PRESIDENCY UNIVERSITY
Private University Estd. in Karnataka State by Act No. 41 of 2013
Itgalpura, Rajankunte, Yelahanka, Bengaluru – 560064

PRESIDENCY SCHOOL OF COMPUTER SCIENCE AND ENGINEERING

Program Regulations and Curriculum 2022-2026

BACHELOR OF TECHNOLOGY (B.Tech.) in COMPUTER SCIENCE AND ENGINEERING-Cyber Security(CCS)

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

Regulations No.: PU/AC-18.8/CSE16 /CCS/2022-2026

Resolution No. 8 of the 18th Meeting of the Academic Council held on 3rd August, 2022, and ratified by the Board of Management in its 19th Meeting held on 4th Aug 2022.

(As amended up to the 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)

AUGUST-2022

Table of Contents

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 Computer Science and Engineering

- To be a value based, practice-driven School of Computer Science and Engineering, committed to developing globally-competent Engineers, dedicated to developing cutting-edge technology, towards enhancing Quality of Life.

1.4 Mission of Presidency School of Computer Science and Engineering

- Cultivate a practice-driven environment, with computing-based pedagogy, integrating theory and practice.
- Attract and nurture world-class faculty to excel in Teaching and Research, in the realm of Computing Sciences.
- Establish state-of-the-art computing facilities, for effective Teaching and Learning experiences.
- Promote Interdisciplinary Studies to nurture talent for global impact.
- Instill 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 B.Tech 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 Technology Degree Program Regulations and Curriculum 2022-2026.
b. These Regulations are subject to, and pursuant to the Academic Regulations.
c. These Regulations shall be applicable to the ongoing Bachelor of Technology Degree Programs of the 2022-2026 batch, and to all other Bachelor of Technology Degree Programs which may be introduced in future.
d. These Regulations shall supersede all the earlier Bachelor of Technology Degree Program Regulations and Curriculum, along with all the amendments thereto.
e. These Regulations shall come into force from the Academic Year 2022-2023.

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 / Director of the concerned School;*

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

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

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

x. *"Discipline" means specialization or branch of B.Tech. Degree Program;*

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

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

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

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

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

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

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

ff. *"Program Regulations" means the Bachelor of Technology Degree Program Regulations and Curriculum, 2022-2026;*

gg. *"Program" means the Bachelor of Technology (B.Tech.) Degree Program;*

hh. *"PSCS" means the Presidency School of Computer Science and Engineering;*

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

jj. *"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;*

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

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

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

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

oo. *"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;*

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

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

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

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

5. Program Description

The Bachelor of Technology Degree Program Regulations and Curriculum 2022-2026 are subject to, and, pursuant to the Academic Regulations. These Program Regulations shall be applicable to the following ongoing Bachelor of Technology (B.Tech.) Degree Programs of 2022-2026 offered by the Presidency School of Computer Science and Engineering (PSCS):

1. Bachelor of Technology in Computer Science and Engineering, abbreviated as CSE
2. Bachelor of Technology in Computer Science and Technology (Big Data), abbreviated as CBD
3. Bachelor of Technology in Computer Science and Engineering (Block Chain), abbreviated as CBC
4. Bachelor of Technology in Computer Science and Technology (Dev Ops), abbreviated as CDV
5. Bachelor of Technology in Computer Science and Engineering (Cyber Security), abbreviated as CCS
6. Bachelor of Technology in Computer Science and Engineering (Internet of Things), abbreviated as CIT
7. Bachelor of Technology in Computer Science and Engineering (Data Science), abbreviated as CSD
8. Bachelor of Technology in Computer Science and Technology, abbreviated as CSG
9. Bachelor of Technology in Information Science and Technology, abbreviated as IST
10. Bachelor of Technology in Computer Engineering, abbreviated as COM
11. Bachelor of Technology in Information Science and Engineering, abbreviated as ISE and
12. Bachelor of Technology in Computer Science and Engineering (Artificial Intelligence and Machine Learning) abbreviated as CAI

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 Technology Degree Program is a Four-Year, Full-Time Semester based program. The minimum duration of the B.Tech. Program is four (04) years and each year comprises of two academic Semesters (Odd and Even Semesters) and hence the duration of the B.Tech. program is eight (08) 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 (Sub-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:

PEO1. Demonstrate as a Computer Engineering Professional.

PEO2. Engage in lifelong learning through research and professional development,

PEO3. Serve as a leader in the profession through consultancy, extension activities 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:

PO1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem Analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. **Design/Development of Solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. 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 technological change.

8.2 Program Specific Outcomes (PSOs):

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

PSO01: Problem Analysis: Identify, formulate, and analyze complex engineering problems related to Cyber Security principles and practices, Programming, and Computing technologies. Utilize research literature and apply first principles of mathematics, natural sciences, and engineering sciences to draw substantiated conclusions.

PSO02: Design/Development of Solutions: Design innovative solutions for complex engineering challenges in Cyber Security principles and practices, Programming, and Computing technologies. Develop system components or processes that address specified needs while considering public health and safety, cultural, societal, and environmental factors.

PSO03: Modern Tool Usage: Select, create, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to tackle complex engineering problems related to Cyber Security principles and practices, Programming in Cyber Security, and Computing & Analytics, with an understanding of their limitations.

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 B.Tech. 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, the applicant must have taken Physics and Mathematics as compulsory subjects in the Pre-University / Higher Secondary / (10+2) / (11+1) examination, along with either Chemistry / Biology / Electronics / Computer Science / Biotechnology subject, and, the applicant must have obtained a minimum of 45% of the total marks (40% in case of candidates belonging to the Reserved Category as classified by the Government of Karnataka) in these subjects taken together.

9.3 The applicant must have appeared for Joint Entrance Examinations (JEE) Main / JEE (Advanced) / Karnataka CET / COMED-K, or any other State-level Engineering Entrance Examinations.

9.4 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.

9.5 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.

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

9.7 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.

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

10 Lateral Entry / Transfer Students requirements

10.1 Lateral Entry

The University admits students directly to the second year (3rd Semester) of the B.Tech. Degree program as per the provisions and/or regulations of the Government of Karnataka pertaining to the "Lateral Entry" scheme announced by the Government from time to time. Further, the general conditions and rules governing the provision of Lateral Entry to the B.Tech. Program of the University are listed in the following Sub-Clauses:

10.1.1 Admission to 2nd year (3rd Semester) of the B.Tech. Degree program shall be open to the candidates who are holders of a 3-year Diploma in Engineering (or equivalent qualification as recognized by the University), who have secured not less than forty-five percentage (45%) marks in the final year examination (5th and 6th Semesters of the Diploma Program) in the appropriate branch of Engineering. Provided that, in case

of SC / ST and OBC candidates from Karnataka the minimum marks for eligibility shall be forty percent (40%).

10.1.2 Provided further that, candidates seeking Lateral Entry may be required to complete specified bridge Courses as prescribed by the University. Such bridge Courses, if any, shall not be included in the CGPA computations.

10.1.3 All the existing Regulations and Policies of the University shall be binding on all the students admitted to the Program through the provision of Lateral Entry.

10.1.4 The Course requirements prescribed for the 1st Year of the B.Tech. Program shall be waived for the student(s) admitted through Lateral Entry and the duration of the B.Tech. Program for such students is three (03) years, commencing from the 3rd Semester (commencement of the 2nd Year) of the B.Tech. Program and culminating with the 8th Semester (end of the 4th Year) of the B.Tech. Program.

10.1.5 Provided that, if a Lateral Entry student misses any mandatory program specific courses that are typically offered in the 1st year (1st or 2nd semesters), then those courses must be cleared by the students as soon as possible, preferably during the Summer Term.

10.1.6 The existing Program Regulations of the concerned Program to which the student is admitted through the provision of Lateral Entry shall be binding on the student with effect from the 3rd Semester of the Program. i.e., the Program Structure and Curriculum from the 3rd to 8th Semesters of the Program concerned shall be binding on the student admitted through Lateral Entry. Further, any revisions / amendments made to the Program Regulations thereafter, shall be binding on all the students of the concerned Program.

10.1.7 All the Courses (and the corresponding number of Credits) prescribed for the 1st Year of the concerned B.Tech. Program shall be waived for the student(s) admitted to the concerned B.Tech Program through Lateral Entry. Further, the *Minimum Credit Requirements* for the award of the B.Tech. Degree in the concerned Program shall be prescribed / calculated as follows:

The ***Minimum Credit Requirements*** for the award of the Bachelor of Technology (B.Tech.) Degree prescribed by the concerned Bachelor of Technology Degree Program Regulations and Curriculum, 2024-2028, minus the number of Credits prescribed / accepted by the Equivalence Committee for the 1st Year (1st and 2nd Semesters) of the B.Tech. Program.

For instance, if the *Minimum Credit Requirements* for the award of the Bachelor of Technology (B.Tech.) Degree as prescribed by the Regulations for B.Tech. (Cyber Security Engineering) is "N" Credits, and, if the total credits prescribed in the 1st Year (total credits of the 1st and 2nd Semesters) of the Program concerned is "M" Credits, then the *Minimum Credit Requirements* for the award of the B.Tech. in Cyber Security Engineering for a student who joins the Program through the provision of the Lateral Entry, shall be "N – M" Credits.

10.1.8 Further, no other waiver except the Courses prescribed for the 1st year of the B.Tech. Program of the University shall be permissible for students joining the B.Tech. Program through the provision of Lateral Entry.

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

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

10.2.1 The concerned student fulfils the criteria specified in Sub-Clauses 2.3.1, 2.3.2 and 2.3.3.

10.2.2 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) B.Tech. Program commencing on August 1 on the year concerned.

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

10.2.4 The transfer may be provided on the condition that the Courses and Credits completed by the concerned student in the 1st Year of the B.Tech. / B.E. / B.S. Four 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 B.Tech. Program of the University.

10.2.5 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 B.Tech. 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 B.Tech. Program to eligible students in accordance with the following rules and guidelines: framed by the University from time to time.

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

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

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

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

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

11.5.1 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;

11.5.2 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.

The process of change of Branch shall be completed within the first five days of Registration for the 3rd Semester of the B.Tech. 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 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 8.10 of Academics Regulations) 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

12.6

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	Continuous Assessments	75%

P component in the L-T-P Structure is predominant (Examples: 0-0-4; 1-0-4; 1-0-2; etc.)	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 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 in Clause 5.2 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. The same shall be approved by the respective DAC.

12.7 Minimum Performance Criteria:

12.7.1 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.

12.7.2 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.

12.7.3 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 Clause 12.7.1, 12.7.2) in the "Make-Up Examinations" of the concerned Course. Further, the student has an option to re-register for the Course and clear the same in the summer term/ subsequent semester if he/she wishes to do so, provided the Course is offered.

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

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

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

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

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

13.3.1 A student may complete SWAYAM/NPTEL/other approved MOOCs as mentioned in Clause 17.3(As per 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 13.3 (As per 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 (13.0) shall not be included in the calculation of the CGPA.

PART-B: PROGRAM STRUCTURE

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

The B.Tech-CSE (Cyber Security) Program Structure (2022-2026) totalling 160 credits. Table 3.0 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 3.0: B.Tech-CSE(Cyber Security) 2022-2026: Summary of Mandatory Courses and Minimum Credit Contribution from various Baskets

S.No	Baskets	Credit Contribution
1.	SCHOOL CORE	61
2	PROGRAM CORE	60
3.	DISCIPLINE ELECTIVE	30
4.	OPEN ELECTIVE	9
	TOTAL CREDITS	**Min. 160**

In the entire Program, the practical and skill based course component contribute to an extent of approximately 64% out of the total credits of 160 for B.Tech-CSE(Cyber Security) program of four years' duration.

15. Minimum Total Credit Requirements of Award of Degree

As per the AICTE guidelines, a minimum of 160 credits is required for the award of a B.Tech. degree.

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

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

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

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

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

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

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

PART-C:CURRICULUM STRUCTURE

17.Curriculum Structure – Basket Wise Course List

Type of Skill
F - Foundation S - Skill Development EM – Employability EN – Entrepreneurship

Course Caters to
GS - Gender Sensitization ES - Environment and sustainability HP - Human values and Professional Ethics

Table 3.1 : List of School Core Courses

Sl. No.	Course Code	Course Name	L	T	P	C	Contact Hours	Type of Skills	Pre-requisites
1	MAT1001	Calculus and Linear Algebra	3	0	2	4	5	F	-
2	MAT1002	Transform Techniques, Partial Differential Equations and their Applications	3	0	0	3	3	F	MAT1001
3	MAT1003	Applied Statistics	1	0	2	2	3	EM	-
4	MAT2003	Numerical Methods for Engineers	1	0	2	2	3	S	-
5	CSE1001	Problem Solving using JAVA	2	0	2	3	4	S	-
6	CSE1005	Programming in Python	1	0	4	3	5	S	-
7	CSE2001	Data Structures and Algorithms	3	0	2	4	5	S	-
8	CSE1002	Innovative Projects - Arduino using Embedded 'C'	0	0	4	2	4	S	-
9	CIV1008	Basic Engineering Sciences	2	0	0	2	2	S	-
10	MEC1006	Engineering Graphics	2	0	0	2	2	S	-
11	ECE2011	Innovative Projects Using Raspberry Pi	-	-	-	1		S	-
12	CSE7101	Capstone Project	-	0	-	4		S/ EM/ EN	-
13	CSE7302	Internship	-	-	-	8		S/ EM/ EN	-
14	CSE3216	Mastering Object-Oriented Concepts in Python	0	0	2	1	2		-
15	CSE3217	Data Structure and Web Development with Python	0	0	2	1	2		CSE1005
16	ECE1001	Elements of Electronics Engineering	3	0	2	4	5	F	-
17	PHY1002	Optoelectronics and Device Physics	2	0	2	3	4	F	-
18	ENG1001/ ENG1002	Foundation of English/ Technical English	1	0	2	2	3	F	-

19	ENG1002/ ENG2001	Technical English/ Advanced English	1	0	2	2	3	S	ENG1002
20	KAN1001/ KAN1002	Kali Kannada/ Thili Kannada	1	0	0	1	1	S	Non-Karnataka
21	PPS1001	Introduction to soft skills	0	0	2	1	2	S	-
22	PPS1002	Soft Skills for Engineers	0	0	2	1	2	S	-
23	PPS2002	Being Corporate Ready	0	0	2	1	2	S/EM	-
24	PPS4002	Introduction to Aptitude	0	0	2	1	2		
25	PPS4006	Logical and Critical Thinking	0	0	2	1	2	S	-
26	PPS4005	Aptitude for Employability	0	0	2	1	2	S/EM	-
27	PPS3018	Preparedness for Interview	0	0	2	1	2	S/EM	-
28	CHE1018	Environmental Science	1	0	2	0	3	F	-
Total No. of Credits						**61**			

Table 3.2 : List of Program Core Courses

Sl. No.	Course Code	Course Name	L	T	P	C	Contact Hours	Type of Skill/Focus	Pre-requisites/ Co-requisites
1	CSE2067	Web Technologies	2	0	2	**3**	3	S/EM	
2	CSE2007	Design and Analysis of Algorithms	3	0	0	**3**	3	S/EM/EN	CSE2001
3	CSE2009	Computer Organization and Architecture	3	0	0	**3**	3	S/EM	CSE2015
4	CSE2010	Operating Systems	3	0	0	**3**	3	S/EM	CSE2001
5	CSE2011	Data Communications and Computer Networks	3	0	0	**3**	3	S/EM	
6	CSE2074	Database Management Systems	2	0	2	**3**	3	S/EM	CSE2001
7	CSE2013	Cloud Computing	3	0	0	**3**	3	S/EM/EN	CSE2011
8	CSE2014	Software Engineering	3	0	0	**3**	3	S/EM	-
9	ECE2007	Digital Design	2	0	2	**3**	3	F / S	
10	MAT2004	Discrete Mathematical Structures	3	0	0	**3**	3	EM	MAT1001
11	CSE2018	Theory of Computation	3	0	0	**3**	3	F	

12	CSE2026	Data Handling and Visualization	2	0	2	**3**	3	F	CSE2027
13	CSE3001	Artificial Intelligence and Machine Learning	2	0	2	**3**	3	S/EM	MAT1001
14	CSE3078	Cryptography and Network Security	3	0	0	**3**	3	S/EM	CSE2011
15	CSE2027	Fundamentals of Data Analytics	3	0	0	**3**	3	S/EM/EN	-
16	CSE2037	Cyber Forensics	2	0	2	3	3	S/EM	CSE3078
17	CSE2039	Ethical Hacking	2	0	2	3	3	S/EM/EN	CSE2011
18	CSE2040	Cyber threats for IOT and Cloud	3	0	0	3	3	S/EM	CSE3078
19	CSE3097	Web Security	2	0	2	3	3	S	CSE2011
20	CSE3145	Intrusion Detection and Prevention System	3	0	0	3	3	S	CSE3078
Total No.of Credits						**60**			

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 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 B.Tech. 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). The same shall be prescribed in the Course Handout.

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 8th Semester, 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.

18.1.4.1 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 Capstone Project

A student may undergo a Capstone Project for a period of 12-14 weeks in an industry / company or academic / research institution in the 7th Semester as applicable, subject to the following conditions:

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

18.2.2 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;

18.2.3 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 18.2.2 above.

18.2.4 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 Internship Policy of the University.

18.2.5 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.

