **Experiential Learning** techniques. This is attained through assessmentcomponent mentioned in course handout.

CSA3001 – CAPSTONE PROJECT

Course Code: **CSA3001**	**Course Title: Capstone Project** **Type of Course: Project**	**L- T-P- C**	-	-	-	4
Version No.	**1.0**					
Course Pre-requisites	**Knowledge and Skills related to all the courses studied in previous semesters.**					
Anti-requisites	**NIL**					
Course Description	The Capstone Project course is a culmination of the BCA program, enabling students to apply their technical knowledge and skills to solve real-world problems. This course fosters innovation and creativity, guiding students through the end-to-end development of software, applications, or IT solutions. Students collaborate in teams or individually to identify a problem, design solutions, and					

	implement them using industry-relevant tools and technologies. The course emphasizes project planning, coding, testing, and documentation, with mentorship provided by faculty. Through this experiential learning opportunity, students gain practical exposure, enhance their problem-solving abilities, and prepare for careers in the IT industry.
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Professional Practice and attain Employability **Skills** through Experiential **Learning** techniques.
Course Outcomes	On successful completion of this course the students shall be able to: 1. Analyze complex real-world problems, evaluate potential solutions, and select appropriate technologies and methodologies to design an effective solution. *(Analyze)* 2. Design, develop, and implement a functional project by applying programming, database management, and software engineering principles. *(Apply)* 3. Collaborate effectively in teams, document the development process comprehensively, and present the project outcomes professionally to diverse stakeholders. *(Create)*

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.	1.0					
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 Solving techniques**.			
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. CO2: **Predict** the characteristics of statistical data with the help of measures of central tendency, dispersion, correlation and regression. CO3: **Interpret** the symmetry of a data set with the help of measures of skewness and kurtosis. CO4: **Employ** suitable formulae for solving problems pertaining to the basic probability, additive and multiplicative laws for both independent and dependent events.			
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.
Topics relevant to SKILL DEVELOPMENT: To acquaint students with various statistical methods. To cultivate statistical thinking among students. To prepare students for future courses having quantitative components for **Skill Development through Problem Solving methodologies.** This is attained through assessment component mentioned in course handout.

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.	1.0					
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. CO2: Comprehend the concepts of differential calculus and its applications. CO3: Explain various methods of integration and their advantages. CO4: Apply matrix techniques to solve system of linear equations.					

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 Calculus**			**10 classes**
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, 9th Edn, 1998.
3. Ron Larson, Elementary Linear Algebra, Brooks/Cole Cengage Learning, 7th Edn., 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, 11th Edn, 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/

CSA3008 – Internship

Course Code: CSA3008	**Course Title: Internship** **Type of Course:**	**L- T-P- C**	-	-	-	08
Version No.	**1.0**					
Course Pre-requisites	**Knowledge and Skills related to all the courses studied in previous semesters.**					
Anti-requisites	**NIL**					
Course Description	During the summer internship course, students have the opportunity to witness science and technology in action, gaining insight into the methods of scientific experimentation. This experience allows them to operate sophisticated equipment, observe multidisciplinary teams addressing techno-economic problems, and apply principles of management learned in class. The course enhances language, communication, and interpersonal skills through seminars, group discussions, and project report preparation. With a strong foundation in mathematics and science, students can opt for Project Work and Dissertation at the university, Project Work in an Industry/Company/Research Laboratory, or an Internship Program in an Industry/Company.					

Course Objectives	The objective of the course is to familiarize the learners with the concepts of Internship and attain **Employability Skills** through **Experiential Learning** techniques.
Course Outcomes	On successful completion of this course the students shall be able to: 1. Demonstrate the application of theoretical knowledge and practical skills acquired during academic coursework in a real-world setting. 2. Develop effective problem-solving skills by identifying, analyzing, and proposing solutions to challenges encountered during the internship experience. 3. Improve communication skills by effectively articulating ideas, presenting findings, and interacting professionally with colleagues, supervisors, and stakeholders. 4. Develop adaptability and a capacity for continuous learning by successfully navigating a dynamic work environment, acquiring new skills, and adapting to evolving tasks and responsibilities.

ENG1003 – Communicative English

Course Code: **ENG 1003**	**Course Title: Communicative English** **Type of Course: School Core Theory Only**	**L- T- P- C**	2	0	0	2
Version No.	1.0					
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					

<table>
<tr><td></td><td colspan="4">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.</td></tr>
<tr><td>Course Objectives</td><td colspan="4">The objective of the course is skill development of student by using Participative Learning techniques</td></tr>
<tr><td>Course Outcomes</td><td colspan="4">1. Explain basic Communication Process.
2. Apply speaking skills in various situations.
3. Demonstrate writing strategies in drafting business letters.
4. Interpret the ideas of the author in the text.</td></tr>
<tr><td>Module 1</td><td>Art of Communication</td><td>Assignment</td><td>Written Assignment</td><td>Classes- 7</td></tr>
<tr><td colspan="5">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</td></tr>
<tr><td>Module 2</td><td>Listen and Speak</td><td>Extempore</td><td>Speech/ Narration/Role Play</td><td>Classes -7</td></tr>
<tr><td colspan="5">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</td></tr>
<tr><td>Module 3</td><td>Business Writing</td><td>Assignment (Case study)</td><td>Exercise & Quiz</td><td>Classes- 7</td></tr>
<tr><td colspan="5">Topics:
1. Basic writing skills: Introduction to writing, Cohesion, Coherence, Steps of writing</td></tr>
</table>

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 comprehension)**	**Exercise & Quiz**	**Classes- 7**

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

Targeted Application & Tools that can be used: Relevant videos from YouTube and articles for all the skills will be used to reinforce the concepts.

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course

1. **Written Assignment on Communication skills during pandemic/natural calamity/unfavorable situation.**
2. **Quizzes based on all four modules.**
3. **Summarizing / analyzing written documents, short stories and conversations.**

Text Book

1. Course Material by the Instructor.
2. PPT's and Videos and Worksheets provided by the instructor.

References

1. 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.

Web Resources

1.https://presiuniv.knimbus.com/user#/searchresult?searchId=Communication%20Skills
2. https://presiuniv.knimbus.com/user#/searchresult?searchId=Communicative%20English

Topics relevant to development of “ EMPLOYABILITY SKILLS”: PRESENTATIONS AND PUBLIC SPEAKING

Topics relevant to development of “PROFESSIONAL SKILLS”: Business Writing

ENG2005 – Technical Written Communication

ENG2005	**Technical Written Communication**	**L-T-P- C**	2	0	0	2
Version No.	1.0					
Course Pre-requisites	ENG2005 Technical Written Communication					
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 Outcome	On successful completion of the course the students shall be able to: 1) Apply strategies and techniques for organizing and drafting descriptions and specifications. 2) Develop skills in writing sentences and paragraphs for content on websites and blogs. 3) Write technical/professional emails, letters and memo					
Course Content:						
Module 1	**Technical Descriptions and Specifications**			**15 Classes**		
• 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**			**10 Classes**		
Topic-1: Creating Infographics Topic-2: Creating summary maps						
	Technical			**5**		

KAN1001-Kali Kannada

Course Code: KAN1001	**Course Title: Kali Kannada** **Type of Course: School Core**	**L- T- P- C**	1	0	0	1

Version No.		1.0
Course Pre-requisites		**Mother tongue with thorough knowledge**
Anti-requisites		–
Course Description		This course aims to help the non Kannada speaking students to converse in Kannada for their day- to –day life activities. It supports to develop strong cognitive skills, use of local language, helps to mingle with the local society,. At the end of the course, the students will have better skills, to the students of Engineering for a better communication. Furthermore, this course is offered to all the students, irrespective of their domain.
OBJECTIVE OF THE COURSE		**The objective of the course is SKILL DEVELOPMENT of students by using PARTICIPATIVE LEARNING techniques**
Course Out Comes		**On successful completion of the course the students shall be able to:** 1] Identify Alphabets and few words with phonetic sound ; understand and express Kannada language for social interaction and basic reading capacity 2] Recognize different basic Kannada vocabulary to know about others perspectives. 3] Use simple kannada in the different contexts 4] Respect the Regional Language and Culture.
Course Content:		The course contents in the form of different modules each module having similar topics in order in which we have given such type of the topics are arranged from given topics 1 Credit course must have 4 modules, 2 Credit course must have 5 modules

Module 1	**Alphabet –**	**Assignment**	**Pronunciation Listening**		**No. of Hours 3**

	VarNamal e,				
	***Alphabet** –varNamale, ***Vowels**-Short vowels,Long vowels, Pronunciation of vowels,writing vowels ***Consonants**,(vyanjanagalu)-classified consonants, unclassified consonants, pronunciation of consonants, Unseparated (alpa praana), Aspirated (mahaapraana),Nasals(anunaasika) ***Origin of sound**				
Module 2	**Parts of Speech**	**Pronunciation Practice**	**Vocabulary Practice to remember the words, Translation and transliteration**		**No. of Hours 4**
	Parts of Speech 1. Nouns 2. Pronoun 3. Adjective 4. Verbs 5. Adverbs 6. Prepositions 7. Conjunctions 8. Interjections				
Module 3	**TENSE & GENDER**	**Assignment**	**Speaking Listening Practice conversation**		**No. of Hours 4**
	* **Tense -** Types and Examples * **Gender** – Types and Examples * Simple Sentences using Tense and Gender				

Module 4	**SAMBHASHANE (CONVERSATION)**	**Assignment**	**Speaking Listening Practice conversatio n**	**No. of Hours 4**

* **Conversation** (sambhaashane)
Interrogative words and Interrogative sentences
Introducing each other
Conversation on Enquiring about room

	Conversation on Enquiring about friends family Conversation between doctor and patient Conversation in vegetable market List of simple proverbs **Practice to speaking with friends different context should conversation** **Practice: Translation and transliteration in kannada**
	Assignment: Assignment proposed for this course: students should write Alphabet and simple kannada vocabularies in English Transliteration form, students should record audio or video of kannada vocabularies and simple sentence reading.
	Practice speaking , self-introduce video with audio or audio , Translation Activities: by telling and giving examples of other Languages if those Lecturer know other languages
	Text Book: In the name of Kali kannada first time we will be preparing syllabus. **Currently we are using kannada Text book introduced by Vishweshvarayya technology University in the name of kannada kali and balake kannada.**
1.	**2. Reference books: Spoken Kannada – Publication – Kannada Sahitya parishath Bengaluru.** **3. Kannada Kirana – Publication – Bangalore Institute of Languages, Bangalore.** **4. Kannada kali** **5. Balake kannada**
	Topics relevant to "SKILL DEVELOPMENT": Speaking Skills, Writing Skills, Presentation Skills, Interpretation Skills, Group Presentations, Group Discussions and Seminars for Skill Development through Participative Learning techniques. This is attained through the Presentation as mentioned in the assessment component.

KAN2001- Thili Kannada

Course Code: KAN2001	**Course Title: ತಿಳಿ ಕನ್ನಡ(THILI KANNADA)** **Type of Course: School Core**	**L- T-P-C**	1	0	0	1

Version No.	1.0			
ಪೂರಕ ಅವಶ್ಯಕತೆಗಳು	ಅವಶ್ಯಕವಿಲ್ಲ, ಈಗಾಗಲೇ ಪಿಯು ಹಂತದಲ್ಲಿ ಕನ್ನಡ ಭಾಷೆಯನ್ನು ಒಂದು ವಿಷಯವಾಗಿ ಕಲಿತಿರುತ್ತಾರೆ.			
ಪೂರಕವಲ್ಲದ ಅವಶ್ಯಕತೆಗಳು	ಅನ್ವಯಿಸುವುದಿಲ್ಲ.			
ಕೋರ್ಸ್ ವಿವರಣೆ	ಭಾಷೆಯನ್ನು ಮಾತನಾಡುವ, ಬರೆಯುವ ಕೌಶಲ್ಯ, ಸಾಹಿತ್ಯದ ಬಗ್ಗೆ ಸ್ಥೂಲವಾಗಿ ಪರಿಚಯಿಸುವ ಮೂಲಕ ವಿದ್ಯಾರ್ಥಿಗಳ ವ್ಯಕ್ತಿತ್ವ ವಿಕಾಸ ಹಾಗು ಸ್ಪರ್ಧಾತ್ಮಕ ಪರೀಕ್ಷೆಗಳನ್ನು ಗಮನದಲ್ಲಿಟ್ಟುಕೊಂಡು, ಪ್ರಸ್ತುತ ಸಂದರ್ಭಕ್ಕೆ ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಸಜ್ಜುಗೊಳಿಸಲು ಪಠ್ಯವನ್ನು ರೂಪಿಸಲಾಗಿದೆ. ಕಲೆ ಮತ್ತು ವಿಜ್ಞಾನ, ವಾಣಿಜ್ಯ, ತಂತ್ರಜ್ಞಾನ, ಅನುವಾದ ವಿಚಾರಗಳಿಗೆ ಒತ್ತನ್ನು ನೀಡಲಾಗಿದೆ. ಇದು ಒಂದು ಕ್ರೆಡಿಟ್ ಹೊಂದಿದೆ.			
ಪಠ್ಯದ ಉದ್ದೇಶ	ಭಾಗವಹಿಸುವಿಕೆ/ಪಾಲ್ಗೊಳ್ಳುವಿಕೆಯ ಕಲಿಕೆಯ ತಂತ್ರಗಳ ಮೂಲಕ ಕೌಶಲ್ಯವನ್ನು ಅಭಿವೃದ್ಧಿಪಡಿಸುವುದು ಪಠ್ಯದ ಉದ್ದೇಶವಾಗಿದೆ.			
ಕಲಿಕಾ ಫಲಿತಗಳು	ಈ ಕೋರ್ಸ್ ನ ಮೂಲಕ ವಿದ್ಯಾರ್ಥಿಯಲ್ಲಿ…. • ಜನಪದ, ವಚನ, ಹೊಸಗನ್ನಡ ಕವಿತೆಗಳು, ಹೊಸಗನ್ನಡದ ಸಣ್ಣಕಥೆಗಳು ಕಲಿಕೆಯ ಮೂಲಕ ಕಾಲದ ಸ್ಥಿತ್ಯಂತರಗಳನ್ನು ಅದರ ಒಳನೋಟಗಳನ್ನು ಬೆಳೆಸುತ್ತದೆ. • ಸಾಮಾಜಿಕ, ರಾಜಕೀಯ, ಧಾರ್ಮಿಕ, ಸಾಂಸ್ಕೃತಿಕ ಹಾಗೂ ಲಿಂಗಸಂಬಂಧಿ ವಿಚಾರಗಳೆಡೆ ಗಮನ ಹರಿಸುವುದರೊಂದಿಗೆ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಚರ್ಚಾ ಮನೋಭಾವವವು ಬೆಳೆಯುತ್ತದೆ. • ವ್ಯವಸಾಯ,ವಾಣಿಜ್ಯ, ತಂತ್ರಜ್ಞಾನಕ್ಕೆ ಸಂಬಂಧಿಸಿದ ಕೌಶಲಗಳನ್ನು ಜೀವನ ಸಂಬಂಧಿ ವಿಷಯಗಳ ಜೊತೆ ಸಮೀಕರಿಸಿಕೊಳ್ಳುವ ಸಾಧ್ಯತೆಯನ್ನು ಹೆಚ್ಚಿಸುತ್ತದೆ. • ಜೀವನದಲ್ಲಿ ಬರುವ ಅಭಿಪ್ರಾಯ ಬೇಧಗಳು, ಸಮಸ್ಯೆಗಳನ್ನು ಗುರುತಿಸಿ ಆಧುನಿಕ ಸಂದರ್ಭದಲ್ಲಿ ಮಾನವೀಯತೆಯೊಂದಿಗೆ ನಿರ್ವಹಿಸುವಂತೆ ಪ್ರೇರೇಪಿಸುತ್ತದೆ.			
ಪರಿವಿಡಿ	ಈ ವಿಷಯವು ೩ ಘಟಕಗಳನ್ನು ಒಳಗೊಂಡಿದ್ದು ಕತೆ, ಲೇಖನ ಮತ್ತು ಅನುವಾದ, ವಚನ ಇವುಗಳನ್ನು ಒಳಗೊಂಡಿದೆ.			
ಘಟಕ -೧	**ಕತೆ**	ಫ್ಯಾಂಟೆಸಿ ಕತೆಗಳ ಮೂಲಕ ಪ್ರಸ್ತುತ ಪಡಿಸುವಿಕೆ	ಪರಿಸರದ ಕತೆಗಳು –ಪುಸ್ತಕದಲ್ಲಿನ ಇತರ ಕಥೆಗಳನ್ನು ಓದುವುದು	**ಒಟ್ಟು ಅವಧಿ 6**
1.1 ಸಂಬಳಕ್ಕೆ ಸಿಕ್ಕಿಕೊಂಡ ದೆವ್ವ- ಕೆ.ಪಿ.ಪೂರ್ಣ ಚಂದ್ರ ತೇಜಸ್ವಿ				
ಘಟಕ -೨	**ಲೇಖನ**	ವೈಚಾರಿಕ ಚಿಂತನೆಯೊಂದಿಗೆ ಚರ್ಚೆ	ಪ್ರಸ್ತುತ ವೈಜ್ಞಾನಿಕ ಆವಿಷ್ಕಾರಗಳ ಬಗ್ಗೆ ತಿಳಿದುಕೊಳ್ಳುವುದು	**ಒಟ್ಟು ಅವಧಿ 5**
ಬಿಸಿನೆಸ್ ಗೆ ಬೇಕು ಇ-ಮೊಬೈಲ್- ಯು.ವಿ ಪವನಜ, ಮನಸ್ಸಿಗೆ ಕನ್ನಡಿ ಹಿಡಿವ ಫೇಸೆಟ್ – ವಿಶ್ವನಾಥ ಶರ್ಮ				

ಘಟಕ – ೪	**ವಚನ**	ಗಾಯನ ಮತ್ತು ಪ್ರಸ್ತುತ ಸ್ಥಿತಿಗೆ ಅನ್ವಯಿಸಿ ವಿವರಿಸುವುದು.	ವಚನಕಾರರ ಚಿಂತನೆಯನ್ನು ಪ್ರಸ್ತುತ ಸ್ಥಿತಿಗೆ ಅನ್ವಯಿಸುವುದು	**ಒಟ್ಟು ಅವಧಿ 2**
ವಚನ - ಅಲ್ಲಮ ಪ್ರಭು - ೨ ವಚನಗಳು				
ಪ್ರಾಯೋಜಿತ ಕಾರ್ಯಗಳು(Assignments) : 1. ವಚನಕಾರರ ಬಗ್ಗೆ ಮಾಹಿತಿ ಸಂಗ್ರಹಿಸುವುದು. 2. ಕಥೆಗೆ ಸಂಬಂಧಿಸಿದ ಆಡಿಯೋ ಮತ್ತು ವಿಡಿಯೋ ಮಾಡುವುದು. 3. ವಿಷಯಕ್ಕೆ ಸಂಬಂಧಿಸಿದ ಇತರ ಸೃಜನಶೀಲ ಚಟುವಟಿಕೆಗಳು.				
ಪಠ್ಯಪುಸ್ತಕ(Text book) : ತಿಳಿ ಕನ್ನಡ – ಪ್ರಕಟಣೆ : ಪ್ರೈಸಿಡೆನ್ಸಿ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಂಗಳೂರು **ಆಕರಗಳು(Reference book) :** 6. ಸಾಮಾನ್ಯನಿಗೆ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ- ಸಂಪುಟಗಳು೧-೧೦ - ಜಿ.ಎಸ್ ಶಿವರುದ್ರಪ್ಪ. ಸ್ವಪ್ನ ಬುಕ್ ಹೌಸ್, ಬೆಂಗಳೂರು. ೨೦೧೩ 7. ಹೊಸಗನ್ನಡ ಸಾಹಿತ್ಯ ಚರಿತ್ರೆ –ಎಲ್ ಎಸ್ ಶೇಷಗಿರಿರಾವ್. ಸ್ವಪ್ನ ಬುಕ್ ಹೌಸ್, ಬೆಂಗಳೂರು. ೨೦೧೮ 8. ಪರಿಸರದ ಕಥೆಗಳು – ಪೂರ್ಣಚಂದ್ರ ತೇಜಸ್ವಿ.ಪುಸ್ತಕ ಪ್ರಕಾಶನ. ಮೈಸೂರು. ೨೦೧೩ ಅಂತರ್ ಜಾಲ ಮಾಹಿತಿ 1. https://sanchaya.org 2. https://mylang.in/products/parisarada-kathe-inr 3. https://gfgc.kar.nic.in/malleshwaram/FileHandler/13-9fbd7be2-4a20-4d3d-9e1c-ed7ccc195661				
ಕೌಶಲ್ಯ ವೃದ್ಧಿಯ ವಿಷಯ: ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಪಠ್ಯ ವಿಷಯದಲ್ಲಿ ಬರುವ ವಿಚಾರಗಳನ್ನು ಚರ್ಚೆ ಸಂವಾದದ ಮೂಲಕ ಸಮಯ ಸಂದರ್ಭಕ್ಕ ತಕ್ಕಂತೆ ಮಾತನಾಡುವ ಕೌಶಲ್ಯವನ್ನು ವೃದ್ಧಿಸಲಾಗುವುದು. ಮತ್ತು ಸೃಜನಾತ್ಮಕ ಚಟುವಟಿಕೆಗಳನ್ನು ನೀಡುವ ಮೂಲಕ ಅಂದರೆ, ಸಂಬಳಕ್ಕೆ ಸಿಕ್ಕಿಕೊಂಡ ದೆವ್ವ ಕತೆಯನ್ನು ತಮ್ಮದೇ ಮಾಡಿನಲ್ಲಿ ಆಡಿಯೋ ಮತ್ತು ಕತೆಯ ಸನ್ನಿವೇಶಕ್ಕೆ ತಕ್ಕಂತೆ ಚಿತ್ರಗಳು ಇಲ್ಲ ಅನ್ನಿಮೇಷನ್ ಚಿತ್ರಗಳನ್ನು ಬಳಸಿಕೊಂಡು ವಿಡಿಯೋ ಮಾಡುವುದು(Group activity). ಹಾಗೆಯೇ ಚಿತ್ರ ಕತೆಯನ್ನು ಹೇಳುವಂತಹ ಚಟುವಟಿಕೆಯಲ್ಲಿ ಭಾಗವಹಿಸುವಿಕೆ/ಪಾಲ್ಗೊಳ್ಳುವಿಕೆಯ ಕಲಿಕೆಯ ತಂತ್ರಗಳ ಮೂಲಕ ಕೌಶಲ್ಯವನ್ನು ಅಭಿವೃದ್ಧಿಪಡಿಸಲಾಗುವುದು.				

PPS1012 – Enhancing Personality through Soft skills

Course Code: **PPS1012**	**Course Title: Introduction to Soft skills** **Type of Course: School Core**	**L- T- P- C**	0	0	2	1
Version No.	1.0					
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 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 Outcome	**On successful completion of this course the students shall be able to:** CO1. Prepare professional social media profile CO2. Recognize the significance of Soft Skills CO3. List the techniques of unlearning poor habits and forming healthy habits CO4. Demonstrate appropriate team behavior & people management CO5. Identify traits, skills and attributes required for adaptability CO6. Identify styles of communication					
Course Content:						
Module 1	INTRODUCTION TO SOFT SKILLS	Review a Movie, Personality, Technology	**04 Hours**			

		or Book.	
Topics: Setting Expectations, Ice Breaker, Significance of soft skills.			
Module 2	PROFESSIONAL BRAND BUILDING	Brand Framework Activity	**04 Hours**
Topics: Significance of a profile**.** Creating an online profile. Networking - 100 connections, LinkedIn as a live resume, Create a dashboard.			
Module 3	HABIT FORMATION	Worksheets & Assignment	**04 Hours**
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	Classroom and outdoor team building activities.	**04 hours**
Topics: Importance of team, Get to know team needs (Maslow's Theory of needs), Trust and collaboration, Virtual Team building.			
Module 5	ADAPTABILITY	Situation based cases, THEATRIX on adaptability	**06 Hours**
Topics: Change management: VUCA, adapting to changes, growth and fixed mindset, Continuous Learning			
Module 6	EFFECTIVE COMMUNICATION	Communication activities / Emotional situations activities – group task	**04 Hours**

Topics: Different styles of communication, Difference between hearing and listening, Effective communication for success. Self-introduction framework. **Emotional Intelligence** **Topics:** Self-awareness, Empathy, Self-management, Social awareness, and Relationship management			
Targeted Application & Tools that can be used: LMS			
Assignments proposed for this course 1. Create a dashboard on LinkedIn, Networking. 2. Prepare a habit chart			
Text Book			
1. 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) 2. The Power of Habit: Why We Do What We Do in Life and Business is a book by Charles Duhigg (Module – Habit Formation) 3. Leaders eat last- Simon Sinek (Module: Team skills and People Management) 4. Social Media Marketing Workbook 2021 by Jason McDonald PhD (Module: Professional Brand building) 5. Me 2.0: Build a Powerful Brand to Achieve Career Success (Module: Professional Brand building) 6. Atomic Habits: An Easy & Proven Way to Build Good Habits & Break Bad Ones by James Clear (Module – Habit Formation)			
E-Resources: • How to Write a Blog on LinkedIn • 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)

PPS1006 - Employability for Young Professionals

Course Code: PPS 1006	**Course Title: Employability for Young Professionals** Type of Course: Practical	L- T- P- C	0	0	2	1
Version No.	1.0					
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 Out Comes	**On successful completion of this course the students shall be able to:** • CO1 **Show** effective communication skills through self-introduction • CO2 **Analyse** information through questioning technique					

	for better decision making • CO3 **Identify** individual strengths and weaknesses for self-awareness and stress management • CO4 **Apply** SMART technique to achieve goals and increase productivity		
Course Content:			
Module 1	Art of Questioning	Role plays	4 classes
Topics: Note Taking, Framing Questions, Open-ended and Close-ended questions, Funnel technique, Probing questions, Leading questions, Rhetorical questions, 5W1H Technique			
	Vocab Building		Every Class
Dedicate 5-10minutes towards vocabulary building in every session			
Module 2	Goal Setting & Time Management	Journal + Outbound training	8 Classes
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	Grooming checks + Evaluation + Alumni talk	8 classes
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	Industry expert intervention	4 Classes
Topics: Dos and Don'ts of professional email etiquette, practice writing emails (activity)			
REVISION	Recap & Summary		6 Classes
Revision of all the modules, overall feedback from the students with regards to the syllabus.			
Targeted Application & Tools that can be used: LMS			
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course			
1) Evaluation of Self-introduction			

2) LMS MCQ

PPS2002 - Being Corporate Ready

Course Code: **PPS 2002**	**Course Title: Being Corporate Ready** **Type of Course: Practical Only Course**	**L-T-P-C**	0	0	2	1
Version No.	1.0					
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 this course the students shall be able to:** CO 1 **Recognize the fundamental nuances of Corporate Etiquette** CO2 **Express** thoughts/opinions in an acceptable manner in group discussions CO 3 **Demonstrate** effective presentation skills					
Course Content:						
Module 1	Presentation skills – practice and evaluation of individual	Talk by Industry Expert+ Outbound			**14 Session**	

	presentation	Activity		**s**

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	Talk by Alumni		**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	Role play+ Flipped classroom		**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			**2 Sessions**

Topics:

Revision of all the modules, overall feedback from the students about the syllabus.

Targeted Application & Tools that can be used:

1. TED Talks
2. YouTube Links
3. Videos by L&D Team shared on Edhitch/YouTube.com
4. LMS

Assignments proposed for this course

3. Evaluation of Presentation skills

YouTube Links: https://youtu.be/z__jxoczNWc

TED Talks: https://youtu.be/xkq8dr_5ofs

References

References

7. Talk Like TED - The 9 Public-Speaking Secrets of the World's Top Minds By Carmine Gallo
   St. Martin's Press Copyright © 2014 Carmine Gallo All rights reserved. ISBN: 978-1-250-04112-8
8. The Presentation Secrets of Steve Jobs: How to Be Insanely Great in Front of Any Audience MP3 CD – Import, 22 April 2014
9. The Definitive Book of Body Language: The Hidden Meaning Behind People's Gestures and Expressions Hardcover – Illustrated, 25 July 2006
10. Crucial Conversations: Tools for Talking When Stakes Are High Paperback – Import, 1 July 2002
11. Priyadarshi Patnaik, “Group Discussion and Interview Skills”, Cambridge University Press India; Second edition (1 September 2015)
12. The Essentials of Business Etiquette: How to Greet, Eat, and Tweet Your Way to Success Paperback by Barbara Pachter – 16 August 2013

Web links:

1. http://www.forbes.com/sites/lisaquast/2014/04/07/office-etiquette-tips-to-overcome-bad-manners-at-work/
2. https://www.wordstream.com/blog/ws/2014/11/19/how-to-improve-presentation-skills
3. https://www.cbs.de/en/blog/15-effective-presentation-tips-to-improve-presentation-skills/

PPS3001 - Problem Solving through Aptitude

Course Code: PPS3001	**Course Title: Problem Solving through Aptitude Type of Course: Practical Only Course**	**L- T-P-C**	0	0	2	1
Version No.	1.0					

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 Outcomes		On successful completion of the course the students shall be able to: CO1] **Recall** all the basic mathematical concepts they learnt in high school. CO2] **Identify** the principle concept needed in a question. CO3] **Solve** the quantitative and logical ability questions with the appropriate concept. CO4] **Analyze** the data given in complex problems.
Course Content:		

Module 1	Quantitative Ability	Assignment	Bloom's Level : Application		**10 Hours**
	Topics: Introduction to Aptitude, working of Tables, Squares, Cubes, Number Series, Wrong number series, Letter series.				
Module 2	Logical Reasoning	Assignment	Bloom's Level : Application		**20 Hours**
	Topics: Linear & Circular Arrangement Puzzle, Coding & Decoding, Blood Relations, Directions, Ordering and Ranking, Clocks and Calendars				

	Targeted Application & Tools that can be used: Application area: Placement activities and Competitive examinations. Tools: LMS
	Continuous Evaluation • CA1 Online Test
	• CA2 Online Test
	• CA3 Online Test
	• Assignment
	Text Book 1. Quantitative Aptitude by R S Aggarwal 2. Verbal & Non-Verbal Reasoning by R S Aggarwal
	References 1. www.indiabix.com 2. www.youtube.com/c/TheAptitudeGuy/videos 3. Prepinsta.com
	Topics relevant to Skill development: Quantitative and reasoning aptitude for Skill Development through Problem solving Techniques. This is attained through assessment component mentioned in course handout.