18.3 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:

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

The student may do the Research Project / Dissertation in an Industry / Company or academic / research institution of her / his choice subject to the above mentioned condition (Sub-Clause 18.3.1). 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 3.3 : Discipline Electives Courses/Specialization Tracks - Minimum of 24 credits is to be earned by the student in a particular track and overall 30 credits

Artificial Intelligence and Machine Learning Basket

Sl.No	Course Code	Course Name	L	T	P	C	Contact Hours	Type of Skills	Prerequisites
1	CSE3087	Applied Machine Learning	2	0	2	3	4	S	CSE3001
2	CSE3189	Deep Learning	2	0	2	3	4	S	CSE3008
3	CSE3011	Reinforcement Learning	2	0	2	3	4	S	CSE3008
4	CSE3012	Time Series Analysis	2	0	2	3	4	S	CSE3001
5	CSE3188	Natural Language Processing	2	0	2	3	4	S/EM	CSE3008
6	CSE3015	Advanced Natural Language Processing	2	0	2	3	4	S	CSE3014
7	CSE3017	Autonomous Navigation and Vehicles	3	0	0	3	3	S/EM	MAT1002
8	CSE3018	Digital Health and Imaging	3	0	0	3	3	S/EM	CSE3008
9	CSE3019	Stochastic Decision Making	3	0	0	3	3	S/EM	MAT1003

10	CSE3088	Business Intelligence and Analytics	3	0	0	3	3	S/ EM	CSE3008
11	CSE3103	Cognitive Science & Analytics	3	0	0	3	3	S/ EM	CSE3008
12	CSE3108	Expert Systems	3	0	0	3	3	S/ EM	CSE3008
13	CSE3208	Artificial Intelligence in Practice	2	0	2	3	4	S/ EM	CSE3001
Big Data Basket									
1	CSE2021	Data Mining	3	0	0	3	3	S/ EM	MAT1001
2	CSE2022	Domain Specific Predictive Analytics	3	0	0	3	3	S/EM	CSE2027
3	CSE2023	Data Warehousing and its Applications	3	0	0	3	3	S/EM	MAT1001
4	CSE2024	No SQL Databases	2	0	2	3	4	S	CSE2012
5	CSE3002	Big Data Technologies	2	0	2	3	4	S	CSE2012
6	CSE3030	Mining Massive Datasets	2	0	2	3	4	S/EM	CSE2027
7	CSE3031	Web Intelligence and Analytics.	2	0	2	3	4	S	CSE2027
8	CSE3032	Streaming Data Analytics	2	0	2	3	4	S	CSE2027
9	CSE3033	Information Visualization	2	0	2	3	4	S/EM	CSE2027
10	CSE3034	Big Data Security and Privacy.	3	0	0	3	3	S	CSE3002
Block Chain Basket									
1	CSE3021	Blockchain for Public Sector	3	0	0	3	3	S/EM	CSE2020
2	CSE3022	Crypto Currency Technology	3	0	0	3	3	S/EM	CSE2019
3	CSE3024	Emerging Areas in Blockchain	3	0	0	3	3	S/EM	CSE2020
4	CSE3025	Industry Use Cases using Blockchain	3	0	0	3	3	S/EM	CSE2020
5	CSE2019	Foundations of Blockchain Technology	3	0	0	3	3	S	-
6	CSE2020	Blockchain Technology and Applications	3	0	0	3	3	S	-
7	CSE3020	Smart Contract and Solidity	2	0	2	3	4	S	CSE2019
8	CSE3023	Distributed Ledger Technology	2	0	2	3	4	S	CSE 2019
9	CSE3028	Blockchain Security and Performance	2	0	2	3	4	S	CSE2019
Cyber Security Basket									

1	CSE2037	Cyber Forensics	2	0	2	3	4	S	CSE3078
2	CSE2038	Privacy and Security in Online Social Media	3	0	0	3	3	S/EM	CSE1001
3	CSE3342	Ethical Hacking	1	0	4	3	5	S	CSE2011
4	CSE2040	Cyber Threats for IoT and Cloud	3	0	0	3	3	S	CSE3078
5	CSE3145	Intrusion Detection and Prevention System	3	0	0	3	3	S	CSE3078
6	CSE3094	Cyber Security	3	0	0	3	3	S/EM	CSE3078
7	CSE3096	Cyber Digital Twin	3	0	0	3	3	S/EM	CSE2069
8	CSE3097	Web Security	2	0	2	3	4	S	CSE2011
9	CSE3098	Vulnerability Assessment and Penetration Testing	3	0	0	3	3	S/EM	CSE3078
10	CSE3099	Digital and Mobile Forensics	2	0	2	3	4	S/EM	CSE2011
11	CSE3100	Security Assessment and Testing	2	0	2	3	4	S/EM	CSE2011
12	CSE3101	Digital Watermarking and Steganography	3	0	0	3	3	S/EM	CSE3078
13	CCS3402	Identity and Access Management	3	0	0	3	3	S/EM	CSE2013
14	CCS3413	Security Auditing and Governance	3	0	0	3	3	S/EM	CSE3078
15	CCS3403	AI and ML in Cyber Security	3	0	0	3	3	S/EM	CSE3078
16	CCS3404	Incident Response and Threat Hunting	3	0	0	3	3	S/EM	CSE3078
17	CCS3411	Security Information and Event Management (SIEM)	3	0	0	3	3	S/EM	CSE3078
18	CSE3102	Malware Analysis	3	0	0	3	3	S/EM	CSE3078
19	CSE3095	Cloud Security	3	0	0	3	3	S/EM	CSE3078
Data Science Basket									
1	CSE2028	Statistical Foundations of Data Science	2	0	2	3	4	S/EM	MAT1003
2	CSE2029	Web Data Analytics	2	0	2	3	4	S/EM	CSE2027
3	CSE3035	R programming for Data Science	1	0	4	3	5	S/EM	CSE2027
4	CSE3038	Applied Data Science	2	0	2	3	4	S	CSE2027
5	CSE3039	Social Media Analytics	2	0	2	3	4	S	CSE3036
6	CSE3136	E-Business and Marketing Analytics	3	0	0	3	3	S	CSE2025

7	CSE3137	Text Mining and Analytics	3	0	0	3	3	S/EM	CSE3001
DevOps Basket									
1	CSE3040	Agile Structures and Frameworks	3	0	0	3	3	S	-
2	CSE3042	Applied DevOps	2	0	2	3	4	S/EM	CSE2014
3	CSE3043	Automated Test Management	2	0	2	3	4	S	CSE2014
4	CSE3044	Build and Release Management	3	0	0	3	3	S/EM	CSE2014
5	CSE3045	Development Automation	2	0	2	3	4	S	CSE2014
6	CSE3046	DevOps Tools Internals	2	0	2	3	4	S	-
7	CSE3050	Software Project Management	3	0	0	3	3	S/EM	CSE2014
8	CSE3051	System Monitoring	3	0	0	3	3	S/EM	CSE3120
9	CSE3052	System Provisioning and Configuration Management	3	0	0	3	3	S	CSE2014
IoT Basket									
1	CSE2032	Introduction to Fog Computing	3	0	0	3	3	S	CSE2011
2	CSE3053	Big Data Analytics for IoT	1	0	4	3	5	S	CSE3002
3	CSE3055	Wireless Communication in IoT	3	0	0	3	3	S	CSE2011
4	CSE3063	Privacy and Security in IoT	3	0	0	3	3	S	CSE3078
5	CSE3066	Mobile Application for IoT	3	0	0	3	3	S	CSE2011
6	ECE3075	IoT: Architecture and Protocols	3	0	0	3	3	S / EM	-
7	ECE3076	IoT Platforms and Application Development	2	0	2	3	4	S / EM	-
8	ECE3086	Industrial Internet of Things (IIoT)	3	0	0	3	3	S / EM	-
9	ECE3088	Internet of Medical Things (IoMT)	3	0	0	3	3	S / EM	-
General Basket									
1	CSE2033	Go Programming	3	0	0	3	3	S/ EM	CSE1002
2	CSE2066	Computer Graphics	3	0	0	3	3	S	-
3	CSE3146	Advanced Java Programming	1	0	4	3	5	S	CSE1001
4	CSE2036	Programming in C++	1	0	4	3	5	S/ EM	CSE1001
5	CSE3068	Advanced Database Management Systems	2	0	2	3	4	S/ EM	CSE2012
6	CSE3069	Introduction to Bioinformatics	3	0	0	3	3	S/ EM	-

7	CSE3070	Advanced Computer Networks	3	0	0	3	3	S/ EM	CSE2011
8	CSE3071	Computer Vision	2	0	2	3	4	S/ EM	MAT 1003
9	CSE3072	Wireless Sensor Networks	3	0	0	3	3	S/ EM	CSE 2011
10	CSE3073	Game Design and Development	3	0	0	3	3	S/ EM	-
11	CSE3074	Microprocessors and Microcontrollers	3	0	0	3	3	S/ EM	-
12	CSE3075	Mobile Application Development	1	0	4	3	5	S	CSE1001
13	CSE3077	Compiler Design	2	0	2	3	4	S	-
14	CSE3079	Parallel Computing	3	0	0	3	3	S/ EM	CSE2009
15	CSE3080	Quantum Computing	3	0	0	3	3	S/ EM	MAT1002
16	CSE3081	Digital Image Processing	2	0	2	3	4	S/ EM	MAT1002
17	CSE3082	Object Oriented Analysis and Design	3	0	0	3	3	S	CSE1001
18	CSE3083	Advanced Computer Architecture	3	0	0	3	3	S/ EM	CSE2009
19	CSE3084	Software Quality Assurance	2	0	2	3	4	S/ EM	CSE2014
20	CSE3085	Real Time Operating System	3	0	0	3	3	S/ EM	CSE2010
21	CSE3086	Information Theory and Coding	3	0	0	3	3	S/ EM	MAT1002
22	CSE3089	Software Architecture	3	0	0	3	3	S/ EM	CSE2009
23	CSE3090	5G Networking	3	0	0	3	3	S/ EM	CSE2011
24	CSE3091	Programming in C# and .NET	1	0	4	3	5	S/ EM	CSE1001
25	CSE2052	Distributed Systems	3	0	0	3	3	S/ EM	CSE2010
26	CSE3152	.NET Full Stack Development	2	0	2	3	4	S/ EM	-
27	CSE3150	Front End Full stack development	2	0	2	3	4	S/ EM	-
28	CSE3151	Java Full Stack Development	2	0	2	3	4	S/ EM	-
Cloud Computing Basket									
1	CSE2034	Edge Computing	3	0	0	3	3	S/EM	CSE2011
2	CSE3095	Cloud Security	3	0	0	3	3	S/EM	CSE2069
3	CSE3054	Data Center Design	3	0	0	3	3	S/EM	CSE2069

4	CSE3127	Cloud Application Development	3	0	0	3	3	S/EM	CSE2069
5	CSE3129	Middleware Technologies	3	0	0	3	3	S/EM	CSE2011
Information Science & Engineering Basket									
1	CSE2050	System Software	3	0	0	3	3	S	CSE2009
2	CSE2051	Information Retrieval	3	0	0	3	3	S	CSE2011
3	CSE2053	Enterprise Network Design	3	0	0	3	3	S	CSE2011
4	CSE3120	Operating System with Linux Internals	2	0	2	3	4	S/EM	
5	CSE3122	Pattern Recognition	2	0	2	3	4	S	CSE2007
6	CSE3123	Search Engine Optimization	3	0	0	3	3	S	CSE2007
7	CSE3125	Service Oriented Architecture	3	0	0	3	3	S/EM	CSE2001
8	CSE3126	E-Commerce	3	0	0	3	3	S/EM	CSE2007
Information Science & Technology Basket									
1	CSE2054	Storage Area Networks	3	0	0	3	3	S	CSE2011
2	CSE2055	Information Systems Audit	3	0	0	3	3	S	CSE2011
3	CSE2056	Web 2.0	2	0	2	3	4	S/EM	CSE2007
4	CSE2057	Cloud Computing and Virtualization	3	0	0	3	3	S/EM	CSE2011
5	CSE2058	Firewall and Internet Security	2	0	2	3	4	S	CSE2011
6	CSE2059	Mobile Networking	2	0	2	3	4	S	CSE2011
7	CSE2060	Information Security and Management	3	0	0	3	3	S/EM	CSE2011
8	CSE3128	Human Computer Interaction	3	0	0	3	3	S/EM	CSE2007
9	CSE3143	Infrastructure Management	3	0	0	3	3	S/EM	CSE2011
10	CSE3132	Network Management Systems	3	0	0	3	3	S	CSE2011
Special Basket									
1	CAI3427	Language Models for Text Mining	2	0	2	3	4	S/EM	CSE3001
2	CAI3428	Practical Deep Learning with TensorFlow	2	0	2	3	4	S/EM	CSE3001
3	CAI3429	Deep Learning Techniques for Computer Vision	2	0	2	3	4	S/EM	MAT1003
Total # of Credits to be earned from DE = 30									

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

Table 3.4 : Open Elective Courses Baskets: Minimum Credits to be earned from this Basket is 9											
Sl. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Type of Skill/ Focus**	**Course Caters to**	**Prerequisites/ Corequisites**	**Antirequisites**	**Future Courses that need this as a Prerequisite**
Chemistry Basket											
1	CHE1003	Fundamentals of Sensors	3	0	0	3	S	ES	-	-	-
2	CHE1004	Smart materials for IOT	3	0	0	3	S	ES	-	-	-
3	CHE1005	Computational Chemistry	2	0	0	2	S	ES	-	-	-
4	CHE1006	Introduction to Nano technology	3	0	0	3	S	ES	-	-	-
5	CHE1007	Biodegradable electronics	2	0	0	2	S	ES	-	-	-
6	CHE1008	Energy and Sustainability	2	0	0	2	S	ES	-	-	-
7	CHE1009	3D printing with Polymers	2	0	0	2	S	ES	-	-	-
8	CHE1010	Bioinformatics and Healthcare IT	2	0	0	2	S	ES	-	-	-
9	CHE1011	Chemical and Petrochemical catalysts	3	0	0	3	S	ES	-	-	-
10	CHE1012	Introduction to Composite materials	2	0	0	2	S	ES	-	-	-
11	CHE1013	Chemistry for Engineers	3	0	0	3	S	ES	-	-	-
12	CHE1014	Surface and Coatings technology	3	0	0	3	S	ES	-	-	-
13	CHE1015	Waste to Fuels	2	0	0	2	S	ES	-	-	-
14	CHE1016	Forensic Science	3	0	0	3	S	ES	-	-	-
Civil Engineering Basket											
1	CIV1001	Disaster mitigation and management	3	0	0	3	S	-	-	-	-
2	CIV1002	Environment Science and Disaster Management	3	0	0	3	FC	-	-	-	-
3	CIV2001	Sustainability Concepts in Engineering	3	0	0	3	S	-	-	-	-
4	CIV2002	Occupational Health and Safety	3	0	0	3	S	-	-	-	-
5	CIV2003	Sustainable Materials and Green Buildings	3	0	0	3	EM	-	-	-	-
6	CIV2004	Integrated Project Management	3	0	0	3	EN	-	-	-	-
7	CIV2005	Environmental Impact Assessment	3	0	0	3	EN	-	-	-	-
8	CIV2006	Infrastructure Systems for Smart Cities	3	0	0	3	EN	-	-	-	-

9	CIV2044	Geospatial Applications for Engineers	2	0	2	3	EM	-	-	-	-
10	CIV2045	Environmental Meteorology	3	0	0	3	S	-	-	-	-
11	CIV3046	Project Problem Based Learning	3	0	0	3	S	-	-	-	-
12	CIV3059	Sustainability for Professional Practice	3	0	0	3	EN	-	-	-	-
Commerce Basket											
1	COM2001	Introduction to Human Resource Management	2	0	0	2	F	HP/GS	-	-	-
2	COM2002	Finance for Non Finance	2	0	0	2	S	-	-	-	-
3	COM2003	Contemporary Management	2	0	0	2	F	-	-	-	-
4	COM2004	Introduction to Banking	2	0	0	2	F	-	-	-	-
5	COM2005	Introduction to Insurance	2	0	0	2	F	-	-	-	-
6	COM2006	Fundamentals of Management	2	0	0	2	F	-	-	-	-
7	COM2007	Basics of Accounting	3	0	0	3	F	-	-	-	-
Computer Science Basket (not to be offered for CSE Department students)											
1	CSE2002	Programming in Java	2	0	2	3	S/EM	-	-	-	-
2	CSE2003	Social Network Analytics	3	0	0	3	S	GS	-	-	-
3	CSE2004	Python Application Programming	2	0	2	3	S/ EM	-	-	-	-
4	CSE2005	Web design fundamentals	2	0	2	3	S/ EM/EN	-	-	-	-
Design Basket											
1	DES1001	Sketching and Painting	0	0	2	1	S	-	-	-	-
2	DES1002	Innovation and Creativity	2	0	0	2	F	-	-	-	-
3	DES1121	Introduction to UX design	1	0	2	2	S	-	-	-	-
4	DES1122	Introduction to Jewellery Making	1	0	2	2	S	-	-	-	-
5	DES1124	Spatial Stories	1	0	2	2	S	-	-	-	-
6	DES1125	Polymer Clay	1	0	2	2	S	-	-	-	-
7	DES2001	Design Thinking	3	0	0	3	S	-	-	-	-
8	DES1003	Servicability of Fashion Products	1	0	2	2	F	ES	-	-	-
9	DES1004	Choices in Virtual Fashion	1	0	2	2	F	ES, GS, HP	-	-	-
10	DES1005	Fashion Lifestyle and Product Diversity	1	0	2	2	F	ES, GS, HP	-	-	-
11	DES1006	Colour in Everyday Life	1	0	2	2	F	ES	-	-	-
12	DES2080	Art of Design Language	3	0	0	3	S	-	-	-	-
13	DES2081	Brand Building in Design	3	0	0	3	S	-	-	-	-
14	DES2085	Web Design Techniques	3	0	0	3	S	-	-	-	-
15	DES2089	3D Modeling for Professionals	1	0	4	3	S	-	-	-	-
16	DES2090	Creative Thinking for Professionals	3	0	0	3	S	-	-	-	-
17	DES2091	Idea Formulation	3	0	0	3	S	-	-	-	-
Electrical and Electronics Basket											
1	EEE1002	IoT based Smart Building Technology	3	0	0	3	S	-	-	-	-
2	EEE1003	Basic Circuit Analysis	3	0	0	3	S	-	-	-	-
3	EEE1004	Fundamentals of Industrial Automation	3	0	0	3	S	-	-	-	-
4	EEE1005	Electric Vehicles & Battery Technology	3	0	0	3	S	-	-	-	-
5	EEE1006	Smart Sensors for Engineering Applications	3	0	0	3	S	-	-	-	-
Electronics and Communication Basket											

1	ECE1003	Fundamentals of Electronics	3	0	0	3	F	-	-	-	-
2	ECE1004	Microprocessor based systems	3	0	0	3	F	-	-	-	-
3	ECE3089	Artificial Neural Networks	3	0	0	3	S	-	-	-	-
4	ECE3097	Smart Electronics in Agriculture	3	0	0	3	F/EM	-	-	-	-
5	ECE3098	Environment Monitoring Systems	3	0	0	3	F/EM	-	-	-	-
6	ECE3102	Consumer Electronics	3	0	0	3	F/EM	-	-	-	-
7	ECE3103	Product Design of Electronic Equipment	3	0	0	3	S/F/ EM / EN	-	-	-	-
8	ECE3106	Introduction to Data Analytics	3	0	0	3	F/EM	-	-	-	-
9	ECE3107	Machine Vision for Robotics	3	0	0	3	F/EM	-	-	-	-
English Basket											
1	ENG1008	Indian Literature	2	0	0	2	-	GS/ HP	-	-	-
2	ENG1009	Reading Advertisement	3	0	0	3	S	-	-	-	-
3	ENG1010	Verbal Aptitude for Placement	2	0	2	3	S	-	-	-	-
4	ENG1011	English for Career Development	3	0	0	3	S	-	-	-	-
5	ENG1012	Gender and Society in India	2	0	0	2	-	GS/ HP	-	-	-
6	ENG1013	Indian English Drama	3	0	0	3	-	-	-	-	-
7	ENG1014	Logic and Art of Negotiation	2	0	2	3	-	-	-	-	-
8	ENG1015	Professional Communication Skills for Engineers	1	0	0	1	-	-	-	-	-
DSA Basket											
1	DSA2001	Spirituality for Health	2	0	0	2	F	HP	-	-	-
2	DSA2002	Yoga for Health	2	0	0	2	S	HP	-	-	-
3	DSA2003	Stress Management and Well Being	2	0	0	2	F	-	-	-	-
Kannada Basket											
1	KAN1001	Kali Kannada	1	0	0	1	S	-	-	-	-
2	KAN1003	Kannada Kaipidi	3	0	0	3	S	-	-	-	-
3	KAN2001	Thili Kannada	1	0	0	1	S	-	-	-	-
4	KAN2003	Pradharshana Kale	1	0	2	2	S	-	-	-	-
5	KAN2004	Sahithya Vimarshe	2	0	0	2	S	-	-	-	-
6	KAN2005	Anuvadha Kala Sahithya	3	0	0	3	S	-	-	-	-
7	KAN2006	Vichara Manthana	3	0	0	3	S	-	-	-	-
8	KAN2007	Katha Sahithya Sampada	3	0	0	3	S	-	-	-	-
9	KAN2008	Ranga Pradarshana Kala	3	0	0	3	S	-	-	-	-
Foreign Language Basket											
1	FRL1004	Introduction of French Language	2	0	0	2	S	S	-	-	-
2	FRL1005	Fundamentals of French	2	0	0	2	S	S	-	-	-
3	FRL1009	Mandarin Chinese for Beginners	3	0	0	3	S	S	-	-	-
Law Basket											
1	LAW1001	Introduction to Sociology	2	0	0	2	F	HP		-	-
2	LAW2001	Indian Heritage and Culture	2	0	0	2	F	HP/GS		-	-
3	LAW2002	Introdcution to Law of Succession	2	0	0	2	F	HP/GS		-	-
4	LAW2003	Introduction to Company Law	2	0	0	2	F	HP		-	-
5	LAW2004	Introduction to Contracts	2	0	0	2	F	HP	-	-	-
6	LAW2005	Introduction to Copy Rights Law	2	0	0	2	F	HP	-	-	-
7	LAW2006	Introduction to Criminal Law	2	0	0	2	F	HP	-	-	-
8	LAW2007	Introduction to Insurance Law	2	0	0	2	F	HP	-	-	-
9	LAW2008	Introduction to Labour Law	2	0	0	2	F	HP	-	-	-
10	LAW2009	Introduction to Law of Marriages	2	0	0	2	F	HP/GS	-	-	-
11	LAW2010	Introduction to Patent Law	2	0	0	2	F	HP	-	-	-
12	LAW2011	Introduction to Personal Income Tax	2	0	0	2	F	HP	-	-	-

13	LAW2012	Introduction to Real Estate Law	2	0	0	2	F	HP	-	-	-
14	LAW2013	Introduction to Trademark Law	2	0	0	2	F	HP	-	-	-
15	LAW2014	Introduction to Competition Law	3	0	0	3	F	HP	-	-	-
16	LAW2015	Cyber Law	3	0	0	3	F	HP	-	-	-
17	LAW2016	Law on Sexual Harrassment	2	0	0	2	F	HP/GS	-	-	-
18	LAW2017	Media Laws and Ethics	2	0	0	2	F	HP/GS	-	-	-
Mathematics Basket											
1	MAT2008	Mathematical Reasoning	3	0	0	3	S	-	-	-	-
2	MAT2014	Advanced Business Mathematics	3	0	0	3	S	-	-	-	-
3	MAT2041	Functions of Complex Variables	3	0	0	3	S	-	-	-	-
4	MAT2042	Probability and Random Processes	3	0	0	3	S	-	-	-	-
5	MAT2043	Elements of Number Theory	3	0	0	3	S	-	-	-	-
6	MAT2044	Mathematical Modelling and Applications	3	0	0	3	S	-	-	-	-
Mechanical Basket											
1	MEC1001	Fundamentals of Automobile Engineering	3	0	0	3	F	-	-	-	-
2	MEC1002	Introduction to Matlab and Simulink	3	0	0	3	S/EM	-	-	-	-
3	MEC1003	Engineering Drawing	1	0	4	3	S	-	-	-	-
4	MEC2001	Renewable Energy Systems	3	0	0	3	F	ES	-	-	-
5	MEC2002	Operations Research & Management	3	0	0	3	F	-	-	-	-
6	MEC2003	Supply Chain Management	3	0	0	3	S/ EM/ EN	-	-	-	-
7	MEC2004	Six Sigma for Professionals	3	0	0	3	S/EM	-	-	MEC 2008	-
8	MEC2005	Fundamentals of Aerospace Engineering	3	0	0	3	F	-	-	-	-
9	MEC2006	Safety Engineering	3	0	0	3	S/EM	ES	-	-	-
10	MEC2007	Additive Manufacturing	3	0	0	3	F/EM	-	-	-	-
11	MEC3069	Engineering Optimisation	3	0	0	3	S/EM	-	-	-	-
12	MEC3070	Electronics Waste Management	3	0	0	3	F/S	ES	-	-	-
13	MEC3071	Hybrid Electric Vehicle Design	3	0	0	3	S/EM	ES	-	-	-
14	MEC3072	Thermal Management of Electronic Appliances	3	0	0	3	S/EM	-	-	-	-
15	MEC3200	Sustainable Technologies and Practices	3	0	0	3	S/EM	-	-	-	-
16	MEC3201	Industry 4.0	3	0	0	3	S/EM	-	-	-	-
Petroleum Basket											
1	PET1011	Energy Industry Dynamics	3	0	0	3	FC	ES	-	NIL	-
2	PET1012	Energy Sustainability Practices	3	0	0	3	FC	ES	-	NIL	-
Physics Basket											
1	PHY1003	Mechanics and Physics of Materials	3	0	0	3	FC / SD				
2	PHY1004	Astronomy	3	0	0	3	FC				
3	PHY1005	Game Physics	2	0	2	3	FC / SD				
4	PHY1006	Statistical Mechanics	2	0	0	2	FC				
5	PHY1007	Physics of Nanomaterials	3	0	0	3	FC				
6	PHY1008	Adventures in nanoworld	2	0	0	2	FC				
7	PHY2001	Medical Physics	2	0	0	2	FC	ES			
8	PHY2002	Sensor Physics	1	0	2	2	FC / SD				
9	PHY2003	Computational Physics	1	0	2	2	FC				
10	PHY2004	Laser Physics	3	0	0	3	FC	ES			

11	PHY2005	Science and Technology of Energy	3	0	0	3	FC	ES			
12	PHY2009	Essentials of Physics	2	0	0	2	FC				
Management Basket- I											
1	MGT2007	Digital Entrepreneurship	3	0	0	3	S/EM/EN	-	-	-	-
2	MGT2015	Engineering Economics	3	0	0	3	S	-	-	-	-
3	MGT2023	People Management	3	0	0	3	S/EM/ EN	HP	-	-	-
Management Basket- II											
1	MGT1001	Introduction to Psychology	3	0	0	3	F	HP	-	-	-
2	MGT1002	Business Intelligence	3	0	0	3	EN	-	-	-	-
3	MGT1003	NGO Management	3	0	0	3	S	-	-	-	-
4	MGT1004	Essentials of Leadership	3	0	0	3	EM/ EN	GS/ HP	-	-	-
5	MGT1005	Cross Cultural Communication	3	0	0	3	S/EM/ EN	HP	-	-	-
6	MGT2001	Business Analytics	3	0	0	3	S/ EM/EN	-	-	-	-
7	MGT2002	Organizational Behaviour	3	0	0	3	F	HP	-	-	-
8	MGT2003	Competitive Intelligence	3	0	0	3	S	-	-	-	-
9	MGT2004	Development of Enterprises	3	0	0	3	S/EM/EN	-	-	-	-
10	MGT2005	Economics and Cost Estimation	3	0	0	3	S/EM	-	-	-	-
11	MGT2006	Decision Making Under Uncertainty	3	0	0	3	S	-	-	-	-
12	MGT2008	Econometrics for Managers	3	0	0	3	S	-	-	-	-
13	MGT2009	Management Consulting	3	0	0	3	S/EM/EN	-	-	-	-
14	MGT2010	Managing People and Performance	3	0	0	3	S/EM/EN	HP/GS	-	-	-
15	MGT2011	Personal Finance	3	0	0	3	F	-	-	-	-
16	MGT2012	E Business for Management	3	0	0	3	S/EM	-	-	-	-
17	MGT2013	Project Management	3	0	0	3	EN / EM	GS/HP/ ES	-	-	-
18	MGT2014	Project Finance	3	0	0	3	EN / EM	HP	-	-	-
19	MGT2016	Business of Entertainment	3	0	0	3	EM/ EN	-	-	-	-
20	MGT2017	Principles of Management	3	0	0	3	S/EM/ EN	-	-	-	-
21	MGT2018	Professional and Business Ethics	3	0	0	3	S/EM/ EN	HP	-	-	-
22	MGT2019	Sales Techniques	3	0	0	3	S/EM/ EN	HP	-	-	-
23	MGT2020	Marketing for Engineers	3	0	0	3	S/EM/ EN	HP	-	-	-
24	MGT2021	Finance for Engineers	3	0	0	3	S/EM/ EN	HP	-	-	-
25	MGT2022	Customer Relationship Management	3	0	0	3	S/EM/ EN	HP	-	-	-
Media Studies Basket											
1	BAJ3050	Corporate Filmmaking and Film Business	0	0	4	2	EM	HP	-	-	-
2	BAJ3051	Digital Photography	2	0	2	3	EM	HP	-	-	-
3	BAJ3055	Introduction to News Anchoring and News Management	0	0	2	1	EM	-	-	-	-

Research URE Basket											
1	URE2001	University Research Experience	-	0	-	3					
2	URE2002	University Research Experience	-	0	-	0					

21.List of MOOC Courses

21.1 Presidency University students are given the opportunity to study abroad in International Universities through a selection process coordinated by the Office of International Affairs (OIA). Such selected students need to complete their credits for the semester that they are abroad in the following way:

21.1.1 The student needs to study and complete School Core and Program Core Courses in offline mode only.

21.1.2 Massive Open Online Course (MOOC) courses maybe given for Open Elective and Discipline Elective Courses. These courses need to be approved by the concerned BOS and Academic Council from time to time.

21.1.3 SWAYAM/NPTEL/ other approved MOOCs shall be approved by the concerned Board of Studies and placed in the concerned PRC.

21.1.4 Student shall register for these courses in the ERP of Presidency University.

21.1.5 For these MOOC courses faculty coordinators are identified. These faculty should have undergone similar MOOC courses and therefore should be familiar with the mode of class conduction, types of assessments and evaluation procedures.

21.1.6 Study materials shall be provided to the students as video lectures shared by the MOOCs Coordinator(s), or the students may access the approved MOOCs Portal directly. The mode of class conduction is determined by the MOOCs coordinator(s) as detailed in the Course Catalogue and Course Plan.

21.1.7 The question paper shall be prepared by the MOOCs coordinator(s).

21.1.8 Students write the exams in online mode. These exams are scheduled and conducted by the School.

21.1.9 Results are evaluated by School and given to the Office of the Controller of Examinations (CoE).

21.1.10 The details of the duration, credits and evaluation are given below:

Sl#	Duration	Credits
1.	12 weeks	3
2.	8 weeks	2
3	4 weeks	1

21.2 MOOC – Discipline Elective Courses for B.Tech-CSE(Cyber Security) Program.

Table 3.5 : MOOC Discipline Elective Courses				
Sl.No	**Course Code**	**Course Name**	**Credits**	**L-T-P-C**
1	CSE3111	Artificial Intelligence: Search Methods for Problem Solving	3	3-0-0-3
2	CSE3112	Privacy and Security in Online Social Media	3	3-0-0-3
3	CSE3113	Computational Complexity	3	3-0-0-3
4	CSE3114	Deep Learning for Computer Vision	3	3-0-0-3
5	CSE3115	Learning Analytics Tools	3	3-0-0-3
6	CSE3119	Coding Skills in Python	3	3-0-0-3
7	CSE3121	Parallel Computer Architecture	3	3-0-0-3
8	CSE3124	Games and Information	3	3-0-0-3
9	CSE3140	Introduction to Industry 4.0 and Industrial Internet of Things	3	3-0-0-3
10	CSE3142	Affective Computing	3	3-0-0-3
11	CSE3196	Foundations of Cyber Physical Systems	3	3-0-0-3
12	CSE3197	Getting Started with Competitive Programming	3	3-0-0-3
13	CSE3198	GPU Architectures and Programming	3	3-0-0-3
14	CSE3199	Artificial Intelligence: Knowledge Representation and Reasoning	3	3-0-0-3
15	CSE3200	Programming in Modern C++	3	3-0-0-3
16	CSE3201	Circuit Complexity Theory	3	3-0-0-3
17	CSE3202	Basics of Computational Complexity	3	3-0-0-3
18	CSE3212	Introduction to Computer and Network Performance Analysis using Queuing	1	1-0-0-1
19	CSE3213	C Programming and Assembly Language	1	1-0-0-1
20	CSE3214	Python for Data Science	1	1-0-0-1
21	CSE3215	Software Conceptual Design	1	1-0-0-1
22	CSE3117	Industrial Digital Transformation	3	3-0-0-3
23	CSE3118	Blockchain for Decision Makers	3	3-0-0-3
24	CSE3349	Technology for Lawyers	3	3-0-0-3
25	CSE3430	Deep Learning for Natural Language Processing	3	3-0-0-3
26	CSE3431	Machine Learning for Engineering and Science Applications	3	3-0-0-3
27	CSE3432	Algorithms in Computational Biology and Sequence Analysis	3	3-0-0-3
28	CSE3433	Introduction to Large Language Models (LLMs)	3	3-0-0-3
29	CSE3434	Quantum Algorithms and Cryptography	3	3-0-0-3
30	CAI3430	Responsible & Safe AI Systems	3	3-0-0-3

31	CCS3416	Practical Cyber Security for Cyber Security Practitioners	3	3-0-0-3
32	IST3409	Design & Implementation of Human-Computer Interfaces	3	3-0-0-3

21.3 MOOC - Open Elective Courses for B. Tech-Computer Science and Engineering(Cyber Security) Program.

Table 3.6: MOOC Open Elective Courses
Courses duration is 4 weeks (01 credit)/ 8 weeks (02 credits)/ 12 weeks (03 credits)

Sl. No.	Course Code	Course Name	Total Credits	L-T-P-C
1	BBA2022	Supply Chain digitization	3	3-0-0-3
2	BBA2021	E Business	3	3-0-0-3
3	BBB2016	Business Analytics for Management Decisions	3	3-0-0-3
4	BBB2015	Artificial Intelligence for Investments	3	3-0-0-3
5	MEC3001	Design and Development of Product	1	1-0-0-1
6	ENG3004	Perspectives of Neurolinguistics	1	1-0-0-1
7	PPS4009	Working in Contemporary Teams	1	1-0-0-1
8	MGT3001	Data Analysis and Decision Making	3	3-0-0-3
9	MEC3001	Design and Development of Product	1	1-0-0-1
10	EEE3105	Microsensors and Nanosensors	3	3-0-0-3
11	CIV3065	Drone Systems and Cont¯rol	3	3-0-0-3
12	ECE3183	Neural Networks for Signal Processing - I	3	3-0-0-3
13	CIVXXXX	Disaster Management	3	3-0-0-3

NOTE:

MEC3001 is offered to the students who had 1 credit shortage because of implementation of CBCS system during their 1st year.