CHE1020 -Environmental Studies and Sustainable Development

Course Code: **CHE1020**	**Course Title: Environmental Studies and Sustainable Development** **Type of Course: School Core- Theory**	**L- T- P- C**	**2**	**0**	**0**	**0**
Version	**1.0**					
Course Pre-requisites	NIL					
Anti-requisites	**NIL**					
Course Description	This course is designed to improve the learners' SKILL DEVELOPMENT by using PATICIPATIVE LEARNING techniques. This course emphasizes the need to conserve biodiversity and adopt a more sustainable lifestyle by utilizing resources in a responsible way. Topics covered include basic principles of ecosystem functions; biodiversity and its conservation; human population growth; water resources, pollution; climate change; energy resources, and sustainability; Sustaining human societies, policies, and education.					

	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) Outline the need for eco-balance 2) Discuss the issues related to ecosystems, biodiversity and natural resources 3) Identify environmental hazards affecting air, water and soil quality 4) Recognize the importance of healthy environment and finding the sustainable methods to protect the environment			
Course Content:				
Module 1	**Environment and Ecosystem**	Assignment, Case study	Data Collection	**06 Classes**
Topics: Significance and need for environmental studies, environmental perceptions in various disciplines; Environmental ethics; Ecosystem, components of the ecosystem; Ecological pyramids, Energy flow in the ecosystem; Biogeochemical cycles; Effect of human activities on these cycles.				
Module 2	**Biodiversity**	Assignment, Case study	Data Collection	**07 Classes**
Topics: Importance, types, factors affecting biodiversity; Types of species - Extinct, endemic, endangered, and rare species, their interaction with each other; mega-biodiversity; Hot-spots; Ecological succession; Threats, and Conservation of biodiversity.				
Module 3	**Human population and Environmental pollution**	Assignment, Case study	Data analysis	**07 Classes**
Topics: Environmental hazards: Biological, Chemical, Biomedical, noise, Risk and evaluation of hazards; Urban environmental problems; Types of pollution, effects, and mitigation. Solid waste management (plastics); Climate disruption, global warming, and ozone depletion; Environmental policies.				
Module 4	**Sustaining Natural resources**	**Assignment, Case study**	**Data analysis**	**6 Classes**
Topics: Health and Hygiene. Food and soil conservation, Water resources and water quality management– Desalination;				

Energy resources- Renewable and non-renewable, efficiency and conservation. Sustainable strategies for conservation of natural resources.

Targeted Application & Tools that can be used: Application areas are Energy, Environment and sustainability

Tools: Statistical analysis of environmental pollutants using excel/origin etc.

Project work/Assignment:

Project Assignment:

Assessment Type:

- Midterm exam
- Assignment (review of digital/ e-resource from PU link given in references section - mandatory to submit screenshot accessing digital resource.)
- Quiz
- Self-learning topic
- End Term Exam

Assignments:

- **Write detailed notes on Major environment policies and legislations in India.**
- **What is air pollution? Explain its integrated impact on forest condition under changing climate.**

Text Book

1. G. Tyler Miller and Scott Spoolman (2020), Living in the Environment, 20th Edition, Cengage Learning, USA

Reference Books

1. David M. Hassenzahl, Mary Catherine Hager, Linda R. Berg (2017), Visualizing Environmental Science, 5th Edition, John Wiley & Sons, USA.
2. William P. Cunningham and Mary Ann Cunningham (2020), Principles of Environmental Science: Inquiry & Applications, 9th Edition, McGraw-Hill Education, USA.

E-resources:

1. https://presiuniv.knimbus.com/user#/searchresult?searchId=environmental%20pollution&_t=1660711559321
2. https://presiuniv.knimbus.com/user#/searchresult?searchId=ecosystem&_t=1660711829548
3. https://presiuniv.knimbus.com/user#/searchresult?searchId=air%20pollution&_t=16607116334 72
4. https://presiuniv.knimbus.com/user#/searchresult?searchId=water%20pollution&_t=166071169 1050
5. https://presiuniv.knimbus.com/user#/searchresult?searchId=soil%20conservation&_t=16607117 39373
6. https://presiuniv.knimbus.com/user#/searchresult?searchId=renewable%20energy&_t=1660711 878844

https://www.intechopen.com/chapters/11768

The topics related 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.

Program Core

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 Fundamentalsand attain the SKILL DEVELOPMENT through EXPERIENTIAL LEARNING.					
Course Outcomes	On successful completion of this course the students shall be able to: Apply minimization techniques to simplify Boolean expressions. Demonstrate the Combinational circuits for a given logic. Illustrate the Sequential logic circuits. Implement various combinational logic circuits using gates. Verify the performance of various sequential logic circuits using gates and memory elements.					

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
Topics relevant to “SKILL DEVELOPMENT”: Adders, Multiplexers, Decoders / Encoders; Flip-Flops, Counters and Registersfor Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

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.	2.0						
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 Learning** techniques.						
Course Out Comes	CO1 : outline basic structure and operations of a computer. [Understand] CO2 : categorize the arithmetic and logic unit and implementation of fixed-point and floating-point arithmetic unit. CO3 : experiment the basics of pipelined execution.						
	CO4 : explain parallelism and multi-core processors.						
Course Content:							
Module 1	**COMPUTER ORGANIZATION &**	assignments	Quizzes form basics of CA	**10 Sessions**			

	INSTRUCTIONS			
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:				
1. Assignments are given after completion of each module which the student need to submit within the stipulated deadline.				
Text Book 1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, “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.

CSA1001- Problem Solving Using C

Course Code: **CSA1001**	**Course Title:** Problem Solving Using C **Type of Course: Integrated**	**L- T-P-C**	2	0	4	4
Version No.	1.0					
Course Pre-requisites	Basic knowledge of Mathematics problems					
Anti-requisites	Nil					
Course Description	This Course will provide an introduction to foundational concepts of computer programming to students of all branches of Engineering. 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, Unions, File handling and pointers. In the lab secession students are required to solve problems based on the above concepts to illustrate the features of the structured programming.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Problem-Solving Using C and attain **Skill Development** through E**xperiential Learning** techniques.					
Course Out Comes	On successful completion of the course the students shall be able to: CO1: Outline the solution to the problem through programming. CO2: Apply the basic concepts and control structures of programming to solve the problem. CO3: Illustrate the concepts of array and strings to represent data and its operations. CO4: Apply the concepts of functions, structures, unions and Files in solving the related scenarios.					
Course Content:						
Module 1	Introduction to Problem Solving: Basics of Computers	Assignment				**20 Sessions**
Introduction to Problem Solving: Basics of Computers, Hardware, Software, Problem solving – algorithms and flowcharts. Introduction to C: Structure of C program, variables, keywords, data types and sizes, declaration and initialization of variables, storage class, operators and expression, managing input and output operations, compiling and linking.						

Module 2	Branching and looping	Assignment		**21 Sessions**

Module 2: Branching and looping [21Hrs] [Blooms 'level selected: Application]

Decision Making and Branching: if, if-else, if-else ladder, nested if and switch case
Looping: for, while, do-while, and nested looping statements.

Module 3	Arrays and Strings	Term paper/Assignment		**24 Sessions**

Module 3: Arrays and Strings [24 Hrs] [Blooms 'level selected: Application]

Arrays: Introduction, one-dimensional arrays, two dimensional arrays String: Introduction to strings, String Manipulation functions

Module 4	Functions	Term paper/Assignment		**20 Sessions**

Module 4: Functions, Structures [20 Hrs] [Blooms 'level selected: Comprehension]

Functions: Introduction, User defined functions, Categories of functions, Actual Parameters and Formal Parameters, Passing arrays to function, and recursion.
Structures: Introduction, array of structure, unions, Structures and functions.

Module 5	Pointer and Files	Assignment	**20 sessions**

Module 5: Pointers and File Handling [10 Hrs] [Blooms 'level selected: Comprehension]

Pointers: Definition, Pointer to basic data types, Pointer to a pointer, pointer operations
File Handling: Definition, File Pointer, File Operations- Create, Open, Close, Read and Write. [change to be incorporated: make pointers and file handling as another module, Reduce number of hours for first module]

Assignment:

Assignment 1: Write a program to take input of 5 subjects. Find total and calculatepercent. On the basis of percent provide grade like: IF Per > 80 "A+" Per >= 65 and per <=80 "A" Per > =50 and per <=65 "B" Per >= 42 and per <=50 "C" Per < 42 "Fail".

Assignment 2: Write a program by using switch case if user enter 11 it will have are area of circle and when user enter 22 it will have area of rectangle and when user enter 33 it will give area of square when user enter 44 it will give area of triangle.

Assignment 3: Create a structure student having data members to store roll number, name of student, name of three subjects, max marks.mim marks.Declare a structure

variable of student provide facilities to input data in data member and display result of student.

Text Book:

T1. 1. E. Balagurusamy, “Programming in ANSI C”, Seventh Edition - Tata McGraw Hill.

References:

R1. Yale Patt, Sanjay Patel, “Introduction to Computing Systems: From bits and gates to C and beyond”, McGraw Hill.

R2. Behrouz A Forouzan, Richard F Gilberg, “Computer Science: A structured programming approach using C”, Cengage Learning.

R3. B.W. Kernighan & D. M. Ritchie, “The C Programming Language”, Second Edition, 2001,Pearson Education

Web Resources:

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

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

Topics relevant to Skill Development : Concepts of C program , Branching and looping, storage class Functions, Structures, Pointer and Files **for Skill Development** through **Experiential Learning** techniques. This is attained through assessment component mentioned in course handout.

CSA1002- Web Design and Development

Course Code: CSA1002	Course Title: Web Design and Development Type of Course:1] School Core 2] Laboratory integrated	L-T-P-C	1	0	4	3
Version No.	1.0					
Course Pre-requisites	Web Design and Development [CSA1002]					
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 Learningtechniques.			
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 (Applica	Assignment	Programming activity	6 Hours

	tion)			

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)
Topics relevant to "SKILL DEVELOPMENT": HTML, Javascript, PHP for Skill development through Experiential Learning techniques. This is attained through the assessment component mentioned in the course handout.

CSA2001-Data Structures and Algorithms

Course Code: CSA2001	**Course Title: Data Structures and Algorithms**	**L-T-P- C**	**3**	**0**	**2**	**4**
Version No.	0.1					
Course Pre-requisites	**"CSA1001 – Problem Solving Using C" course**					
Anti-requisites	**NIL**					

<table>
<tr><td>Course Description</td><td colspan="4">The purpose of the course is to provide the fundamental concepts of data structures and algorithms, to emphasize the importance of choosing an appropriate data structure and algorithm for program development.
The student should have C programming skills, to solve engineering / computational problems.
The associated laboratory provides an opportunity to implement the concepts and enhance critical thinking and analytical skills.
With a good knowledge in the fundamental concepts of data structures and algorithm the student can gain practical experience in implementing them, enabling the student to be an effective designer, developer for new software applications.</td></tr>
<tr><td>Course Objective</td><td colspan="4">The objective of the course is to familiarize the learners with the concepts of Data Structures and Algorithms and attain Skill Development through Experiential Learning techniques.</td></tr>
<tr><td>Course Out Comes</td><td colspan="4">On successful completion of this course the students shall be able to:
1] Implement program for given problems using fundamentals of data structures.
2] Apply an appropriate linear data structure for a given scenarios.
3] Apply an appropriate non-linear data structure for a given scenarios.
4] Analyze complexity of given searching and sorting algorithms.</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Introduction to Data Structure and Linear data structure – Stacks and Queues (Application)</td><td>Assignment</td><td>Programming activity</td><td>13 Hours</td></tr>
<tr><td colspan="5">Topics:
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.</td></tr>
<tr><td>Module 2</td><td>Linear Data Structure- Linked List (Application)</td><td>Assignment</td><td>Programming activity</td><td>12 Hours</td></tr>
<tr><td colspan="5">Topics:
Linked List - Singly Linked List, Operation on linear list using singly linked storage structures, Circular List and Applications of Linked list.
Recursion - Recursive Definition and Processes and Programming examples.</td></tr>
<tr><td>Module 3</td><td>Non-linear Data Structures- Trees and Graph (Application)</td><td>Assignment</td><td>Programming activity</td><td>10 Hours</td></tr>
<tr><td colspan="5">Topics:
Trees - Introduction to Trees, Binary tree: Terminology and Properties, Use of Doubly</td></tr>
</table>

Linked List, Binary tree traversals: Pre-Order traversal, In-Order traversal and Post-Order traversal.
Graph - Basic Concept of Graph Theory and its Properties and Representation Of Graphs.

Module 4	Searching & Sorting Performance Analysis (Comprehension)	Assignment	Programming activity	**10 Hours**

Topics:
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:
Labsheet -1 [4 Practical Sessions]
Experiment No 1:
Level 1: Array and its operations
Experiment No. 2:
Level 1 - Stack and its operations with conditions(Exceptions underflow, overflow)
Level 2 - Stack application infix to postfix Conversion
Experiment No. 3:
Level 1 - Queues and its operations with conditions(Exceptions underflow, overflow)
Level 2 - Real time application implementation using queue
Labsheet -2 [4 Practical Sessions]
Experiment No. 1:
Level 1 - Linked list and its operations.
Level 2 - Real time scenario based application using Linked List
Experiment No. 2:
Level 1 - Linked list and its operations.
Level 2 - Real time scenario based application using Linked List
Labsheet – 3 [4 Practical Sessions]
Experiment No. 1:
Level 1 - Doubly linked list implementation and its operations
Level 2 - Construction of BST
Experiment No. 2:
Level 2 - Binary Search Tree Traversal
Experiment No. 3:
Level 1 - Construction of Graph
Level 2 - Graph application – Breadth first search
Labsheet – 4 [3 Practical Sessions]
Experiment No. 1:
Level 1 - Implementation of Linear Search
Level 2 - Time complexity Estimation of Linear Search
Experiment No. 2:
Level 1 - Implementation of Binary Search
Level 2 - Time complexity Estimation of Binary Search
Experiment No. 3:
Level 1 - Implementation of Sorting – Insertion Sort

Level 2 - Time complexity Estimation of Insertion Sort
Targeted Application & Tools that can be used: C Compiler
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course 1] Problem Solving: Choose an appropriate data structure and implementation of programs. 2] Programming: Implementation of given scenario using C
Text Book 1] Richard F Gilberg and Behrouz A Forouzan, “Data Structures: A Pseudocode Approach with C”, Second Edition, Cengage learning, 2018.
References 1] Seymour Lipschutz , ”Data Structures with C” (Schaum's Outline Series) McGraw Hill Education, July 2017 2] Robert L Kruse, Bruce P Leung and Clovis L Tondo, “Data Structures and Program Design in C”, Pearson. 3] R. Venkatesan, S. Lovelyn Rose,” Data Structures” Wiley, Second edition, January 2019.
Topics relevant to “SKILL DEVELOPMENT”: Introduction to Data Structures, Singly Linked List, Operation on linear list using singly linked storage structures, Use of Doubly Linked List, Sequential and Binary Search, Sorting – Selection and Insertion sort for **Skill Development** through **Experiential Learning** techniques. This is attained through assessment component mentioned in course handout.

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.	2.0					
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 Learning techniques.					
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	11 Class		

CSA1006 - Operating System And Unix Programming

Course Code: CSA1006	Course Title: OPERATING SYSTEM AND UNIX PROGRAMMING Type of Course: Integrated		L-T-P-C	2	0	2	3
Version No.	1.0					
Course Pre-requisites	The prerequisites for this course are Data Structures and Computer Organization. You are expected to have a working knowledge of C / C++, including a familiarity with its basic data types and control structures, and an understanding of computer organization.					
Anti-requisites	Nil					
Course Description	The main objective of this course is to cover basic concepts of operating systems. Operating Systems functions, Basic Concepts, Notion of a process, Concurrent processes, Problem of mutual exclusion, Deadlock, Process Scheduling, Memory management, Multiprogramming, File systems; time sharing systems and their design consideration. This course will prepare students to develop software in and for Linux/UNIX environments. Also this course helps the students in UNIX operating system and their effective use for problem solving.					
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Operating System and Unix Programming and attain Skill Development through Experiential Learningtechniques.					
Course Outcomes	Explain the various OS Types, Services, structures and layers, system calls related to OS management and interpreting different stages of various process states. Express the process synchronization and Deadlocks with methodologies and explore the communication between inter process and synchronization techniques. Understand the Memory Management, Allocation concepts and virtual memory. Understand the Unix and File Management.					
Course Content:						
Module 1	Introduction to OS and Processes	Assignment		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	Process Synchronization and Deadlocks	Assignment		7 Sessions
Topics: Process Synchronization: The Critical Section Problem, Synchronization hardware, Semaphores, Classical problems of synchronization, Critical regions, monitors. Dead locks: System model, Characterization, Dead lock prevention, avoidance and detection, Recovery from dead lock, Combined approach to deadlock handling, banker's algorithm.				
Module 3	Memory Management and Virtual Memory	Case Study		8 Sessions
Topics: Memory Management: Logical and Physical address maps, Memory allocation: Contiguous Memory allocation – Fixed and variable partition. Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page allocation, Partitioning, Paging, Page fault, Working Set, Segmentation, Demand paging.				
Module 4	Unix and File Management	Case Study and Project		7 Sessions
Topics: Unix: History of Unix, salient features, Unix Components, types of shell, Internal and External commands, Files and File Organization- Categories of files, Unix file system, directories, file related commands, Directory related commands, wild cards, Printing and Comparing files. Ownership of files, File attributes File permissions and Manipulations, Standard I/O, Redirection, pipe, filter. 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				
Targeted Application & Tools that can be used: Linux / Vi Editor				
Project work/Assignment:				

Assignment:

Lab Experiments

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 find the Fibonacci series.
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 and largest digit of a value
Level 2 : Write a shell script to perform integer arithmetic operations
Experiment 9
Level 1 : Write a shell program to check the number is palindrome or not
Level 2 : Write a shell program to find the sum of prime numbers in an array
Experiment 10
Level 1 : Write a Simple Shell script to print the sum, sum of square of n natural numbers.
Level 2 : Write a shell program to count the number of digits of a value.

Study of Linux commands – System Information, Files and Directories, Process, Text Processing and Scripting, Programming. Creating Child process (using fork), Zombie, Orphan. Displaying system information using C. Shell scripting (I/O, decision making, looping) IPC (Threads, Pipes) CPU Scheduling Algorithms (FCFS, SJF, RR, Priority) Deadlock Avoidance Algorithm (Bankers algorithm) Process synchronization (Producer Consumer / Reader Writer/Dining Philosopher using semaphores) Page Replacement Algorithms. (FIFO, LRU, Optimal) Dynamic Memory Allocation Algorithms (First fit, Best fit, Worst fit) Disk Scheduling Algorithms
Text Books Abraham Silberschatz, Peter B. Galvin, Greg Gagne-Operating System Concepts, Wiley, 10th Edition, 2019. Thomas Anderson, Michael Dahlin. Operating systems: principles and practices, Second Edition, , 2019.
Reference Books Sumitabha Das, Unix : Concepts and Applications, 4th Edition, McGraw Hill Publications. Brain W. Kernighan & Rob Pike, The Unix programming Environment Pike, Pearson Publications. M.G. Venkateshmurthy, Introduction to Unix Shell Programming, Pearson Publications. Remzi H. Arpaci-Dusseau, Andrea C. Arpaci-Dusseau, Operating Systems, Three Easy Pieces,Arpaci-Dusseau Books, Inc, 2015 Dhamdhere, Dhananjay M. Operating systems: a concept-based approach, 2E. Tata McGraw-Hill Education, 2006. Deitel, Harvey M., Paul J. Deitel, and David R. Choffnes. Operating systems. Delhi. Pearson Education: Dorling Kindersley, 2004.
Topics relevant to “SKILL DEVELOPMENT”: Process Synchronization, Memory Management for Skill development through Experiential Learning techniques. This is attained through the assessment component mentioned in the course handout.

MAT2028 Graph Theory

Course Code: MAT2028	**Course Title**: Graph Theory **Type of Course:** Program Core	**L- T- P- C**	2-1-0-3
Version No.	1.0		
Course Pre-requisites	Set theory and basic counting techniques (Permutations and Combinations)		
Anti-requisites	**Nil**		
Course Description	Graph Theory is a blend of the mathematical techniques applicable to Computer science, Information Technology and Statistics. Graph Theory gives us, both an easy way to pictorially represent many major mathematical results, and insights into the deep theories behind them. This course, among other intriguing applications, shows how GPS systems find shortest routes, how engineers design integrated circuits, how biologists assemble genomes, why a political map can always be colored using a few colors.		
Course Objective	The objective of the course is to **familiarize the learners with the concepts of "Graph Theory"** and attain **Skill Development through Problem Solving techniques.**		
Course Outcomes	On successful completion of the course the students shall be able to: CO-1: Apply different mathematical proofs and techniques in solving real time problems.		

	CO-2: Discuss the fundamental concepts of Graph theory and able to analyze different structures by using isomorphism. CO-3: Discuss the special graphs and able to understand the concept of colorings in graph theory. CO-4: Discuss different types of structures of trees for developing programming skills. CO-5: Apply different algorithms to find optimal path for a given graph.			
Course Content:				
Module 1	Principles of Counting			**8 Hours**
The Principle of Inclusion and Exclusion, Generalizing Inclusion – Exclusion Principles, Derangements – Nothing is in its Right Place, Rook Polynomials.				
Module 2	Introduction to Graph Theory			**10 Hours**
Basic Concepts: definition, types of graphs, Graph Terminology, Representation of a graph and connectedness (paths, walk. cycles, edge deleted and vertex deleted), and Graph isomorphism.				
Module 3	Special graphs and colouring			**10 Hours**
Special Types of Graph (Complete graph, Bipartite graph, Complete Bipartite graph, Star graph), Eulerian graph, Hamiltonian graph, Planar graph,(three utility problem), Graph coloring.				
Module 4	Trees			**9 Hours**
Tree: Definitions, Properties, Rooted trees, Binary search tree, Decision tree, spanning tree: BFS, DFS. Directed Graphs (types of diagraphs, diagraphs and binary relations, directed paths and connectedness, Euler diagraphs)				
Module 5	Algorithm on networks			**8 Hours**
Shortest path algorithm-Dijikstra's algorithm, Minimal spanning tree- Kruskal algorithm and Prim's algorithm.				
Targeted Application & Tools that can be used: Computer Science, Electrical Engineering, Linguistics, Physics and Chemistry, Computer Network, Social Sciences, Biology, Mathematics and can write Program by using MATLAB, C++, JAVA.				

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course
Assignment 1: Rook polynomials and Isomorphism. **Assignment 2:** Trees and Algorithms.
Text Book 1. K H Rosen, “Discrete Mathematics and its Application”, McGraw Hill, 8th Edition, 2019.
References: 1. Kenneth H. Rosen, “Hand Book Of Discrete And Combinatorial Mathematics” CRC press, 2nd Edition, 2017. 2. Grimaldi,” Graph Theory and Combinatorics”, Pearson Education, 2014. 3. Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, 5th Edition, Pearson Education, 2007.
Topics relevant to SKILL DEVELOPMENT: Graph Theory is a blend of the mathematical techniques applicable to Computer science, Information Technology and Statistics. Graph Theory gives us, both an easy way to pictorially represent many major mathematical results, and insights into the deep theories behind them for **Skill Development through Problem Solving methodologies.** This is attained through assessment component mentioned in course handout.

CSA2003- Relational Database Management Systems

Course Code: CSA2003	Course Title: Relational Database Management Systems Type of Course: Integrated	L-T-P-C	2	0	4	4
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-	NIL					

requisites				
Course Description	This course offers detailed concept on principles and techniques required in the design and implementation of database systems. It helps the students to learn and practice data modeling using the entity-relationship diagrams. It covers relation database management (RDBMS) concepts and also provides detail knowledge on how to design, maintain and retrieve the information effectively and efficiently. The corresponding laboratory is intended to implement database design using SQL software. All the experiments will focus on the fundamentals of database creation, populating, interactive querying which includes use of various data definition, data manipulation commands, functions, joins, sub-queries, views, set operations, procedures, triggersand executing database transactions.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of Relational Database Managememtand attain Skill Development through Experiential Learningtechniques.			
Course Out Comes	On successful completion of this course the students shall be able to: Define the basic concepts of database and ER modeling in designing the database.[Remember] Apply Relational Algebra and Database Querying concepts in designing the database. [Apply] Analyze various normalization techniques for designing a robust database. [Analyze] Explain the Transaction control and concurrency control mechanisms.[Understand]			
Course Content:				
Module 1	Introduction	Assignment	Theory	10 Hours
Topics: Introduction to Database: Database Management System, Characteristics of Database Approach, Types of Database users, DBA, Data Models, Schema, Instance, Three-Schema Architecture, Data Independence, Disadvantages in traditional file system, advantages of database over traditional file systems. Conceptual Modeling: Data Modeling Using Entity Relationship (ER) Model, ER Model to Table Conversion, Examples on ER model.				
Module 2	Query Languages	Assignment	Programming activity	12 Hours
Topics: Relational Algebra: selection, projection, rename, set operations, Cartesian product, joins and division operator. Examples on Relational Algebra Operations. Database Querying:DDL, DML, Constraints, Operators- BETWEEN, IN, LIKE,				

where clause, orderby command, Set Operators, Aggregate Functions, having clause, Views, Procedures, Cursors and Triggers.				
Module 3	Designing and Refining Database Schema	Assignment	Programming activity	10 Hours
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, Rules and Types of Decomposition.				
Module 4	Transaction Management and Concurrency Control	Assignment	Theory	13 Hours
Topics: Transaction: *Transactions:* Introduction to Transaction Processing, Transaction and System concepts, Desirable properties (ACID) of Transactions, Simultaneous Transactions and their problems like dirty read, lost update and incorrect summary, Serializability, Conflict Serializability, View Serializability. Transaction Support in SQL *Concurrency Control*: Need for Concurrency, Locking and Time-stamping concurrency schemes.				
List of Laboratory Experiments: Create Student, Employee, Banking and Library Management databases and populate with necessary data. Perform the following various experiments on those databases. Labsheet-1[4 Practical Sessions] Experiment No 1: [2 Sessions] To study and implement Data Definition Language (DDL) commands and Data Manipulation Language (DML) commands of MySQL. Level 1: Perform basic operations using Data Definition Language (Create, Alter, Drop, Truncate & Rename) and Data Manipulation Language commands on Student Database. Experiment No. 2: [2 Sessions] To study and implement different types of constraints, relational, logical, pattern matching, BETWEEN, IS NULL, IN and NOT IN Special Operators. Level 1: Create tables on Employee 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 Employee Database. Labsheet-2[4 Practical Sessions] Experiment No. 3: [2 Sessions] To study and implement for aggregation of data in to groups and sub-groups using GROUP BY, HAVING clauses and sort data using ORDER BY clause.				

Level 1: Implementing GROUP BY, HAVING, ORDER BY and aggregate functions on Employee Database. Experiment No. 4: [2 Session] To study and implement various 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 Employee Database. Labsheet-3 [2 Practical Sessions] Experiment No. 5: [2 sessions] To study and implement Views, Procedures and Functions in MySQL. Level 1: Implement MySQL Views and Procedures in MySQL on Banking database. Labsheet-4 [2 Practical Sessions] Experiment No. 6: [2 Sessions] To study and implement Cursors and Triggers in MySQL. Level 1: Implement MySQL Cursors and Triggers in MySQL on Employee database.
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course
Constructing E-R diagrams. Implementation of SQL queries on a given scenario.
Text Book AviSilberschatz, Henry F. Korth, S. Sudarshan, “Database System Concepts”, 7th Edition, McGraw-Hill, 2021. Elmasri R and Navathe S B, “Fundamentals of Database System”, 7th Edition, Pearson Publication, 2017.
References 1. Hector Garcia Molina, Jeffery D Ullman, JennifferWidom, “Database systems: The Complete Book”, 2nd edition, Pearson Publication,2013.
Topics relevant to “SKILL DEVELOPMENT”: Schema Design, Schema Refinement, Transactions for Skill development through Experiential Learning techniques. This is attained through the assessment component mentioned in the course handout.

CSA1005- Object Oriented Programming Using Java

Course Code: **CSA**1005	**Course Title:** Object Oriented Programming using Java **Type of Course:1] School Core 2] Laboratory integrated**	**L-T- P-C**	**1**	**0**	**4**	**3**
Version No.	2.0					
Course Pre-requisites	**Basic Programming Skills**					

<table>
<tr><td>Anti-requisites</td><td colspan="4">NIL</td></tr>
<tr><td>Course Description</td><td colspan="4">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.</td></tr>
<tr><td>Course Objective</td><td colspan="4">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.</td></tr>
<tr><td>Course Out Comes</td><td colspan="4">On successful completion of this course the students shall be able to:

1. Discuss the OOP’s concept and Apply the concepts to design, implement, compile, test and execute simple Java programs. [Understanding and Apply]
2. Explain the concepts related to classes and Use built-in methods of String and String Buffer classes. . [Understanding and Apply]
3. Implement concepts of Constructors, Polymorphism, Inheritance, Interfaces and Packages with programs. [Understanding, Analysing and Apply]
4. Understand and use the multithreading, exception handling mechanism and file handling mechanism of Java. [Understanding and Apply]
5. Design the GUI form using Applet and Swing components [Create]</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Introduction to OOP : Class and Object (Comprehension)</td><td>Assignment</td><td>Programming activity</td><td>8 Hours</td></tr>
<tr><td colspan="5">Topics:
Introduction to object-oriented programming, Java Evolution, How Java differs from C++, Features of Java, Java Program Development, Java Source File Structure, Compilation, Executions, JDK, JVM, JRE. Java Tokens: Datatypes, Variables,</td></tr>
</table>

Operators, Control Statements. Classes, Objects, and Methods: Defining a class, Access Specifiers, instantiating objects, Reference variable, Accessing class members and methods, constructors, method overloading, Inner class and its types				
Module 2	Arrays, Strings , Extending Class (Comprehension)	Assignment	Programming activity	**8 Hours**
Topics: Defining an Array, Initializing & Accessing Array, Multi –Dimensional Array, Strings: Operation on String, Mutable & Immutable String, Creating Strings using StringBuffer 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 (Comprehension and Application)	Assignment	Programming activity	**8 Hours**
Topics: Defining interfaces, extending interfaces, implementing interfaces - Organizing Classes and Interfaces in Packages, Package as Access Protection, Defining Package, CLASSPATH Setting for Packages, Import and Static Import, Making Jar files for Library packages, Naming Convention for Packages. Exception Handling: Introduction to Exceptions, Difference between Exceptions & Errors, Types of Exception, Handling of Exceptions: Use of try, catch, finally, throw, throws, User Defined Exceptions, Checked and Un-checked Exceptions.				
Module 4	Multithreaded Programming (Applications)	Assignment	Programming activity	**8 Hours**
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 5	Collection &	Assignment	Programming activity	**8**

	GUI Programming (Comprehension)			**Hours**

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:
Lab sheet -1 [5 Practical Sessions]
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 [2 Practical Sessions]
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 [3 Practical Sessions]
Level 1 - Programs to demonstrate Exceptions Handlers.
Level 2 - Programs to implements nested handlers, Checked and Unchecked Exception Handlers.

Lab sheet – 4 [4 Practical Sessions]
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 [1 Practical Session]
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 [2 Practical Session]]
Experiment No. 1:
Level 1 – Programs to implement concepts of GUI.
Level 2 – Programs to create Registration form using Swing.

Targeted Application & Tools that can be used: Notepad++, Eclipse IDE, NetBeans IDE

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course

3] Programming: Implementation of given scenario using Java

Text Book

1. Herbert Schildt, Java: The Complete Reference, Eleventh Edition

   (PROGRAMMING & WEB DEV - OMG), McGraw-Hill Education, 2019.
2. E Balagurusamy, Programming with Java, 7th Edition, McGraw-Hill Education, 2020.

References

1. Bruce Eckel, Thinking in Java. 4th ed.
2. **R. Nageswara Rao, Core Java: An Integrated Approach, New: Includes All Versions upto Java 8 2016.**
3. **Brett McLaughlin, Head First Object-Oriented Analysis and Design: A Brain Friendly Guide to OOA&D, DreamtechPress , 2016.**

Web References

W1. NPTEL Course on “Java Programming”, Prof.DebasisSamanta, https://archive.nptel.ac.in/courses/106/105/106105191/

W2. “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.

W3. “Building java programs” https://presiuniv.knimbus.com/user#/searchresult?searchId=java%20programming&_t=1662620793642

Topics relevant to “SKILL DEVELOPMENT”:

Interfaces, Exception Handling, Threads for Skill development through

Experiential Learning techniques. This is attained through the assessment component mentioned in the course handout.

CSA3075 Social Media Analytics

Course Code: CSA3075	**Course Title: Social Media Analytics** **Type of Course: Integrated**	**L- T-P- C**	1-0-4-3
Version No.	1.0		
Course Pre-requisites	Python Programming		

Anti-requisites				
Course Description	This course will introduce concepts and approaches to mining social media data. It focuses on obtaining and exploring those data, mining networks, and mining text from social platforms. Students will learn how to apply previously learned data mining concepts to a domain that will likely be familiar to all of them: social media. Students will learn to explore, model, and predict with network and textual data from existing social platforms.			
Course Objective	The objective of the course is EMPLOYBILITY of student by using EXPERIENTIAL LEARNING techniques.			
Course Out Comes	**On successful completion of the course the students shall be able to:** • **CO1:** *Explain the concepts and importance of Social Media Analytics in various organizational contexts.* ➤ **RBT Level:** *L2 – Understand* • **CO2:** *Apply basic network models and visualization techniques to interpret social network data.* ➤ **RBT Level:** *L3 – Apply* • **CO3:** *Analyze user behavior and engagement using web analytics tools and micro-text analysis techniques.* ➤ **RBT Level:** *L4 – Analyze* • **CO4:** *Evaluate the performance and effectiveness of social media campaigns using relevant metrics and data.* ➤ **RBT Level:** *L5 – Evaluate*			
Course Content:				
Module 1	**Introduction to Social Media Analytics**	Assignment	Data Collection/Interpretation	**12 Sessions**
Introduction to Social Media Analytics (SMA): Social media landscape, Need for SMA; SMA in Small organizations; SMA in large organizations; Application of SMA in different areas. **Network fundamentals and models:** The social networks perspective - nodes, ties and influencers, Social network and web data and methods. Graphs and Matrices- Basic measures for individuals and networks. Information visualization				
Module 2	**Making connections:** & **Web analytics tools:**	Case studies / Case let	Case studies / Case let	**10 Sessions**
Making connections: Link analysis. Random graphs and network evolution. Social contexts: Affiliation and identity. **Web analytics tools:** Clickstream analysis, A/B testing, online surveys, Web crawling and Indexing. Natural Language Processing Techniques for Micro-text Analysis				
Module 3	**Network Data Analytics:**	Quiz	Case studies / Case let	**11 Sessions**
Introduction, parameters, demographics. Analyzing page audience. Reach and Engagement analysis. Post- performance on Social Network. Social campaigns. Measuring and Analyzing				

social campaigns, defining goals and evaluating outcomes, Network Analysis. (LinkedIn, Instagram, YouTube Twitter etc. Google analytics. Introduction. (Websites)				
Module 4	**Processing and Visualizing Data**	Quiz	Case studies / Case let	**12 Sessions**
Processing and Visualizing Data, Influence Maximization, Link Prediction, Collective Classification, Applications in Advertising and Game Analytics Introduction to Python Programming, Collecting and analyzing social media data; visualization and exploration.				
Practical: Students should analyze the social media of any ongoing campaigns and present the findings.				
Project work/Assignment:				
Assignment on: Types of Data, Data Transfer, Fundamental Twitter Terminology				

Text Book

T1 Mathew A. Russell, "*Mining the Social Web*", O'Reilly, 3rd Edition, 2019.

T2 Marco Bonzanini, "*Mastering Social Media Mining with Python*", PacktPub, 2016

References

R1 Michal Krystyanczuk and Siddhartha Chatterjee, "Python Social Media Analytics", Packt Publishing, 2017

R2 Sponder, M "*Social media analytics: Effective tools for building, interpreting, and using metrics"*. McGraw Hill Professional.

E book link R1:

E book link R2

R3 **Web resources:**

a) https://www.coursera.org/learn/social-media-data-analytics
b) https://www.udemy.com/course/introduction-to-social-analytics/
c) https://onlinecourses.nptel.ac.in/noc21_cs28
d) https://research.facebook.com/publications/realtime-data-processing-at-facebook/

Weblinks:

1. **https://www.coursera.org/learn/social-media-analytics-introduction**
2. **https://academy.quintly.com/courses/free-social-media-analytics**
3. **https://presidencyuniversity.in/facility/library/**

Topics relevant to development "Entrepreneurship", **Dealing with Unstructured Data, Realtime Data Processing at Facebook, Fundamental Twitter Terminology**

CSA2005- Analysis of Algorithms

Course Code: CSA2005	Course Title: Analysis of Algorithms Type of Course: THEORY Only	L- T-P-C	2	1	0	3
Version No.	2.0					
Course Pre-requisites	Introduction to Pseudo code, Knowledge of Recursive and Non Recursive algorithms, Meaning of correctness.					
Anti-requisites						
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 Algorithmsand 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. Discuss the Brute Force Technique used for solving a problem. Explain divide and conquer technique for searching and sorting problems. Discuss the Dynamic Programming Algorithm used for solving a problem. Discuss the Back tracking technique and limitations of Algorithms.					
Course Content:						
Module 1	Introduction	Assignment	Simulation/Data Analysis	08 Sessions		
Important Problem types, Asymptotic Notations and its properties, Mathematical analysis for Recursive and Non-recursive algorithms.						
Module 2	Algorithm design techniques-Brute force	Assignment	Numerical from E-Resources	09 Sessions		
Selection Sort, sequential search, Uniqueness of Array, Exhaustive search Travelling Salesman, Knapsack						

Problem.				
Module 3	Divide-and-conquer	Term paper/ Assignment	Simulation/Data Analysis	08 Sessions
Master Theorem, Merge sort, Quick sort, Binary search.				
Module 4	Dynamic programming and greedy technique	Term paper/ Assignment	Simulation/Data Analysis	08 Sessions
Introduction, Coin changing problem, Multi stage graph – Optimal Binary Search Trees, warshall's, floyds,0/1 Knapsack, Prim's, Kruskal's, Dijkstra's Algorithm.				
Module 5	Complexity Classes	Term paper/ Assignment	Simulation/Data Analysis	06 Sessions
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. Donald E. Knuth, "*The Art of Computer Programming",* Volumes 1and 3 Pearson.				

CSA2020 - ARTIFICIAL INTELLIGENCE

Course Code: CSA2020	Course Title: ARTIFICIAL INTELLIGENCE Type of Course: Theory Only Course	L- T-P- C	3	0	0	3
Version No.	1					
Course Pre-requisites	Mathematics: Logic, Algebra, Probability					
Anti-requisites						

Course Description	This Course will introduce the basic principles in artificial intelligence. It will cover representation schemes, problem solving paradigms, search strategies, knowledge representation and Probabilistic Reasoning. Topics include: AI methodology and fundamentals, intelligent agents, search algorithms, game playing, supervised and unsupervised learning, uncertainty and probability theory, probabilistic reasoning in AI and Bayesian networks
Course Objective	: This course is designed to improve the learners' EMPLOYABILITY SKILLS by using PROBLEM SOLVING Methodologies.
Course Out Comes	On successful completion of the course the students shall be able to: CO1: Explain the basic concepts of Artificial Intelligence and application of AI in several domains such as business and governance domains. [Comprehension] CO2: Demonstrate knowledge of reasoning and knowledge representation for solving real world problems[Application] CO3: Analyze and illustrate how informed and uninformed search algorithms play vital role in problem solving. [Application] CO4: Explain learning probabilistic reasoning in AI. [Comprehension] CO5: Explain simple and complex decision making in AI. [Comprehension]
Course Content:	

Module 1	Introduction to Artificial Intelligence	Assignment	Data Collection/Interpretation	6Sessions
Topics: Introduction to Artificial Intelligence, Definitions, foundation, History and Applications; Agents: Types of Agents, Structure of Intelligent agent and its functions, Agents and Environment. Case Studies: Agricultural Domain, Business and Marketing, Automatic Car Parking System.				
Module 2	Logic based Knowledge Representation and Reasoning	Case studies / Case let	Case studies	7 Sessions
Topics: Introduction to Knowledge representation, Knowledge-based Agents, Knowledge-Based Systems; Frame Structures, Propositional Logic, First order Logic, Inference in First Order Logic (FOL), Introduction to Reasoning, types of reasoning				
Module 3	Problem Solving by	Quiz	Case studies	9 Sessions

	searching			
Topics: Problem space and search, State space search techniques solving problems by searching: Classical Search, Adversarial Search, and Constraint Satisfaction Problem, Adversarial Search Methods.				
Module 4	Learning and Probabilistic reasoning in AI	Quiz	Case studies	8 Sessions
Topics: Introduction to learning, Learning Concepts, Methods and Models: Supervised Learning, Unsupervised Learning, Reinforcement Learning, ANN-based Learning, Probabilistic reasoning in AI, Bayesian networks				
Module 5	Decision Making	Quiz	Case studies	8 Sessions
Topics: Making Simple Decisions: Beliefs and Desires under Uncertainty, Utility Theory, Making Complex Decisions: Sequential Decision Problems, Multiagent Decision Making				
Assignment: Assignment-1 (Report) Assignment-2 (Quiz) Group Seminar				
Text Book T1.Stuart J. Russell and Peter Norvig, "*Artificial intelligence: A Modern Approach*", 4th edition, Upper Saddle River, Prentice Hall, 2020.				
References R1. David L. Poole and Alan K. Mackworth,*"Artificial Intelligence: Foundations of Computational Agents*", 2nd edition, Cambridge University Press, 2020 R2. John Paul Mueller, Luca Massaron, "*Artificial Intelligence for dummies*", 2nd edition, Wiley, 2021. R3. Daeyeol Lee, "*Birth of Intelligence: From RNA to Artificial Intelligence",* 1st edition, Oxford University Press, 2020.				

E book link R1: https://www.researchgate.net/file.PostFileLoader.html?id=5440e3bdd5a3f298288b45fe&assetKey=AS%3 A273625985290242%401442248926315 Book link R2: tps://www.wiley.com/en-us/Artificial+Intelligence+For+Dummies,+2nd+Edition-p-9781119796763 Web resources: pu.informatics.global
Topics relevant to development of “Skill Development”: Knowledge-based Agents, Knowledge-Based Systems; Frame Structures, Propositional Logic, First order Logic, Inference in First Order Logic (FOL). Methods and Models: Supervised Learning, Unsupervised Learning, Reinforcement Learning, ANN-based Learning, Probabilistic reasoning in AI, Bayesian networks Topics relevant to development of “Environment and sustainability:NA

CSA3002 – MACHINE LEARNING ALGORITHMS

Course Code: CSA3002	Course Title: MACHINE LEARNING ALGORITHMS Type of Course: Integrated	L-T-P-C	2	0	2	3
Version No.	2.0					
Course Pre-requisites	Programming in Python (CSA1004)					
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. Machine learning algorithms can be categorized into several types based on their learning approach: Supervised learning algorithms - Its learn from labeled examples, where each data instance is associated with a known target or output value. Unsupervised learning algorithms - Its learn from unlabeled data, where there are no predefined output labels. Semi-supervised learning algorithms - Its combine elements of supervised and unsupervised learning. They leverage a small amount of labeled data along with a larger amount of unlabeled data to improve learning performance.			
	Each machine learning algorithm has its own strengths, weaknesses, and assumptions. The choice of algorithm depends on the specific problem, the available data, and the desired outcome.			
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		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		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	Case Study		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	Capestone project	Case Study and 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.
Targeted Application & Tools that can be used: Linux / Vi Editor
Project work/Assignment:

Assignment:

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 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.

CSA 2006 -Fundamentals of Software Engineering

Course Code:	Course Title: Fundamentals of Software Engineering	L- T-P-C	3	0	0	3

CSA2006	Type of Course: Program Core - Theory					
Version No.	2.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	The objective of this course is to help students understand the process and fundamental principles involved in software system development and software project management. The course covers software process models, software requirement engineering processes, system analysis, design, implementation and testing aspects of software system development. The course also covers project evaluation, planning, effort estimation and risk management aspects in software project planning.					
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 Outcomes	On successful completion of this course the students shall be able to: Understand the software engineering principles, ethics and process models. [Knowledge] Identify the requirements and appropriate design models for a given application. [Comprehension] Discuss the various types of testing methods and Quality Assurance. [Comprehension] Apply project planning, scheduling, evaluation and risk management principles for a given project. [Application]					
Course Content:						
Module 1	Introduction to Software Engineering & Process Models	Assignment	AgileDevelopment	11 Sessions		
Topics: Softwareand SoftwareEngineering: NatureofSoftware,SoftwareEngineeringPractice,SoftwareMyths,SDLC and SoftwareProcesses:GenericModel,PrescriptiveProcessModel,UnifiedProcessModel,Agile Development: Extreme Programming, SCRUM.						
Module 2	SoftwareRequirementsandDesign	Assignment	Functional and non- Functional requirements	10 Sessions		
Topics: Requirements Engineering: Eliciting requirements, Functional and non- Functional requirements,SRS,Requirementsmodeling:DevelopingUseCases,DevelopingActivitydiagramandSwim lane diagram, Design: Design concepts, Architectural design, Component based design,Userinterfacedesign.						
Module 3	Software Testing	Assignment	SCM process	11 Sessions		

	And Quality			
Topics: Introduction to Software Testing: verification and validation, Test Strategies for conventionalSoftware,ValidationTesting,WhiteboxTesting:Basispathtesting,Blackbox Testing.SoftwareQuality Assurance: Elements of software quality assurance, SQA Tasks, Goals and Metrics,Softwareconfigurationmanagement:SCM process.				
Module 4	SoftwareProject Management	Case Study	Estimation of Software Projects	13 Sessions
Topics: Project Management Concepts, Project Planning, Overview of metrics, Estimation for Softwareprojects,ProjectScheduling,RiskManagement,MaintenanceandReengineering,SoftwareProcessImprovement (SPI): CMMLevels.				
Targeted Application & Tools that can be used: MatLab, Python, Netbeans and AWS etc.,				
Project work/Assignment:				
Assignment 1: Testing sample application using Black box and White box approaches and understand the differences in selecting of test cases from the test suite. Assignment 2: Preparation of Software Configuration Management template for a software project. • Calculation of Test metrics for Sample application. Project 1: Designing UI of Sample application				
Textbooks: T1: Roger S. Pressman, *"Software Engineering: A Practitioner's Approach", Seventh Edition,* McGraw Hill International edition, 2009. T2. BobHughes,MikeCotterell,RajibMall,*"Software ProjectManagement",VIEdition*,McGraw-Hill, 2018.				
References: R1 : Ian Sommerville, *"Software Engineering, Ninth Edition",* Pearson Education, 2008. R2 : Watts S.Humphrey, *"A Discipline for Software Engineering"*, Pearson Education, 2007. R3. RajibMall,*"FundamentalsofSoftwareEngineering",VIEdition*,PHIlearningprivatelimited,2014. Web references: 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/

Topics relevant to “SKILL DEVELOPMENT”:

Software engineering, Requirement engineering, Software testing, Project Management for Skill development through Experiential Learning techniques. This is attained through the assessment component mentioned in the course handout.

CSA2102 – Information Retrieval

Course Code:	Course Title: Information Retrieval	L-T-	3	0	0	3

CSA2102	Type of Course: Theory	P-C				
Version No.	1.0					
Course Pre-requisites	ML USING PYTHON Basics of Data mining such as classification and clustering techniques					
Anti-requisites						
Course Description	The course is an intermediary course and aims to provide students with an in-depth understanding of design and implementation of data warehousing and data mining. The course will help students to enhance their understanding of various classification, clustering and outlier analysis methods. An interest to understand the concepts of data warehousing, data mining and a desire to be a successful data scientist are key to enable students to complete the course successfully. Topics include: Data Model for Data Warehouses, data extraction, cleansing, transformation and loading, data cube computation, materialized view selection, OLAP query processing. Data mining-Fundamentals. Mining Techniques and Application: Classification, Clustering, Outlier analysis.					
Course Objective	The objective of the course is SKILL DEVELOPMENT of student by using PARTICIPATIVE LEARNING techniques					
Course Out Comes	On successful completion of the course the students shall be able to: Define basic concepts of information Retrieval-(Remember) Calculate the effectiveness and efficiency of different information retrieval methods [Apply] Demonstrate the concept of web retrieval and crawling. [Apply] Classify different recommender system and its aspect. [Understand]					
Course Content:						
Module 1	Introduction to Information Retrieval	Assignment	Data Collection/Interpretation	[10 Hours]		
Topics: Information Retrieval: Web Search, Other IR Applications, Information Retrieval Systems: The Software Architecture, Documents and Update, Performance Evaluation, Open Source IR Systems: Lucene, Indri, Wumpus, Basic Techniques: Inverted Indices, Retrieval and Ranking,						

Evaluation.				
Module 2	Indexing	Assignment	Case studies / Case let	12 Sessions
Topics: Module: 2: Static Inverted Indices: Index Components and Index Life Cycle, The Dictionary, Postings Lists, Interleaving Dictionary and Postings Lists, Index Construction, Other Types of Indices, Query Processing: Query Processing for Ranked Retrieval, Lightweight Structure, Index Compression: General-Purpose Data Compression, Symbolwise Data Compression, Compressing Postings Lists, Compressing the Dictionary, Dynamic Inverted Indices: Batch Updates, Incremental Index Updates, Document Deletions, Document Modifications.				
Module 3	Retrieval and Ranking	Assignment	Case studies / Case let	14 Sessions
Topics: Probabilistic Retrieval: Modeling Relevance, The Binary Independence Model, The Robertson/Sparck Jones Weighting Formula, Document Length - BM25, Field Weights – BM25F, Language Modeling and Related Methods: Generating Queries from Documents, Language Models and Smoothing, Ranking with Language Models, Kullback-Leibler Divergence, Divergence from Randomness, Passage Retrieval and Ranking, Categorization and Filtering: Classification, Probabilistic Classifiers, Linear Classifiers, Similarity-Based Classifiers				
Module 4	Evaluation	Assignment	Case studies / Case let	10 Sessions
Topics: Measuring Effectiveness: Traditional Effectiveness Measures, The Text Retrieval Conference, Using Statistics in Evaluation, Minimizing Adjudication Effort, Nontraditional Effectiveness Measures, Measuring Efficiency: Efficiency Criteria, Queuing Theory, Query Scheduling, Caching				
Project work/Assignment:				
Assignment:				

Text Book T1. Stefan Buttcher, Charles L. A. Clarke, Gordon V. Cormack, "*Information Retrieval - Im odern Information Retrieval: The Concepts and Technology behind Search*", 3rd Edition, ACM Press Books, 2018. T2. Ricci. F. Rokach, L. Shapira, B. Kantor, "*Recommender Systems Handbook*", 4th Edition, 2018.
References R1. Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, "*Information Retrieval: Implementing and Evaluating Search Engines*", The MIT Press, 2017. R2. Jian-Yun Nie Morgan, Claypool, "*Cross-Language Information Retrieval"*, Publisher series 2011. R3 Web resources:
Topics relevant to development of "Skill Development": Dimensionality Reduction, Recommendation System Topics relevant to development of "Environment and sustainability

CSA3071 – Deep Learning

Course Code: CSA3071	Course Title: Deep Learning Type of Course: Program Core Theory and Laboratory Integrated	L-T-P-C	2	0	2	3
Version No.	1.0					
Course Pre-requisites	Data Mining and Machine Learning fundamentals					

	Basic working knowledge of Statistics and Probability Familiarity with programming languages and hands on coding			
Anti-requisites	NIL			
Course Description	The course introduces the core intuitions behind Deep Learning, an advanced branch of Machine Learning involved in the development and application of Artificial Neural Networks that function by simulating the working principle of human brain. Deep learning algorithms extract layered high-level representations of data in a way that maximizes performance on a given task. The course includes theory and lab components which emphasizes on understanding the implementation and application of deep neural networks in various prominent problem domains like speech recognition, sentiment analysis, recommendations, and computer vision etc. The course facilitates the students to interpret and appreciate the successful application of deep neural nets in various prediction and classification tasks of ML.			
Course Object	The objective of the course is EMPLOYBILITY of student by using PARTICIPATIVE LEARNING techniques.			
Course Out Comes	On successful completion of the course the students shall be able to: Apply basic concepts of Deep Learning to develop feed forward models Apply Supervised and Unsupervised Deep Learning techniques to build effective models for prediction or classification tasks Identify the deep learning algorithms which are more appropriate for various types of learning tasks in various domains of Machine Learning and Machine vision. Analyze performance of implemented Deep Neural models			
Course Content:				
Module 1	Introduction to Deep Learning	Assignment	Programming	No. of Classes: 10
Topics: Machine Learning in a nutshell, Fundamentals of deep learning and neural networks, Deep Neural Network, Feedforward Neural Network, , Perceptron, MLP Structures, Activation Functions, Loss Functions, Gradient Descent, Back-propagation, Training Neural Networks Building your Deep Neural Network: Step by Step, Deep Neural Network for Classification.				
Module 2	Improving Deep Neural Networks	Assignment	Programming	No. of Classes: 10
Topics:				

Hyperparameter tuning, Initialization, Overfitting and Underfitting, Regularization and Optimization, Dropout, Batch Normalization

Module 3	Deep Supervised Learning Models	Assignment	Programming	No. of Classes:20

Topics:

Convolutional neural network, Prediction of image using Convolutional Neural Networks, Deep learning in Sequential Data, RNN & LSTM, GRU, Sentiment Analysis

Module 4	Deep Unsupervised Learning	Assignment	Programming	No. of Classes:20

Topics:

Basics of Deep unsupervised learning, Auto encoders, Restricted Boltzmann Machine, Recommender systems

Text Book

Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press, 2017

References

1. Duda, R.O., Hart, P.E., and Stork, D.G. Pattern Classification. Wiley-Inderscience, 2nd Edition. 2013

2. Theodoridis, S. and Koutroumbas, K. Pattern Recognition. Edition 4, Academic Press, 2015

3. Russell, S. and Norvig, N. Artificial Intelligence: A Modern Approach. Prentice Hall Series in Artificial Intelligence, 2013

4. Bishop, C. M. Neural Networks for Pattern Recognition, Oxford University Press, 2008.

https://sm-nitk.vlabs.ac.in/

https://nptel.ac.in/courses/105105157

Topics relevant to development of “Employability”: Real time Data Analysis using Deep learning.

Topics relevant to “PROFESSIONAL ETHICS”: Naming and coding convention for Data Science Project Development using ML/DL.

CSA3014 – Natural Language Processing

Course Code: **CSA 3014**	**Course Title: Natural Language Processing** **Type of Couse: Theory & Integrated Laboratory**	**L- T- P- C**	2	0	2	3
Version No.	2.0					
Course Pre-requisites	The student is expected to have a fundamental knowledge of control structures, statistics and Python.					
Anti-requisites	**NIL**					
Course Description	This course covers a wide range of tasks, basic to advance, in Natural Language Processing (NLP). NLP deals with the study of computing systems that can process, understand and communicate in human language. It addresses fundamental questions at the intersection of human languages and computer science. This course also provides an introduction to current techniques, strategies and toolkits for NLP.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Natural Language Processing** attain **Skill development through Experiential Learning** techniques.					
Course Outcomes	On successful completion of this course the students shall be able to: 1: Understand the fundamental concepts of Natural Language Processing. **[Understand]** 2: Demonstrate the various levels involved in NLP. **[Apply]** 3: Application of relevant feature extraction methods on text and Analysis of various techniques of sentiment analysis in text. **[Apply]** 4. Understand and apply advanced sentiment analysis techniques using Artificial Neural Networks (ANN) and BERT to achieve high accuracy in evaluating textual data.**[Apply]**					

Course Content:			
Module 1	**Introduction to NLP**	Quiz/Assignment	**16 Sessions**
Topics: Introduction to NLP; History of NLP; Understanding the Basics of NLP – Programming Languages vs Natural Languages, Current Applications of NLP; Python Libraries for NLP; Basic Text Analytics in NLP; Various Steps in NLP – Tokenization, PoS Tagging, Stop Word Removal, Text Normalization, Spelling Correction, Stemming, Lemmatization, Named Entity Recognition (NER); Word Sense Disambiguation; Sentence Boundary Detection.			
Module – 2:	**Feature Extraction Methods**	Quiz/Assignment	**14 Sessions**
Topics: Types of Data; Cleaning Text Data – Text Cleaning and Tokenization, extracting n-grams; Types of Tokenizers; Converting Words in the Present Continuous Tense into Base Word; Singularizing and Pluralizing Words; Language Translation; Removing Stop Words from Text.			
Module -3	**Feature Extraction from Text**	Presentation	**16 Sessions**
Extracting General Features from Raw Text and Text; Bag of Words; Zipf's Law; Term Frequency – Inverse Document Frequency (TFIDF); Finding Text Similarity. Finding Text Similarity – Application of Feature Extraction; Calculating Text Similarity Using Jaccard and Cosine Similarity. Word Sense Disambiguation Using the Lesk Algorithm; Implementing the Lesk Algorithm Using String Similarity and Text Vectorization.			
Module-4	**Sentiment Analysis**	Certification	**14 Sessions**
Topics: Introduction; Why is Sentiment Analysis Required? Growth of Sentiment Analysis; Tools used for Sentiment Analysis; Text Blob; Discovering sentiment analysis; Sentiment analysis using ANN; Using BERT for sentiment Analysis.			

List of Laboratory Tasks:

Experiment No. 1: Text Analytics and NLP

Level 1: To Analyze the Study of Processing text

Experiment No. 2: Programs on Various Steps in NLP

Level 1: Analyze the problem and generate word forms from root and suffix information.

Level 2: Study and Implementation of morphological analysis

Experiment No. 3: Word Sense Disambiguation

Level 1: Study and implement Word sense Disambiguation

Experiment No. 4: Programs on Text Normalization and learning Text Data

Level 1: Identify Text data and convert them in to input for algorithms.

Experiment No. 5: Feature Extraction from Texts

Level 1: Translate textual data to real valued vectors

Experiment No. 6: Finding text similarity

Level 1: Study the applications of text similarity
Level 2: Describe the process involved in the text similarity

Experiment No. 7: Sentiment Analysis

Experiment No. 8: Tools used for Sentiment Analysis

Level 1: Perform sentiment analysis Level 1: Interpret the customer need as the input of sentiment analysis using Text Blob
Level 2: Illustrate the process of training BERT model for Sentiment Analysis

Experiment No. 9: Project Presentation and Evaluation

Level 1: Demonstrate a comprehensive understanding of core Natural Language Processing (NLP) techniques and the ability to apply them to real-world problems.

Experiment No. 10: Named Entity Recognition (NER) Implementation

Level 1: Use the SpaCy library to build an NER model.
Level 2: Perform NER on a sample text using SpaCy's pre-trained model.