ENG3004 is offered to the students who had 2 credits shortage along with the MEC3001 because of implementation of CBCS System during their 1st year.

PPS4009 is offered to only International students in place of Interview Preparedness course of their batch mates.

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

SEMESTER-1										
S. NO.	COURSE CODE	COURSE NAME	CREDIT STRUCTURE					BASKET	TYPE OF SKILL	COURSE ADDRESSES TO
			L	T	P	C	CONTACT			

							HOURS			
1	MAT1001	Calculus and Linear Algebra	3	0	2	4	5	SCHOOL CORE	F	
2	PHY1002	Optoelectronics and Device Physics	2	0	2	3	4	SCHOOL CORE	F	
3	ECE1001	Elements of Electronics Engineering	3	0	2	4	5	SCHOOL CORE	F	
4	ENG1001/ ENG1002	Foundation of English/ Technical English	1	0	2	2	3	SCHOOL CORE	F	
5	PPS1001	Introduction to soft skills	0	0	2	1	2	SCHOOL CORE	S	
6	CSE1002	Innovative Projects - Arduino using Embedded 'C'	0	0	4	2	4	SCHOOL CORE	S	
7	CHE1018	Environmental Science	1	0	2	0	3	SCHOOL CORE	F	
		TOTAL	10	0	16	16	26			
SEMESTER-2										
S. NO.	COURSE CODE	COURSE NAME	CREDIT STRUCTURE					BASKET	TYPE OF SKILL	COURSE ADDRESSES TO
			L	T	P	C	CONTACT HOURS			
1	MAT1003	Applied Statistics	1	0	2	2	3	SCHOOL CORE	F	
2	ECE2007	Digital Design	2	0	2	3	4	PROGRAM CORE	F	
3	CIV1008	Basic Engineering Sciences	2	0	0	2	2	SCHOOL CORE	F	
4	MEC1006	Engineering Graphics	2	0	0	2	2	SCHOOL CORE	F	
5	CSE1001	Problem Solving using JAVA	2	0	2	3	5	SCHOOL CORE	F/ S/ EM	
6	ENG1002/ ENG2001	Technical English/ Advanced English	1	0	2	2	3	SCHOOL CORE	S/ EM	
7	CSE2014	Software Engineering	3	0	0	3	3	PROGRAM CORE	F/ EM	
8	PPS1002	Soft Skills for Engineers	0	0	2	1	2	SCHOOL CORE	S/ EM	

9	KAN1001/	Kali Kannada / Thili Kannada	1	0	0	1	1	SCHOOL CORE	S	
		TOTAL	13	0	12	19	25			
SEMESTER-3										
S. NO.	COURSE CODE	COURSE NAME	CREDIT STRUCTURE					BASKET	TYPE OF SKILL	COURSE ADDRESSES TO
			L	T	P	C	CONTACT HOURS			
1	MAT1002	Transform Techniques, Partial Differential Equations and Their Applications	3	0	0	3	3	SCHOOL CORE	F	
2	CSE1005	Programming in Python	1	0	4	3	5	SCHOOL CORE	F	
3	CSE2001	Data Structures and Algorithms	3	0	2	4	5	SCHOOL CORE	F	
4	CSE2011	Data Communications and Computer Networks	3	0	0	3	3	PROGRAM CORE	F	
5	CSE2009	Computer Organization and Architecture	3	0	0	3	3	PROGRAM CORE	F	
6	CSE2018	Theory of Computation	3	0	0	3	3	PROGRAM CORE	F	
7	CSE3190	Fundamentals of Data Analytics	2	0	2	3	4	PROGRAM CORE	F	
8	CSEXXXX	Discipline Elective – I	3	0	0	3	3	DISCIPLINE ELECTIVE	S/EM	
9	PPS4002	Introduction to Aptitude	0	0	2	1	2	SCHOOL CORE	S/EM	
		TOTAL	21	0	10	26	31			
SEMESTER-4										
S. NO.	COURSE CODE	COURSE NAME	CREDIT STRUCTURE					BASKET	TYPE OF SKILL	COURSE ADDRESSES TO
			L	T	P	C	CONTACT HOURS			
1	MAT2003	Numerical Methods for Engineers	1	0	2	2	3	SCHOOL CORE	F	

2	CSE2007	Design and Analysis of Algorithms	3	0	0	3	3	PROGRAM CORE	F	
3	CSE2074	Database Management Systems	2	0	2	3	4	PROGRAM CORE	F	
4	CSE2010	Operating Systems	3	0	0	3	4	PROGRAM CORE	F	
5	CSE3078	Cryptography and Network Security	3	0	0	3	3	PROGRAM CORE	F	
6	CSE2026	Data Handling and Visualization	2	0	2	3	3	PROGRAM CORE	F/ EM	
7	CSEXXXX	Discipline Elective – II	3	0	0	3	3	DISCIPLIN E ELECTIVE	S/ EM	
8	XXXXXXX	Open Elective – I	3	0	0	3	3	OPEN ELECTIVE	F/ S/ EM	
9	PPS4004	Aptitude Training- Intermediate	0	0	2	1	2	SCHOOL CORE	S/ EM	
10	ECE2011	Innovative Projects Using Raspberry Pi	-	0	-	1	0	SCHOOL CORE	S	
		TOTAL	19	0	10	25	29			
SEMESTER-5										
S. NO.	COURSE CODE	COURSE NAME	CREDIT STRUCTURE					BASKET	TYPE OF SKILL	COURSE ADDRESSES TO
			L	T	P	C	CONTACT HOURS			
1	CSE3001	Artificial Intelligence and Machine Learning	2	0	2	3	4	PROGRAM CORE	F	
2	CSE2037	Cyber Forensics	2	0	2	3	4	PROGRAM CORE	F	
3	CSE3342	Ethical Hacking	1	0	4	3	5	PROGRAM CORE	F	
4	CSE3343	Cloud Computing	2	0	2	3	4	PROGRAM CORE	F/ EM	
5	CSE2067	Web Technologies	2	0	2	3	4	PROGRAM CORE	F	
6	CSEXXXX	Discipline Elective – III	3	0	0	3	3	DISCIPLIN E ELECTIVE	S/ F/ EM	
7	CSEXXXX	Discipline Elective – IV	3	0	0	3	3	DISCIPLIN E ELECTIVE	S/ F/ EM	
8	PPS4006	Logical and Critical Thinking	0	0	2	1	2	SCHOOL CORE	S/ EM	

9	CSE3216	Mastering Object-Oriented Concepts in Python	0	0	2	1	2	SCHOOL CORE	S/EM	
		TOTAL	18	0	10	23	31			
SEMESTER-6										
S.NO.	COURSE CODE	COURSE NAME	CREDIT STRUCTURE					BASKET	TYPE OF SKILL	COURSE ADDRESSES TO
			L	T	P	C	CONTACT HOURS			
1	CSE2040	Cyber Threats for IoT and Cloud	3	0	0	3	3	PROGRAM CORE	F	
2	CSE3145	Intrusion Detection and Prevention System	3	0	0	3	3	PROGRAM CORE	F	
3	CSE2018	Theory of Computation	3	0	0	3	3	PROGRAM CORE	F	
4	CSE3097	Web Security	2	0	2	3	4	PROGRAM CORE	F	
5	CSEXXXX	Discipline Elective - V	3	0	0	3	3	DISCIPLINE ELECTIVE	S/F/EM	
6	CSEXXXX	Discipline Elective – VI	3	0	0	3	3	DISCIPLINE ELECTIVE	S/F/EM	
7	XXXXXXX	Open Elective - II	3	0	0	3	3	OPEN ELECTIVE	S/F/EM	
8	PPS4005	Aptitude for Employability	0	0	2	1	2	SCHOOL CORE	S/EM	
9	CSE3217	Data Structure and Web Development with Python	0	0	2	1	2	SCHOOL CORE	S/EM	
		TOTAL	20	0	8	23	29			
SEMESTER-7										
S.NO.	COURSE CODE	COURSE NAME	CREDIT STRUCTURE					BASKET	TYPE OF SKILL	COURSE ADDRESSES TO
			L	T	P	C	CONTACT HOURS			
1	XXXXXXX	Open Elective – III	3	0	0	3	3	OPEN ELECTIVE	S/EM/EN	

2	CSEXXXX	Discipline Elective – VII	3	0	0	3	3	DISCIPLINE ELECTIVE	S/EM/EN	
3	CSEXXXX	Discipline Elective – VIII	3	0	0	3	3	DISCIPLINE ELECTIVE	S/EM/EN	
4	CSEXXXX	Discipline Elective – IX	3	0	0	3	3	DISCIPLINE ELECTIVE	S/EM/EN	
5	CSEXXXX	Discipline Elective – X	3	0	0	3	3	DISCIPLINE ELECTIVE	S/EM/EN	
6	CSE7101	Capstone Project	-	0	-	4	0	SCHOOL CORE	S/EM	
7	PPS3018	Preparedness for Interview	0	0	2	1	2	SCHOOL CORE	S/EM	
		TOTAL	15	0	2	20	17			

SEMESTER-8										
S.NO.	COURSE CODE	COURSE NAME	CREDIT STRUCTURE					BASKET	TYPE OF SKILL	COURSE ADDRESSES TO
			L	T	P	C	CONTACT HOURS			
1	CSE7302	Internship	-	0	-	8	0	SCHOOL CORE	S/EM/EN	
		TOTAL	0	0	0	8				

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.

The Course Catalogues for the Courses offered in each basket are attached below:

SEMESTER I

Course Code: MAT1001	**Course Title: Calculus and Linear Algebra** **Type of Course: School Core**	**L-T- P-C**	**3**	**0**	**2**	**4**

	Lab Integrated					
Version No.		3.0				
Course Pre-requisites		NIL				
Anti-requisites		**NIL**				
Course Description		The course focuses on the concepts of calculus and linear algebra with reference to specific engineering problems. The course is of both conceptual and analytical type in nature. The lab sessions associated with the course are concerned with acquiring an ability to use the MATLAB software.				
Course Objective		The objective of the course is **Skill Development** of student by using **Problem Solving Techniques.**				
Course Out Comes		On successful completion of the course the students shall be able to: 1) Comprehend the knowledge of applications of matrix principles. 2) Understand the concept of partial derivatives and their applications. 3) Apply the principles of integral calculus to evaluate integrals. 4) Adopt the various analytical methods to solve differential equations. 5) Demonstrate the use of MATLAB software to deal with a variety of mathematical problems.				
Course Content:						
Module 1	**Linear Algebra**					**10 Classes**
	Review: Types of matrices, elementary transformations, rank of a matrix, normal form, Solution of systems of linear equations: (Homogenous and non-homogenous system) AX = O and AX = B using rank method. **Linear Algebra:** Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms. Engineering Applications of Linear Algebra.					
Module 2	**Partial Derivatives**					**10 CLASSES**
	Review: Differential calculus with single variable. **Partial Derivatives:** Homogeneous functions and Euler‘s theorem, Total derivative, Change of variables, Jacobians, Partial differentiation of implicit functions, Taylor‘s series for functions of two variables, Maxima and minima of functions of two variables, Lagrange‘s method of undetermined multipliers. Engineering Applications of partial derivatives.					

Module 3	**Advanced Integral calculus**				**12 Classes**
	Review: Integral calculus for single integrals. **Advanced Integral calculus:** Beta and Gamma functions–interrelation-evaluation of integrals using gamma and beta functions; error function-properties. Multiple Integrals- Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves, evaluation of triple integrals-change of variables between Cartesian and cylindrical and spherical polar co-ordinates. Engineering applications of partial derivatives.				
Module 4	**Ordinary Differential Equations**	**Assignment**	**Programming**		**12 Classes**
	Review: First order and first-degree Ordinary Differential Equations, Method of separation of variables, Homogeneous and Non- Homogeneous Equations reducible to Homogeneous form. Linear Differential Equations, Bernoulli's Differential Equation, Exact and Non- Exact Differential Equations, Higher order Differential Equation with constant coefficients and with right hand side of the form e^{ax}, sinax, cosax, $e^{ax}f(x)$, $x^nf(x)$ etc., Linear equations with variable coefficients such as Cauchy Equation and Lagrange's Equation, D-operators and Inverse D-operators, Method of Variation of Parameters. Engineering applications of differential equations.				
	List of Laboratory Tasks: Introductory Task: Introduction to usage of the software and simple programming tasks. [3 Sessions] Experiment N0 1: Solution of Simple differentiation with single variable and use of chain Rule. Experiment No. 2: Solution based on application of Tailors' Series using software Experiment No. 3: Application of Maxima and Minima condition using software. Experiment No. 4 Computation of different functions for a specific problem Experiment No. 5 Computation of Area under a curve. Experiment No. 6 Solution of a set of simultaneous equations in matrix method Experiment No. 7 Computation of Eigen Values and Eigen Vectors. Experiment No. 8 Solution of Partial Differential equation Experiment No. 9 solution using Cauchy Equation and Lagrange's Equation				
	Targeted Application & Tools that can be used:				

	The contents of this course has direct applications in most of the core engineering courses for problem formulations, Problem Solution and system Design. Tools Used: MatLab, Zylink.
	Assignment:
	1. List at least 3 sets of Matrix Applications concerning the respective branch of Engineering and obtain the solution using MATLAB. 2. Select any one simple differential equation pertaining to the respective branch of engineering, identify the dependent and independent variable – Obtain the solution and compare the solution sets by varying the values of the dependent variable.
	Text Book 1. Sankara Rao, Introduction to Partial differential equations, Prentice Hall of India, edition, 2011 2. B. S. Grewal (2017), Higher Engineering Mathematics by, 44th Edition, Khanna Publishers.
	References: 1. Victor Henner, Tatyana Belozerova, Mickhail Khenner, Ordinary and Partial Differential Equations, CRC Press, Edition, 2013. 2. Walter Ledermann, Multiple integrals, Springer, 1st edition 3. Lay, Linear Algebra ansd its applications, 3rd Ed., 2002, Pearson Education India. 4. Erwin Kreyzig, Advanced Engineering Mathematics, John Wiley and sons, Inc.10th Edition 5. MatLab usage manual **E-resources/ Web links:** 1. https://nptel.ac.in/courses/109104124 2. https://nptel.ac.in/courses/111106051 3. https://nptel.ac.in/courses/111102137 4. https://www.cuemath.com/learn/mathematics/algebra-vs-calculus/ 5. https://stanford.edu/~shervine/teaching/cs-229/refresher-algebra-calculus 6. https://math.hmc.edu/calculus/hmc-mathematics-calculus-online-tutorials/linear-algebra/ 7. https://www.math.hkust.edu.hk/~maqian/ma006_0607F.html 8. https://www.scu.edu.au/study-at-scu/units/math1005/2022/
	Topics relevant to the development of Foundation Skills: All solution methods **Topics relevant to development of Employability skills: Use of Matlab software.**

Course Code: **PHY1002**	**Course Title: Optoelectronics and Device Physics** **Type of Course: 1] School Core & Laboratory integrated**	L-T-P-C	2-0-2-3

Version No.	1.0			
Course Pre-requisites	**NIL**			
Anti-requisites	**NIL**			
Course Description	The purpose of this course is to enable the students to understand the fundamentals, working and applications of optoelectronic devices and to develop the basic abilities to appreciate the applications of advanced microscopy and quantum computers. The course develops the critical thinking, experimental and analytical skills. The associated laboratory provides an opportunity to validate the concepts taught and enhances the ability to use the concepts for technological applications. The laboratory tasks aim to develop following skills: **An attitude of enquiry, confidence and ability to tackle new problems, ability to interpret events and results, observe and measure physical phenomena, select suitable equipment, instrument and materials, locate faults in systems.**			
Course Out Comes	On successful completion of the course the students shall be able to: CO1: Describe the concepts of semiconductors, magnetic materials and superconductors. CO2: Apply the concept of materials in the working of optoelectronic and magnetic devices. CO3: Discuss the quantum concepts used in advanced microscopy and quantum computers. CO4: Explain the applications of lasers and optical fibers in various technological fields. CO5: Interpret the results of various experiments to verify the concepts used in optoelectronics and advanced devices. **[Lab oriented].**			
Course Objective	The objective of the course is to familiarize the learners with the concepts of "Optoelectronics and device physics "and attain **Skill Development** through **Experiential Learning** techniques			
Course Content:				
Module 1	**Fundamentals of Materials.**	Assignment	Plotting of magnetization (M) v/s Magnetic field (H) for diamagnetic, paramagnetic and ferromagnetic materials using excel/ origin software.	**No. of Classes: 07**
	Topics: Concept of energy bands, charge carriers, carrier concentration, concept of Fermi level, Hall effect, Magnetic materials, Superconductors:			

Module 2	**Advanced Devices and applications**	Assignment	Data collection on efficiency of solar cells.	**No. of Classes: 8**
	Topics: p-n junctions, Zener diode, transistor characteristics, Optoelectronic devices:, Solar cells, I-V characteristics, and LEDs			
Module 3	**Quantum concepts and Applications**	Term paper	Seminar on quantum computers.	**No. of classes: 8**
	Topics: Planck's quantum theory, applications of Quantum theory: de-Broglie hypothesis, matter waves, properties. de-Broglie wavelength associated with an electron. Heisenberg's uncertainty principle. Schrodinger time independent wave equation. Particle in a box			
Module 4	**Lasers and Optical fibers**	Term paper	Case study on medical applications of Lasers.	**No. of classes :07**
	Topics: Interactions of radiations with matter, Characteristics of laser, conditions and requisites of laser, Modern day applications of laser: LIDAR, LASIK, Cutting, Welding and Drilling. Principle of optical fibers, Numerical aperture and acceptance angle (Qualitative), Attenuation, Applications: Point to point communication with block diagram, application of optical fibers in endoscopy.			
	List of Laboratory Tasks: Experiment No. 1: Experimental errors and uncertainty using excel Level 1: Calculation of accuracy and precision of a given data Level 2: propagation of errors in addition, subtraction, multiplication and division. Experiment N0 2: To determine the wavelength of semiconductor diode Laser and to estimate the particle size of lycopodium powder using diffraction. Level 1: Determination of Wavelength of Laser Level 2: Finding the particle size of lycopodium powder. Experiment No. 3: To determine the proportionality of Hall Voltage, magnetic flux density and the polarity of Charge carrier. Level 1: To determine the proportionality of Hall Voltage and magnetic flux density Level 2: To determine the polarity of Charge carrier. Experiment No. 4: To study the I-V characteristics of a given zener diode in forward and reverse bias conditions. Level 1: To study I –V characteristics of the given Zener diode in reverse bias and to determine break down voltage. Level 2: To study I –V characteristics of the given Zener diode in forward bias and to determine knee voltage and forward resistance. Experiment No. 5: To study input and output characteristics of a given Transistor.			