Experiment No. 11: Sentence Boundary Detection and Text Summarization

Level 2 Implement sentence boundary detection using NLTK or SpaCy.

Experiment No. 12,13,14: Infosys Certification in NLP

Level 1: Introductory knowledge on key AI and NLP concepts, such as understanding basic models like bag-of-words, word embeddings (Word2Vec, GloVe), and simple pre-trained models.
Level 2: More sophisticated tasks, such as working with deep learning models like LSTMs, Transformers, and conducting NLP tasks like text
Level 3: In-depth study of advanced NLP tasks like building generative models, fine-tuning pre-trained large language models (LLMs) for specific use cases.

Targeted Application & Tools that can be used:

1. **Python Libraries (Eg. NLTK, TextBlob, Spacy, etc.)**
2. **Java (Stanford CoreNLP)**
3. **Google Colab**

Project work/Assignment:

Students will have to do group assignments for Modules 1 & 2 As a part of their assignments, they will have to implement the solution to problems.

Textbook(s):

1. The Natural Language Processing Workshop By Rohan Chopra , Aniruddha M. Godbole , Nipun Sadvilkar August 2020

References:

R1. Python Natural Language Processing Cookbook: Zhenya Antić March 2021)
R2. Hands-On Natural Language Processing with Python Rajesh Arumugam, Rajalingappaa Shanmugamani (18 July 2018)

Online Resources:

1. NPTEL Course on NLP : https://onlinecourses.nptel.ac.in/noc23_cs45/preview by Prof. Pawan Goyal.
2. https://www.geeksforgeeks.org/natural-language-processing-overview/

Topics relevant to SKILL DEVELOPMENT: Assignment implementations in software, batch wise presentations for **Skill Development** through Participative **Learning**

techniques. This is attained through assessment component mentioned in course handout.	
Catalogue prepared by	Ms. Devi.S
Recommended by the Board of Studies on	
Date of Approval by the Academic Council	

CSA3003- Android Mobile Application Development

Course Code: CSA3003	Android Mobile Application Development	**L- T-P- C**	1	0	4	3
Version No.	2.0					
Course Pre-requisites	The student needs to have fundamental understanding of object-oriented programming concepts with Java/C#, XML, usage of any integrated development environment.					
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 **Andriod Application Development** and attain **Skill Development** through **Experiential Learning**techniques.					

<table>
<tr><td>Course Out Comes</td><td colspan="4">On successful completion of the course the students shall be able to:
1. Discuss the fundamentals of mobile application development and architecture.
[Understand]
2. Illustrate mobile applications with appropriate android view. [Apply]
3. Demonstrate the use of services, broadcast receiver, Notifications and content
4. Apply data persistence techniques, to perform CRUD operations.
[Apply]
5. Use advanced concepts for mobile application development. [Apply]</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Introduction and Architecture of Android</td><td>Assignment</td><td>Simulation/Data Analysis</td><td>10 Sessions</td></tr>
<tr><td colspan="5">Android: History and features, Architecture, Development Tools, Android Debug Bridge (ADB), and Life cycle.</td></tr>
<tr><td>Module 2</td><td>User Interfaces, Intent and Fragments</td><td>Assignment</td><td>Numerical from E-Resources</td><td>15 Sessions</td></tr>
<tr><td colspan="5">Views, Layout, Menu, Intent and Fragments.</td></tr>
<tr><td>Module 3</td><td>Components of Android</td><td>Term paper/Assignment</td><td>Simulation/Data Analysis</td><td>15 Sessions</td></tr>
<tr><td colspan="5">Activities, Services, Broadcast receivers, Content providers, User Navigation</td></tr>
<tr><td>Module 4</td><td>Notifications and Data Persistence</td><td>Term paper/Assignment</td><td>Simulation/Data Analysis</td><td>15 Sessions</td></tr>
<tr><td colspan="5">Notification, Shared Preferences, SQLite database, Android Room with a View, Firebase</td></tr>
<tr><td>Module 5</td><td>Advance App Development</td><td>Term paper/Assignment</td><td>Simulation/Data Analysis</td><td>15 Sessions</td></tr>
<tr><td colspan="5">Graphics and Animation, Sensors, Performance, Location, Places, Mapping, Custom Views,</td></tr>
</table>

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.

Targeted Application & Tools that can be used:

Android Studio, Visual Studio Code

Assignment:

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

T3. Barry Burd (Author), “Android Application Development” ALL – IN – ONE FOR Dummies

T4. Jeff Mcherter (Author),ScottGowell (Author), “Professional mobile Application Development” paperback, Wrox - Wiley India Private Limited

T5. Wei-Meng Lee (Author) “Beginning Android Application Development” Wrox – Wiley India Private Limited

References

1. 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”
2. Erik Hellman, “Android Programming – Pushing the Limits”, 1st Edition, Wiley India Pvt Ltd, 2014.
3. Dawn Griffiths and David Griffiths, “Head First Android Development”, 1st Edition, O’Reilly SPD Publishers, 2015.
4. J F DiMarzio, “Beginning Android Programming with Android Studio”, 4th Edition, Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126565580
5. Anubhav Pradhan, Anil V Deshpande, “ Composing Mobile Apps” using Android, Wiley 2014, ISBN: 978-81-265-4660-2
6. Reto Meier “Professional Android Application Development”

E-Resources

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

Topics relevant to “SKILL DEVELOPMENT”:

SQLite database, Android Room with a View for **Skill development** through **Experiential Learning t**echniques. This is attained through the assessment component mentioned in

the course handout.

CSA3074 – Reinforcement Learning

Course Code: **CSA3074**	**Course Title: Reinforcement Learning** **Type of Course: Discipline elective**	**L-T-P-C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	1. Knowledge of programming in Python is required. 2. Knowledge of probabilities/statistics, calculus and linear algebra is required. 3. Machine learning background, as provided for example by COMP-551 or COMP-652 is required.					
Anti-requisites	NIL					
Course Description	The goal of this class is to provide an introduction to reinforcement learning, a very active research sub-field of machine learning. Reinforcement learning is concerned with building programs that learn how to predict and act in a stochastic environment, based on past experience. Applications of reinforcement learning range from classical control problems, such as power plant optimization or dynamical system control, to game playing, inventory control, and many other fields. Notably, reinforcement learning has also produced very compelling models of animal and human learning. During this course, we will study theoretical properties and practical applications of reinforcement learning. We will follow the second edition of the classic textbook by Sutton & Barto (available online for free, or from MIT Press), and supplement it as needed with papers and other materials.					
Course Objective	The objective of the course **Reinforcement earning** is to familiarize the learners with the concepts of attain **Employability** through **Experiential Learning** techniques					
Course Out Comes	On successful completion of the course the students shall be able to:					

	1. Knowledge of basic and advanced reinforcement learning techniques. 2. Identification of suitable learning tasks to which these learning techniques can be applied. 3. Appreciation of some of the current limitations of reinforcement learning techniques. 4. Formulation of decision problems, set up and run computational experiments, evaluation of results from experiments.			
Course Content:				
Module 1	Introduction	Assignment	Programming	**No. of Classes:10**
Topics: Course logistics and overview. Origin and history of Reinforcement Learning research. Its connections with other related fields and with different branches of machine learning. **Probability Primer** Brush up of Probability concepts - Axioms of probability, concepts of random variables, PMF, PDFs, CDFs, Expectation. Concepts of joint and multiple random variables, joint, conditional and marginal distributions. Correlation and independence.				
Module 2	Markov Decision Process	Assignment	Programming	**No. of Classes:10**
Topics: Introduction to RL terminology, Markov property, Markov chains, Markov reward process (MRP). Introduction to and proof of Bellman equations for MRPs along with proof of existence of solution to Bellman equations in MRP. Introduction to Markov decision process (MDP), state and action value functions, Bellman expectation equations, optimality of value functions and policies, Bellman optimality equations.				
Module 3	Prediction and Control by Dynamic Programing	Assignment	Programming	**No. of Classes:10**
Topics: Overview of dynamic programing for MDP, definition and formulation of planning in MDPs, principle of optimality, iterative policy evaluation, policy iteration, value iteration, Banach fixed point theorem, proof of contraction mapping property of Bellman expectation and optimality operators, proof of convergence of policy evaluation and value iteration				

algorithms, DP extensions

Monte Carlo Methods for Model Free Prediction and Control

Overview of Monte Carlo methods for model free RL, First visit and every visit Monte Carlo, Monte Carlo control, On policy and off policy learning, Importance sampling.

Module 4	TD Methods and Policy Gradients	Assignment	Programming	**No. of Classes:10**

Topics:

Incremental Monte Carlo Methods for Model Free Prediction, Overview TD(0), TD(1) and TD(λ), k-step estimators, unified view of DP, MC and TD evaluation methods, TD Control methods - SARSA, Q-Learning and their variants.

Getting started with policy gradient methods, Log-derivative trick, Naive REINFORCE algorithm, bias and variance in Reinforcement Learning, Reducing variance in policy gradient estimates, baselines, advantage function, actor-critic methods.

Targeted Application & Tools that can be used:

While Convolution Neural Network (CNN) and Recurrent Neural Network (RNN) are becoming more important for businesses due to their applications in Computer Vision (CV) and Natural Language Processing (NLP), Reinforcement Learning (RL) as a framework for computational neuroscience to model decision making process seems to be undervalued. Besides, there seems to be very little resources detailing how RL is applied in different industries. Despite the criticisms about RL's weaknesses, RL should never be neglected in the space of corporate research given its huge potentials in assisting decision making.

Tools: Torch, Google Colaboratory, Spider, Jupiter Notebook

Project work/Assignment:

This part is written for general readers. At the same time, it will be of greater value for readers with some knowledge about RL.

1. Resources management in computer clusters

Designing algorithms to allocate limited resources to different tasks is challenging and requires human-generated heuristics. The paper "Resource Management with Deep Reinforcement Learning" [2] showed how to use RL to automatically learn to allocate and schedule computer resources to waiting jobs, with the objective to minimize the average job slowdown.

State space was formulated as the current resources allocation and the resources profile of

jobs. For action space, they used a trick to allow the agent to choose more than one action at each time step. Reward was the sum of (-1/duration of the job) over all the jobs in the system. Then they combined REINFORCE algorithm and baseline value to calculate the policy gradients and find the best policy parameters that give the probability distribution of actions to minimize the objective.

2. Traffic Light Control

Researchers tried to design a traffic light controller to solve the congestion problem. Tested only on simulated environment though, their methods showed superior results than traditional methods and shed a light on the potential uses of multi-agent RL in designing traffic system.

Five agents were put in the five-intersection traffic network, with a RL agent at the central intersection to control traffic signalling. The state was defined as eight-dimensional vector with each element representing the relative traffic flow of each lane. Eight choices were available to the agent, each representing a phase combination, and the reward function was defined as reduction in delay compared with previous time step. The authors used DQN to learn the Q value of the {state, action} pairs.

3. Robotics

There are tremendous works on applying RL in Robotics. Readers are referred to for a survey of RL in Robotics. In particular, trained a robot to learn policies to map raw video images to robot's actions. The RGB images were fed to a CNN and outputs were the motor torques. The RL component was the guided policy search to generate training data that came from its own state distribution.

4. Web System Configuration

There are more than 100 configurable parameters in a web system and the process of

tuning the parameters requires a skilled operator and numerous trail-and-error tests. The paper "A Reinforcement Learning Approach to Online Web System Auto-configuration" showed the first attempt in the domain on how to do autonomic reconfiguration of parameters in multi-tier web systems in VM-based dynamic environments.

The reconfiguration process can be formulated as a finite MDP. The state space was the system configuration, action space was {increase, decrease, keep} for each parameter, and reward was defined as the difference between the given targeted response time and measured response time. The authors used the model-free Q-learning algorithm to do the task.

Text Book

1. "Reinforcement Learning: An Introduction", Richard S. Sutton and Andrew G. Barto, 2nd Edition
2. "Probability, Statistics, and Random Processes for Electrical Engineering", 3rd Edition, Alberto Leon-Garcia
3. "Machine Learning: A Probabilistic Perspective", Kevin P. Murphy

References

1. Richard S. Sutton and Andrew G. Barto, "Reinforcement learning: An introduction", Second Edition, MIT Press, 2019.
2. Li, Yuxi. "Deep reinforcement learning." arXiv preprint arXiv:1810.06339 (2018).
3. Wiering, Marco, and Martijn Van Otterlo. "Reinforcement learning." Adaptation, learning, and optimization 12 (2012):

E-Resources

NPTEL course – https://onlinecourses.nptel.ac.in/noc19_cs55/preview

https://archive.nptel.ac.in/courses/106/106/106106143/

https://www.digimat.in/nptel/courses/video/106106143/L35.html

	Topics relevant to "EMPLOYABILITY DEVELOPMENT": Reinforcement Learning (RL) as a framework for computational neuroscience to model decision making process seems to be undervalued **for developing**

	Employability Skills through Experiential Learning techniques. This is attained through assessment component mentioned in the course handout.

CSA2008 – Essentials of Cloud Computing

Course Code: CSA2008	Course Title: Essentials of Cloud Computing Type of Course: Program Core	L-T-P-C	3	0	0	3
Version No.	2.0					
Course Pre-requisites	Computer Networks					
Anti-requisites	NIL					
Course Description	This course aims to introduce the core concepts of cloud computing to gain the foundational knowledge required for understanding cloud computing from a business perspective as also for becoming a cloud practitioner. From the course student will understand the definition and essential characteristics of cloud computing, its history, the business case for cloud computing, and emerging technology use cases enabled by cloud. This course covers on various cloud service models (IaaS, PaaS, SaaS), deployment models (Public, Private, Hybrid), the key components of a cloud infrastructure (VMs, Networking, Storage - File, Block, Object) and security issues in the cloud.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Essentials of Cloud Computing and attain Skill Development through Participative Learningtechniques.					
Course Out Comes	On successful completion of this course the students shall be able to: Understand the significance of Cloud computing technologies. [Knowledge] Identify appropriate Virtualization techniques to virtualize infrastructures.					

	[Comprehension] Demonstrate the different services provided by cloud [Application] Analyze cloud security issues in cloud computing. [Comprehension]			
Course Content:				
Module 1	Introduction to Cloud (Comprehension)	Quiz		10 Hours
Topics: Cloud computing basics: - Cloud computing components- Infrastructure-services- storage applications database services – Deployment models of Cloud- Services offered by Cloud- Benefits and Limitations of Cloud Computing				
Module 2	Virtualization fundamentals(C omprehension)	Assignment		10 Hours
Topics: Virtualization – Enabling technology for cloud computing- Types of Virtualization- Server Virtualization- Desktop Virtualization – Memory Virtualization – Application and Storage Virtualization- Tools and Products available for Virtualization.				
Module 3	Cloud Services(SAAS, PAAS,IAAS)(Com prehension)	Seminar		10 Hours
Topics: Getting started with SaaS - Understanding the multitenant nature of SaaS solutions- Understanding Open SaaS Solutions.Understanding Service Oriented Architecture PaaS- Benefits and Limitations of PaaS, Security as a Service, Understanding IaaS- Improving performance through Load balancing- Server Types within IaaS solutions- Utilizing cloud based NAS devices – Understanding Cloud based data storage- Cloud based database solutions- Cloud based block storage				
Module 4	Cloud Computing Software Security Fundamentals(C omprehension)	Test		10 Hours
Topics: Cloud Information Security Objectives, Cloud Security Services , Authentication , Authorization, Auditing, Accountability, Secure Cloud Software Requirements, Secure Development Practices, Approaches to Cloud Software Requirements Engineering.				

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course
5] Problem Solving: Design and implement dynamic resource allocation for virtual machine using cloud computing environment.
Text Book R. Buyya, C. Vecchiola, S T. Selvi, Mastering Cloud Computing, McGraw Hill (India) Pvt Ltd., 2013. Ronald L.Krutz, Russell vines, Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Wiley Publishing Inc., 2010.
References Douglas E. Comer, "The Cloud Computing Book: The Future of Computing Explained", Chapman and Hall/CRC; 1st edition, July 2021. Kris Jamsa, Cloud Computing: SaaS, PaaS, IaaS, “Virtualization, Business Models, Mobile, Security and more, Jones & Bartlett Learning Company, 2013 Gautam Shroff, Enterprise Cloud Computing - Technology, Architecture, Applications, Cambridge University Press, 2010
Topics relevant to “SKILL DEVELOPMENT”: Virtualization, SaaS, Cloud Information Security forSkill development through Participative Learning techniques. This is attained through the assessment component mentioned in the course handout.

CSA3005- Internet of Things

Course Code: **CSA3005**	**Course Title: Internet of Things** **Type of Course: Integrated**	**L-T-P-C**	1	0	4	3
Version No.	1.0				
Course Pre-requisites	1. Students should know basic python programming. 2. Students have basic knowledge basic electronic components such as sensors – temperature, motion, pressure, and actuators etc. 3. Students should have basic idea about Cloud and its uses.				
Anti-requisites	NIL				
Course Description	The Internet of Things (IoT) is an emerging paradigm combining heterogeneous devices at an unprecedented scale, thereby enabling individuals and organizations to gain greater value from networked connections among people, processes, data, and things. The Internet of Things (IoT) is a course of objects interacting with people, with information systems, and with other objects. The course will focus on creative thinking, IoT concepts & IoT technologies.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Internet of Things** and attain **Employability** through **Experiential Learning** techniques.				
Course Out Comes	On successful completion of the course the students shall be able to: **1.** Identify the application areas of IoT **2.** Understand building blocks of Internet of Things and characteristics **3.** Describe IoT Protocols **4.** Demonstrate use of IoT devices for simple application				
Course Content:					
Module 1	INTRODUCTION TO INTERNET OF THINGS	Assignment	Simulation/Data Analysis	**18 Sessions**	
Introduction, Definition & Characteristics of IOT, Physical Design of IoT- Things in IoT, IoT Protocols, Logical design of IoT- IoT functional blocks, IoT Communication Models, IoT Communication APIs, IoT Enabling Technologies- Wireless sensor networks, Cloud computing, Big data Analytics					
Module 2	IOT COMMUNICATION MODEL AND PROTOCOLS	Assignment	Numerical from E-Resources	**18 Sessions**	
Connectivity Protocols: 6LoWPAN, IEEE 802.15.4, Zigbee, Wireless HART, Z-Wave, ISA 100,NFC, RFID. Communication/Transport Protocols: Bluetooth. Data Protocols: Message Queue Telemetry Transport (MQTT), Constrained Application Protocol (CoAP), Advanced Message Queuing Protocol (AMQP), XMPP – Extensible Messaging and Presence Protocol					
Module 3	IOT COMMUNICATION MODEL AND PROTOCOLS	Term paper/Assignment	Simulation/Data Analysis	**19 Sessions**	
Communication/Transport Protocols: Bluetooth. Data Protocols: Message Queue Telemetry Transport (MQTT), Constrained Application Protocol (CoAP), Advanced Message Queuing Protocol (AMQP), XMPP – Extensible Messaging and Presence Protocol. RFID: Introduction, Principle of RFID, Components of an RFID system.					
List of Laboratory Tasks 1 Installation of arduino IDE & Arduino program to implement scrolling LED, to glow even/odd LED 2 Arduino program to demonstrate usage of push button to control the LED 3 Arduino program to demonstrates traffic control system 4 Arduino program to demonstrates usage of servo motor with potentio meter					

CSA3052 – PATTERN RECOGNITION

Course Code: CSA3052	Course Title: PATTERN RECOGNITION	L-T- P-C	3	0	0	3
Version No.	1.0					
Course Pre-requisites	linear algebra, probability, random process, statistics, programming experience (MATLAB/C/C++) will be helpful.					
Anti-requisites	-					
Course Description	Pattern recognition techniques are used to design automated systems that improve their own performance through experience. This course covers the methodologies, technologies, and algorithms of statistical pattern recognition from a variety of perspectives. Topics including Bayesian Decision Theory, Estimation Theory, Linear Discrimination Functions, Nonparametric Techniques, Support Vector Machines, Neural Networks, Decision Trees, and Clustering Algorithms etc. will be presented.					

Course Objective	The objective of the course is to familiarize the learners with the concepts of PATTERN RECOGNITIONattainEmployability through Participative Learning techniques.
Course Out Comes	On successful completion of the course the students shall be able to: CO1: Identify areas where Pattern Recognition and Machine Learning can offer a solution.[knowledge] CO2: Describe the strength and limitations of some techniques used in computational Machine Learning for classification, regression and density estimation problems[Comprehensive] CO3: Describe genetic algorithms, validation methods and sampling techniques[Comprehensive] CO4: Describe and model data to solve problems in regression and classification[Comprehensive] CO5: Implement learning algorithms for supervised tasks. [Application]

Course Content:				
Module 1		quiz	Case studies / Case let	8 Sessions
Importance of pattern recognition, Features, Feature Vectors, and Classifiers, Supervised, Unsupervised, and Semi- supervised learning, Introduction to Bayes Decision Theory, Discriminant Functions and Decision Surfaces, Gaussian PDF and Bayesian Classification for Normal Distributions. L1, L2				
Module 2		Assignment	Case studies / Case let	8 Sessions
Introduction, Basis Vectors, The KarhunenLoeve (KL) Transformation, Singular Value Decomposition, Independent Component Analysis (Introduction only). Nonlinear Dimensionality Reduction, Kernel PCA. L1, L2				
Module 3		Quiz	Case studies / Case let	10 Sessions
Maximum Likelihood Parameter Estimation, Maximum a Posteriori Probability estimation, Bayesian Interference, Maximum Entropy Estimation, Mixture Models, Naive-Bayes Classifier, The Nearest Neighbor Rule. L1, L2, L3				
Module 4 12 Session Introduction, Linear Discriminant Functions and Decision Hyperplanes, The Perceptron Algorithm, Mean Square Error Estimate, Stochastic Approximation of LMS Algorithm, Sum of Error Estimate. L1, L2, L3				
Text Book Pattern Recognition: Sergios Theodoridis, Konstantinos Koutroumbas, Elsevier India Pvt. Ltd (Paper Back), 4th edition. Pattern Recognition and Image Analysis Earl Gose: Richard Johnsonbaugh, Steve Jost, ePub eBook.				
References R1. The Elements of Statistical Learning: Trevor Hastie, Springer-Verlag New York, LLC (Paper Back), 2009. R2. Pattern Classification: Richard O. Duda, Peter E. Hart, David G. Stork. John Wiley & Sons, 2012.				
Topics relevant to “EMPLOYABILITY DEVELOPMENT”: The Perceptron Algorithm, Mean Square Error Estimate, Stochastic Approximation of LMS Algorithm, Sum of Error Estimate. L1, L2, L3fordeveloping Employability Skills through Experiential Learning techniques. This is attained through assessmentcomponent mentioned in the course handout.				

Course Code: MAT2028	**Course Title**: Graph Theory **Type of Course:** Program Core	**L-T-P- C**	2	1	0	3
Version No.	1.0					
Course Pre-requisites	Set theory and basic counting techniques (Permutations and Combinations)					
Anti-requisites	**Nil**					
Course Description	Graph Theory is a blend of the mathematical techniques applicable to Computer science, Information Technology and Statistics. Graph Theory gives us, both an easy way to pictorially represent many major mathematical results, and insights into the deep theories behind them. This course, among other intriguing applications, shows how GPS systems find shortest routes, how engineers design integrated circuits, how biologists assemble genomes, why a political map can always be colored using a few colors.					
Course Objective	The objective of the course is to **familiarize the learners with the concepts of "Graph Theory " and attain Skill Development through Problem Solving techniques.**					
Course Outcomes	On successful completion of the course the students shall be able to: CO-1: Apply different mathematical proofs and techniques in solving real time problems. CO-2: Discuss the fundamental concepts of Graph theory and able to analyze different structures by using isomorphism. CO-3: Discuss the special graphs and able to understand the concept of colorings in graph theory. CO-4: Discuss different types of structures of trees for developing programming skills. CO-5: Apply different algorithms to find optimal path for a given graph.					
Course Content:						
Module 1	Principles of Counting					**8 Hours**
The Principle of Inclusion and Exclusion, Generalizing Inclusion – Exclusion Principles, Derangements – Nothing is in its Right Place, Rook Polynomials.						
Module 2	Introduction to Graph Theory					**10 Hours**
Basic Concepts: definition, types of graphs, Graph Terminology, Representation of a graph and connectedness (paths, walk. cycles, edge deleted and vertex deleted), and Graph isomorphism.						
Module 3	Special graphs and					**10**

	colouring			**Hours**
Special Types of Graph (Complete graph, Bipartite graph, Complete Bipartite graph, Star graph), Eulerian graph, Hamiltonian graph, Planar graph,(three utility problem), Graph coloring.				
Module 4	Trees			**9 Hours**
Tree: Definitions, Properties, Rooted trees, Binary search tree, Decision tree, spanning tree: BFS, DFS. Directed Graphs (types of diagraphs, diagraphs and binary relations, directed paths and connectedness, Euler diagraphs)				
Module 5	Algorithm on networks			**8 Hours**
Shortest path algorithm-Dijikstra's algorithm, Minimal spanning tree- Kruskal algorithm and Prim's algorithm.				

Targeted Application & Tools that can be used:

Computer Science, Electrical Engineering, Linguistics, Physics and Chemistry,

Computer Network, Social Sciences, Biology, Mathematics and can write Program by using MATLAB, C++, JAVA.

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course

Assignment 1: Rook polynomials and Isomorphism.
Assignment 2: Trees and Algorithms.

Text Book

1. K H Rosen, "Discrete Mathematics and its Application", McGraw Hill, 8th Edition, 2019.

References:

1. Kenneth H. Rosen, "Hand Book Of Discrete And Combinatorial Mathematics" CRC press, 2nd Edition, 2017.

2. Grimaldi," Graph Theory and Combinatorics", Pearson Education, 2014.
3. Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, 5th Edition, Pearson Education, 2007.

Topics relevant to SKILL DEVELOPMENT: Graph Theory is a blend of the mathematical techniques applicable to Computer science, Information Technology and Statistics. Graph Theory gives us, both an easy way to pictorially represent many major mathematical results, and insights into the deep theories behind them for **Skill Development through Problem Solving methodologies.** This is attained through assessment component mentioned in course handout.

Discipline Electives

CSA3022: Advanced Java

Course Code: CSA3022	Course Title: Advanced Java Type of Course:1] School Core 2] Laboratory integrated	L-T-P- C	1	0	4	3
Version No.	1.0					
Course Pre-requisites	OOPS using Java					
Anti-requisites	NIL					
Course Description	The purpose of this course is to introduce the students to Java Advanced API enhanced by Design Patterns and SOLID Principles. The course is both conceptual and analytical and is understood with JDK 8 software & IntelliJ IDE. This course develops critical thinking skills by augmenting the student's ability to develop distributed model for control of various modern management systems like banking management system, student information management system, , Library Management System etc. w*ith* the necessary API for communication with database enhanced by the current industrial approach of Java's SOLID principle and design patterns. This course also involves essential core java concepts like multithreading, file handling, event handling etc.					
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Advanced Java Programming and attain Employability through Experiential Learning techniques.					
Course Outcomes	On successful completion of this course the students shall be able to: Explain the benefits of Design-Pattern & SOLID principle in java based applications. Understand Concurrent Programming using Java Multi-Threading. Apply Communication mechanisms of Java with DBMS. Implement Web MVC application using Servlet and JSP Technology. Test JPA Implementation using Hibernate.					
Course Content:						

Module 1	Multi-Threading (Comprehension)	Assignment	Knowledge Ability	10 sessions
Topics: Multi-Threading in Java: Understanding Threads , Needs of Multi-Threaded Programming ,Thread Life-Cycle, Thread Priorities ,Synchronizing Threads, Inter Communication of Threads ,Critical Factor in Thread –DeadLock, The Executor Framework.				
Module 2	Input & Output Operation in Java (Comprehension)	Assignment	File Operations	10 sessions
Topics: Java I/O Operations : Input/Output Operation in Java(java.io Package),Streams and the new I/O Capabilities ,Understanding Streams, Working with File Object, File I/O Basics, Reading and Writing to Files, Buffer and Buffer Management, Read/Write Operations with File Channel, Serializing Objects, Observer and Observable Interfaces.				
Module 3	Collection and Database programming using JDBC (Comprehension)	Assignment	Data Storage	10 sessions
Topics: Collection - The Collection Framework : Collections of Objects , Collection Types, Sets , Sequence, Map, Understanding Hashing, Uses of ArrayList & Vector , Comparable and Comparator Interfaces. Database Programming using JDBC- Introduction to JDBC, JDBC Drivers & Architecture, CRUD operation Using JDBC, Connecting to non-conventional Databases.				
Module 4	Distributed Programming with Servlet (Application)	Assignment	Distributed Programming	10 sessions
Topics: Servlet - Web Application Basics, Architecture and challenges of Web Application, Introduction to servlet, Servlet life cycle, Developing and Deploying Servlets, Create and compile servlet source code, start tomcat, start a web browser and request the servlet, servlet API, Handling HTTP Requests and Responses: Handling HTTP GET requests and POST request, Session Tracking, Simple Servlet Program to fetch database records				
Module 5	Distributed Programming with JSP (Application), Introduction to Spring	Assignment	Distributed Programming	5 sessions

	Framework (Application)			

Topics:

JSP - Introduction to JSP, Creating simple JSP Programs, How JSP is processed, JSP Scripting Constructs, Predefined Variables, JSP Directives, Simple JSP Program to fetch database records.
Spring CORE, Overview of Spring, Spring Architecture, bean life cycle, Java and XML Configuration on Spring, Spring Different Modules.
Spring JPA, JPA Specification, Classes and Interfaces, Object Relational Mapping using JPA, JPA implementation with Hibernate, Simple JPA-Hibernate program to Create Database schemas.

List of Laboratory Tasks:

Labsheet -1 [4 + 1 Practical Sessions]
Experiment No 1:
Level 1: Demonstration of Thread Class and Runnable Interface.
Level 2 – Implementation of Producer-Consumer Problem.
Labsheet -2 [3 +1 Practical Sessions]
Experiment No. 1:
Level 1 – Usages of Java.io.* package.
Level 2 – File operations with a case study.

Labsheet – 3 [3 +1 Practical Sessions]
Experiment No. 1:
Level 1 – Practicing classes and methods in java.util.collection.
Level 2 – Scenario based questions to apply all collections. [Group wise]

Labsheet – 4 [3 + 1 Practical Sessions]
Experiment No. 1:
Level 1 – JDBC complete Demonstration with Student Database
Level 2 – Implementation of Student Information Management (Standalone). [Group wise]

Labsheet – 5 [3 + 1 Practical Sessions]
Experiment No. 1:
Level 1 – Web page creation using HTML, Dynamic web page using java.servlet and JDBC
Level 2 – Implementation of Student Information Management (WEB based). [Group wise]

Labsheet – 6 [3 + 1 Practical Sessions]
Experiment No. 1:
Level 1 – Web page creation using HTML, Dynamic web page using java.servlet , JSP and JDBC
Level 2 – Implementation of Student Database using JPA Hibernate

Build a Standalone database application using Java Swing as Front End. Indicative areas include; TimeTable Management, Student Expense Tracker, Important Mail Fetcher, etc.
Build a real time database application using J2EE as Front End. Indicative areas include;

health care, education, industry, Library, Transport and supply chain, etc.
Text Books Cay S Horstmann and Gary Cornell, “CORE JAVA volume II-Advanced Features, 9th Edition.
References Herbert Schildt, *“Java 2: The Complete Reference”*, Tata McGraw-Hill Education,6th Edition. Y.Daniel Liang, “Introduction to Java programming Comprehensive Version”, Pearson Education, 10th Edition. Core and Advanced Java Black Book, Dream Tech Press. Spring in Action , Graig Walls, 5th Edition Java Persistence with Hibernate , Christian Bauer & Gavin King, 2nd Edition https://www.youtube.com/watch?v=JGNTYXkVCVY&list=PLd3UqWTnYXOkTSBCBNyyhxo_jxlY_uTWA&index=2
Topics relevant to “Employability”: Create and compile servlet source code, start tomcat, start a web browser and request the servlet for Employobility through Experiential Learning techniques. This is attained through assessment component mentioned in course handout

CSA3024: ADVANCE PYTHON

Course Code: CSA3024	Course Title: ADVANCE PYTHON Type of Course: Elective	L-T- P- C	2	0	2	3
Version No.	1.0					
Course Pre-requisites	Nil					
Anti-requisites	Nil					
Course Description	The advanced Python course covers a wide range of topics and skills to enhance your proficiency in Python programming. Throughout the course, you will delve into advanced concepts such as neural networks, web scraping, data analysis, building RESTful APIs, natural language processing, image processing, and data visualization. By completing this course, student will have a solid understanding of advanced Python techniques and be well-equipped to tackle complex programming tasks, analyze data, build applications, and work on projects in various domains.					
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Advance Python and attain Skill Development through Experiential Learning techniques.					
Course Outcomes	Knowledge of training and testing the datasets using machine Learning techniques. Design a models through machine learning algorithm. Apply optimization and parameter tuning techniques for machine Learning algorithms. Apply a machine learning model to solve various problems using machine					

	learning algorithms.			
Course Content:				
Module 1	Introduction to Advanced Python Concepts	Assignment		4 Sessions
Topics: Recap of Python basics and syntax Introduction to advanced data structures and libraries (NumPy, Pandas, etc.) Overview of object-oriented programming (OOP) concepts and principles				
Module 2	Neural Networks and Deep Learning	Assignment		5 Sessions
Topic: Introduction to neural networks and their architecture Understanding activation functions, backpropagation, and gradient descent Exploring deep learning frameworks like TensorFlow or PyTorch				
Module 3	Web Scraping and Data Analysis	Case Study		8 Sessions
Topics: A.Introduction to web scraping and HTML parsing B.Working with web scraping libraries (BeautifulSoup, Scrapy) C.Data cleaning, manipulation, and analysis using Pandas				
Module 4	Building RESTful APIs	Case Study and Project		13 Sessions
Topics: Understanding the principles of REST and API design Building APIs with Flask or Django frameworks Handling authentication, request/response formats, and error handling				
Module 4	Natural Language Processing (NLP)	Case Study and Project		
Topics: Introduction to NLP and its applications Text preprocessing techniques (tokenization, stemming, etc.) Text classification, sentiment analysis, and named entity recognition				
Module 5	Image Processing and Computer Vision	Case Study and Project		
Topics: Overview of image processing techniques (filters, transformations, etc.) Introduction to computer vision libraries (OpenCV) Object detection and image recognition algorithms				
Module 6	Data Visualization with			

	Interactive Dashboards		
Topics: Introduction to data visualization principles and best practices Creating interactive visualizations with Plotly or Bokeh Building interactive dashboards for data exploration			

Basics: Use UCI repository and Kaggle dataset for each experiments. Introduction to Python Stack for Data Science, Core Python Libraries for data analysis, Anaconda platform and its installation, Executing programs on Jupiter IDE.

Experiment 1

Implementation of a Neural Network:

L1-Build a neural network from scratch using NumPy or TensorFlow.
L2- Train the network on a dataset and evaluate its performance.

Experiment 2

Web Scraping and Data Analysis:

L1- Scrape data from a website using libraries like BeautifulSoup or Scrapy.,
L2-Perform data analysis and visualization on the scraped data using Pandas and Matplotlib.

Experiment 3:

Building a RESTful API:

L1-Create a RESTful API using a web framework like Flask or Django.
L2-Implement CRUD (Create, Read, Update, Delete) operations for a specific resource.

Experiment 4

Natural Language Processing (NLP) Project:

L1- Develop a text classification or sentiment analysis model using NLP libraries like NLTK or spaCy

L2- .Apply the model to analyze text data and extract meaningful insights.

Experiment 5

Image Processing and Computer Vision:

L1- Implement image processing techniques such as edge detection, image filtering, or object detection using libraries like OpenCV.
L2- Build a simple image recognition system using machine learning algorithms.

Experiment 6 Data Visualization with Interactive Dashboards: L1- Create interactive dashboards using libraries like Plotly or Bokeh. L2- Visualize data in various formats (e.g., charts, maps) and add interactive features for exploration.
Text Books Manaranjan Pradhan, U Dinesh Kumar, “Machine Learning Using Python” Wiley, First Edition 2019. Fluent Python, 2nd Edition Released April 2022, Publisher(s): O'Reilly Media, Inc., ISBN: 9781492056355 Python Cookbook" by David Beazley and Brian K. Jones
Web References https://nptel.ac.in/courses/ https://www.udemy.com/course/ https://www.coursera.org/learn/

CSA3022: Advanced Java

Course Code: CSA3022	Course Title: Advanced Java Type of Course:1] School Core 2] Laboratory integrated	L-T-P- C	1	0	4	3
Version No.	1.0					
Course Pre-requisites	OOPS using Java					
Anti-requisites	NIL					
Course Description	The purpose of this course is to introduce the students to Java Advanced API enhanced by Design Patterns and SOLID Principles. The course is both conceptual and analytical and is understood with JDK 8 software & IntelliJ IDE. This course develops critical thinking skills by augmenting the student’s ability to develop distributed model for control of various modern management systems like banking management system, student information management system, , Library Management System etc. w*ith* the necessary API for communication with database enhanced by the current industrial approach of Java’s SOLID principle and design patterns. This course also involves essential core java concepts like multithreading, file handling, event handling etc.					

Course Objectives	The objective of the course is to familiarize the learners with the concepts of Advanced Java Programming and attain Employability through Experiential Learning techniques.			
Course Outcomes	On successful completion of this course the students shall be able to: Explain the benefits of Design-Pattern & SOLID principle in java based applications. Understand Concurrent Programming using Java Multi-Threading. Apply Communication mechanisms of Java with DBMS. Implement Web MVC application using Servlet and JSP Technology. Test JPA Implementation using Hibernate.			
Course Content:				
Module 1	Multi-Threading (Comprehension)	Assignment	Knowledge Ability	10 sessions
Topics: Multi-Threading in Java: Understanding Threads , Needs of Multi-Threaded Programming ,Thread Life-Cycle, Thread Priorities ,Synchronizing Threads, Inter Communication of Threads ,Critical Factor in Thread –DeadLock, The Executor Framework.				
Module 2	Input & Output Operation in Java (Comprehension)	Assignment	File Operations	10 sessions
Topics: Java I/O Operations : Input/Output Operation in Java(java.io Package),Streams and the new I/O Capabilities ,Understanding Streams, Working with File Object, File I/O Basics, Reading and Writing to Files, Buffer and Buffer Management, Read/Write Operations with File Channel, Serializing Objects, Observer and Observable Interfaces.				
Module 3	Collection and Database programming using JDBC (Comprehension)	Assignment	Data Storage	10 sessions
Topics: Collection - The Collection Framework : Collections of Objects , Collection Types, Sets , Sequence, Map, Understanding Hashing, Uses of ArrayList & Vector , Comparable and Comparator Interfaces. Database Programming using JDBC- Introduction to JDBC, JDBC Drivers & Architecture, CRUD operation Using JDBC, Connecting to non-conventional Databases.				
Module 4	Distributed Programming with Servlet (Application)	Assignment	Distributed Programming	10 sessions
Topics: Servlet - Web Application Basics, Architecture and challenges of Web Application,				

Introduction to servlet, Servlet life cycle, Developing and Deploying Servlets, Create and compile servlet source code, start tomcat, start a web browser and request the servlet, servlet API, Handling HTTP Requests and Responses: Handling HTTP GET requests and POST request, Session Tracking, Simple Servlet Program to fetch database records

Module 5	Distributed Programming with JSP (Application), Introduction to Spring Framework (Application)	Assignment	Distributed Programming	5 sessions

Topics:

JSP - Introduction to JSP, Creating simple JSP Programs, How JSP is processed, JSP Scripting Constructs, Predefined Variables, JSP Directives, Simple JSP Program to fetch database records.
Spring CORE, Overview of Spring, Spring Architecture, bean life cycle, Java and XML Configuration on Spring, Spring Different Modules.
Spring JPA, JPA Specification, Classes and Interfaces, Object Relational Mapping using JPA, JPA implementation with Hibernate, Simple JPA-Hibernate program to Create Database schemas.

List of Laboratory Tasks:

Labsheet -1 [4 + 1 Practical Sessions]
Experiment No 1:
Level 1: Demonstration of Thread Class and Runnable Interface.
Level 2 – Implementation of Producer-Consumer Problem.
Labsheet -2 [3 +1 Practical Sessions]
Experiment No. 1:
Level 1 – Usages of Java.io.* package.
Level 2 – File operations with a case study.

Labsheet – 3 [3 +1 Practical Sessions]
Experiment No. 1:
Level 1 – Practicing classes and methods in java.util.collection.
Level 2 – Scenario based questions to apply all collections. [Group wise]

Labsheet – 4 [3 + 1 Practical Sessions]
Experiment No. 1:
Level 1 – JDBC complete Demonstration with Student Database
Level 2 – Implementation of Student Information Management (Standalone). [Group wise]

Labsheet – 5 [3 + 1 Practical Sessions]
Experiment No. 1:
Level 1 – Web page creation using HTML, Dynamic web page using java.servlet and JDBC
Level 2 – Implementation of Student Information Management (WEB based). [Group wise]

Labsheet – 6 [3 + 1 Practical Sessions]
Experiment No. 1:
Level 1 – Web page creation using HTML, Dynamic web page using java.servlet , JSP and

JDBC Level 2 – Implementation of Student Database using JPA Hibernate
Build a Standalone database application using Java Swing as Front End. Indicative areas include; TimeTable Management, Student Expense Tracker, Important Mail Fetcher, etc. Build a real time database application using J2EE as Front End. Indicative areas include; health care, education, industry, Library, Transport and supply chain, etc.
Text Books Cay S Horstmann and Gary Cornell, “CORE JAVA volume II-Advanced Features, 9th Edition.
References Herbert Schildt, *“Java 2: The Complete Reference”*, Tata McGraw-Hill Education,6th Edition. Y.Daniel Liang, “Introduction to Java programming Comprehensive Version”, Pearson Education, 10th Edition. Core and Advanced Java Black Book, Dream Tech Press. Spring in Action , Graig Walls, 5th Edition Java Persistence with Hibernate , Christian Bauer & Gavin King, 2nd Edition https://www.youtube.com/watch?v=JGNTYXkVCVY&list=PLd3UqWTnYXOkTSBCBNyyhxo_jxlY_uTWA&index=2
Topics relevant to “Employability”: Create and compile servlet source code, start tomcat, start a web browser and request the servlet for Employobility through Experiential Learning techniques. This is attained through assessment component mentioned in course handout

CSA3027: Cryptography and Network Security

Course Code: CSA3027	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	“Data Communications and Computer Networks”					
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 (Knowledge) CO2: Express the different types of Cryptographic Algorithms (Comprehension) CO3: Recognize the Public key Cryptographic Techniques for various applications. (Comprehension)					

	CO4: Apply the network security concepts during their implementation of network security application developments. (Application)			
Course Content:				
Module 1	Introduction to Cryptography and types of Ciphers	Assign ment	Data Collection/Interpr etation	8 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	13 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	14 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:
https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=fBYckQKJvP3a/8Vd3L08tQ
https://onlinecourses.nptel.ac.in/noc22_cs90/preview

Topics relevant to "EMPLOYABILITY SKILLS": Helman Key exchange, Man in the middle attack, Cryptographic Hash functions, Secure Hash Algorithm for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout..

CSA3028: Embedded Systems

Course Code: CSA3028	Course Title: Embedded Systems Type of Course: Discipline Elective	L-T- P- C	3	0	0	3
Version No.	1.0					
Course Pre-requisites	Before attempting this course the student should have prior knowledge of Comparison between microprocessors and microcontrollers, Instruction set of microprocessors and microcontrollers, Real world interfacing, Embedded C programming.					
Anti-requisites	NIL					
Course Description	The course provides insights into the fundamentals of Embedded Systems and their design using ARM microcontrollers. This course demonstrates System design examples and case studies for real-world applications. This course also gives brief introduction of Embedded Real Time Operating System (RTOS).					
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Embedded Systems and attain Employability Skills through Participative Learning techniques.					

Course Out Comes	On successful completion of this course the students shall be able to: Describe Embedded Systems and their Interfacing to the Analogue world Distinguish between various ARM architecture versions Program ARM processors using Assembly and C Languages Understand the concept of Real Time Operating systems			
Course Content:				
Module 1	Fundamentals of Embedded Systems	Assignment	Programming activity	9 Hours
Topics: What is an Embedded System?, Inside the Embedded System, Embedded Processors, Memory Systems, Basic Peripherals, Interfacing to the Analogue world, Interrupts and Exceptions.				
Module 2	ARM Architecture	Assignment	Programming activity	12 Hours
Topics: Introduction to ARM® and ARM® Architecture, Cortex™-M TM4C123X processor, Comparing ARM® Cortex™-M TM4C123X processor with LPC21xx architecture, ARM and Thumb Instruction Set Overview, ARM Addressing Modes, ARM Assembly Programming.				
Module 3	ARM Programming and Interfacing	Assignment	Programming activity	12 Hours
Topics: Embedded C Programming– Conditional Statements, Loop Statements, debugging, single stepping, breakpoints, Concepts of Input and Output Ports, Basics of Interfacing Switches and LEDs, Interfacing Stepper Motors and DC Motors, Serial Communication, USB, RS232, CAN BUS, MOD BUS, I2C.				
Module 4	Real Time Operating Systems (RTOS)	Assignment	Programming activity	12 Hours
Topics: Introduction to Embedded Real Time Operating Systems (RTOS), Types of RTOS, Architecture of Embedded RTOS, Kernel in RTOS, Overview of various systems:- MicroC/OS-II, VX Works, RTLinux, Free RTOS, Differences in operating systems.				
Targeted Application & Tools that can be used: Editor: A text editor is the first tool you need to begin creating an embedded system, Compiler, Source code is written in a high-level programming language, Assembler, Debugger, Linker, Emulator, Integrated Development Environment (IDE), PyCharm.				
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course				
Problem Solving: Choose an appropriate tool to design Embedded and Tiny Embedded Systems. Programming: Implementation of the chosen applications.				
Text Book Andrew N. Sloss, Dominic Symes, Chris Wright, “ARM System Developer's Guide, Designing				

and Optimizing System Software", Morgan Kaufmann Publishers, 2nd Edition.
Alexander G. Dean, "Embedded Systems Fundamentals with Arm Cortex M Based Microcontrollers: A Practical Approach", ARM Education Media, 2nd Edition
K.V.K.K.Prasad, "Embedded Real-Time Systems: Concepts, Design & Programming", Dream Tech Press, 2010, 3rd Edition
Steve Heath, "Embedded System Design", Elsevier India, 2nd Edition.

Web Links:

Joseph Sifakis, "Embedded systems design - Scientific challenges and work directions 2009 Design", Automation & Test in Europe Conference & Exhibition https://ieeexplore.ieee.org/document/5090623
Gabor Karsai; Fabio Massacci; Leon Osterweil; Ina Schieferdecker, "Evolving Embedded Systems", Computer , VOL. 43, issue 5 https://ieeexplore.ieee.org/document/5472888
Sachin P. Kamat, "An eye on design: Effective embedded system software", IEEE Potentials, VOL. 29, issue 5 https://ieeexplore.ieee.org/document/5568178
Yanbing Li; M. Potkonjak; W. Wolf, "Real-time operating systems for embedded computing", IEEE International Conference on Computer Design: VLSI in Computers and Processors, (ICCD), 12-15 Oct. 1997 https://ieeexplore.ieee.org/document/628899

References

Jonathan W. Valvano, "Embedded Systems: Introduction to Arm® Cortex™-M Microcontroller- Vol 01", CreateSpace Independent Publishing Platform, 1st Edition
Jonathan W. Valvano, "Embedded Systems: Real-Time Operating Systems for Arm® Cortex™-M Microcontrollers", CreateSpace Independent Publishing Platform, 1st Edition.
ARM Cortex Datasheet available on (https://www.arm.com/)
Raymond J.A. Buhr, Donald L.Bailey, "An Introduction to Real-Time Systems- From Design to Networking with C/C++", Prentice Hall, 1st Edition

Topics relevant to "EMPLOYABILITY SKILLS": ARM architecture, ARM Programming, Real Time Operating Systems for developing Employability Skills through Participative Learning. This is attained through assessment component mentioned in course handout.

CSA3029 Storage Area Networks

Course Code: CSA3029	Course Title: Storage Area Networks Type of Course: Discipline elective	L- T- P- C	3	0	0	3
Version No.	1					
Course Pre-requisites	Basics of information storage					
Anti-requisites						
Course Description	The course aims to equip students with basic introduction to Storage Area Networks, including storage architectures, logical and physical components of a storage infrastructure, managing and monitoring the data center and basic Disaster Recovery principles.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Storage Area Networks attain Employability through Experiential Learning techniques.					
Course Out Comes	On successful completion of the course the students shall be able to: CO1 Identify key challenges in managing information and analyze					

	different storage networking technologies. [Understanding] CO2 Explain physical and logical components of a storage infrastructure of RAID, and intelligent storage systems. [Comprehension] CO3 Describe Object and Content addressed storage and storage virtualization. [Comprehension] CO4 Articulate business continuity solutions—backup and archive for managing fixed content. [Application]			
Course Content:				
Module 1	Storage System: Introduction to Information Storage	Assignment	Data Collection/Interpretation	10 Sessions
Topics: Information Storage, Evolution of Storage Architecture, Data Center Infrastructure, Virtualization and Cloud Computing. Data Center Environment: Application Database Management System (DBMS), Host (Compute), Connectivity, Storage, Disk Drive Components, Disk Drive Performance, Host Access to Data, Direct-Attached Storage, Storage Design Based on Application				
Module 2	Data Protection – RAID, Intelligent Storage Systems	Case studies / Case let	Case studies / Case let	08 Sessions
Topics: RAID Implementation Methods, RAID Array Components, RAID Techniques, RAID Levels, RAID Impact on Disk Performance, RAID Comparison. Intelligent Storage Systems: Components of an Intelligent Storage System, Types of Intelligent Storage Systems.				
Module 3	Object-Based and Unified Storage	Quiz	Case studies / Case let	08 Sessions
Topics: Object-Based Storage Architecture: Components of OSD, Object Storage and Retrieval in OSD, Benefits of Object-Based Storage, Content-Addressed Storage. Virtualization in SAN: Block-level Storage Virtualization, Virtual SAN (VSAN)				
Module 4	Backup and Archive, Replication	Quiz	Case studies / Case let	10 Sessions
Backup Purpose, Backup Considerations, Backup Granularity, Recovery Considerations, Backup Methods, Backup Architecture, Backup and Restore Operations, Backup Topologies, Backup in NAS Environments. Local Replication: Replication Terminology, Uses of Local Replicas, Replica Consistency, Local Replication Technologies, Tracking Changes to Source and Replica, Restore and Restart Considerations, Creating Multiple Replicas. Remote Replication: Modes of Remote Replication, Remote Replication Technologies.				
Targeted Application & Tools that can be used:				
Project work/Assignment:				
Assignment: Group Seminar/Quiz				
Text Book **T1.** G. Somasundaram, Alok Shrivastava. "*Information Storage and Management*", EMC Education Services, Wiley India. 2nd Edition.2012.				
References R1. Ulf Troppens, Rainer Erkens and Wolfgang Muller. "*Storage Networks Explained*", Wiley India. 2nd Edition.2015. **R2.** Rebert Spalding. "*Storage Networks The Complete Reference*", Tata McGraw Hill, Indian Edition.2017. **R3.** Richard Barker and Paul Massiglia. "Storage Area Networks *Essentials A Complete*				

Guide to Unde standing and Implementing SANs", Wiley. 1st Edition.2008. **E-Resource: pu.informatics.global.** R3 Web resources: Students may find articles and significance of SAN at https://www.ibm.com/topics/storage-area-network and EMC² and may refer an eBook on "Storage Area Network Essentials" A Complete Guide to Understanding and Implementing SANs by Richard Barker, Paul Massiglia
Topics relevant to "EMPLOYABILITY SKILLS": Block-level Storage Virtualization, Virtual SAN (VSAN) for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

CSA3032 Semantic Web Technologies

Course Code: CSA3032	Course Title: SEMANTIC WEB TECHNOLOGIES Type of Course: Discipline Elective			L- T- P- C	3	0	0	3
Version No.	1.01.0							
Course Pre-requisites	Object Oriented Programming Web Technologies							
Anti-requisites	NIL							
Course Description	The aim of this course is to teach the students the concepts, technologies and techniques underlying and making up the Semantic Web. At the end of the course the student should be able to: understand and discuss fundamental concepts, advantages and limits of the semantic web; understand and use ontologies in the context of Computer Science and the semantic web; use the RDF framework and associated technologies such as RDFA; understand the relationship between Semantic Web and Web 2.0.							
Course Objective	The objective of the course is to familiarize the learners with the concepts of Semantic Web Technologies and attain Employability Skills through Participative Learning techniques.							
Course Outcomes	On successful completion of this course the students shall be able to: Explain the basics of Semantic Web and Social Networks. [Knowledge] Describe Knowledge Representation for the RDF [Comprehension] Illustrate the role of ontology and inference engines in semantic web [Application] Demonstrate the applications of Semantic Web [Application]							
Course Content:								
Module 1	Introduction to Web Semantics	Assignment/ Quiz	Building Models	10 Sessions				
Topics: Introduction to Web Intelligence, the World Wide Web, Building Models, Semantic Web Technologies, XML Programming. Assignment: Building Models								
Module 2	XML & RDF	Assignment	Resource Description	10				

			Framework,	Sessions
Topics: Modeling Information, Extensible Markup Language, Metadata and Data in Information Sharing, Resource Description Framework, RDF Schema Assignment: Resource Description Framework				
Module 3	Ontology in Semantic Web	Case study	Constructing Ontology	10 Sessions
Topics: Ontology Engineering, Constructing Ontology, Ontology Development Tools, Ontologies in OWL, Ontologies for Standardizations. Assignment: Constructing Ontology				
Module 4	Data Security & Event Logging	Case study	Application of Semantic Web	10 Sessions
Topics: Application of Semantic Web, Web 2.0, Web Data Exchange and Syndication, Semantic Wikis, Semantic Web in Life Sciences, e-learning Assignment: Application of Semantic Web				
Targeted Application & Tools that can be used: Search engine development, Facebook's open graph protocol, siri is a powerfull realization of the semantic web, yahoo, facebook, social networks based applications Professionally Used Software:				
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): T1.Pascal Hitzler, Markus Krötzsch, Markus Krötzsch "Foundations of Semantic Web Technologies" CRC publication 2008 T2.John hebeler, Mathew fisher "Semantic Web Programming" 1st Edition Wiley; 1st edition (March 27, 2009)				
Reference(s): Reference Book(s): R1.Semantic Web Technologies, Trends and Research in Ontology Based Systems, J. Davies, R. Studer, P. Warren, John Wiley & Sons,2018. R2.Semantic Web and Semantic Web Services -Liyang Lu Chapman and Hall/CRC Publishers,(Taylor & Francis Group) R3.Information sharing on the semantic Web – Heiner Stuckenschmidt; Frank Van Harmelen, Springer Publications. R4.Programming the Semantic Web, T. Segaran, C. Evans, J. Taylor, O'Reilly, SPD,2020. Online Resources (e-books, notes, ppts, video lectures etc.): 1. Semantic Web Technology - an overview | ScienceDirect Topics 2. Semantic Web Technologies | openHPI 3. Semantic Web Technologies for e-Learning: Models and Implementation (vu.lt)				

Topics relevant to “EMPLOYABILITY SKILLS”: Concepts of Semantic Web Technologies, Web Data Exchange and Syndication, Semantic Wikis, Semantic Web in Life Sciences for developing Employability Skills through Participative Learning. This is attained through assessment component mentioned in course handout.

CSA3033 Robotic Process Automation

Course Code: CSA3033	Course Title: Robotic Process Automation Type of Course: Theory	L- P- T-C	3	0	0	3
Version No.	1.0					
Course Pre-requisites	Basic Programming Concepts.					
Anti-requisites	NIL					
Course Description	Through real-world, pertinent data preparation use cases, this course aims to equip students with practical literacy in robotic process automation. It will help identify potential uses, benefits, and considerations of robotic process automation.					
Course Outcomes	On successful completion of this course the students shall be able to: Describe RPA, where it can be applied, and how it's implemented. Describe the different types of variables, control flow, and data manipulation techniques. Identify and understand image, text, and data table automation. Describe how to handle user events and various types of exceptions and strategies. Understand the deployment of the robot and how to maintain the connection.					
Course Content:						
Module 1	Introduction to robotic process automation	Assignment			08 Classes	
Topics: Scope and techniques of automation, Robotic process automation - What can RPA do?, Benefits of RPA, Components of RPA, RPA platforms, The future of automation. RPA Basics: History of Automation - What is RPA - RPA vs Automation - Processes & Flowcharts - Programming Constructs in RPA - What Processes can be Automated - Types of Bots - Workloads which can be automated - RPA Advanced Concepts - Standardization of processes - RPA Development methodologies - Difference from SDLC - Robotic control flow architecture - RPA business case - RPA Team - Process Design Document/Solution Design Document - Industries best suited for RPA - Risks & Challenges with RPA - RPA and emerging ecosystem.						
Module 2	RPA tool introduction	Assignment			08 Classes	

	and basics			
Topics: Introduction to RPA Tool - The User Interface - Variables - Managing Variables - Naming Best Practices - The Variables Panel - Generic Value Variables - Text Variables - True or False Variables - Number Variables - Array Variables - Date and Time Variables - Data Table Variables - Managing Arguments - Naming Best Practices - The Arguments Panel - Using Arguments - About Imported Namespaces - Importing New Namespaces- Control Flow - Control Flow Introduction - If Else Statements - Loops - Advanced Control Flow - Sequences - Flowcharts - About Control Flow - Control Flow Activities - The Assign Activity - The Delay Activity - The Do While Activity - The If Activity - The Switch Activity - The While Activity - The For Each Activity - The Break Activity - Data Manipulation - Data Manipulation Introduction - Scalar variables, collections and Tables - Text Manipulation - Data Manipulation - Gathering and Assembling Data.				
Module 3	Advanced automation concepts & techniques	Assignment		08 Classes
Topics: Recording Introduction - Basic and Desktop Recording - Web Recording - Input/Output Methods - Screen Scraping - Data Scraping - Scraping advanced techniques - Selectors - Defining and Assessing Selectors - Customization - Debugging - Dynamic Selectors - Partial Selectors - RPA Challenge - Image, Text & Advanced Citrix Automation - Introduction to Image & Text Automation - Image based automation - Keyboard based automation - Information Retrieval - Advanced Citrix Automation challenges - Best Practices - Using tab for Images - Starting Apps - Excel Data Tables & PDF - Data Tables in RPA - Excel and Data Table basics - Data Manipulation in excel – Extracting Data from PDF - Extracting a single piece of data - Anchors - Using anchors in PDF.				
Module-4	Handling user events & assistant bots, exception handling	Assignment		08 Classes
Topics: Assistant bots - Monitoring system event triggers - Hotkey trigger - Mouse trigger - System trigger - Monitoring image and element triggers - An example of monitoring email - Example of monitoring a copying event and blocking it - Launching an assistant bot on a keyboard event. Exception handling: Debugging and Exception Handling - Debugging Tools - Strategies for solving issues - Catching errors.				
Module-5	Deploying and maintaining the bot	Assignment		08 Classes
Topics: Publishing using publish utility - Creation of Server - Using Server to control the bots - Creating a provision Robot from the Server - Connecting a Robot to Server - Deploy the Robot to Server - Publishing and managing updates - Managing packages - Uploading packages - Deleting packages.				
Project work/Assignment:				
Assignment 1 on (Module 1 and Module 2)				

Assignment 2 on (Module 3 and Module 4) Assignment on (Module 5)
REFERENCE MATERIALS: TEXTBOOKS Alok Mani Tripathi, "*Learning Robotic Process Automation*", Packt Publishing, 2018. REFERENCES Frank Casale , Rebecca Dilla, Heidi Jaynes , Lauren Livingston, "*Introduction to Robotic Process Automation: a Primer*", Institute of Robotic Process Automation,1st Edition 2015. Richard Murdoch, "*Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant*", Independently Published, 1st Edition 2018. Srikanth Merianda, "*Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation"*, Consulting Opportunity Holdings LLC, 1st Edition 2018. Lim Mei Ying, "*Robotic Process Automation with Blue Prism Quick Start Guide: Create software robots and automate business processes*", Packt Publishing, 1st Edition 2018. JOURNALS/MAGAZINES IEEE Transactions on Automation Science and Engineering ACM Transactions on Software Engineering and Methodology IEEE Robotics and Automation Letters Information Systems, Elsevier Computers in Industry, Elsevier WEB RESOURCES: https://www.coursera.org/specializations/roboticprocessautomation https://www.uipath.com/rpa/robotic-process-automation https://www.academy.uipath.com

CSA3034 Parallel Computing

Course Code: CSA3034	Course Title: Parallel Computing Type of Course: Discipline Elective	L-T-P-C	1	0	4	3
Version No.	1.0					
Course Pre-requisites	Nil					
Anti-requisites	NIL					
Course Description	To study the scalability & clustering issues, understand the technologies used for parallel computation, study the different inter connection networks and the different software programming models. `					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Parallel Computing and attain Employability Skills through Experiential Learning techniques.					