	Level 1: To determine the input resistance of a given transistor. Level 2: To determine current transfer characteristics and transistor parameters of a given transistor. Experiment No. 6: Determination of Fermi energy and Fermi temperature of a given metal and bimetallic wire. Level 1: Determination of Fermi energy and Fermi temperature of given metal wire. Level 2: Determination of Fermi energy and Fermi temperature of given bimetallic wire. Experiment No. 7: To study the current vs voltage characteristics of CdS photo-resistor at constant irradiance and To measure the photo-current as a function of the irradiance at constant voltage. Level 1 To study the current vs voltage characteristics of CdS photo-resistor at constant irradiance. Level 2: To measure the photo-current as a function of the irradiance at constant voltage. Experiment No. 8: To study the I-V characteristics and I-R characteristics of a solar cell as a function of the irradiance. Level 1: To study the I-V characteristics Level 2: I-R characteristics of a solar cell as a function of the irradiance. Experiment No. 9: Calculate the numerical aperture and study the losses that occur in optical fiber cable. . Level 1: Calculate the numerical aperture. Level 2: study the losses that occur in optical fiber cable. Experiment No. 10: To determine the magnetic susceptibility of a given diamagnetic and paramagnetic substances using Quincke's method. Level 1: To determine the magnetic susceptibility of a given diamagnetic substance. Level 2: To determine the magnetic susceptibility of a given paramagnetic substance. Experiment No. 11: Plotting I-V characteristics in forward and reverse bias for LEDs and Determination of knee voltage. Level 1: Plotting I-V characteristics in forward and reverse bias for LEDs Level 2: Determination of knee voltage. Experiment No. 12: Determination of Stefan's constant and verification of Stefan-Boltzmann Law. Level 1: Determination of Stefan's constant Level 2: Verification of Stefan-Boltzmann Law.
	Targeted Application & Tools that can be used: 1. Areas of application are optoelectronics industry, Solar panel technologies, quantum computing software, electronic devices using transistors and diodes, memory devices, endoscopy, SQUIDS in MRI, Advanced material characterizations using SEM and STM. 2. Origin, excel and Mat lab soft wares for programming and data analysis.
	Project work/Assignment: Mention the Type of Project /Assignment proposed for this course

	Assessment Type • Midterm exam • Assignment (review of digital/ e-resource from PU link given in references section - mandatory to submit screen shot accessing digital resource.) • Quiz • End Term Exam • Self-Learning 1. Prepare a comprehensive report on non-conventional energy resources in Karnataka and their pros and cons. 2. Write a report on importance of quantum entanglement in supercomputers.
	Text Book 1. Engineering Physics by Avadhanalu, Revised edition, S. Chand Publications,2018.
	References: 1. Elementary Solid state Physics: Principles and Applications by M.A. Omar, 1st Edition, Pearson Publications, 2002. 2. Principles of Quantum Mechanics by R Shankar, 2nd edition, springer Publications, 2011. 3. Optoelectronics: An Introduction by John Wilson and John Hawkes, 3rd edition, Pearson Publications, 2017. 4. Engineering Physics by Gaur and Gupta, Dhanpat Rai Publications, 2012. 5. Introduction to Quantum Mechanics, David J Griffiths, Cambridge University Press, 2019
	E-Resourses: 1. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=553045&site=ehost-live 2. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=833068&site=ehost-live 3. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=323988&site=ehost-live 4. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1530910&site=ehost-live 5. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=486032&site=ehost-live
	Topics relevant to "SKILL DEVELOPMENT": Fundamentals of materials, Lasers and optical fibers. for Skill Development through Participative Learning Techniques. This is attained through the Assignment/ Presentation as mentioned in the assessment component in course handout.

Course Code: ENG1002	**Course Title:** Technical English **Type of Course:** 1] School Core 2] Laboratory integrated	**L-T-P-C**	1-0-2-2
Version No.	1.0 V. 3		
Course Pre-requisites	NIL		
Course Anti-requisites	NIL		
Course Description	Technical English course is designed to equip students with the language skills necessary for effective communication in technical and scientific contexts. The course focuses on the specialized vocabulary, writing styles, and communication techniques used in various technical fields, including engineering and information technology.		
Course Objectives	The objective of this course is to develop the learners' **EMPLOYABILITY SKILLS** by using **EXPERIENTIAL LEARNING** and **PARTICIPATIVE LEARNING TECHNIQUES.**		
Course Outcomes	**On successful completion of the course, the students shall be able to:** 1. Develop proficiency in using technical vocabulary and terminology. 2. Apply language skills for better speaking skills in technical fields. 3. Write technical descriptions 4. Demonstrate writing skills in writing technical documents such as reports, manuals, and articles.		
Course Content:			

Module 1	**Fundamentals of Technical Communication**	**Worksheets& Quiz**	**Vocabulary building**	**9 Classes**
Introduction to Technical English Differences between Technical English and General English Technical Writing Basics Technical Vocabulary				
Module 2	**Technical Presentation**	**Presentations**	**Speaking Skills**	**12 Classes**
Introduction Planning the Presentation Creating the Presentation Giving the Presentation				

Module 3	Technical Description	Assignment	Group Presentation	12 Classes
Product Description Process Description User Manuals Transcoding: Diagrams, charts and images				
Module 4	**Technical Writing**	**Assignment**	**Writing Skills**	**12 Classes**
Email Writing Persuasive and Descriptive Language Professional Email Etiquette Writing clear and concise technical emails Communicating technical information effectively **Technical Report Writing** Types of technical reports (Lab reports, research reports, etc.) Components of technical reports Writing an abstract and executive summary Structure and content organization Transcoding: diagrams, charts and images				

List of Laboratory Tasks:

1. Module-1

Level 1: Worksheets
Level 2: Worksheets

2. Module 2

Level 1: Preparing Presentation
Level 2: Giving Presentation (Individual)

3. Module-3

Level 1: Product Description & User Manual
Level 2: Process Description & Transcoding

4. Module 4

Level 1: Email Writing
Level 2: Report Writing

Targeted Applications & Tools that can be used:

1. Flipgrid
2. Quizzes
3. Youtube Videos
4. Podcast

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

1. **Bring out the essence of technical communication with reference to the conventions of technical communication, with examples**

2. **Prepare a technical presentation on the importance of Technical Communication and its relevance in a technical field, with real-life examples.**

The following individual, as well as group Assignments, will be given to the students.

1. **Presentation**
2. **Describing a product/process**
3. **Individual Reports**

Text Books

1. Kumar, Sanjay; Pushpalatha. *English Language and Communication Skills for Engineers.* Oxford University Press. 2018.
2. Brieger, Nick and Alison Paul. *Technical English Vocabulary and Grammar*. https://nmetau.edu.ua/file/technical_english_vocabulary_and_grammar.pdf

Reference Book:

1. Chauhan, Gajendra Singh, and Kashmiramka, Smita, ***Technical Communication.*** Cengage Publication. 2018.
2. Sunder Jain. *Technical Report Writing*. Centrum Press, 2013.
3. John Bowden. "Writing a Report: How to Prepare, Write & Present Really Effective Reports?". 9th Edition 2011

Comfort, Jeremy et. al. 1984. *Business Reports in English*. Cambridge University Press.

4. Sharma, R.C. and K. Mohan. 2011. Business Correspondence and Report Writing, Fourth Edition. Tata McGraw Hill.

Web Resources:

1:https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=JSTOR1_3307.

2;https://puniversity.informaticsglobal.com:2282/ehost/detail/detail?vid=5&sid=3a77d69b-abe5-4681-b39d-32dfdcb8f4a5%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=154223466&db=iih

3: Last,Suzan, et. al. ***Technical Writing Essentials.*** University of Victoria, British Columbia, 2019 (E-Book)

4 Wambui, Tabita Wangare, et al. ***Communication Skills- Volume 1,*** LAP LAMBRET, USA, 2012 (E Book)

Topics Relevant to the Development of Employability Skills:

Speaking Skills, Writing Skills, Critical Thinking and Critical Analysis, and Group Communication.

Course Code: CSE1004	Course Title: Problem Solving Using C Type of Course: School Core Lab Integrated.	L-T-P-C	1	0	4	3

Version No.	1.0			
Course Pre-requisites	NIL			
Anti-requisites	NIL			
Course Description	The course is designed to provide complete knowledge of C language. Students will be able to develop logics which will help them to create programs and applications in C. ACAlso by learning the basic programming constructs they can easily switch over to any other language in future.			
Course Object	The objective of the course is to familiarize the learners with the concepts of Problem Solving Using C and attain Employability through Problem Solving Methodologies.			
Course Outcomes	On successful completion of this course the students shall be able to: Write algorithms and to draw flowcharts for solving problems Demonstrate knowledge and develop simple applications in C programming constructs Develop and implement applications using arrays and strings Decompose a problem into functions and develop modular reusable code Solve applications in C using structures and Union Design applications using Sequential and Random Access File Processing.			
Course Content:				
Module 1	Introduction to C Language	Quiz	Problem Solving	9 Hrs.
Topics: Introduction to Programming – Algorithms – Pseudo Code - Flow Chart – Compilation – Execution – Preprocessor Directives (#define, #include, #undef) - Overview of C – Constants, Variables and Data types – Operators and Expressions – Managing Input and Output Operations – Decision Making and Branching - Decision Making and Looping.				
Module 2	Introduction to Arrays and Strings	Quiz	Problem Solving	9 Hrs.
Topics: Arrays: Introduction – One Dimensional Array – Initialization of One Dimensional Arrays – Example Programs – Sorting (Bubble Sort, Selection Sort) – Searching (Linear Search) - Two Dimensional Arrays – Initialization of Two Dimensional Arrays. Example Programs – Matrix operations. Strings: Introduction – Declaring and Initializing String Variables – Reading Strings from Terminal – Writing String to Screen – String Handling Functions.				
Module 3	Functions and Pointers	Quiz	Problem Solving	9 Hrs.
Topics: Functions: Introduction – Need for User-defined functions – Elements of User-Defined Functions: declaration, definition and function call–Categories of Functions – Recursion. Pointers: Introduction – Declaring Pointer Variables – Initialization of Variables – Pointer Operators – Pointer Arithmetic – Arrays and Pointers – Parameter Passing: Pass by Value, Pass by Reference.				

Module 4	Structures and Union	Quiz	Problem Solving	9 Hrs.
Topics: Structures: Introduction – Defining a Structure – Declaring Structure Variable – Accessing Structure Members – Array of Structures – Arrays within Structures – Union: Introduction – Defining and Declaring Union – Difference Between Union and Structure.				
Module 5	File handling	Case Study	Problem Solving	9 Hrs.
Topics: Files: Defining and Opening a File – Closing a File – Input / Output Operations on File – Random Access Files				
List of Practical Tasks Lab Sheet 1 (Module I) Programs using IO Statements, Conditional Statements and Looping Statements Lab Sheet 2 (Module II) Programs using Arrays and Strings Lab Sheet 3 (Module III) Programs using Functions and Pointers Lab Sheet 4 (Module IV) Programs using Structures and Unions Lab Sheet 5 (Module V) Programs using Files				
Text Book(s): 1. E. Balaguruswamy, “Programming in ANSI C”, 8th Edition, 2019, McGraw Hill Education, ISBN: 978-93-5316- 513-0.				
Reference Book(s): Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020. ReemaThareja, “Programming in C”, Oxford University Press, Second Edition, 2016. Kernighan, B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2015 Schildt Herbert, “C: The Complete Reference”, Tata McGraw Hill Education, 4th Edition, 2014. Stephen G. Kochan, “Programming in C”, Addison-Wesley Professional, 4th Edition, 2014.				
Web Links and Video Lectures: 1. https://nptel.ac.in/courses/106/105/106105171/ 2. https://archive.nptel.ac.in/courses/106/104/106104128/				

Topics:

Overview of natural resources: Definition of resource; Classification of natural resources- biotic and abiotic, renewable and non-renewable. **Water resources**: Types of water resources- fresh water and marine resources;

Soil and mineral resources: Important minerals; Mineral exploitation Soil as a resource and its degradation.

Energy resources: Sources of energy and their classification, renewable and non-renewable sources of energy; Advantages and disadvantages.

Self- learning topics: Availability and use of water resources; Environmental impact of over-exploitation, issues and challenges.; Environmental problems due to extraction of minerals and use; Sustainable Development Goals (SDGs)- targets, indicators, and challenges for SDGs.

Module 3	**Environmental Issues: Local, Regional and Global**	Case study		**02 Classes**

Topics:

Environmental Pollution: Types of Pollution- air, noise, water, soil, municipal solid waste, hazardous waste; Trans- boundary air pollution; Acid rain; Smog.

Land use and Land cover change: land degradation, deforestation, desertification, urbanization. Global change: Ozone layer depletion; Climate change

Self -learning topics: Environmental issues and scales

Module 4	**Conservation of Biodiversity and Ecosystems**	Assignment		**02 Classes**

Topics:

Biodiversity-Introduction, types, Species interactions, Extinct, endemic, endangered and rare species, Threats to biodiversity: Natural and anthropogenic activities.

Self-learning topics: Mega-biodiversity, Hot-spots, Major conservation policies. Biodiversity loss: past and current trends, impact.

Module 5	**Environmental Pollution and Health**	Case study		**03 Classes**

Topics:

Pollution, Definition, point and nonpoint sources of pollution, **Air pollution**- sources, major air pollutants, health impacts of air pollution.

Water pollution– Pollution sources, adverse health impacts on human and aquatic life and mitigation, Water quality parameters and standards.

Soil pollution and solid waste- Soil pollutants and their sources, solid and hazardous waste, Impact on human health.

Self-learning topics: Noise pollution, Thermal and radioactive pollution.

Module 6	**Climate Change: Impacts, Adaptation**	Assignment/case		**02 Classes**

	and Mitigation			

Topics:

Understanding climate change: Natural variations in climate; Projections of global climate change with special reference to temperature, rainfall and extreme events; Importance of 1.5 °C and 2.0 °C limits to global warming; Impacts

Vulnerability and adaptation to climate change: Observed impacts of climate change on ocean and land systems; Sea level rise, changes in marine and coastal ecosystems; Impacts on forests and natural ecosystems; Indigenous knowledge for adaptation to climate change. Self-learning topics: Mitigation of climate change: Synergies between adaptation and mitigation measures; National and international policy instruments for mitigation.

Module 7	**Environmental Management**	Case study	Data analysis	**02 Classes**

Topics:

Environmental management system: ISO 14001; Environmental risk assessment Pollution control and management; Waste Management- Concept of 3R (Reduce, Recycle and Reuse) and sustainability.

Self-learning topics: Environmental audit and impact assessment; Eco labeling /Eco mark scheme

Module 8	**Environmental Treaties and Legislation**	Case study	Data analysis	**01 Classes**

Topics:

Major International Environmental Agreements: Convention on Biological Diversity (CBD), Major Indian Environmental Legislations: Environmental Protection Act, Forest Conservation Act, Public awareness.

Self-learning topics: Paris Agreement, Conference of the Parties (COP), India's status as a party to major conventions: Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act.

List of laboratory tasks : Any eight experiments will be conducted

1. Determination of total alkalinity of a water sample (knowledge)
2. Estimation of water hardness by EDTA method and its removal (by zeolite/ ion exchange method) (Comprehensive)
3. Estimation of copper from industrial effluents by colorimetric method (Comprehensive)
4. Estimation of iron from industrial effluents by titrimetric method/potentiometric method (Comprehensive)
5. Estimation of nickel from industrial effluents by titrimetric method (Comprehensive)
6. Estimation of chloride in drinking water by titrimetric method (Comprehensive)
7. Estimation of fluoride in ground water by colorimetric method (Comprehensive)
8. Determination of calcium in aqueous solution (Comprehensive)
9. Determination of Total Dissolved Salts, conductivity and pH of a water samples (Knowledge)
10. Determination of Chemical oxygen demand in the industrial effluent. (Comprehensive)
11. Biological oxygen demand of waste water sample (Comprehensive)
12. Determination of dissolved oxygen of an industrial effluent (Comprehensive)

13. Quality monitoring analysis of a soil sample (knowledge)
14. Flame photometric estimation of Sodium and potassium (Application)
15. Gas Chromatographic analysis of volatile organic compounds (Application)

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:

Assessment Type

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

Assignment 1: Write a Statement of Environment report of your town/city/state/country

Assignment 2: Individual students will carry out the analyses of polluted solid, liquid, and gaseous samples and propose suitable mitigation measures. A detailed and in-depth report needs to be submitted for each case. This may include preparation of reagents, sample preparation (extraction), chemical analysis carried out, instruments and tools used, data collected and processed, inferences made and conclusions arrived at. Necessary support is given in the form of
lab manual and reference links to e-books.