<table>
<tr><td>Course Out Comes</td><td colspan="4">On successful completion of the course the students shall be able to:
Study the scalability and clustering issues and the technology necessary for them. [Knowledge]
Understand the technologies enabling parallel computing. [Comprehension]
Practice the different types of interconnection networks. [Application]
Demonstrate the software support needed for shared memory programming. [Application]</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>SCALABILITY AND CLUSTERING</td><td>Quizzes and assignments</td><td>Simulation</td><td>15Sessions</td></tr>
<tr><td colspan="5">Evolution of Computer Architecture – Dimensions of Scalability – Parallel Computer Models – Basic Concepts Of Clustering – Scalable Design Principles – Parallel Programming Overview – Processes, Tasks and Threads – Parallelism Issues – Interaction / Communication Issues – Semantic Issues In Parallel Programs.</td></tr>
<tr><td>Module 2</td><td>SYSTEM INTERCONNECTS</td><td>Quizzes and assignments</td><td>Simulation</td><td>15 Sessions</td></tr>
<tr><td colspan="5">Basics of Interconnection Networks – Network Topologies and Properties – Buses, Crossbar and Multistage Switches, Software Multithreading – Synchronization Mechanisms.</td></tr>
<tr><td>Module 3</td><td>PARALLEL PROGRAMMING</td><td>Term paper/Assignment</td><td>Simulation</td><td>15 Sessions</td></tr>
<tr><td colspan="5">Paradigms And Programmability – Parallel Programming Models – Shared Memory Programming.</td></tr>
<tr><td>Module 4</td><td>MESSAGE PASSING PROGRAMMING</td><td>Term paper/Assignment</td><td>Simulation</td><td>15 Sessions</td></tr>
<tr><td colspan="5">Message Passing Paradigm – Message Passing Interface – Parallel Virtual Machine.</td></tr>
<tr><td colspan="5">List of Laboratory Tasks:
Basics of MPI (Message Passing Interface)
To learn Communication between MPI processes
To get familiarized with advance communication between MPI
Study of MPI collective operations using ‘Synchronization’
Study of MPI collective operations using ‘Data Movement’
Study of MPI collective operations using ‘Collective Computation’
To understand MPI Non-Blocking operation
Basics of OpenMP API (Open Multi-Processor API)
To get familiarized with OpenMP Directives
Sharing of work among threads using Loop Construct in OpenMP
Clauses in Loop Construct
Sharing of work among threads in an OpenMP program using ‘Sections Construct’
Sharing of work among threads in an OpenMP program using ‘Single Construct’
Use of Environment Variables in OpenMP API</td></tr>
<tr><td colspan="5">Targeted Application & Tools that can be used:
Any IDE – JDK, NetBeans and etc.</td></tr>
<tr><td colspan="5">Assignment:</td></tr>
</table>

Assignments are given after completion of each module which the student need to submit within the stipulated deadline.
Text Book Kai Hwang and Zhi.Wei Xu, “Scalable Parallel Computing”, Tata McGraw-Hill, New Delhi, 2003.
References David E. Culler & Jaswinder Pal Singh, “Parallel Computing Architecture: A Hardware/Software Approach”, Morgan Kaufman Publishers, 1999. Michael J. Quinn, “Parallel Programming in C with MPI & OpenMP”, Tata McGraw-Hill, New Delhi, 2003. Kai Hwang, “Advanced Computer Architecture” Tata McGraw-Hill, New Delhi, 2003. E-Resources https://onlinecourses.nptel.ac.in/noc21_cs39/preview(Introduction to Parallel Computing) https://www.coursera.org/courses?query=parallel%20computing https://online.stanford.edu/courses/cs149-parallel-computing https://presiuniv.knimbus.com/user#/home https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=2706929&site=ehostlive
Topics relevant to “EMPLOYABILITY SKILLS”: Message Passing Interface – Parallel Virtual Machine for developing Employability Skills through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

CSA2018- Data Modelling and Visualization

Course Code: CSA2018	**Course Title:** Data Modeling and Visualization **Type of Course:Integrated**	**L-T-P-C**	2	0	2	3
Version No.	1.0					
Course Pre-requisites	Programming in Python.					
Anti-requisites	NIL					
Course Description	A Data Scientist’s ability to structure problems is crucial. A smart Data Scientist may build and represent an informative visualization, showcasing the raw Data and business activities, associate with the Key Performance, Indicator and business use cases, such as new Customer Acquisition, Product Design, desk location to reduce distraction and so on. All these factors are considered while carrying out the process of Data Science Modeling.					

	Topics include: Data Science, Missing Data, Outliers, Feature Scaling, Data Visualization, Graphs, Trees.			
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: 1. Break down the business problem into a procedural flow. **[Application]** 2. Apply the EDA to get familiarized with the Data by extracting useful insights. **[Application]** 3. Identify the features that contribute the most to the prediction variable. **[Knowledge]** 4. Understand data by visualization it so that patterns, trends and correlations can be identified.**[Comprehension]**			
Course Content:				
Module 1	Introduction	Assignment	Programming	**No. of Sessions:10**
Topics: Introduction to Data Science: Key skills required in Data Science, Need for Data Science, Steps involved in Data Modeling, Understanding the problem, Data Extraction, Imputing Missing Data, Encoding Categorical Variables, Transforming Numerical Variables, Working with Outliers, Performing Feature Scaling.				
Module 2	Data Modeling	Assignment	Programming	**No. of Sessions:10**
Topics: Fundamentals, Significance of EDA, Comparing EDA with classical and Bayesian analysis, Loading the dataset, Data Transformation.				
Module 3	Data Visualization – I	Assignment	Programming	**No. of Sessions:08**
Topics: Data Visualization history, how does visualization help decision-making, Visualization Techniques for Spatial Data, Time-Oriented Data,				

Multivariate Data, Trees, Graphs and Networks.

Module 4	Data Visualization – II	Assignment	Programming	**No. of Sessions:12**

Topics:

Visualization Techniques for Geospatial Data, Spatial Data, Point Data, Line Data, Area Data.Interaction Concepts: Operators, Operands and Spaces, A Unified Framework. Designing Effective Visualizations: Steps in Designing Visualizations; Problems in Designing Effective Visualizations.

Comparing and Evaluating Visualization Techniques: User Tasks, User Characteristics, Data Characteristics, Visualization Characteristics, Structures for Evaluating Visualizations, Benchmarking Procedures

List of laboratory tasks:

SKILL SETS TO BE DEVLOPED:

SK1: An attitude ofenquiry.

SK2: Confidence and ability to tackle newproblems.

SK3: Ability to interpret events andresults.

SK4: Ability to work as a leader and as a member of ateam.

SK5: Assess errors in systems/processes/programs/computations and eliminatethem.

SK6: Observe and measure physicalphenomena.

SK7: Writereports.

SK8: Select suitable equipment, instrument, materials &software

SK9: Locate faults insystem/Processes/software.

SK10: Manipulative skills for setting and handling systems/Process/Issues

SK11: The ability to follow standard /Legal procedures.

SK12: An awareness of the ProfessionalEthics.

SK13: Need to observe safety/Generalprecautions.

SK14: To judge magnitudes/Results/issues without actual measurement/actualcontacts

Targeted Application & Tools that can be used:

Tools : Draw.io, Lucidchart, SQuirreL SQL Client, MySQL Workbench, Amundsen, erwin Data Modeler, ER/Studio, Datagrip

Project work/Assignment:

Throughout the progression in each module, students will have to submit scenario based programming Assignments/Experiments as listed in “List of Lab Tasks”. On completion of each module, students will be asked to develop a Mini Project, similar to the following:

- Visualization Design.
  In this assignment, you will design visualization for a small data set and provide arigorous rationale for your design choices.After the World War II, antibiotics were considered as "wonder drugs", since they wereeasy remedy for what had been intractable ailments. To learn which drug worked mosteffectively for which bacterial infection, performance of the three most popular antibiotics on 16 bacteria were gathered. The values Table 1 represent the minimum inhibitoryconcentration (MIC), a measure of the effectiveness of the antibiotic, which represents theconcentration of antibiotic required to prevent growth in vitro. The reaction of the bacteriato Gram staining is described by the covariate “gram staining”. Bacteria that are staineddark blue or violet are Gram-positive. Otherwise, they are Gram-negative
- **Exploratory Data Analysis.**
  In this assignment, you will design two visualizations techniques for a small dataset andprovide a rigorous rationale for your design choices. TasksThe dataset contains some important statistics from a large sample of movies. The data includesthemoviebudgetandrevenuefromdifferentsourcesaswellasratingsfromRottenTomatoes,The NumbersandIMDB.
  Step 1.Pose an initial question that you would like to answer.For example: Is there a relationship between columns? Are the columns IMDB rating andProduction budget correlated? Is there any relationship between the movie budget andrevenue?
  Step 2.Assess the fitness of the data for answering your question. Inspect the data--it is invariably helpful to first look at the raw values. Does the data seemappropriate for answering your question? If not, you may need to start the process over.
- Exploratory Data Analysis and Interactive Visualization
  In this assignment, you will design three interactive visualizations techniques for achallenging dataset and provide a rigorous rationale for your design choices.
  Tasks
  The dataset contains some important information about flights among the states of the UnitedStated of America in 2009.
  Step 1.Pose an initial question that you would like to answer as you did in theassignment 2.
  Step 2.Assess the fitness of the data for answering your question.Inspect the data--it is invariably helpful to first look at the raw values. Does the data seemappropriate for answering your question? If not, you may need to start the process over. Ifso, does the data need to be reformatted or

cleaned prior to analysis? Perform any stepsnecessary to get the data into shape prior to visual analysis.
Step 3.Design three interactive visualization techniques that you believe effectively

Text Book

1. Madhavan, Samir, "*Mastering Python for Data Science*", Packt Publishing Ltd, 2015.
2. Wilkinson, Leland, "*The Grammar of Graphics*", Springer-Verlag New York, 2015.

References

Andy Kirk, "*Data Visualization: A Handbook for Data Driven Design*", Sage Publications, 2016.

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

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

E-Resources

NPTEL course https://nptel.ac.in/courses/106106179

https://www.naukri.com/learning/data-visualization-courses-certification-training-by-nptel-st583-tg1061

Topics relevant to development of "Skills": Real time Data Modeling using Deep learning.

CSA3049 Software Metrics and Quality Management

Course Code: CSA3049	Course Title: Software Metrics and Quality Management Type of Course: Discipline elective	L-T-P- C	2	2	0	3
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	This course will focus on the processes, principles, and techniques of software testing and analysis. It covers a full spectrum of topics from basic principles and underlying theory of testing to organizational and process issues in real-world applications. The emphasis is on selecting practical techniques to achieve an acceptable level of quality at an					

	acceptable cost. This course will provide software engineering professionals with realistic strategies for reliable and cost-effective software testing.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of Software Metrics and Quality Management attain Employability through Experiential Learning techniques.			
Course Out Comes	On successful completion of this course the students shall be able to: To understand software testing and quality assurance as a fundamental component of software life cycle [Knowledge] To efficiently perform T & QA activities using modern software tools [Comprehension] To prepare test plans and schedules for a T&QA project [Application]			
Course Content:				
Module 1	Introduction to Quality			12 Hours
Topics: Introduction to Quality: Historical Perspective of Quality, what is Quality? (Is it a fact or perception?), Definitions of Quality, Core Components of Quality, Quality View, Financial Aspect of Quality, Customers, Suppliers and Processes, Total Quality Management (TQM), Quality Principles of Total Quality Management, Quality Management Through Statistical Process Control, Quality Management Through Cultural Changes, Continual (Continuous) Improvement Cycle, Quality in Different Areas, Benchmarking and Metrics, Problem Solving Techniques, Problem Solving Software Tools.				
Module 2	Software Quality			12 Hours
Topics: Introduction, Constraints of Software Product Quality Assessment, Customer is a King, Quality and Productivity Relationship, Requirements of a Product, Organisation Culture, Characteristics of Software, Software Development Process, Types of Products, Schemes of Criticality Definitions, Problematic Areas of Software Development Life Cycle, Software Quality Management, Why Software Has Defects? Processes Related to Software Quality, Quality Management System Structure, Pillars of Quality Management System, Important Aspects of Quality Management.				
Module 3	Software Verification and Validation			14 Hours
Topics: Introduction, Verification, Verification Workbench, Methods of Verification, Type, Entities involved in verification, Reviews in testing lifecycle, Coverage in Verification, Concerns of Verification, Validation, Validation Workbench, Levels of Validation, Coverage in Validation, Acceptance Testing, Management of Verification and Validation, Software development verification and validation activities. V-test Model: Introduction, V-model for software, Testing during Proposal stage, Testing during requirement stage, Testing during test planning phase, Testing during design phase, Testing during coding, VV Model, Critical Roles and Responsibilities.				
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course				
Case study on real time software applications like MSTeam Implementation of verification and validation for any realtime software application.				
Text Book T1 Software Testing and Continuous Quality Improvement, William E. Lewis, CRC Press, 3rd,2016.				

T2 Software Testing: A Craftsman's Approach, Paul C. Jorgenson, CRC Press, 4th, 2017.
References R1. P. Ammann and J. Offutt. Introduction to Software Testing. Cambridge University Press, 2008. R2. https://www.tutorialspoint.com/software_quality_management/software_quality_management_metrics.htm https://nptel.ac.in/courses/106105150 https://nptel.ac.in/courses/106101163
Topics relevant to "EMPLOYABILITY SKILLS": V-test Model: Introduction, V-model for software for developing Employability Skills through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

CSA3050 Ethical Hacking

Course Code: CSA3050	Course Title: Ethical Hacking Type of Course: Discipline Elective in Cyber Security Basket	L-T- P-C	3	0	0	3
Version No.	1.0					
Course Pre-requisites	basic networking tools knowledge and Cryptography & Network Security					
Anti-requisites	NIL					
Course Description	This course introduces students to a wide range of topics related to ethical hacking. It also provides an in-depth understanding of how to effectively protect computer networks. These topics cover some of the tools and penetration testing methodologies used by ethical hackers and provide a thorough discussion of what and who an ethical hacker is and how important they are in protecting corporate and government data from cyber-attacks					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Ethical Hacking attain Employability through Experiential Learning techniques.					
Course OutComes	On successful completion of this course the students shall be able to: Illustrate the importance of ethical hacking Categorize the various techniques for performing reconnaissance. Demonstrate various types of system scanners and their functions Demonstrate the function of sniffers on a network					
Course Content:						
Module 1	Introduction to Hacking (Knowledge, Application)	Assignment	Programming activity	11 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 Rafay Baloch, 2014: “Ethical Hacking and Penetration Testing Guide” Apple Academic Press Inc.				
References Gary Hall, Rrin Watson, 2016: “Hacking: Computer Hacking, Security Testing,Penetration Testing, and Basic Security”. James Corley, Kent Backman, Michael Simpson, 2010: “Hands-On Ethical Hacking and Network Defense”, 2nd Edition, Cengage Learning.				
Topics relevant to “EMPLOYABILITY SKILLS”: BackTrack - Changing the Default Screen Resolution for developing Employability Skills through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.				

CSA3051.NET Programming Using C#

Course Code: **CSE3051**	**Course Title: .NET Programming Using C#** **Type of Course: Program Core Theory & Laboratory integrated**	**L-T- P - C**	1	0	4	3
Version No.	1.1					
Course Pre-requisites	**NIL**					
Anti-requisites	**NIL**					

Course Description	This course is designed to teach third-year computer science students, to provide an introduction to the .net framework and C# language. This course deals with the programming skills that are required to create applications using the C# language. Helps the students to build an application that incorporates several features of the .NET Framework.
Course Objective	The objective of the course is to **SKILL DEVELOPMENT** of student by using problem solving methodology.
Course Out Comes	**COURSE OUTCOMES:** On successful completion of the course the students shall be able to**:** C01: Apply OOPS concepts in C# for solutions to real-world problems [Knowledge]. C02: Creating ADO.NET GUI [Application]. C03: Demonstrating Write GUI applications in C# [Application]. C04: Creating the application with the help of database [Application].
Course Content:	

Module 1	**C # Languag e Syntax**	Assignment	Programming Task	**12 Sessions**

Topics:
Knowledge

C # Language Syntax - Datatypes & Variables Declaration, Implicit and Explicit Casting, Checked and Unchecked Blocks, Enum and Constant, Operators, Control Statements, Working with Arrays, working with Methods, Pass by value and by reference and out parameters.

OOPs-Concept - Learning about Class, Object, Component, encapsulation, Inheritance, Polymorphism.Abstract Class, Overview of Interface, Types of Inheritance.

Exception Handling-Defining Exception, Understandings try and catch keywords, Using “finally” block, “using” statement, Throwing exceptions, Creating User-defined/Custom Exception class.

IO Streams - What are a stream, Types of Stream, Standard I/O Streams, Console, Handling text in files, Dealing with Binary files.

Module 2	**Developing GUI Application Using WINFORMS**	Assignment	Data Collection/Excel	**12 Session s**

Topics:
Application
Developing GUI Application Using WINFORMS- Basic Controls, Panel & Layouts, Drawing

and GDI Devices, MenuStrip, ToolbarStrip and Context MenuStrip , Model and Modeless Dialog boxes ,Multiple Document Interface(MDI) ,Form Inheritance , Building Login Form, Working with Resource Files and Setting, Notify Icon Controls, Using Components like Timer, FileSystemWatcher, Process, BackgroundWorker . Drag and Drop.

Module 3	**Managing Data using DataSet**	Assignment	Programming/Data analysis task	**14 Sessions**

Topics
Application

Managing Data using DataSet -Introduction DataSet and its Object Model, Filling DataSet using DataAdapter, Binding DataSet to DataGridView, Updating changes to the database using DataAdapter, DataAdapter events.

A few Advanced Features-Reflection and Attributes, Delegates & Events**,** User Control and Custom Control. Multithreading- Threading Overview, Thread States, Methods of Thread Class, Thread Pool, Thread Synchronization. Packaging and Deployment**.**

Module 4
Topics
Application

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, How to implement Login facility with the database, Inserting Image into a Database table

Targeted Application & Tools that can be used:

Project work/Assignment:

Text Book

1. Andrew Troelsen, “C# and the .NET Platform”
2. J . Liberty, “Programming C#”, O’Reilly

References

R1:E. Balagurusamy, “Programming in C#”, Tata McGraw-Hill.

R2: Microsoft Visual C# Step by Step, 9th Edition By John Sharp, Microsoft Press

R3:Herbert Schildt, “The Complete Reference: C#”

Weblinks:

https://dotnet.microsoft.com/en-us/apps/aspnet

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Case study link:

https://www.researchgate.net/publication/296561714_C_and_the_NET_Framework

https://docs.microsoft.com/en-us/dotnet/csharp/getting-started/

E book link R1:

https://www.oreilly.com/library/view/mastering-c-and/9781785884375/

E book link R2:

https://www.packtpub.com/product/mastering-c-and-net-framework/9781785884375

Topics relevant to development of ".NET Programming Using C#":
MVC — Model-View-Controller is a software design pattern. It describes interactions between the three components of a web application and its GUI.

Topics relevant to development of "": Learning about Class, Object, Component, encapsulation, Inheritance, Polymorphism.
Understanding the Role of Managed Provider and ADO.NET Objects, Connecting to Database and Connection Pooling,

CSA 3006: Blockchain Technology

Course Code: CSA 3006	Course Title: Block Chain Technology Type of Course: Program Core	L-T-P-C	3	0	0	3
Version No.	1.0					
Course Pre-requisites	Basic concepts in networking					
Anti-requisites	NIL					
Course Description	The course will introduce the technical foundations of blockchain and its applications to a wide range of industries including finance, computer science, supply-chain, smart power grid and social networking. Initially, the course explores on Bitcoin protocol followed by the Ethereum protocol – to lay the foundation necessary for developing applications and programming. Also the course addresses on privacy and security issues in Blockchain.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Blockchain Technology and attain Skill Development through Participative Learning techniques.					
Course Out Comes	On successful completion of this course the students shall be able to: Define the essential components of a blockchain platform. [Remember] Recall basics and working of Bit coin and Ethereum Block chain. [Remember]					

	Develop blockchain based application with Swarm and IPFS. [Apply] Summarize the privacy and security issues in Blockchain. [Understand]			
Course Content:				
Module 1	INTRODUCTION TO BLOCKCHAIN	Assignment	Knowledge, Quizzes	No. Of Classes:8
Topics: Distributed DBMS – Limitations of Distributed DBMS, Introduction to Block chain – History, Definition, Distributed Ledger, Blockchain Categories – Public, Private, Consortium, Blockchain Network and Nodes, Peer-to-Peer Network, Mining Mechanism, Generic elements of Blockchain, Features of Blockchain, and Types of Blockchain, Types of Consensus Algorithm Assignment: Distributed Ledger, Blockchain Categories – Public, Private, Consortium, Blockchain Network and Nodes.				
Module 2	Bitcoin & Ethereum Basics	Assignment	Knowledge, Quizzes	No. Of Classes:9
Topics: Bitcoin Basics: Bitcoin blockchain, Challenges and solutions, proof of work, Proof of stake, alternatives to Bitcoin consensus, Bitcoin scripting language and their use. Ethereum Basics: Ethereum and Smart Contracts, The Turing Completeness of Smart Contract Languages and verification challenges, using smart contracts to enforce legal contracts, comparing Bitcoin scripting vs. Ethereum Smart Contracts. Assignment: Bitcoin blockchain, Challenges and solutions, Ethereum and Smart Contracts.				
Module 3	DISTRIBUTED STORAGE IPFS AND SWARM	Case Study	Application, Project Work	No. Of Classes:7
Topics: Ethereum Virtual Machine- Swarm and IPFS: Installing IPFS, hosting our frontend: Serving your frontend using IFPS, serving your frontend using Swarm, IPFS file uploader project: Project setup the web page Practical component: Case Study: Install IPFS locally on our machine, initialize your node, view the nodes in network and add files and directories install Swarm and run any test file.				
Module 4	Privacy, Security issues in Blockchain	Case study	Application, Quizzes	No. Of Classes:6
Topics: Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation, attacks on Block chains: Sybil attacks, selfish mining, 51% attacks advent of algorand; Sharding based consensus algorithms to prevent these attacks. Case Study: Block chain in Financial Service, Supply Chain Management and Government Services.				
Targeted Application & Tools that can be used: IPFS, Ethereum Block chain.				
Project work/Assignment:				
Blockchain Use Cases: Crowd funding, Compliance to KYC, International Trade finance, Supply Chain Management. Research in Blockchain: Discussion of Latest research papers.				
Textbook(s): Tiana Laurence, Blockchain for Dummies, 2nd Edition 2019, John Wiley & Sons. Anshul Kaushik, Block Chain & Crypto Currencies, Khanna Publishing House, 2018. Kirankalyan Kulkarni, Essentials of Bitcoin and Blockchain, Packt Publishing,2018.				
References Imran Bashir, “Mastering Blockchain: Distributed Ledger Technology, decentralization, and				

smart contracts explained", 2nd Edition, Packt Publishing Ltd, March 2018. Bellaj Badr, Richard Horrocks, Xun (Brian) Wu, "Blockchain By Example: A developer's guide to creating decentralized applications using Bitcoin, Ethereum, and Hyperledger", Packt Publishing Limited, 2018.
Web Resources and Research Articles: Corresponding Online Resources: 1. https://www.coursera.org/specializations/blockchain. 2. https://nptel.ac.in/courses/106105184/ 3. Introduction to Blockchain Technology and Applications, https://swayam.gov.in/nd1_noc20_cs01/preview
Topics relevant to "SKILL DEVELOPMENT": Pseudo-anonymity vs. anonymity, Zcash and Zk-SNARKS for anonymity preservation, attacks on Block chains for skill development through Participative Learning techniques. This is attained through the assessment component mentioned in the course handout.

CSA3004 Big Data Analytics

Course Code: CSA3004	Course Title: Big Data Analytics Type of Course: Integrated	L- T-P-C	2	0	2	3
Version No.	1.0					
Course Pre-requisites	DDL, DML of SQL Queries and Creation of Class & object, interface, reading & writing a file, control statements in java programming.					
Anti-requisites	NIL					
Course Description	This course is designed to provide the fundamental knowledge to equip students being able to handle real world big data problems including the three key resources of Big Data: people, organizations, and sensor. With the advancement of IT storage, processing, computation and sensing technologies, big data has become a novel norm of life.					
Course Objective	The objective of the course is to familiarize the learners with the concepts Big Data Analytics 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 fundamental concepts of big data analytics (Knowledge) CO2: Apply Map-Reduce programming on the given datasets to extract required insights. (Application). CO3: Employ appropriate Hadoop Ecosystem tools such as Hive, Hbase to perform data analytics for a given problem (Application) CO4: Use Spark tool to analyse the given dataset for a given problem. (Application).					
Course Content:						
Module 1	Introduction to Big data Analytics	Assignment	Simulation/Data Analysis	10 Sessions		
Introduction to Big Data: Basics of Distributed File System, Four Vs, Drivers for Big data, Big data applications, Structured, unstructured, semi-structured and quasi structured data. Big data Challenges-Traditional versus big data approach, The Big Data Technology Landscape: No-SQL The Hadoop: History of Hadoop-Hadoop use cases, The Design of HDFS, Blocks and replication management, Rack awareness, HDFS architecture, HDFS Federation, Name node and data node, Anatomy of File write, Anatomy of File read.						
Module 2	Hadoop MapReduce Framework	Assignment	Numerical from E-Resources	20 Sessions		
MapReduce : Hadoop Map Reduce paradigm, Map and reduce tasks, Job Tracker and task tracker, Map reduce execution pipeline, Key value pair, Shuffle and sort, Combiner and Partitioner, APIs used to Write/Read files into/from Hadoop. Hadoop 2.0 Features, Name Node						

High Availability, YARN Architecture.				
Module 3	Hive and Hbase Analytical tools	Term paper/Assignment	Simulation/Data Analysis	20 Sessions
Hive : Apache Hive with Hive Installation, Hive Data Types, Hive Table partitioning, Hive DDL commands, Hive DML commands, and Hive sort by vs. order by, Hive Joining tables, Hive bucketing. Hbase : Introduction to HBase and its working architecture- Commands for creation and listing of tables- disabled and is disabled of table - enable and is enabled of table- describing and dropping of table-Put and Get command - delete and delete all command-commands for scan, count, truncate of tables.				
Module 4	Data Analytics with Spark	Term paper/Assignment	Simulation/Data Analysis	10 Sessions
Spark: Introduction to Apache Spark A unified Spark, Who uses Spark and for what?, A Brief History of Spark, Spark version and releases, Storage layers for Spark. Programming with RDDs: RDD Basics, Creating RDDs, RDD Operations, Passing functions to Spark, Common Transformations and Actions, Persistence. Scala: The Basics, Control Structures and functions, Working with arrays, Maps and Tuples.				
List of Laboratory Tasks Introduction to Hadoop Ecosystem tools Introduction to Hadoop distributed file System. Installation of Hadoop single node cluster using Ubuntu operating system. Working with Hadoop Commands Introduction to Mapreduce framework Word Count analysis using sample data set (MapReduce) Stock analysis using sample data set (MapReduce) Web log analysis using sample data set (MapReduce) Temperature analysis using sample data set .(MapReduce) Working on basic hive commands Working on basic hbase commands Install, Deploy & configure Apache Spark Word count analysis using RDD and FlatMap				
Targeted Application & Tools that can be used: HDFS – for data storage Map reduce – Mapping and reducing. Hive - Database Hbase – No SQL Spark – SCALA LANGUAGE				
Assignment:				
Built-in Functions of hadoop mapreduce framework in java and basics of scala , Industry oriented latest Hadoop ecosystem tool. Dataset resource link: https://www.kaggle.com/datasets				
Text Book Big Data and Analytics- Seema Acharya, Subhashini Chellappan-2019, 2nd Edition, Wiley Publication. Analytics in a Big data world- Bart Baesens- 2nd Edition, Wiley Publication. 2018				
References Tom White, “Hadoop: The Definitive Guide”, O’reilly. Douglas Eadline, “Hadoop 2 Quick-Start Guide: Learn the essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem”, 1st Edition, Pearson Education 2016, ISBN-13: 978933257035 E-Resources https://presiuniv.knimbus.com/user#/home https://onlinecourses.nptel.ac.in/noc20_cs92/preview https://www.coursera.org/learn/big-data-introduction,				

https://www.edx.org/course/big-data-fundamentals
Topics relevant to “SKILL DEVELOPMENT”: Programming with RDDs: RDD Basics, Creating RDDs, RDD Operations, Passing functions to Spark for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

CSA3089 : Predictive Analytics

Course Code: CSA3089	**Course Title: Predictive Analytics** **Type of Course: Discipline Elective**	**L- T - P- C**	2	0	2	3
Version No.	1.0					
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 analysing 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:** • CO 1: Define the nature of analytics and its applications (Knowledge) • CO 2: Discuss the concepts of predictive analytics and data mining (Comprehension) CO 3: Compute the analytical tools in business scenarios to achieve competitive advantage (Application) • CO 4: Relate the real-world insights in decision trees and time series analysis methods in dynamic business environment (Application) • CO 5: Outline the importance of big data in predictive analytics (Comprehension)					
Course Content:						
Module 1	Introduction to Predictive Analytics	Self-Learning	Applications of analytics			**12 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	Case analysis	Predictive Analytics – Employee Attrition Case center.CO2. https://www.thecasecentre.org/products/view?id=143229	**12 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	Participative Learning & Case Analysis	Predictive analytics in HR	**14 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	Discussion & Presentation	Business Forecasting	10 Sessions
Topics Module 4: 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				
Module 5	Big Data in Predictive Analytics	Discussion & Presentation	Darkside of data mining, Challenges and problems in data analytics	06 Sessions
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.