Text Book

1. G. Tyler Miller and Scott Spoolman (2020), Living in the Environment, 20th Edition, Cengage Learning, USA
2. Krishnamurthy, K.V. (2003) Text book of Biodiversity, Science Publishers, Plymouth, UK.
3. Jackson, A.R. & Jackson, J.M. (2000), Environmental Science: The natural environment and human impact, Pearson Education.

Reference Books

1. Fisher, Michael H. (2018) An Environmental History of India- From Earliest Times to the Twenty-First Century, Cambridge University Press.
2. William P. Cunningham and Mary Ann Cunningham (2017), Principles of Environmental Science: Inquiry & Applications, 8th Edition, McGraw-Hill Education, USA.
3. Sinha N., (2020) Wild and Wilful. Harper Collins, India.
4. www.ipcc.org; https://www.ipcc.ch/report/sixth-assessment-report-cycle/
5. Theodore, M. K. and Theodore, Louis (2021) Introduction to Environmental Management, 2nd Edition. CRC Press.
6. Richard A. Marcantonio, Marc Lame (2022). Environmental Management: Concepts and Practical Skills. Cambridge University Press.

E-resources:

1. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DO_AB_1_06082022_18126
2. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DO_AB_1_06082022_8761
3. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DO_AJ_1_02082022_3333
4. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DO_AB_1_06082022_3063
5. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DO_AB_1_06082022_20719
6. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DO_AB_1_06082022_16824
7. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DO_AB_1_06082022_3954
8. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DO_AB_1_06082022_491
9. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=CUSTOM_PACKAGE_16012023_WORLD_BUSINESS_COUNCIL_SUSTAINABLE_488
10. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=CUSTOM_PACKAGE_16012023_WORLD_BUSINESS_COUNCIL_SUSTAINABLE_583
11. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=SP_RINGER_INDEST_1_171
12. https://presiuniv.knimbus.com/user#/searchresult?searchId=3R%20principle&_t=1687427221129
13. https://presiuniv.knimbus.com/user#/searchresult?searchId=eco%20labelling&_t=1687427279979
14. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=TEXTBOOK_LIBRARY01_06082022_395&xIndex=4
15. https://www.ugc.gov.in/oldpdf/modelcurriculum/env.pdf

Topics relevant to Skill Development:

Industrial revolution and its impact on the environment, Environmental impact of over-exploitation of water resources, pollution and ill effects, lab experiments for Skills development through Problem solving Techniques. This is attained through assessment component mentioned in course handout.

All topics in theory component are relevant to Environment and Sustainability.

Course Code: PPS1001	**Course Title: Introduction to Soft Skills**	L- T-P- C	0	2	1

	Type of Course: Practical Only Course				
Version No.	1.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	This course is designed to enable students understand soft skills concepts 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 to **familiarize the learners with the concepts of "Soft Skills" and attain SKILL DEVELOPMENT through RTICIPATIVE LEARNING techniques.**				
Course Out Comes	**On successful completion of this course the students shall be able to:** CO1: **Recognize** significance of soft skills CO2: **Illustrate** effective communication while introducing oneself and others CO3: **List** techniques of forming healthy habits CO4: **Apply** SMART technique to achieve goals and increase productivity				
Course Content:					
Module 1	INTRODUCTION TO SOFT SKILLS	**Classroom activity**	**04 Hours**		
Topics: Setting Expectations, Ice Breaker, Significance of soft skills, Formal grooming, punctuality					
Module 2	EFFECTIVE COMMUNICATION	**Individual Assessment**	**10 Hours**		
Topics: Different styles of communication, Difference between hearing and listening, Effective communication for success, Email etiquette, Self-introduction framework, Video introduction, email-writing, Resume Building- Digital, Video, Traditional.					
Module 3	HABIT FORMATION	**Worksheets & Assignment**	**4 Hours**		
Topics: Professional and personal ethics for success, Identity based habits, Domino effect, Habit Loop, Unlearning, standing up for what is right					
Module 4	Goal setting & Time Management	**Goal sheet**	**8 Hours**		
A session where students will be introduced to Time management, setting SMART Goals, Introduction to OKR Techniques, 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					
Targeted Application & Tools that can be used: LMS					
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course					
1) Individual Assessment 2) LMS MCQ					

The topics related to Skill Development: Communication and professional grooming, Goal setting and presentation for skill development through participative learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: **CHE1018**	**Course Title:** **Environmental Science** **Type of Course:** **School Core- Theory and Lab**	**L- T- P- C**	**1**	**0**	**2**	**0**
		Contact hours	**1**	**0**	**2**	**3**
Version No.	2.0					
Course Pre-requisites	NIL					
Anti-requisites	**NIL**					
Course Description	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 to **familiarize the learners with the concepts of "Environmental Science" and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques.**					
Course Outcomes	On successful completion of this course the students shall be able to: 1) Appreciate the historical context of human interactions with the environment and the need for eco-balance. 2) Describe basic knowledge about global climate change with particular reference to the Indian context. 3) Understand biodiversity and its conservation 4) Develop an understanding on types of pollution and ways to protect the environment 5) Learn about various strategies on Global environmental management systems					
Course Content:						
Module 1	**Humans and the Environment**	Assignment	Data Collection	**01 class**		
Topics: The man-environment interaction: Mastery of fire; Origin of agriculture; Emergence of city-states; Great ancient civilizations and the environment. ***Self-learning topics:*** Humans as hunter-gatherers; Industrial revolution and its impact on the environment; Environmental Ethics and emergence of environmentalism.						

Module 2	Natural Resources and Sustainable Development	Assignment		03 Classes

Topics:
Overview of natural resources: Definition of resource; Classification of natural resources- biotic and abiotic, renewable and non-renewable. **Water resources**: Types of water resources- fresh water and marine resources;

Soil and mineral resources: Important minerals; Mineral exploitation Soil as a resource and its degradation.

Energy resources: Sources of energy and their classification, renewable and non-renewable sources of energy; Advantages and disadvantages.

Self- learning topics: Availability and use of water resources; Environmental impact of over-exploitation, issues and challenges.; Environmental problems due to extraction of minerals and use; Sustainable Development Goals (SDGs)-targets, indicators, and challenges for SDGs.

Module 3	Environmental Issues: Local, Regional and Global	Case study		02 Classes

Topics:
Environmental Pollution: Types of Pollution- air, noise, water, soil, municipal solid waste, hazardous waste; Trans-boundary air pollution; Acid rain; Smog.

Land use and Land cover change: land degradation, deforestation, desertification, urbanization. Global change: Ozone layer depletion; Climate change

Self -learning topics: Environmental issues and scales

Module 4	Conservation of Biodiversity and Ecosystems	Assignment		02 Classes

Topics:
Biodiversity-Introduction, types, Species interactions, Extinct, endemic, endangered and rare species, Threats to biodiversity: Natural and anthropogenic activities.

Self-learning topics: Mega-biodiversity, Hot-spots, Major conservation policies. Biodiversity loss: past and current trends, impact.

Module 5	Environmental Pollution and Health	Case study		03 Classes

Topics:
Pollution, Definition, point and nonpoint sources of pollution, **Air pollution**- sources, major air pollutants, health impacts of air pollution.

Water pollution– Pollution sources, adverse health impacts on human and aquatic life and mitigation, Water quality parameters and standards.

Soil pollution and solid waste- Soil pollutants and their sources, solid and hazardous waste, Impact on human health.

Self-learning topics: Noise pollution, Thermal and radioactive pollution.

Module 6	Climate Change: Impacts, Adaptation and Mitigation	Assignment/case		02 Classes

Topics:
Understanding climate change: Natural variations in climate; Projections of global climate change with special reference to temperature, rainfall and extreme events; Importance of 1.5 °C and 2.0 °C limits to global warming; Impacts

Vulnerability and adaptation to climate change: Observed impacts of climate change on ocean and land systems; Sea level rise, changes in marine and coastal ecosystems; Impacts on forests and natural ecosystems; Indigenous knowledge for adaptation to climate change.

Self-learning topics: Mitigation of climate change: Synergies between adaptation and mitigation measures; National and international policy instruments for mitigation.

Module 7	**Environmental Management**	Case study	Data analysis	**02 Classes**

Topics:
Environmental management system: ISO 14001; Environmental risk assessment Pollution control and management; Waste Management- Concept of 3R (Reduce, Recycle and Reuse) and sustainability.

Self-learning topics: Environmental audit and impact assessment; Eco labeling /Eco mark scheme

Module 8	**Environmental Treaties and Legislation**	Case study	Data analysis	**01 Classes**

Topics:
Major International Environmental Agreements: Convention on Biological Diversity (CBD), Major Indian Environmental Legislations: Environmental Protection Act, Forest Conservation Act, Public awareness.

Self-learning topics: Paris Agreement, Conference of the Parties (COP), India's status as a party to major conventions: Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act.

List of laboratory tasks : Any eight experiments will be conducted

16. Determination of total alkalinity of a water sample (knowledge)
17. Estimation of water hardness by EDTA method and its removal (by zeolite/ ion exchange method) (Comprehensive)
18. Estimation of copper from industrial effluents by colorimetric method (Comprehensive)
19. Estimation of iron from industrial effluents by titrimetric method/potentiometric method (Comprehensive)
20. Estimation of nickel from industrial effluents by titrimetric method (Comprehensive)
21. Estimation of chloride in drinking water by titrimetric method (Comprehensive)
22. Estimation of fluoride in ground water by colorimetric method (Comprehensive)
23. Determination of calcium in aqueous solution (Comprehensive)
24. Determination of Total Dissolved Salts, conductivity and pH of a water samples (Knowledge)
25. Determination of Chemical oxygen demand in the industrial effluent. (Comprehensive)
26. Biological oxygen demand of waste water sample (Comprehensive)
27. Determination of dissolved oxygen of an industrial effluent (Comprehensive)
28. Quality monitoring analysis of a soil sample (knowledge)
29. Flame photometric estimation of Sodium and potassium (Application)
30. Gas Chromatographic analysis of volatile organic compounds (Application)

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:

Assessment Type

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

Assignment 1: Write a Statement of Environment report of your town/city/state/country

Assignment 2: Individual students will carry out the analyses of polluted solid, liquid, and gaseous samples and propose suitable mitigation measures. A detailed and in-depth report needs to be submitted for each case. This may include preparation of reagents, sample preparation (extraction), chemical analysis carried out, instruments and tools used, data collected and processed, inferences made and conclusions arrived at. Necessary support is given in the form of lab manual and reference links to e-books.

Text Book

4. G. Tyler Miller and Scott Spoolman (2020), Living in the Environment, 20th Edition, Cengage Learning, USA
5. Krishnamurthy, K.V. (2003) Text book of Biodiversity, Science Publishers, Plymouth, UK.
6. Jackson, A.R. & Jackson, J.M. (2000), Environmental Science: The natural environment and human impact, Pearson Education.

Reference Books

7. Fisher, Michael H. (2018) An Environmental History of India- From Earliest Times to the Twenty-First Century, Cambridge University Press.
8. William P. Cunningham and Mary Ann Cunningham (2017), Principles of Environmental Science: Inquiry & Applications, 8th Edition, McGraw-Hill Education, USA.
9. Sinha N., (2020) Wild and Wilful. Harper Collins, India.
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12. Richard A. Marcantonio, Marc Lame (2022). Environmental Management: Concepts and Practical Skills. Cambridge University Press.

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5. **https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_20719**
6. **https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_16824**
7. **https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_3954**
8. **https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DOAB_1_06082022_491**
9. **https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=CUSTOM_PACKAGE_16012023_WORLD_BUSINESS_COUNCIL_SUSTAINABLE_488**
10. **https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=CUSTOM_PACKAGE_16012023_WORLD_BUSINESS_COUNCIL_SUSTAINABLE_583**
11. **https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=SPRINGER_INDEST_1_171**
12. **https://presiuniv.knimbus.com/user#/searchresult?searchId=3R%20principle&_t=1687427221129**
13. **https://presiuniv.knimbus.com/user#/searchresult?searchId=eco%20labelling&_t=1687427279979**
14. **https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=TEXTBOOK_LIBRARY01_06082022_395&xIndex=4**
15. **https://www.ugc.gov.in/oldpdf/modelcurriculum/env.pdf**

Topics relevant to Skill Development:
Industrial revolution and its impact on the environment, Environmental impact of over-exploitation of water resources, pollution and ill effects, lab experiments for Skills development through Problem solving Techniques. This is attained through assessment component mentioned in course handout.

All topics in theory component are relevant to Environment and Sustainability.

SEMESTER II

Course Code: **MAT1003**	**Course Title: Applied Statistics** **Type of Course:** School Core	**L –T-P- C**	1	0	2	2
Version No.	3.0					
Course Pre-requisites	NIL					
Anti-requisites	Nil					
Course Description	The goal of this course is to provide a firm understanding of probability and statistics by means of a thorough treatment of descriptive statistics, probability and probability distributions keeping in mind the future courses having statistical, quantitative and probabilistic components. The course covers topics such as descriptive statistics, probability, rules for probability, random variables and probability distributions, standard discrete and continuous probability distributions.					
Course Objective	The objective of the course is to **familiarize the learners with the concepts of "**Applied Statistics" and attain **Skill Development Through Problem Solving techniques**.					
Expected Outcome:	At the end of this course, students will be in a position to 1. apply the techniques of descriptive statistics effectively 2. interpret the ideas of probability and conditional probability 3. demonstrate the knowledge of probability distributions 4. Compute statistical parameters, correlation and regression, probability and sampling distributions using R software.					
Module 1	**Descriptive Statistics**	Assignment	Coding needed		**10 classes**	
Introduction to Statistics, Data and statistical thinking, review of basic statistical parameters, Covariance, Correlation, Types of Measures of Correlation - Karl Pearson's Correlation Coefficient, Spearman Rank Correlation, linear regression, Multi linear regression **.**						
Module 2	**Probability**				**6 classes**	
Introduction to Probability, Probability of an event, Addition Principle, Multiplication law, Conditional Probability, Total Probability and Baye's theorem with examples						

Module 3	**Random Variables and Probability Distributions**		Coding needed	**14 classes**
Introduction to Random variables, Discrete Random Variables and Continuous Random Variables, Probability Distributions, Probability Mass Function and Probability Density Function, Various Probability distributions, Binomial, **Negative Binominal (Self Study)**, Poisson, Normal and Exponential distributions				
Module 4	**Sampling Theory**		Coding needed	**15 classes**
Introduction to Sampling Theory, Population, Statistic, Parameter, Sampling Distribution, Standard Error. Testing of Hypothesis, Types of Errors, Critical Region, level of Significance. Difference between Parametric and Non-parametric Tests, Large Sample Tests: Z-Test for Single Mean and **Difference of Means (Self Study)**, Small Sample Tests: Student's t-Test for Single Mean and **Difference of Means,** F-Test, Chi-Square Test.				

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 basic statistical tools to tackle engineering and real-life problems.
Tools used: R Software / MS-Excel

Text Book

1. Ronald E Walpole, Raymond H Myers, Sharon L Myers, and Keying 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. David R. Anderson, Dennis J. Sweeney, Thomas A. Williams, Essentials of Modern Business Statistics with Microsoft Excel, 2020.
3. David R. Anderson, Dennis J. Sweeney, Thomas A. Williams, Essentials of Statistics for Business and Economics, 2019.
4. Douglas C. Montgomery and George 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.

Topics relevant to SKILL DEVELOPMENT: The goal of this course is to provide a firm understanding of probability and statistics by means of a thorough treatment of descriptive statistics, probability and probability distributions keeping in mind the future courses having

statistical, quantitative and probabilistic components. The course covers topics such as descriptive statistics, probability, rules for probability, random variables and probability distributions, standard discrete and continuous probability distributions for **Skill Development through Problem Solving methodologies.** This is attained through assessment component mentioned in course handout.

Course Code: **MEC1006**	**Course Title:** **Engineering Graphics** **Type of Course:** **School Core & Theory Only**	**L- T-P-C**	2-0-0-2
Version No.	1.2		
Course Pre-Requisites	**NIL**		
Anti-requisites	**NIL**		
Course Description	**The course is designed with the objective of giving an overview of engineering graphics. It is introductory in nature and acquaints the students with the techniques used to create engineering drawings. The course emphasizes on projection of points, lines, planes and solids and isometric projections.**		
Course Objective	**The objective of the course is to familiarize the learners with the concepts of "Engineering Graphics" and attain SKILL DEVELOPMENT through Problem solving methodologies.**		
Course Outcomes	**On successful completion of this course the students shall be able to:** **(1) Demonstrate competency of Engineering Graphics as per BIS conventionsand standards.** **(2) Comprehend the theory of projection for drawing projections of Points, Lines andPlanes under different conditions.** **(3) Prepare multiview orthographic projections of Solids by visualizing them indifferent positions.** **(4) Prepare pictorial drawings using the principles of isometric projections to visualizeobjects in three dimensions.**		

Course Content:				
Module 1	Introduction to Drawing	Assignment	Standard technical drawing	**02 Sessions**
Topics: **Introduction, drawing instruments and their uses, relevant BIS conventions and standards, Lettering, Lineconventions, dimensioning, Selection of drawing sheet size and scale.** **[02 Hours: Comprehension Level]**				
Module 2	Orthographic projections of	Assignment	Projection methods Analysis	**10 Sessions**

	Points, Straight Linesand Plane Surfaces			
Topics: **Introduction, Definitions – Elements of projection and methods of projection, Planes of projection, reference line and conventions adopted. First angle and third angle projections. Projection of Points inall 4 quadrants.** **Projections of Straight Lines (located in first quadrant/first angle projection only): True and apparent lengths, true and apparent Inclinations to reference planes. (No application problems). Projection of Plane surfaces (First angle projection): Regular plane surfaces – triangle, square, rectangle, pentagon, hexagon and circle – in different positions inclined to both the planes using change of position method only.** **[10 Hours: Application Level]**				
Module 3	Orthographic Projections of Solids	Assignment	Multi-view drawing Analysis	**10 Sessions**
Topics: **Introduction, Projection of right regular prisms, pyramids, cone, hexahedron and tetrahedron indifferent positions (Problems resting on HP only and First angle projection).** **[10 Hours: Application Level]**				
Module 4	Isometric Projections of Solids (Using isometric scale only)	Assignment	Spatial Visualization	**8 Sessions**
Topics: **Introduction, Isometric scale, Isometric projections of right regular prisms, cylinders, pyramids, cones and their frustums, spheres and hemispheres, hexahedron (cube), and combination of 2 solids, conversion of orthographic view to isometric projection of simple objects.** **[8 Hours: Application Level]**				
Text Book: **1.N. D. Bhatt, "Engineering Drawing: Plane and Solid Geometry," Charotar Publishing House Pvt. Ltd.**				

References: **1. K.R. Gopalakrishna, "Engineering Graphics", Subhash Publishers, Bangalore.** **2. D. M. Kulkarni, A. P. Rastogi, A. K. Sarkar, "Engineering Graphics with AutoCAD," Prentice Hall.** **3. D. A. Jolhe, "Engineering Drawing with Introduction to AutoCAD," Tata McGraw Hill.** **Web resources:** **https://nptel.ac.in/courses/112103019**
Topics relevant to "SKILL DEVELOPMENT": Projection in first and third angle for **SKILL DEVELOPMENT** through **Problem Solving methodologies**. This is attained through the assessment component mentioned in the course handout.

Course Code: ECE2007	**Course Title:** Digital Design **Type of Course:** Theory &Integrated Laboratory	**L- T-P-C**	**2**	**0**	**2**	**3**
Version No.	2.0					
Course Pre-requisites	ECE1001					
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. The course emphasizes on minimization techniques for making canonical and low-cost digital circuit implementations. This course deals with analysis and design of digital electronic circuits. The course also creates a foundation for future courses which includes Computer Architecture, Microprocessors, Microcontrollers, and Embedded Systems etc.** The course 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 Design and attain the SKILL DEVELOPMENT through** EXPERIENTIAL **LEARNING.**					
Course Outcomes	**On successful completion of this course the students shall be able to:** i. **Describe** the concepts of number systems, Boolean algebra and logic gates. ii. **Apply** minimization techniques to simplify Boolean expressions. iii. **Demonstrate** the Combinational circuits for a given logic iv. Demonstrate the Sequential and programmable logic circuits v. **Implement** various combinational and sequential logic circuits using gates.					
Course Content:						

Module 1	**Fundamentals of Number systems- Boolean algebra and digital logic**	Application Assignment	Data Analysis task	**06 classes**
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. Introduction to HDL.				
Module 2	**Boolean function simplification**	Application Assignment	Data Analysis task	**08 Classes**
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, HDL Models of combinational circuits.				
Module 3	**Combinational Logic circuits:**	Application Assignment	Programming Task & Data Analysis task	**08 Classes**
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. HDL Models of Sequential circuits.				

List of Laboratory Tasks:

Experiment N0 1: Verify the Logic Gates truth table
Level 1: By using Digital Logic Trainer kit
Level 2: By using Analog devices like RPS, Volt meter, Resistors and ICs

Experiment No. 2: Verify the Boolean Function and Rules
Level 1: By using Digital Logic Trainer kit
Level 2: By using Analog devices like RPS, Volt meter, Resistors and ICs

Experiment No. 3: Design and Implementations of HA/FA
Level 1: By using basic logic gates and Trainer Kit
Level 2: By using Universal logic gates and Trainer Kit

Experiment No. 4: Design and Implementations of HS/FS
Level 1: By using basic logic gates and Trainer Kit
Level 2: By using Universal logic gates and Trainer Kit

Experiment No. 5: Design and Implementations of combinational logic circuit for specifications
Level 1: Specifications given in the form of Truth table
Level 2: Specification should be extracted from the given scenario

Experiment No. 6: Study of Flip flops

Experiment No. 7: Design and Implementations of sequential logic circuit for specifications
Level 1: Specifications given in the form of Truth table
Level 2: Specification should be extracted from the given scenario

Experiment No.8: HDL coding for basic combinational logic circuits

Level 1: Gate level Modeling
Level 2: Behavioral Modeling

Experiment No.9: HDL coding for basic sequential logic circuit
Level 1: Gate level Modeling
Level 2: Behavioral Modeling

Targeted Application & Tools that can be used:

Digital electronics is the foundation of all modern electronic devices such as cellular phones, MP3 players, laptop computers, digital cameras, high definition televisions, Home Automation, Communication in systems in industries

Professionally Used Software: HDL/VHDL/Verilog HDL/ OOPS

Text Book(s):

1. Mano, M. Morris and Ciletti Michael D., *"Digital Design"*, Pearson Education, 6th edition

2. Thomas L. Floyd "DIGITAL LOGIC DESIGN" , Pearson Education, fourth edition.

Reference(s):
Reference Book(s):

R1. Jain, R. P., "Modern Digital Electronics", McGraw Hill Education (India), 4th Edition

R2. Roth, Charles H., Jr and Kinney Larry L., "Fundamentals of logic Design", Cengage Learning, 7th Edition

Online Resources (e-books, notes, ppts, video lectures etc.): Book Free Download (studymaterialz.in)

1. **eBook1**: Mano, M. Morris and Ciletti Michael D., *"Digital Design"*, Pearson Education.
2. {[PDF] Digital Design By M. Morris Mano, Michael D Ciletti Book Free Download
}
3. **eBook2:**Floyd "DIGITAL LOGIC DESIGN" fourth edition- ePub, eBook- [PDF] DIGITAL LOGIC DESIGN FOURTH EDITION FLOYD | abri.engenderhealth.org.
4. NPTEL Course- NPTEL :: Electrical Engineering - NOC:Digital Electronic Circuits
5. Digital Logic Design PPT Slide 1 (iare.ac.in)
6. Lab Tutorial: 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

7. 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.
2. An encoding technique for design and optimization of combinational logic circuit DipayanBhadra;Tanvir Ahmed Tarique;Sultan Uddin Ahmed;Md. Shahjahan;KazuyukiMurase2010 13th International Conference on Computer and Information Technology (ICCIT)

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.
4. A. Matrosova, V. Provkin and E. Nikolaeva, "Masking Internal Node Faults and Trojan Circuits in Logical Circuits," *2019 IEEE East-West Design & Test Symposium (EWDTS)*, 2019, pp. 1-4, doi: 10.1109/EWDTS.2019.8884434.

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

Course Code: CSE1001	**Course Title:** Problem Solving using JAVA **Type of Course: Integrated**	**L- T-P- C**	2	0	2	3
Version No.	2.0					
Course Pre-requisites	CSE1004					
Anti-requisites	Nil					
Course Description	This course introduces the core concepts of object-oriented programming. This course has theory and lab component which emphasizes on understanding the implementation and application of object-oriented programming paradigm. It helps the student to build real time secure applications by applying these concepts and also for effective problem solving. The students interpret and understand the need for object oriented programming to build applications.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Problem-Solving using JAVA and attain **SKILL DEVELOPMENT** through **EXPERIENTIAL LEARNING** techniques					
Course Out Comes	**On successful completion of the course the students shall be able to:** **C.O. 1:** Describe the basic programming concepts. [Knowledge] **C.O. 2:** Apply the concept of classes, objects and methods to solve problems. [Application] **C.O. 3:** Apply the concept of arrays and strings. [Application] **C.O. 4:** Implement inheritance and polymorphism building secure applications. [Application] **C.O. 5:** Apply the concepts of interface and error handling mechanism. [Application]					
Course Content:						
Module 1	**Basic Concepts of Programming and Java**	Assignment	Data Collection/Interpretation			**12 Sessions**

Topics: Introduction to Principles of Programming: Process of Problem Solving, Java program structure, Download Eclipse IDE to run Java programs, Sample program, Data types, Identifiers, Variables, Constants in java, Operators, Assignments and Expression, Basic Input/ Output functions, Control Statements: Branching and Looping.				
Module 2	**Classes, objects, methods and Constructors**	Case studies / Case let	Case studies / Case let	**12 Sessions**
Topics: Classes, Objects and Methods: Introduction to object Oriented Principles, defining a class, adding data members and methods to the class, access specifiers, instantiating objects, reference variable, accessing class members and methods. Static Polymorphism: Method overloading, constructors, constructor overloading, this keyword, static keyword, Nested classes, Accessing members in nested classes.				
Module 3	**Arrays, String and String buffer**	Quiz	Case studies / Case let	**14 Sessions**
Topics: Arrays: Defining an Array, Initializing & Accessing Array, Multi –Dimensional Array, Array of objects. String: Creation & Operation. String builder class, methods in String Buffer.				
Module 4	**Inheritance and Polymorphism**	Quiz	Case studies / Case let	**14 Sessions**
Topics: Inheritance: Defining a subclass, Types of Inheritance, super keyword. Dynamic Polymorphism: Method overriding. Final keyword: with data members, with member functions and with class. Abstract keyword: with data members, with member functions and with class, Exception handling.				
Module 5	**Input & Output Operation in Java**	Quiz	Case studies / Case let	**14 Sessions**
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.				
List of Laboratory Tasks: P1 - Problem Solving using Basic Concepts. P2 - Problem Solving using Basic Concepts and Command Line Arguments. P3 - Programming assignment with class, objects, methods and Constructors. P4 - Programming assignment with method overloading. P5 - Programming assignment with constructor overloading. P6 - Programming assignment with Static members and static methods. P7 - Programming assignment with Nested classes. P8 - Programming assignment using Arrays. P9 - Programming assignment using Strings. P10 - Programming assignment using String Builder. P11 - Programming assignment using Inheritance and super keyword. P12 - Programming assignment using Method overriding and Dynamic method invocation. P13 - Programming assignment using Final keywords. P14 - Programming assignment using Abstract keywords. P15 - Programming assignment using Interface. P16 - Programming assignment using Interface. P17 - Programming assignment CharacterStream Classes P18 - Programming assignment Read/Write Operations with File Channel				

Targeted Application & Tools that can be used : JDK /eclipse IDE/ net Beans IDE.
Text Book **T1** Herbert Schildt, "The Complete Reference Java 2", Tata McGraw Hill Education.
References **R1**: Cay S Horstmann and Cary Gornell, "CORE JAVA volume I-Fundamentals", Pearson **R2:** James W. Cooper, "Java TM Design Patterns – A Tutorial", Addison-Wesley Publishers. **E book link R1:** http://rmi.yaht.net/bookz/core.java/9780134177373-Vol-1.pdf **E book link R2:** Java(tm) Design Patterns: A Tutorial([PDF] [7qmsenjl97t0] (vdoc.pub) Web **resources** ps://youtube.com/playlist?list=PLu0W_9lII9agS67Uits0UnJyrYiXhDS6q ps://puniversity.informaticsglobal.com:2229/login.aspx
Topics relevant to development of "Skill Development": 1. Static Polymorphism 2. Method overloading, constructors 3. constructor overloading 4. this keyword 5. static keyword and Inner classes 6. Inheritance and Polymorphism. for **Skill Development** through **Experiential Learning** techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE 2014	**Course Title: Software Engineering** **Type of Course: School Core [Theory Only]**	**L-T-P- C**	**3**	**0**	**3**
Version No.	1.0				
Course Pre-requisites	**NIL**				
Anti-requisites	**NIL**				
Course Description	The objective of this course is to provide the fundamentals concepts of Software Engineering process and principles. The course covers software requirement engineering processes, system analysis, design, implementation and testing aspects of software system development. The course covers software quality, configuration management and maintenance.				
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Software Engineering and attain Skill Development through Participative Learning techniques.				

<table>
<tr><td>Course Out Comes</td><td colspan="4">On successful completion of this course the students shall be able to:
1] Describe the Software Engineering principles, ethics and process models(Knowledge)
2] Identify the requirements, analysis and appropriate design models for a given application(Comprehension)
3] Understand the Agile Principles(Knowledge)
4] Apply an appropriate planning, scheduling, evaluation and maintenance principles involved in software(Application)</td></tr>
<tr><td></td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Introduction to Software Engineering and Process Models (Knowledge level)</td><td>Quiz</td><td></td><td>09 Hours</td></tr>
<tr><td colspan="5">Introduction: Need for Software Engineering, Professional Software Development, Software Engineering Ethics, Software Engineering Practice-Essence of Practice, General Principles Software Development Life Cycle
Models: Waterfall Model – Classical Waterfall Model, Iterative Waterfall Model, Evolutionary model-Spiral, Prototype.</td></tr>
<tr><td>Module 2</td><td>Software Requirements, Analysis and Design (Comprehension level)</td><td>Assignment</td><td>Development of SRS documents for a given scenario</td><td>11 Hours</td></tr>
<tr><td colspan="5">Requirements Engineering: Eliciting requirements, Functional and non- Functional requirements, Software Requirements Specification (SRS), Requirement Analysis and validation. Requirements modelling- Introduction to Use Cases, Activity diagram and Swim lane diagram. CASE support in Software Life Cycle, Characteristics of CASE Tools, Architecture of a CASE Environment.
Design: Design concepts, Architectural design, Component based design, User interface design.</td></tr>
<tr><td>Module 3</td><td>Agile Principles & Devops (Knowledge level)</td><td>Quiz</td><td></td><td>09 Hours</td></tr>
<tr><td colspan="5">Agile: Scrum Roles and activities, Sprint Agile software development methods - Scaling, User Stories, Agile estimation techniques, Product backlogs, Stake holder roles, Dynamic System Development Method.
Devops: Introduction, definition, history, tools.</td></tr>
<tr><td>Module 4</td><td>Software Testing and Maintenance (Application Level)</td><td>Assignment</td><td>Apply the testing concepts using Programing</td><td>12 Hours</td></tr>
<tr><td colspan="5">Software Testing-verification and validation, Test Strategies - White Box Testing, Black box Testing. Automation Tools for Testing.
Software Quality Assurance-Elements of software quality assurance, SQA Tasks, Goals and Metrics, Software configuration management- SCM process, SCM Tools (GitHub).
Maintenance- Characteristics of Software Maintenance, Software Reverse Engineering, Software Maintenance Process Models.</td></tr>
<tr><td colspan="5">Targeted Application & Tools that can be used: Selenium, GitHub, CASE Tools</td></tr>
<tr><td colspan="5">Text Book
1] Roger S. Pressman, “Software Engineering – A Practitioner’s Approach”, VII tion, McGraw-Hill, 2017.
2] Bob Hughes, Mike Cotterell, Rajib Mall, “Software Project Management”, VI tion, McGraw-Hill, 2018.</td></tr>
<tr><td colspan="5">References</td></tr>
</table>

Rajib Mall, "Fundamentals of Software Engineering", VI Edition, PHI learning ate limited, 2015. Sommerville, "Software Engineering", IX Edition, Pearson Education Asia, 2011. e Software Development Principles, Patterns and Practices.1st Edition, Wiley, 2002
Topics Relevant to "Skill Development: Balck box Testing, White box Testing, Automated Testing for Skill development through Participative Learning Techniques. This is attained through assessment mentioned in the course handout

ENG2001	**Advanced English**	**L- T- P- C**	1	0	2	2
Version No.	1.3					
Course Pre-requisites	ENG1002					
Anti-requisites	**NIL**					
Course Description	The course emphasizes on technical communication at advanced level by exploring critical reading, technical presentation and review writing. The purpose of the course is to enable learners to review literature in any form or any technical article and deliver technical presentations. Extensive activities in practical sessions equip to express themselves in various forms of technical communications. Technical presentations and the module on career setting focus on learners' area of interests and enhance their English language writing skills to communicate effectively.					
Course Out Come	On successful completion of the course the students shall be able to: 1. Develop a critical and informed response reflectively, analytically, discursively, and creatively to their reading. 2. Communicate effectively, creatively, accurately and appropriately in their writing. 3. Deliver technical presentations 4. Design resume and create professional portfolio to find a suitable career					
Course Content: Theory						
Module 1	**Critical Reasoning and Writing**	**Writing Essays**	**Critical Reading**			**4 Classes**
Topics: • A Catalog of Reading Strategies • The Myth of Multitasking • A Guide to Writing Essays Speculating about Causes or Effects • Is Google Making Us Stupid (Self Study)						
Module 2	**Technical Presentation**	**Presentation**	**Oral Skills**			**3 Classes**
Topics: • Planning the presentation • Creating the presentation						

• Giving the presentation				
Module 3	**Writing Reviews**	**Prezi**	**Review Writing**	**4 Classes**
Topics: • Review Writing • Short film reviews • Advanced English Grammar (Self Study)				
Module 4	**Starting your Career**	**Online Writing Lab**	**Writing Skills**	**4 Classes**
Topics**:** • Preparing a Resume • Writing Effective Application Letter • Creating a Professional Portfolio				

Course Content: Practical Sessions

Module 1	**Critical Reasoning and Writing**	**8 Classes**
1. Reading and Analyzing Level 1 – Annotation Level 2 - Assumptions 2. Writing Narrative Essays Level 1 – Draft 1 Level 2 – Draft 2		
Module 2	**Technical Presentation**	**10 Classes**
3. Fishbowl In Fishbowl, students form concentric circles with a small group inside and a larger group outside. Students in the inner circle engage in an in-depth discussion, while students in the outer circle listen and critique content, logic, and group interaction. Level 1 – within group Level 2 – Among 2 group 4. Technical Group Presentation		
Module 3	**Writing Reviews**	**4 Classes**
5. Practice Worksheets Level 1 – Eliminating the Passive Voice Level 2 – Simple, compound and complex sentences 6. Writing Short Film Reviews		
Module 4	**Starting your Career**	**6 Classes**
7. Collaborative Project Job search and writing report Writing Resume		
Module 1-4	**Academic Journal**	**2 Classes**

8. Academic Journal Writing Level 1- Mid Term Level 2 – End Term
Targeted Application & Tools that can be used: Writing reports, Review writing, Group Discussion, Dyadic interviews, Grammarly.com
Project work/Assignment:
Academic Journal – Assignment In Academic Journal (CIJ), students compile task and activities completed in each module and submit to the instructor at the middle and end of the semester.
References 1. Hering, Heik. *How to Write Technical Reports: Understanding Structure, Good Design, Convincing Presentation*. Springer. 2. Johnson, Richard. (2010) *Technical Communication Today.* Pearson, 2015 3. Rice B. Adelrod, Charles R. Cooper and Ellen C. Carillo. (2020) *Reading Critically Writing Well: A Reader and Guide*. Beford/St. Martin's Macmillan Learning, New York. 4. The Princeton Review. (2010) *MCAT Verbal Reasoning & Writing.* The Princeton Review, Inc. 5. https://www.hitbullseye.com/Strong-and-Weak-Arguments.php Accessed on 10 Dec 2021 6. https://www.inc.com/guides/how-to-improve-your-presentation-skills.html Accessed on 10 Dec 2021
Topics Relevant to "employability": Critical Reasoning, Presentation, Review Writing and Starting Career **Topics Relevant to "Human Values and Professional Ethics":** Critical reasoning

SEMESTER III

Course Code: CSE1005	Course Title: Programming in Python	L- T-P- C	1	0	4	3
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	The purpose of this course is to enable the students to develop python scripts using its basic programming features and also to familiarize the Python IDLE and other software's. This course develops analytical skills to enhance the programming abilities. The associated laboratory provides an opportunity to validate the concepts taught and enhances the ability to build real time applications.					