Targeted Application & Tools that can be used

Statistical tools, documentary review, case analysis and Simulation help students to understand the data driven decisions for firms

Project work/Assignment:

Project:

By developing the questionnaire for specific objective of the brands, primary data collection and do the sales forecasting by using predictive analysis using SPSS software and develop report on data storytelling from the data analysis.

Assignment:

1. Review the article on Organisational capabilities in PA using PU link https://wwwemerald-com-presiuniv.knimbus.com/insight/content/doi/10.1108/MD-03-2018-0324/full/html
2. Develop a podcast of 5 mins of each group discussions on Darkside of data mining. Each group consist of 5 members in the team

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)

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 book link R1: Raman, R., Bhattacharya, S., & Pramod, D. (2018). Predict employee attrition by using predictive analytics. Benchmarking: An International Journal. https://www-emerald-com-presiuniv.knimbus.com/insight/content/doi/10.1108/BIJ-03-2018- 0083/full/html

2. **E book link R2:** Jing, Z., Luo, Y., Li, X., & Xu, X. (2022). A multi-dimensional city data embedding model for improving predictive analytics and urban operations. Industrial Management & Data Systems, (ahead-of-print). https://www-emerald-com-presiuniv.knimbus.com/insight/content/doi/10.1108/IMDS-01-2022- 0020/full/html
3. **E book link R3:** Singh, R., Sharma, P., Foropon, C., & Belal, H. M. (2022). The role of big

data and predictive analytics in the employee retention: a resource-based view. International Journal of Manpower. https://www-emerald-com-presiuniv.knimbus.com/insight/content/doi/10.1108/IJM-03-2021- 0197/full/html

4. **E book link R4:** Mishra, D., Luo, Z., Hazen, B., Hassini, E., & Foropon, C. (2018). Organizational capabilities that enable big data and predictive analytics diffusion and organizational performance: A resource-based perspective. Management Decision. https://www-emerald-com-presiuniv.knimbus.com/insight/content/doi/10.1108/MD-03-2018- 0324/full/html

Web 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/
W6.https://www.marketingevolution.com/knowledge-center/the-role-of-predictive-analyticsin-data-driven-marketing

Swayam & NPTEL Video Lecture Sessions on Predictive Analytics
1. https://onlinecourses.swayam2.ac.in/imb20_mg19/preview
2. https://onlinecourses.nptel.ac.in/noc19_mg42/preview

Case References
1. Predictive Analytics Industry Use cases.
2. https://www.rapidinsight.com/blog/11-examples-ofpredictive-analytics/
3. Srinivasan Maheswaran (2017). Predictive Analytics – Employee Attrition Case center. in https://presiuniv.knimbus.com/user#/home

Topics relevant to "EMPLOYABILITY SKILLS": Predictive Analytics ": Application of Business Analytics to enhances customer satisfaction and firms' success for developing **Employability Skills** through **Experiential Learning techniques**. This is attained through assessment component mentioned in course handout.

CSA3070 : Time Series Analysis

Course Code: CSA3070	**Course Title: Time Series Analysis** **Type of Course: Discipline Elective**	**L- T- P- C**	3	0	0	3
Version No.	1.0					
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 Outcomes	On successful completion of the course the students shall be able to CO1.Select appropriate model, to fit parameter values and make concise decisions based on forecasts obtained CO2. Demonstrate an understanding of the principles behind modern forecasting techniques. CO3. Apply concepts to real time series data using packages.			
Course Content:				
Module 1	Introduction	Assignment	Data Analysis task	**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	Assignment	Data analysis	**10 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	Data analysis	**10 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	Case Study	Data analysis	**10 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

Targeted Application & Tools that can be used:

Targeted Applications: Time series analysis on economics, finance, natural sciences, health care and more

Tools:

- R package astsa (Applied Statistical Time Series Analysis)
- The package ITSM2000 (https://extras.springer.com/)

Project work/Assignment:

Mini Project:
Choose any suitable real time dataset and build time series forecast models.
Example: In the Air Passengers dataset set, go back 12 months in time and build the ARIMA forecast for the next 12 month. Investigate following questions

Is the series stationary? If not what sort of differencing is required?
What is the order of your best model?
What is the AIC of your model?
What is the order of the best model predicted by auto_arima() method?

Term Assignments:
Understand and implement ARMA and ARIMA models in Python/R for time series forecasting

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.
T3.Shumway & Stoffer (2011) Time Series Analysis and its applications, with examples in R , 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

R3.Prado & West (2010) Time Series: Modeling, Computation, and Inference Chapman & Hall

Weblinks

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

	Topics relevant to "EMPLOYABILITY DEVELOPMENT": GARCH Models, Box-Jenkins approach, Introduction to Spectral Analysis, Estimating the Spectrum, **for developing Employability Skills through Experiential Learning techniques. This is attained through assessment component mentioned in the course handout.**

MAT2033: STATISTICAL ANALYSIS USING R

Course Code: MAT2033	**Course Title:** **STATISTICAL ANALYSIS USING R** **Type of Course: Discipline elective**	**L-T-P-C**	2	0	2
Version No.	1.0				
Course Pre-requisites	Statistics				
Anti-requisites	**Nil**				
Course Description	Statistical Analysis is an introductory course designed to provide students with a solid foundation in the principles and techniques of statistical data analysis. This course aims to equip students with the knowledge and skills necessary to effectively interpret, analyze, and draw meaningful conclusions from data, enabling them to make informed decisions in a wide range of academic, professional, and real-world settings.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of **STATISTICAL ANALYSIS** **USING R** attain **Employability** through **Experiential Learning** techniques				
Course Outcomes	On successful completion of the course the students shall be able to: 1] Perceive the knowledge of correlation, regression analysis, regression diagnostics, partial and correlations. 2] Develop ability to critically assess the different types of Random variables and use the knowledge in problems. 3] Conceptualize the significance of different probability distributions. 4] Apply appropriate knowledge to hypothesis testing and draw conclusions.				

	5] Acquire knowledge on R-programming in the statistics and probability models.		
Course Content:			
Module 1	**Introduction and Review of concepts**		**10 Classes**
Statistical Derivatives and Measures of Central Tendency, Measures of Variation and Skewness, Correlation, Karl Pearson's correlation coefficient, Rank correlation – Spearman's and Kendall's measures. Concept of errors, Principle of least squares, fitting of polynomial and exponential curves. Simple linear regression and its properties. Fitting of linear regression line and coefficient of determination.			
Module 2	**Random variable**		**5 Classes**
Random variable, types of random variable, Discrete random variable, Continuous random variable, Two-dimensional random variable, Stochastic independence			
Module 3	**Probability distributions**		**5 Classes**
Probability distributions, probability mass and density functions, Binomial, Poisson and normal distributions			
Module 4	**Testing of Hypothesis**		**10 Classes**
Population, sample, parameter, statistic, Estimation, confidence and intervals, Hypothesis testing, Type I and type II error, one tailed and two-tailed test, small and large samples, Z- test, student t-test, Chi-squared test, Test of Goodness of Fit, Independence Test.			
Targeted Application & Tools that can be used: The objectives of statistical analysis are to extract useful information from data, discover underlying patterns, make predictions, and support evidence-based decision-making in various fields, ranging from scientific research to business and beyond.			
Assignment:			
1. Regression Analysis. 2. Hypothesis testing.			
Text Books T1: Garrett Grolemund, Hadley Wickham, R for Data science, O'Reilly Media, 2016. T2: Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani: An Introduction to Statistical Learning: with Applications in R, Springer New York, NY, 2013			
References: R1: Max Kuhn and Kjell Johnson, Applied Predictive Modeling, Springer New York, NY R2: Andy Field, Jeremy Miles, and Zoe Field, Discovering Statistics Using R, SAGE Publications Ltd, 2012			

Topics relevant to "EMPLOYABILITY DEVELOPMENT": Population, sample, parameter, statistic, Estimation, confidence and intervals, **for developing Employability Skills through Experiential Learning techniques. This is attained through assessment component mentioned in the course handout.**

MAT1008- Probability and Inferential Statistics

Course Code: **MAT1008**	**Course Title: Probability and Inferential Statistics** **Type of Course: Program Core**	**L T P C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	**MAT1007 – Introduction to Statistics**					
Anti-requisites	None					
Course Description	The goal of this course is to provide students with a firm understanding of probability and statistics by means of a thorough treatment of probability, probability distributions, sampling techniques and testing of hypothesis. This course aims at acquainting students with various probability and statistical methods and preparing students for future courses having statistical, quantitative and probabilistic components. On acquiring the necessary knowledge through this course, students will be in a position to identify, interpret, demonstrate and apply probability and statistical tools to a variety of business applications.					
Expected Outcome:	On successful completion of this course, the students will be in a position to 1. adopt various rules for probability in order to tackle practical problems. 2. demonstrate the knowledge of probability and joint probability distributions and their implications. 3. interpret the standard probability distributions and their scope. 4. employ the ideas of sampling distributions and hypothesis testing systematically.					
Module 1	**Probability**			**10 classes**		
Random experiment, sample space, events, probability of an event, addition rule, conditional probability, multiplication law, total probability and Bayes rule.						
Module 2	**Random Variables and Probability**			**10 classes**		

	Distributions			
Random variables, discrete and continuous probability distributions, probability mass and density functions, joint probability and marginal distributions, mean, variance and covariance of random variables.				
Module 3	**Standard Probability Distributions**			**12 classes**
Binomial distribution, geometric distribution, Poisson distribution, continuous uniform distribution, normal and standard normal distributions, exponential distribution.				
Module 4	**Sampling Distributions and Tests of Significance**			**13 classes**
Sampling, types of sampling, parameter and statistic, sampling distributions, central limit theorem, tests of significance, null and alternative hypotheses, errors in sampling, critical region and level of significance, one-tailed and two-tailed tests, procedure for testing of hypothesis, large sample test for single and difference of proportions, large sample test for single and difference of means, large sample test for difference of standard deviations, student's t-test for single and difference of means concerning small samples, F-test for equality of population variances concerning small samples, chi-square test of goodness of fit for small samples.				

Targeted Application & Tools that can be used:

The objective of the course is to familiarize students with the theoretical concepts of probability and statistics and to equip them with probabilistic and statistical tools to tackle business related and real-life problems.

Tool used: R Software / MS-Excel

Text Book

1. R.E. Walpole, R.H. Myers, S.L. Myers and K.E. Ye, Probability and Statistics for Engineers and Scientists, Pearson Education, 2016.

References

1. James T. McClave, P. George Benson and Terry Sincich, Statistics for Business and Economics, 2018.
2. D. R. Anderson, D. J. Sweeney, T. A. Williams, Essentials of Modern Business Statistics with Microsoft Excel, 2020.
3. D. R. Anderson, D. J. Sweeney, T. A. Williams, Essentials of Statistics for Business and Economics, 2019.
4. D. C. Montgomery and G. C. Runger, Applied Statistics and Probability for Engineers,

John Wiley and Sons, 2018.

5. Richard A. Johnson, Miller and Freund's Probability and Statistics for Engineers, 2018.
6. Kishor S Trivedi, Probability and Statistics with reliability, Queuing and Computer Science Applications, John Wiley & Sons, 2008.
7. Berenson and Levine, Basic Business Statistics, Prentice- Hall India, 1996.

CSA2018- Data Modelling and Visualization

Course Code: CSA2018	**Course Title:** Data Modeling and Visualization **Type of Course:Integrated**	**L-T-P-C**	2	0	2	3
Version No.	1.0					
Course Pre-requisites	Programming in Python.					
Anti-requisites	NIL					
Course Description	A Data Scientist's ability to structure problems is crucial. A smart Data Scientist may build and represent an informative visualization, showcasing the raw Data and business activities, associate with the Key Performance, Indicator and business use cases, such as new Customer Acquisition, Product Design, desk location to reduce distraction and so on. All these factors are considered while carrying out the process of Data Science Modeling. Topics include: Data Science, Missing Data, Outliers, Feature Scaling, Data Visualization, Graphs, Trees.					
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: 5. Break down the business problem into a procedural flow. **[Application]** 6. Apply the EDA to get familiarized with the Data by extracting useful insights. **[Application]** 7. Identify the features that contribute the most to the prediction variable. **[Knowledge]**					

	8. Understand data by visualization it so that patterns, trends and correlations can be identified. **[Comprehension]**			
Course Content:				
Module 1	Introduction	Assignment	Programming	**No. of Sessions:10**
Topics: Introduction to Data Science: Key skills required in Data Science, Need for Data Science, Steps involved in Data Modeling, Understanding the problem, Data Extraction, Imputing Missing Data, Encoding Categorical Variables, Transforming Numerical Variables, Working with Outliers, Performing Feature Scaling.				
Module 2	Data Modeling	Assignment	Programming	**No. of Sessions:10**
Topics: Fundamentals, Significance of EDA, Comparing EDA with classical and Bayesian analysis, Loading the dataset, Data Transformation.				
Module 3	Data Visualization – I	Assignment	Programming	**No. of Sessions:08**
Topics: Data Visualization history, how does visualization help decision-making, Visualization Techniques for Spatial Data, Time-Oriented Data, Multivariate Data, Trees, Graphs and Networks.				
Module 4	Data Visualization – II	Assignment	Programming	**No. of Sessions:12**
Topics: Visualization Techniques for Geospatial Data, Spatial Data, Point Data, Line Data, Area Data.Interaction Concepts: Operators, Operands and Spaces, A Unified Framework. Designing Effective Visualizations: Steps in Designing Visualizations; Problems in Designing Effective Visualizations. Comparing and Evaluating Visualization Techniques: User Tasks, User Characteristics, Data Characteristics, Visualization Characteristics, Structures for Evaluating Visualizations, Benchmarking Procedures				

List of laboratory tasks:

SKILL SETS TO BE DEVLOPED:

SK1: An attitude ofenquiry.

SK2: Confidence and ability to tackle newproblems.

SK3: Ability to interpret events andresults.

SK4: Ability to work as a leader and as a member of ateam.

SK5: Assess errors in systems/processes/programs/computations and eliminatethem.

SK6: Observe and measure physicalphenomena.

SK7: Writereports.

SK8: Select suitable equipment, instrument, materials &software

SK9: Locate faults insystem/Processes/software.

SK10: Manipulative skills for setting and handling systems/Process/Issues

SK11: The ability to follow standard /Legal procedures.

SK12: An awareness of the ProfessionalEthics.

SK13: Need to observe safety/Generalprecautions.

SK14: To judge magnitudes/Results/issues without actual measurement/actualcontacts

Targeted Application & Tools that can be used:

Tools : Draw.io, Lucidchart, SQuirreL SQL Client, MySQL Workbench, Amundsen, erwin Data Modeler, ER/Studio, Datagrip

Project work/Assignment:

Throughout the progression in each module, students will have to submit scenario based programming Assignments/Experiments as listed in “List of Lab Tasks”. On completion of each module, students will be asked to develop a Mini Project, similar to the following:

- Visualization Design.
  In this assignment, you will design visualization for a small data set and provide arigorous rationale for your design choices.After the World War II, antibiotics were considered as "wonder drugs", since they wereeasy remedy for what had been intractable ailments. To learn which drug worked mosteffectively for which bacterial infection, performance of the

three most popular antibiotics on 16 bacteria were gathered. The values Table 1 represent the minimum inhibitoryconcentration (MIC), a measure of the effectiveness of the antibiotic, which represents theconcentration of antibiotic required to prevent growth in vitro. The reaction of the bacteriato Gram staining is described by the covariate “gram staining”. Bacteria that are staineddark blue or violet are Gram-positive. Otherwise, they are Gram-negative

- **Exploratory Data Analysis.**
  In this assignment, you will design two visualizations techniques for a small dataset andprovide a rigorous rationale for your design choices.
  TasksThe dataset contains some important statistics from a large sample of movies. The data includesthemoviebudgetandrevenuefromdifferentsourcesaswellasratingsfromRottenTomatoes,The NumbersandIMDB.
  Step 1.Pose an initial question that you would like to answer.For example: Is there a relationship between columns? Are the columns IMDB rating andProduction budget correlated? Is there any relationship between the movie budget andrevenue?
  Step 2.Assess the fitness of the data for answering your question. Inspect the data--it is invariably helpful to first look at the raw values. Does the data seemappropriate for answering your question? If not, you may need to start the process over.
- Exploratory Data Analysis and Interactive Visualization
  In this assignment, you will design three interactive visualizations techniques for achallenging dataset and provide a rigorous rationale for your design choices.
  Tasks
  The dataset contains some important information about flights among the states of the UnitedStated of America in 2009.
  Step 1.Pose an initial question that you would like to answer as you did in theassignment 2.
  Step 2.Assess the fitness of the data for answering your question.Inspect the data--it is invariably helpful to first look at the raw values. Does the data seemappropriate for answering your question? If not, you may need to start the process over. Ifso, does the data need to be reformatted or cleaned prior to analysis? Perform any stepsnecessary to get the data into shape prior to visual analysis.
  Step 3.Design three interactive visualization techniques that you believe effectively

Text Book

3. Madhavan, Samir, “*Mastering Python for Data Science*”, Packt Publishing Ltd, 2015.
4. Wilkinson, Leland, “*The Grammar of Graphics*”, Springer-Verlag New York, 2015.

References Andy Kirk, "*Data Visualization: A Handbook for Data Driven Design*", Sage Publications, 2016. https://presiuniv.knimbus.com/user#/home https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=2706929&site=ehostlive
E-Resources NPTEL course https://nptel.ac.in/courses/106106179 https://www.naukri.com/learning/data-visualization-courses-certification-training-by-nptel-st583-tg1061
Topics relevant to development of "Skills": Real time Data Modeling using Deep learning.

CSA3069: Data management Using Cloud

Course Code: CSA3069	**Course Title: Data management Using Cloud** **Type of Course: Discipline elective**	**L- T - P- C**	3	0	2	3
Version No.	1.0					
Course Pre-requisites	**Basics of Distributed Computing, Service Oriented Architecture**					
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:** 1. Describe fundamentals of cloud computing, virtualization and cloud					

	computing services. 2. Discuss high-throughput and data-intensive computing. 3. Explain security and standards in cloud computing. 4. Demonstrate the installation and configuration of virtual machine.			
Course Content:				
Module 1	**Introduction to Cloud and Virtualization**	Assignment	Data Collection	**10 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	Problem Solving	**10 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	Problem Solving	**7 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	Problem Solving	**9 Sessions**
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
Project work/Assignment:
Project Assignment: 1) Project on domain related cases studies. Assignment: 1] Characteristics and benefits of cloud computing. 2] SaaS 2.0 applications. 3] Explain high-performance computing, high-throughput computing. 4] Explain Windows Azure Platform Appliance.
Text Book **T1** John Rittinghouse and James Ransome, “Cloud Computing, Implementation, Management and Security”, CRC Press. **T2** Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, “Mastering Cloud Computing”, McGraw Hill Education.
References **R1** David E.Y. Sarna, “Implementing and Developing Cloud Applications”, CRC Press. **R2** Anthony T Velte, Toby J Velte, Robert Elsenpeter, “Cloud Computing: A Practical Approach”, Tata McGraw-Hill. R3 **Web resources:** W1. IEEE Transactions on Cloud Computing- https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=6245519 **Web resources:** W2. International Journal of Cloud Computing- https://www.inderscience.com/jhome.php?jcode=ijcc

MAT2038 Linear programming

Course Code: **MAT2038**	**Course Title:** Linear programming **Type of Course: Discipline elective**	**L- T- P- C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	Basic knowledge of linear systems of algebraic equations and matrices.					
Anti-requisites	**Nil**					
Course Description	The aim of this course is to introduce graduate students to linear programming and its extensions with an emphasis on the mathematical formulations, algorithms and solutions for practical problems arising in business research and operations research including supply chains, network science, marketing and finance. The class will also include programming exercises with MATLAB software for formulating and solving real world					

	problems
Course Objective	The objective of the course is to familiarize the learners with the concepts of Linear programing attain **Employability** through **Experiential Learning** techniques
Course Outcomes	On successful completion of the course the students shall be able to: 1] Solve linear programming problems using Simplex method 2] Solve Branch bound method . 3] Apply algorithms to solve the optimization problems 4] Solve Network problems, and use these models to solve real life problems.
Course Content:	

Module 1	**Linear Programming**			**10 Classes**
Introduction to Linear Optimization, Modeling Optimization - Optimization Problems with Examples, The Simplex Method, The Big-M Method, Dual-Simplex Method..				
Module 2	**Integer Linear Programming**			**10 Classes**
Initialization, Degeneracy, Duality - Proof of Strong Duality Theorem.				
Module 3	**Combinatorial Optimization**			**15 Classes**
Complementary Slackness Theorem, Dual variables and Sensitivity. Convex Polyhedra and Geometry, Applications # 1: Norms, Regression and Sparse Regression. Regression and Regularization (Ridge/Lasso Regression). Linear Programming and Games - Integer Linear Programming : Basic Algorithms - Branch and Bound. Integer Linear Programming: Cutting Plane Algorithms.				
Module 4	Network Algorithm			**10 Classes**
Ellipsoidal Algorithm for Linear Programming - Ellipsoidal Method wrapup. Barrier Functions + Path Following Methods. Wrapup of Path Following Methods and Some Analysis. Total Uni-modularity: Network Flow Problems, Max. Bipartite Matching. Network Simplex Algorithm: Wrapup				

Targeted Application & Tools that can be used:

The aim of this course is to introduce graduate students to linear programming and its extensions with an emphasis on the mathematical formulations, algorithms and solutions for practical problems arising in business research and operations research including supply chains, network science, marketing and finance. The class will also include programming exercises with MATLAB software for formulating and solving real world problems.

Assignment:	
1. Convex Polyhedra and Geometry 2. Newton's Method for Optimization	
Text Books T1: M.S. Bazaraa, J.J. Jarvis, H.D. Sherali, Linear programming and network flows, 4th Edition, Wiley, 2010. T2: R. J. Vanderbei, Linear Programming: Foundations and Extensions.	
References: R1: R. Fourer, D. Gay, B. Kernighan, AMPL: A Modeling Language for Mathematical Programming, 2nd Edition, Boyd & Fraser Publishing Company, 2002.	
	Topics relevant to "EMPLOYABILITY DEVELOPMENT": Regression and Regularization (Ridge/Lasso Regression). **for developing Employability Skills through Experiential Learning techniques. This is attained through assessment component mentioned in the course handout.**

CSA2105: Optimization Techniques for Machine Learning

Course Code: **CSA2105**	**Course Title:** Optimization Techniques for Machine Learning **Type of Course:** **Discipline Elective Theory**	**L- T- P- C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	**CSE3008** Optimization Techniques					
Anti-requisites	**NIL**					
Course Description	This course introduces a range of machine learning models and optimization tools that are used to apply these models in practice. Course will introduce what lies behind the optimization tools often used as a black box as well as an understanding of the trade-offs of numerical accuracy and theoretical and empirical complexity. For the students with some optimization background this course will introduce a variety of applications arising in machine learning and statistics as well as novel optimization methods targeting these applications.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Optimization Techniques for Machine Learning** attain **Skill Development** through **Problem Solving methodologies.**					

Course Outcomes	On successful completion of this course the students shall be able to: 1. **Describe** fundamentals of Machine learning [**Knowledge].** 2. **Explain** Machine learning models **[Comprehension].** 3. **Discuss** Convex optimization models **[Comprehension].** 4. **Apply** Methods for convex optimization **[Application].**			
Course Content:				
Module 1:	**Fundamentals of Optimization Techniques**	**Quiz**	Knowledge based Quiz	**8 Sessions**
Topics: Machine learning paradigm, empirical risk minimization, structural risk minimization, learning guarantees, introduction of VC-dimension.				
Module 2:	**Machine learning models**	**Quiz**	Comprehension based Quiz	**10 Sessions**
Topics: logistic regression, support vector machines, sparse regression, low dimensional embedding, low rank matrix factorization, sparse PCA, multiple kernel learning.				
Module 3	**Convex optimization models**	**Assignment**	Batch-wise Assignments	**9 Sessions**
Topics: linear optimization, convex quadratic optimization, second order cone optimization, semidefinite optimization, convex composite optimization				
Module 4:	**Methods for convex optimization**	Assignment and Presentation	Batch-wise Assignment and Presentations	**11 Sessions**
Topics: gradient descent, Newton method, interior point methods, active set, prox methods, accelerated gradient methods, coordinate descent, cutting plances, stochastic gradient.				
Targeted Application & Tools that can be used: **Use of Matlab tool**				
Project work/Assignment: **Survey on Methods for convex optimization** **Survey on Machine learning models related to optimization**				
Text Book T1. Charu C. Aggarwal, " *Linear Algebra and Optimization for Machine Learning*", Springer, 2020. T2. Sra Suvrit, Nowozin Sebastian, and Wright Stephen J, "*Optimization for Machine Learning*", The MIT Press,2012.				
References R1.Guanghui Lan, "*First-order and Stochastic Optimization Methods for Machine Learning*", Springer Cham, 2020.				
Web References				

W1. https://sm-nitk.vlabs.ac.in/ W2. https://nptel.ac.in/courses/
Topics relevant to SKILL DEVELOPMENT: Concepts of Convex optimization models and Methods for convex optimization f**or Skill Development through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.**

CSA2106- Advanced Natural Language Processing

Course Code: CSA2106	Course Title: Advanced Natural Language Processing Type of Course: Theory & Integrated Laboratory	L-T-P- C	2	0	2	3
Version No.	1.0					
Course Pre-requisites						
Anti-requisites	NIL					
Course Description	This course is an advanced course for Natural Language Processing. As a part of the course, students will be introduced to solving multiple problems in natural language processing, such as sentiment analysis, machine translation, cognitive natural language processing, etc. Topics include: Machine Translation, Text summarization, Sentiment analysis, Cognitive NLP, Gaze behaviour, Evaluation Metrics, etc.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Advanced Natural Language Processing and attain Employability through Experiential Learning techniques.					
Course Out Comes	On successful completion of the course the students shall be able to: Describe how to solve different problems in natural language processing. Solve natural language generation problems such as machine translation and text summarization. [Application] Perform sentiment analysis on reviews to discern the stance of the writer. [Application] Use public gaze behaviour data to improve the performance of different NLP systems. [Application]					
Course Content:						
Module 1	Pre-trained Language Models			6 Sessions		

Topics: Introduction to Pre-Trained Language Models. BERT. Multi-lingual variants of BERT. Introduction to NLTK and Huggingface Transformers.				
Module 2	Machine Translation and Text Summarization			10 Sessions
Topics: Introduction to machine translation – source and target languages. Pivot-based machine translation. Using Transformers for machine translation. Monolingual machine translation examples. Machine translation evaluation metrics – BLEU. Implementation of BLEU score calculation using NLTK in Python. Other MT metrics – METEOR, TER, etc. Text summarization – definition. Types of summarizations – Extractive and Abstractive Summarization. Summarization evaluation metrics – ROUGE score.				
Module 3	Sentiment Analysis			10 Sessions
Topics: Introduction to Sentiment Analysis. Solving sentiment analysis using text classification. Classification of sentiment analysis based on different levels – polarity-based and intensity-based. Challenges in sentiment analysis – sarcasm, thwarting, negations. Case studies in sentiment analysis – Reviewer rating prediction, short-text classifications, computational sarcasm, etc.				
Module 4	Cognitive NLP Using Gaze Behaviour			12 Sessions
Topics: Eye-Mind Hypothesis and gaze behaviour terminology. Using gaze behaviour for prediction of translation complexity, sentiment analysis complexity, sarcasm understandability, text complexity, text quality prediction, etc. Challenges with recording gaze behaviour at run time. Comparison of gaze behaviour across different people – normalization and binning. Gaze behaviour datasets. Mitigation of recording gaze behaviour at run time using type aggregation.				
List of Laboratory Tasks: Familiarization with Python. Using Python to read text files, basic tokenization and other preprocessing. Introduction to NLTK and Huggingface Transformers in Python. Using Huggingface Transformers to create a simple MT application. Implementation of pivot-based machine translation using Huggingface Transformers. Calculation of BLEU using NLTK – difference between sentence_bleu and corpus_bleu methods. Implementation of extractive summarization. Polarity classification of text using VADER. Intensity prediction of text using Weighted Normalized Polarity Intensity. Estimating gaze behaviour for a user using normalization and binning Calculating gaze behaviour for a text based on type aggregation in multiple languages. Complex word identification using gaze behaviour.				
Targeted Application & Tools that can be used: Google Colab Python IDE (Eg. PyCharm) Huggingface Transformers				

NLTK
Assignment:
Assignment: Students will have to do a course group assignment over the course of the semester. The assignment topics can be taken from Modules 2 or 3 as per the instructor-in-charge.
Text Book T1 Daniel Jurafsky, and James Martin. "*Speech and Language Processing*" (3rd edition draft, 2024). T2 Pushpak Bhattacharyya, and Aditya Joshi. "*Natural Language Processing*". Wiley Publishers. 1st edition. 2023. T3 Aditya Joshi, Pushpak Bhattacharyya, and Mark J Carman. "*Investigations in Computational Sarcasm"*. Springer, Singapore. 2018. T4 Dennis Rothman. "*Transformers for Natural Language Processing and Computer Vision*". Packt Publishing. 2024. T5 Abhijit Mishra, and Pushpak Bhattacharyya. "*Cognitively Inspired Natural Language Processing: An Investigation Based on Eye Tracking*". Springer, Singapore. 2018.
References R1 Steven Bird, Ewan Klein, and Edward Loper. "*Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit*". O'Reilly Publishers. 2009. R2 Chris Manning, and Heinrich Schutze. "*Foundations of Statistical Natural Language Processing*". MIT Press. 1999. E-Resources: W1. Web resource for T1: https://web.stanford.edu/~jurafsky/slp3/ W2. E book link R1: https://www.nltk.org/book/ W3. Web Resource for R2: https://nlp.stanford.edu/fsnlp/
Topics relevant to the development of Employability: Calculation of BLEU and ROUGE scores using NLTK, Estimating gaze behaviour through type aggregation, Using Hugging face Transformers for machine translation.
The objective of the course is to familiarize the learners with the concepts of Advanced Natural Language Processing and attain Employability through Experiential Learning techniques.

CSA3072: Web Application Security

Course Code: CSA3072	Course Title: Web Application Security Type of Course: Theory Only Course	L-T-P- C	3	0	0	3
Version No.	1					
Course Pre-requisites	CSA3072 – Web Application Security					
Anti-requisites	Basic knowledge of web development and programming.					
Course Description	The purpose of this course is to introduce students to Identify the vulnerabilities in the web applications. Identify the various types of threats and mitigation measures of web applications. Understand the security principles in developing a reliable web application. Understand industry standard tools for web application security and penetration testing to improve the security of web applications. In addition to this, students will also get an introduction to different types of vulnerabilities like SQL					

	Injection, Cross-Site Scripting (XSS). Secure Coding Fundamentals, Web Application Security Testing and advanced Web Security Concepts: Defense against Advanced Attacks.			
Course Objective	The objective of the course is to familiarize the learners with the concepts to identify and aid in fixing any security vulnerabilities during the web development process and attain Skill Development using PROBLEM SOLVING techniques.			
Course Out Comes	On successful completion of the course the students shall be able to: CO1. Reproduce the fundamental concepts of web application security. [Remember] CO2. Explain the common web vulnerabilities and user authentication mechanisms. [Understand] CO3. Outline the secure coding fundamentals with web application security testing. [Understand] CO4. Classify the advanced web security concepts [Application]			
Course Content:				
Module 1	Foundations of Web Security	Quiz	Coding Assignment	9 Sessions
Topics: Introduction to Web Application Security: Overview of Web Security Principles, Common Threats and Attack Vectors, Security Goals and Principles; Web Technologies and Protocols: HTTP/HTTPS Protocols Web Server Architecture (e.g., Apache, Nginx), Client-Server Communication and Security Considerations; Networking and Cryptography Essentials: TCP/IP Basics, Network Security Principles, Cryptography Fundamentals: Encryption, Hashing, SSL/TLS.				
Module 2	Web Application Vulnerabilities	Quiz	Coding Assignment	12 Sessions
Topics: Common Web Vulnerabilities: OWASP Top Ten, SQL Injection, Cross-Site Scripting (XSS), Cross-Site Request Forgery (CSRF), Security Headers and Content Security Policy (CSP), Authentication and Access Control; User Authentication Mechanisms: Authorization Models and Best Practices, Single Sign-On (SSO) and Identity Management.				
Module 3	Secure Coding Practices and Testing	Quiz	Coding Assignment	12 Sessions
Topics: Secure Coding Fundamentals: Input Validation and Output Encoding, Error Handling and Logging Best Practices, Secure Use of APIs and Libraries; Web Application Security Testing: Penetration Testing Methodologies, Vulnerability Assessment Tools and Techniques, Reporting and Remediation Strategies.				
Module 4	Advanced Topics in Web Security	Quiz	Coding Assignment	10 Sessions
Topics: Advanced Web Security Concepts: Defense against Advanced Attacks (e.g., Advanced SQL Injection), Securing Modern Web Technologies (e.g., Single Page Applications, APIs), Mobile Application Security Considerations.				
Targeted Application & Tools that can be used: Java, Java Script, Python				
Project work/Assignment:				
Assignment:				

Students will have to do participate in a shared task / clear a SWAYAM/NPTEL course. Try to get, Certified Ethical Hacker (CEH), Offensive Security Certified Professional (OSCP), Certified Information Systems Security Professional (CISSP). Capstone Project: Real-world Security Assessment of a Web Application., 2. Developing a Comprehensive Security Strategy.	
Text Book T1 Bryan Sullivan and Vincent Liu, "Web Application Security: A Beginner's Guide", 2016. T2 Dafydd Stuttard and Marcus Pinto, "The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws", 2nd edition 2011. T4 OWASP (Open Web Application Security Project), "OWASP Testing Guide", 2015.	
References R1: John Viega and Matt Messier. "Secure Programming Cookbook for C and C++: Recipes for Cryptography, Authentication, Input Validation & More". 1st edition. 2003. R2: Mike Shema. "Hacking Web Apps: Detecting and Preventing Web Application Security Problems". 2012.	
Topics relevant to "SKILL DEVELOPMENT": Understand the security principles in developing a reliable web application Prompt Engineering for Skill Development through Problem solving techniques. This is attained through assessment component mentioned in course handout.	
Catalogue prepared by	Dr. Mohana S D
Recommended by the Board of Studies on	
Date of Approval by the Academic Council	

CSA3048 : Cloud Storage and Application

Course Code: CSA3048	**Course Title: Cloud Storage and Application** **Type of Course: Discipline elective: Theory only**	**L-T- P- C**	3	0	0	3
Version No.	**1.0**					
Course Pre-requisites	**NIL**					
Anti-requisites	**NIL**					
Course Description	This Course is designed to help the students to understand the storage concepts of Cloud Computing and its applications. Cloud Computing has emerged in recent years as a new paradigm for hosting and delivering services over the Internet. The students can understand Cloud Computing terminology and cloud storage methods. With good knowledge of Cloud computing and cloud storage methods, Students can discover a scientific application of cloud in Healthcare, Biology and Geoscience.					
Course	The objective of the course is to familiarize the learners with the					

Objective	concepts of C**loud Storage and Application** and attain **Employability Skills** through **Participative Learning** techniques.			
Course Outcomes	**Upon successful completion of the course the students shall be able to:** **CO1.** Explain the basic concepts along with deployment models in Cloud computing [Knowledge] **CO2.** Identify best storage virtualization technology and techniques [comprehension] **CO3.** Identify appropriate cloud storage service providers and security management [Knowledge] **CO4.**Understand cloud-based application on healthcare, Geoscience and business [Comprehension]			
Course Content:				
Module 1	**Fundamentals of cloud computing**	Assignment	Theory	**8 sessions**
Cloud computing at a glance, Historical developments: Distributed systems, virtualization, web2.0, service-oriented computing, Utility-oriented computing, your organization and cloud computing: Goals and Benefits, Risk and limitations, Security concerns **(text 1)**, Cloud Delivery Models, Cloud Deployment Models (Ref 2)				
Module 2	**Cloud Storage Services**	Assignment	Theory	**8 sessions**
Overview of cloud storage, Storage as a Service, Cloud Storage providers **(Ref 2)**, Cloud storage Devices **(ref 1)**, Amazon storage services: Amazon simple storage service(S3), Elastic Block Store(EBS), ElastiCache, CloudFront ,SimpleDB. **(Text 1)**				
Module 3	**Storage Virtualization**	Assignment	Theory	**8 sessions**
Virtualization and cloud computing, Characteristics of Virtualization environments, Taxonomy of Virtualization techniques, Pros and cons of virtualization, Virtualization Technology examples(**txt1)**, Forms of virtualization, Benefits of Storage Virtualization, Types of Storage Virtualization, SNIA storage virtualization Taxonomy, Storage virtualization challenges (Ref 4).				
Module 4	**Storage security and Management**	Assignment	Theory	**8 sessions**
Securing the storage infrastructure: Information security framework – Risk triad – Storage security domains – Security implementation in storage networking – Managing the storage				

Infrastructure: Monitoring the storage Infrastructure, Storage management Activities, Storage infrastructure management challenges, Developing and Ideal solution. (Ref 4)

Module 5	**Storage Applications**	Assignment	Theory	**7 sessions**

Healthcare: ECG analysis in the cloud, Biology: protein structure prediction, gene expression data analysis for cancer diagnosis, Geoscience: satellite image processing, Business and Consumer application: CRM and ERP, Productivity, social networking, Media applications, multiplayer online gaming. (Text 1)

Targeted Application & Tools that can be used:

Targeted Applications:

Developing applications on Cloud Platforms via Virtual machines

Cloud Tools:

- CloudSim
- VMWare
- Amazon EC2
- Google Compute Engine
- Microsoft Azure

Suggested List of Hands-on Activities:

1. Install Oracle Virtual box and create two VMs on your laptop.
2. Develop a Hello World application using Google App Engine.
3. Develop a Windows Azure Hello World application using

Text Book(s)

1. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, "*Mastering Cloud Computing*", McGraw Hill Education, 2013 edition.

References

1. Thomas Erl, Zaigham Mahmood, and Ricardo Puttini, "*Cloud Computing Concepts, Technology & Architecture*", PHI publisher 2013 edition.
2. Anthony T Velte, Toby J Velte, Robert Elsenpeter, "*Cloud Computing: A Practical Approach*", Tata McGraw-Hill, 2010 edition.
3. David E.Y. Sarna, "*Implementing and Developing Cloud Applications*", CRC Press, 2018 edition.
4. EMC education services. Information Storage and Management: Storing, Managing, and Protecting Digital Information in Classic, Virtualized, and Cloud Environments,
Wiley, 2012.

Web Resources and Research Articles links:

1. IEEE Transactions on Cloud Computing- https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=6245519
2. International Journal of Cloud Computing- https://www.inderscience.com/jhome.php?jcode=ijcc

3. Journal of Network and Computer Networking- https://www.journals.elsevier.com/journal-of-network-and-computer-applications 4. https://presiuniv.knimbus.com/user#/home 5. https://puniversity.informaticsglobal.com:2229/login.aspxdirect=true&db=nlebk&AN=2706929&site=ehostlive
Topics relevant to "EMPLOYABILITY SKILLS": RM and ERP, Productivity, social networking, Media applications, multiplayer online gaming for developing **Employability Skills** through **Participative Learning techniques.** This is attained through assessment component mentioned in course handout..

CSA3020 : Artificial Intelligence For Game Development

Course Code: CSA3020	**Course Title: ARTIFICIAL INTELLIGENCE FOR GAME DEVELOPMENT** **Type of Course: Program Core:Theory Only Course**	**L- T- P- C**	3	0	0	3
Version No.	1					
Course Pre-requisites	BCA 1005 – Programming in Python					
Anti-requisites	NIL					
Course Description	This course provides a solid foundation of the basic and advanced concepts that you would need to build AI for a gaming environment and beyond. This course will develop programming logic for teaching machines to play computer games. Upon completion of the course, the students would be able to understand and utilize different artificial intelligence concepts for game development. **Topics:** Basic Concepts in AI. Path-finding, decision making, strategies and tactics. Types of games and challenges – turn-based games, real-time games, shooting games, driving and sports games, flocking and herding games.					
Course Objective	he objective of the course is to familiarize the learners with the concepts of **Artificial Intelligence for Game Development** and attain **Skill Development** through **Participative Learning** techniques.					
Course Out Comes	**On successful completion of the course the students shall be able to:** • **CO1**. Explain basic artificial intelligence concepts used for developing computer games. **[Knowledge]** • **CO2.** Implement different path-finding algorithms such as A*, Dijkstra's, etc. **[Application]**					

	• **CO3.** Solve common board games and implementing their solutions using either Python / Java / C# **[Application]** • **CO4.** Apply tactical and strategic AI for playing computer games. **[Application]**			
Course Content:				
Module 1	**Introduction to AI for Gaming**	Quiz	Coding Assignment	**6 Sessions**
Topics: Introduction to the course; Basic concepts in AI for gaming; Introduction to path-finding, decision making, strategies and tactics; Types of games and challenges: Turn-based games, real-time games, shooting games, driving and sports games, flocking and herding games.				
Module 2	**Pathfinding for Games**	Quiz	Coding Assignment	**7 Sessions**
Topics: Pathfinding graph; Uninformed Search Techniques; Dijkstra's algorithm for single-source shortest path; A* search; Hierarchical Pathfinding; Continuous Time Pathfinding; Movement Planning.				
Module 3	**Decision Making**	Quiz	Coding Assignment	**7 Sessions**
Topics: Overview of Decision Making; Decision Trees and State Machines; Behaviour Trees; Fuzzy Logic; Markov Systems; Goal-oriented Behaviour; Rule-based Systems; Blackboard Architectures.				
Module 4	**Tactical and Strategic AI**	Quiz	Coding Assignment	**8 Sessions**
Topics: Tactics and Strategies; Tactical analysis and pathfinding; Learning; Action Prediction; Decision Learning; Utility Functions; Introduction to Reinforcement Learning.				
Module 5	**Board Games**	Quiz	Coding Assignment	**8 Sessions**
Topics: Types of games based on information and process; Adversarial search algorithms; Minimaxing, Pruning and Ordering; Transposition Tables; Opening Books and Set Plays; Turn-based Strategy games.				
Targeted Application & Tools that can be used: 1. Python				
Assignment: Students will have to write the AI for **two** games.				
Text Book **T1** Ian Millington and Juhn Fundge, "Artificial Intelligence for Games", 3rd Edition, CRC Press, 2019.				

References

R1 Georgios N. Yannakakis and Julian Togelius, “Artificial Intelligence and Games”, 1st Edition, Springer, 2018.

Web resources: **https://presiuniv.knimbus.com/user#/**

https://nptel.ac.in/courses

Topics relevant to “SKILL DEVELOPMENT”: Adversarial search algorithms; Minimaxing, Pruning and Ordering; Transposition Tables; Opening Books and Set Plays; Turn-based Strategy games **for Skill Development through Participative Learning techniques. This is attained through assessment component mentioned in course handout.**

CSA2102 – Information Retrieval

Course Code: CSA2102	Course Title: Information Retrieval Type of Course: Theory	L-T-P-C	3	0	0	3
Version No.	1.0					
Course Pre-requisites	ML USING PYTHON Basics of Data mining such as classification and clustering techniques					
Anti-requisites						
Course Description	The course is an intermediary course and aims to provide students with an in-depth understanding of design and implementation of data warehousing and data mining. The course will help students to enhance their understanding of various classification, clustering and outlier analysis methods. An interest to understand the concepts of data warehousing, data mining and a desire to be a successful data scientist are key to enable students to complete the course successfully. Topics include: Data Model for Data Warehouses, data extraction, cleansing, transformation and loading, data cube computation, materialized view selection, OLAP query processing. Data mining-Fundamentals. Mining Techniques and Application: Classification, Clustering, Outlier analysis.					
Course Objective	The objective of the course is SKILL DEVELOPMENT of student by using PARTICIPATIVE LEARNING techniques					
Course Out Comes	On successful completion of the course the students shall be able to: Define basic concepts of information Retrieval-(Remember) Calculate the effectiveness and efficiency of different information retrieval methods [Apply]					

	Demonstrate the concept of web retrieval and crawling. [Apply] Classify different recommender system and its aspect. [Understand]			
Course Content:				
Module 1	Introduction to Information Retrieval	Assignment	Data Collection/Interpretation	[10 Hours]
Topics: Information Retrieval: Web Search, Other IR Applications, Information Retrieval Systems: The Software Architecture, Documents and Update, Performance Evaluation, Open Source IR Systems: Lucene, Indri, Wumpus, Basic Techniques: Inverted Indices, Retrieval and Ranking, Evaluation.				
Module 2	Indexing	Assignment	Case studies / Case let	12 Sessions
Topics: Module: 2: Static Inverted Indices: Index Components and Index Life Cycle, The Dictionary, Postings Lists, Interleaving Dictionary and Postings Lists, Index Construction, Other Types of Indices, Query Processing: Query Processing for Ranked Retrieval, Lightweight Structure, Index Compression: General-Purpose Data Compression, Symbolwise Data Compression, Compressing Postings Lists, Compressing the Dictionary, Dynamic Inverted Indices: Batch Updates, Incremental Index Updates, Document Deletions, Document Modifications.				
Module 3	Retrieval and Ranking	Assignment	Case studies / Case let	14 Sessions
Topics: Probabilistic Retrieval: Modeling Relevance, The Binary Independence Model, The Robertson/Sparck Jones Weighting Formula, Document Length - BM25, Field Weights – BM25F, Language Modeling and Related Methods: Generating Queries from Documents, Language Models and Smoothing, Ranking with Language Models, Kullback-Leibler Divergence, Divergence from Randomness, Passage Retrieval and Ranking, Categorization and Filtering: Classification, Probabilistic Classifiers, Linear Classifiers, Similarity-Based Classifiers				
Module 4	Evaluation	Assignment	Case studies / Case let	10 Sessions
Topics: Measuring Effectiveness: Traditional Effectiveness Measures, The Text Retrieval Conference, Using Statistics in Evaluation, Minimizing Adjudication Effort, Nontraditional Effectiveness Measures, Measuring Efficiency: Efficiency Criteria, Queuing Theory, Query Scheduling, Caching				

Project work/Assignment:
Assignment:
Text Book T1. Stefan Buttcher, Charles L. A. Clarke, Gordon V. Cormack, "*Information Retrieval - Im odern Information Retrieval: The Concepts and Technology behind Search*", 3rd Edition, ACM Press Books, 2018. T2. Ricci. F. Rokach, L. Shapira, B. Kantor, "*Recommender Systems Handbook*", 4th Edition, 2018.
References R1. Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, "*Information Retrieval: Implementing and Evaluating Search Engines*", The MIT Press, 2017. R2. Jian-Yun Nie Morgan, Claypool, "*Cross-Language Information Retrieval*", Publisher series 2011.
Topics relevant to development of "Skill Development": Dimensionality Reduction, Recommendation System Topics relevant to development of "Environment and sustainability

CSA3097- Machine Learning For Business

Course Code: **CSA3097**	**Course Title: MACHINE LEARNING FOR BUSINESS** **Type of Course: Theory Only Course**	**L- T-P-C**	3	0	0	3
Version No.	1					
Course Pre-requisites	BCA 1005 – Programming in Python, Data Analysis and Visualization					
Anti-requisites	NIL					
Course Description	This course provides a solid foundation of the basic and advanced concepts that you would need to build AI for a gaming environment and beyond. This course will develop programming logic for teaching machines to play computer games. Upon completion of the course, the students would be able to understand and utilize different artificial intelligence concepts for game development.					

	Topics: Basic Concepts in AI. Path-finding, decision making, strategies and tactics. Types of games and challenges – turn-based games, real-time games, shooting games, driving and sports games, flocking and herding games.			
Course Objective	The objective of the course is to familiarize the learners with the concepts **MACHINE LEARNING FOR BUSINESS** and attain **Skill Development** using PROBLEM SOLVING techniques			
Course Out Comes	**On successful completion of the course the students shall be able to:** (a) **CO1**. Understand the fundamental principles of machine learning and its applications in a business context. **[Knowledge]** (b) **CO2.** Gain insights into decision-making processes and learning mechanisms in ML.**[Application]** (c) **CO3.**Develop a deep understanding of supervised learning techniques and their practical applications. **[Application]** (d) **CO4.** Understand the concepts and applications of SVMs in classification and regression and the structure and training of neural networks.**[Application]** (e) **CO5.** Understand and apply advanced ML techniques in reinforcement learning and societal and ethical implications of ML and how to address them. **[Application]**			
Course Content:				
Module 1	**Introduction to Machine Learning for Business**	Quiz	Coding Assignment	**6 Sessions**
Topics: **How Machine Learning Applies to your Business:** Why are our Business systems so terrible? ; Why is automation important now? ; How do machines make decisions? ; How does a machine learn? ; Tools: AWS; SageMaker; Jupyter Notebook.				
Module 2	**Introduction to Machine Learning**	Quiz	Coding Assignment	**7 Sessions**
Topics: **Introduction to the ML:** Types of Machine Learning models; Validation and testing; Data Cleaning; Bayes' Theorem. **Unsupervised Learning:** Feature scaling; The k-means Algorithm; Alternative clustering approaches; Principal Component Analysis.				
Module 3	**Supervised Learning:**	Quiz	Coding Assignment	**7 Sessions**

	Decision Trees			
Topics: **Supervised Learning**: Linear Regression; Regularization; Application to predicting House Prices; Logistic Regression; Decision criteria; Application to credit decisions, The k-nearest neighbour algorithm. **Decision Trees:** Nature of Decision trees; Information gain measures; Application to LendingClub Data, The naïve Base classifier; Ensemble learning.				
Module 4	**Supervised Learning: SVMs and Neural Networks**	Quiz	Coding Assignment	**8 Sessions**
Topics: **SVMs:** Linear SVM classification; Modification for soft margin; Non- linear separation; Predicting a target's value. **Neural Networks:** ANNs; Other activation functions; Gradient descent algorithm; Applications of Neural Networks.				
Module 5	**Reinforcement Learning, NLP and Issues for society**	Quiz	Coding Assignment	**8 Sessions**
Topics: **Reinforcement Learning:** The multi-armed bandit problem; The game of Nim; Temporal difference learning; Deep Q-learning; Playing chess; Applications; Optimal Trade Execution; Data issues. **Natural Language Processing:** Sources of data; Pre-processing; Bag-of-words model; Application of Naïve Base classifier and other algorithms; G; NLP Applications. **Issues for society:** Data privacy; Biases; Ethics; Transparency; Adversarial Machine learning; Legal Issues; Man vs Machine.				
Targeted Application & Tools that can be used: (f) Python, Jupyter Notebook				
Project work/Assignment:				
Assignment: Students will have to write the ML for **two** case studies.				
Text Book **T1** Doug Hudgeon, Richard Nichol, "Machine Learning for Business", Manning Publications, 2019, ISBN 9781617295836. **T2** John C. Hull , " Machine Learning in Business: An Introduction to the				

World of Data Science ”, 3rd Edition, 2021, ISBN: 9798644074372 .
References **R1** Dr. PANKAJ CHAUDHARY (Author), Mr. NAGENDRA PRASAD KRISHNAM (Author), Mr. VINAY KUMAR SHARMA Dr. USHA S (Author) , “Machine Learning for Business”, 1st Edition, Book Rivers Publisher, 2022, ISBN-13: 978-9355153814. **Web resources: https://presiuniv.knimbus.com/user#/** **https://nptel.ac.in/courses**
Topics relevant to “SKILL DEVELOPMENT”: Proficiency in using AWS, SageMaker, and Jupyter Notebook for **Skill Development** through **Problem solving techniques. This is attained through assessment component mentioned in course handout.**

CSA2109 AI in Healthcare

Course Code: **CSA2109**	**Course Title:** AI in Health Care **Type of Course:** Theory	**L-T-P-C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	Nil					
Anti-requisites	NIL					
Course Description	This course provides an in-depth understanding of how Artificial Intelligence (AI) technologies are transforming the healthcare domain. Students will explore AI-driven solutions for medical diagnosis, treatment planning, and operational efficiency, while addressing ethical and regulatory concerns. Through theoretical frameworks and case studies, the course emphasizes the critical role of AI in improving patient outcomes and reducing healthcare costs.					
Course Objective	The objective of the course is to provide an understanding of AI applications in healthcare, focusing on diagnosis, treatment, ethical considerations, and emerging trends.					
Course Outcomes	CO1 : Explain the fundamental concepts of AI and its applications in the healthcare domain. CO2 : Analyse and apply AI models for diagnostic and predictive tasks in healthcare. CO3 : Evaluate the ethical and regulatory aspects of AI deployment in					

	healthcare systems CO4 : Assess the effectiveness of AI tools through real-world case studies. CO5: Explore emerging trends and future directions of AI in healthcare.

Course Content:				
Module 1	**Foundations of AI in Healthcare**	Assignments	Comprehension based Quizzes and assignments	**9 Sessions**
Introduction to AI, machine learning, and deep learning concepts. Overview of healthcare systems and current challenges. Role of AI in transforming healthcare delivery.				
Module 2	***Healthcare Data and Management***	Test	Comprehension based Quizzes and assignments	**9 Sessions**
Types of healthcare data: Electronic Health Records (EHR), medical imaging, sensor data, and genomics. Data cleaning, preprocessing, and feature engineering. Data security, privacy, and compliance (HIPAA, GDPR).				
Module 3	***AI Techniques and Tools in Healthcare***	Assignment	Comprehension based Quizzes and assignments	**9 Sessions**
Machine learning algorithms: Linear regression, decision trees, ensemble methods. Deep learning models: CNNs for imaging, RNNs for sequential data, and transformers. Introduction to healthcare-specific tools and platforms: TensorFlow, PyTorch, and healthcare datasets.				
Module 4	***Applications of AI in Clinical Settings***	Test	Comprehension based Quizzes and assignments	**9 Sessions**
Diagnostic tools: AI in radiology, pathology, and ophthalmology. Predictive models: Patient risk assessment and early detection of diseases. AI in surgery: Robotics and surgical assistance.				
	Ethical and	Quiz		**9**

Module 5	***Regulatory Frameworks***		CA	**Sessions**
Principles of ethical AI in healthcare: Fairness, accountability, and transparency. Regulatory bodies and standards: FDA, EMA, and ISO for AI in healthcare. Addressing biases, ensuring inclusivity, and maintaining patient trust.				
List of Laboratory Tasks: NA				
Targeted Application & Tools that can be used: NA				
Assignment:				
1. Assignments are given after completion of each module which the student need to submit within the stipulated deadline.				
Text Book 1. Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again – Eric Topol. 2. Artificial Intelligence in Healthcare: A Comprehensive Guide – Adam Bohr and Kaveh Memarzadeh. 3. Machine Learning for Healthcare – John C. Geyer.				
References 1. Artificial Intelligence in Medicine: Applications, Analysis, and Future Prospects – Hassan Ghazal and Mark Last. 2. Big Data and Artificial Intelligence for Healthcare Applications – Ankur Saxena, Nishu Gupta, Ashish Khanna.				

Mandatory Courses (MAC)

LAW7601 Indian Constitution

Course Code: LAW7601	**Course Title: Indian Constitution** **Type of Course: MOOC**	**L-T-P-C**	-	-	-	-
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	This course provides a comprehensive understanding of the Indian Constitution and its foundational elements. It begins with a critical analysis of the historical background, the Preamble, Fundamental Rights, and the basic structure doctrine, enabling students to appreciate the constitutional					

	vision of justice, liberty, equality, and fraternity. The course then delves into the framework of governance at both the central and state levels, highlighting the roles, responsibilities, and interplay between key institutions such as the President, Prime Minister, Parliament, Governors, Chief Ministers, and State Secretariats. Additionally, the course offers insights into the structure and functioning of local self-governments, including District Administration, Municipal Corporations, and Zila Panchayats, thus fostering an understanding of grassroots democracy. Finally, the course assesses the pivotal role of the Election Commission in safeguarding democratic values through the conduct of free and fair elections.			
Course Objective	This course is designed to improve the learners' **Employability Skills** by using **Participatory Learning techniques**.			
Course Outcomes	On successful completion of the course, the students shall be able to: **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.** To analyse the role of the Election Commission in conducting free and fair elections.			
Course Content:				
Module 1	**The Constitution - Introduction**	**CO1**	**Lectures & Discussion**	**08 Sessions**
History of the Making of the Indian Constitution, Preamble and Basic Structure, and its interpretation, Fundamental Rights and Duties and their interpretation, State Policy Principles.				
Module 2	**Union Government**	**CO2**	**Case Study/Group Discussion**	**08 Sessions**
Structure of the Indian Union, President – Role and Power, Prime Minister and Council of Ministers, Lok Sabha and Rajya Sabha.				
Module 3	**State Government**	**CO3**	**Research paper**	**06 Sessions**
Governor – Role and Power, Chief Minister and Council of Ministers, State Secretariat.				
Module 4	**Local Administration**	**CO4**	**Presentation**	**04 Sessions**
District Administration, Municipal Corporation Zila Panchayat.				

Module 5	**Election Commission**	**C05**		**04 Sessions**
Role and Functioning, Chief Election Commissioner, State Election Commission.				

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

Project work/Assignment:

Group Assignment
Details:

1. Presentations and Discussions

Research Project
Details:

1. Research Paper Writing
2. Case Analysis on leading cases

Test Books

1. Ethics and Politics of the Indian Constitution – Rajeev Bhargava, Oxford University Press, New Delhi, 2008
2. The Constitution of India – B.L. Fadia, Sahitya Bhawan, 2017 (New Edition)
3. Introduction to the Constitution of India – D.D. Basu, Lexis Nexis, 2018 (Twenty-Third Edition)

Case Laws

1. Rustom Cavasjee Cooper v. Union of India (1970) 1 SCC 248
2. State of Rajasthan v. Mohan Lal Vyas, AIR 1971 SC 2068
3. Mithilesh Garg v. Union of India (1992) 1 SCC 168
4. Chintamanrao v. The State of Madhya Pradesh, AIR 1951 SC 118
5. Cooverjee B. Bharucha v. Excise Commissioner, Ajmer, AIR 1954 SC 220
6. Automobile Transport (Rajasthan) Ltd. Vs State of Rajasthan, AIR 1962 SC 1406
   (And more as listed)

Reference:

1. Indian Constitution
2. Legislative Department of India
3. Supreme Court of India
4. Toppr Guide: The Indian Constitution

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