Course Object	The objective of the course is to familiarize the learners with the concepts of Programming in Python and attain Employability through Problem Solving Methodologies.			
Course Outcomes	On successful completion of this course the students shall be able to: Summarize the basic Concepts of python. 2. Demonstrate proficiency in using data structures. 3. Illustrate user-defined functions and exception handling. 4. Identify the various python libraries.			
Course Content:				
Module 1	Basics of Python programming	Assignment	Programming	14 Classes
Topics: Data types, operators and Expressions, Input and Output Statements. Control Structures – Selective and Repetitive structures				
Module 2	Indexed and Associative Data Structures	Simple applications	Programming	20 Classes
Topics: Strings, Lists, Sets, Tuples, Dictionaries				
Module 3	Functions, Exception handling and libraries	Case study	Programming	10 Classes
Topics: User defined functions, exception handling, Introduction to python built-in libraries				
List of Laboratory Tasks:				

Sl. No.	Experiment Name
1	PROGRAMS ON OPERATORS AND EXPRESSIONS Level - 1 : Basic programs on Operators and Expressions Level - 2 : Develop applications to solve mathematical equations
2	PROGRAMS ON CONTROL STRUCTURES Level - 1 : Basic programs on Control structures Level - 2 : Create applications to solve the real time problems
3	PROGRAMS ON SELECTIVE AND REPETITIVE STRUCTURES Level - 1 : Basic programs on Selective and Repetitive structures Level - 2 : Create applications to solve the real time problems
4	PROGRAMS ON STRINGS Level - 1 : Basic programs on Strings and its manipulation Level - 2 : Develop Real world applications that involves string matching
5	PROGRAMS ON LISTS, TUPLES and SETS Level - 1 : Basic programs on lists, Tuples and Sets Level - 2 : Create applications that involves sequential and Random access of data
6	PROGRAMS ON DICTIONARIES

	Level - 1 : Basic programs on dictionaries Level - 2 : Create applications that involves structuring of data.
7	PROGRAMS ON FUNCTIONS Level - 1 : Basic programs on Functions Level - 2 : Develop Real world applications using functions
8	PROGRAMS ON EXCEPTION HANDLING Level - 1 : Basic programs on exception handling Level - 2 : Develop applications that involves exception handling
9	BASIC PROGRAMS ON BUILT-IN LIBRARIES Level - 1 : Basic programs on python modules Level – 2: Develop applications using python libraries

Targeted Application & Tools that can be used:
Targeted Application : Web application development, AI, Operating systems
Tools: Python IDLE, ANACONDA

Application Areas:
Web Development
Game Development
Scientific and Numeric Applications
Artificial Intelligence and Machine Learning
Software Development
Enterprise-level/Business Applications
Education programs and training courses
Language Development
Operating Systems
Web Scrapping Applications
Image Processing and Graphic Design Applications

Professionally Used Software: Python IDLE, Spyder, Jupyter Notebook, Google Colab

Project work/Assignment:

Project Assignment: Developing python scripts using built in methods and functions

Text Books:

Martin C. Brown, “Python: The Complete Reference”, McGraw Hill Education, Forth edition (20 March 2018).
Alex Campbell, “Python for Beginners: Comprehensive Guide to the Basics of Programming, Machine Learning, Data Science and Analysis with Python”, August 29, 2021.
Charles Dierbach, “Introduction to Computer Science Using Python”, Wiley India Edition,2015.

References:

E. Balagurusamy, “Introduction to Computing and Problem Solving Using Python”, Tata McGraw-Hill, 2016 Y. Daniel Liang, “Introduction to Programming Using Python”, Pearson, 2017 Brady Ellison, “Python for Beginners: A crash course to learn Python Programming in 1 Week (Programming Languages for Beginners)”, August 25, 2021. Python Tutor - Visualize Python, Java, C, C++, JavaScript, TypeScript, and Ruby code execution https://practice.geeksforgeeks.org/courses/Python-Foundation
Topics relevant to development of “FOUNDATIONS SKILLS”- Solve the real time problems by analyzing and visualizing the data. Topics relevant to “HUMAN VALUES & PROFESSIONAL ETHICS”- Data collection and its arrangement

Course Code: CSE 2001	**Course Title:** Data Structures and Algorithms **Type of Course: Integrated**	**L-T-P- C**	3-0	2	4
Version No.	1.0				
Course Pre-requisites	CSE1001				
Anti-requisites	NIL				
Course Description	This course introduces the fundamental concepts of data structures and to emphasize the importance of choosing an appropriate data structure and technique for program development. This course has theory and lab component which emphasizes on understanding the implementation and applications of data structures using Java programming language. With a good knowledge in the fundamental concepts of data structures and practical experience in implementing them, the student can be an effective designer, developer for new software applications.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Data Structures and Algorithms and attain Skill Development through Experiential Learning techniques.				
Course Out Comes	**On successful completion of the course the students shall be able to:** **CO1:** Implement program for given problems using fundamentals of data structures. [Application] **CO2:** Apply an appropriate linear data structure for a given scenarios. [Application] **CO3:** Apply an appropriate non-linear data structure for a given scenarios. [Application] **CO4:** Explain the performance analysis of given searching and sorting algorithms.				
Course Content:					
Module 1	**Introduction to Data Structure and Linear Data**	Assignment	Program activity		**18 Sessions**

	Structure – Stacks and Queues			
Introduction – Introduction to Data Structures, Types and concept of Arrays. **Stack -** Concepts and representation, Stack operations, stack implementation using array and Applications of Stack. **Queues -** Representation of queue, Queue Operations, Queue implementation using array, Types of Queue and Applications of Queue.				
Module 2	**Linear Data Structure- Linked List**	Assignment	Program activity	**17 Sessions**
Topics: Linked List - Singly Linked List, Operation on linear list using singly linked storage structures, Circular List, Applications of Linked list. **Recursion** - Recursive Definition and Processes, Programming examples.				
Module 3	**Non-linear Data Structures - Trees and Graph**	Assignment	Program activity	**15 Sessions**
Topics: Trees - Introduction to Trees, Binary tree: Terminology and Properties, Use of Doubly Linked List, Binary tree traversals: Pre-Order traversal, In-Order traversal, Post - Order traversal. **Graph** - Basic Concept of Graph Theory and its Properties, Representation of Graphs.				
Module 4	**Searching & Sorting Performance Analysis**	Assignment	Program activity	**14sessions**
Topic: Sorting & Searching - Sequential and Binary Search, Sorting – Selection and Insertion sort. **Performance Analysis** - Time and space analysis of algorithms – Average, best and worst case analysis.				
List of Laboratory Tasks: **Lab sheet -1** **Level 1:** Prompt the user, read input and print messages.Programs using class, methods and objects **Level 2:** Programming Exercises on fundamental Data structure - Arrays based on Scenario. **Lab sheet -2** **Level 1:** Programming Exercises on Stack and its operations **Level 2:** Programming Exercises on Stack and its operations with condition **Lab sheet -3** **Level 1:** Programming on Stack application infix to postfix Conversion **Level 2:** - **Lab sheet -4** **Level 1:** Programming Exercises on Queues and its operations with conditions **Level 2:** - **Lab sheet -5** **Level 1:** Programming Exercises on Linked list and its operations. **Level 2:** Programming Exercises on Linked list and its operations with various positions **Lab sheet -6** **Level 1:** - **Level 2:** Programming scenario based application using Linked List **Lab sheet -7** **Level 1:** Programming Exercises on factorial of a number **Level 2:** Programming the tower of Hanoi using recursion				

Lab sheet -8
Level 1: -
Level 2: Programming the tower of Hanoi using recursion
Lab sheet -9
Level 1: Programming Exercise on Doubly linked list and its operations
Level 2: -
Lab sheet -10
Level 1: Program to Construct Binary Search Tree and Graph
Level 2: Program to traverse the Binary Search Tree in three ways(in-order, pre-order and post-order) and implement BFS and DFS
Lab sheet -11
Level 1: Program to Implement the Linear Search & Binary Search
Level 2: Program to Estimate the Time complexity of Linear Search
Lab sheet -12
Level 1: Program to Implement and Estimate the Time complexity of Insertion Sort
Level 2: Program to Implement and Estimate the Time complexity of Insertion Sort
Lab sheet -13
Level 1: Program to Implement and Estimate the Time complexity of Selection Sort
Level 2: Program to Implement and Estimate the Time complexity of Selection Sort

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

Project work/Assignment:

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

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

References
R1 Mark Allen Weiss: *"Data Structures and Algorithm Analysis in Java",* 4th Edition, Pearson Educational Limited, 2014.
R2 Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser: *"Data Structures and Algorithms in Java"*, 6th Edition, John Wiley & Sons, Inc., ISBN: 978-1-118-77133-4, 2014.
R3 Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, 2017: *"Introduction to Algorithms",* 3rd Edition, PHI Learning Private Limited.
Web resources:
1. For theory: https://onlinecourses.nptel.ac.in/noc20_cs85/preview
2. For Lab : codetantra tool
3. https://puniversity.informaticsglobal.com/login

Topics relevant to "SKILL DEVELOPMENT": Llinked list and its type, Tree traversal and hashing tables for Skill Development through Experiential Learning techniques. This is attained through the assessment component mentioned in the course handout.

Course Code: CSE2011	Course Title: Data Communications and Computer Networks Type of Course: Program Core - Theory	L-T- P-C	3-0	0	3
Version No.	1				
Course Pre-requisites	NIL				
Anti-requisites					
Course Description	This is the first course on data communication and computer networks. This course gives a thorough introduction to all the layers of a 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 also covers necessary foundational topics pertaining to data communications. This course can be followed up with an advanced computer network 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 Data Communications and Computer Networks and attain Skill Development through Participative Learning techniques.				
Course Outcomes	1. Explain the concepts of Computer Networks and Working Principles of Application Layer and Transport Layer (Comprehension) 2. Apply the Knowledge of IP Addressing and Routing Mechanism in Computer Networks. (Application) 3. Discuss the functionalities of Data Link Layer (Comprehension) 4. Explain the Basic Concepts of Data communication. (Comprehension)				
Course Content:					
Module 1	Overview, Application and Transport Layers.	Assignment	Comprehension	13 Sessions	
Introduction: Computer Networks, Topologies, OSI Reference Model, 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, Connection-less Transport: UDP, Principles of Reliable Data Transfer, Connection-Oriented Transport: TCP, Principles of Congestion Control, TCP Congestion Control.					
Module 2	Network Layer	Assignment	Application	12 Sessions	
Overview of Network Layer, Forwarding and Routing, The Data and Control Planes.The Internet Protocol (IP): IPv4, Addressing, IPv6, IPv4 Datagram Format, IPv4 Addressing, 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	Comprehension	10 Sessions	

Introduction to the Link Layer, The Services Provided by the Link Layer, Error-Detection and -Correction Techniques, Parity Checks, Check summing Methods, Cyclic Redundancy Check (CRC), Multiple Access Links and Protocols. Switched Local Area Networks, Link-Layer Addressing and ARP, Ethernet, Link-Layer Switches, Virtual Local Area Networks (VLANs),DHCP,UDP,IP and Ethernet.				
Module 4	Physical Layer with Data Communication	Assignment	Comprehension	O7 Sessions
Data communications: Components, Data Representation, Data Flow, Analog and Digital Signals, Periodic Analog Signals: Sine Wave, Phase, Wavelength, Time and Frequency Domains, Composite Signals, Bandwidth, Digital Signals, Transmission Impairment, Data Rate Limits: Noiseless Channel, Nyquist Bit Rate, Noisy Channel: Shannon Capacity, Performance: Bandwidth, Throughput, Latency (Delay), Bandwidth-Delay Product, Parallel/Serial Transmission, Multiplexing: Frequency-Division Multiplexing, Wavelength-Division Multiplexing, Synchronous Time-Division Multiplexing.				
Targeted Application & Tools that can be used: Instant Messaging Telnet File Transfer Protocol Video Conferencing				
Textbooks: T1. James F. Kurose, Keith W. Ross, “Computer Networking A Top down Approach”, 8th Edition, Pearson, 2021. T2. Behrouz A. Forouzan, “Data Communications and Networking”, 6th Edition, Tata McGraw-Hill, 2021.				
References: R1. William Stallings: “Data and Computer Communication”, 10th Edition, Pearson Education, 2017. R2. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2012. Web references: Digital Learning Resources (Library Resources) W1. https://puniversity.informaticsglobal.com/login https://nptel.ac.in/courses/105106053				
Topics relevant to “Skill Development”: Virtual Local Area Networks (VLANs), DHCP, UDP, IP and Ethernet for Skill Development through Participative Learning Techniques. This is attained through assessment component mentioned in course handout.				

Course Code: CSE2009	Course Title: Computer Organization and Architecture	L-T- P- C	3-0	0	3
Version No.	2.0				
Course Pre-requisites	CSE2015				
Anti-requisites	NIL				

<table>
<tr><td>Course Description</td><td colspan="4">This course introduces the core principles of computer architecture and organization from basic to intermediate level. This theory based course emphasizes on understanding the interaction between computer hardware and software. It equips the students with the intuition behind assembly-level instruction set architectures. It helps the students to interpret the operational concepts of computer technology as well as performance enhancement.</td></tr>
<tr><td>Course Objective</td><td colspan="4">The objective of the course is to familiarize the learners with the concepts of Computer Organization and Architecture and attain Skill Development through Participative Learning techniques.</td></tr>
<tr><td>Course Outcomes</td><td colspan="4">On successful completion of the course the students shall be able to:
1] Describe the basic components of a computer, their interconnections, and instruction set architecture [Comprehension]
2] Apply appropriate techniques to carry out selected arithmetic operations
3] Explain the organization of memory and processor sub-system</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Basic Structure of computers</td><td>Assignment</td><td>Data Analysis task</td><td>12 Classes</td></tr>
<tr><td colspan="5">Topics:
Computer Types, Functional Units, Basic Operational concepts, Bus Structures, Computer systems RISC & CISC, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. Arithmetic Operations on Signed numbers. Instructions and Instruction Sequencing, Instruction formats, Memory Instructions.</td></tr>
<tr><td>Module 2</td><td>Instruction Set Architecture and Memory Unit</td><td>Assignment</td><td>Analysis, Data Collection</td><td>12 Classes</td></tr>
<tr><td colspan="5">Topics:
Instruction Set Architecture: Addressing Modes, Stacks and Subroutines.
Memory System: Memory Location and Addresses, Memory Operations, Semiconductor RAM Memories, Internal Organization of Memory chips, Cache memory mapping Techniques.</td></tr>
<tr><td>Module 3</td><td>Arithmetic and Input/output Design</td><td>Case Study</td><td>Data analysis task</td><td>10 Classes</td></tr>
<tr><td colspan="5">Topics:
Arithmetic: Carry lookahead Adder, Signed-Operand Multiplication, Integer Division, and Floating point operations.
Input/output Design: Accessing I/O Devices, I/O communication, Interrupt Hardware, Direct Memory Access, Buses, Interface Circuits</td></tr>
<tr><td>Module 4</td><td>BPU and Pipelining</td><td>Assignment</td><td>Analysis, Data Collection</td><td>11 Classes</td></tr>
<tr><td colspan="5">Topics:
Basic Processing Unit: Fundamental Concepts, Single Bus organization, Control sequence, Execution of a Complete Instruction, Multiple Bus Organization.
Pipelining: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, Hazards.</td></tr>
</table>

Targeted Application & Tools that can be used: Targeted employment sector is processor manufacturing and memory chip fabrication vendors like Intel, AMD, Motorola, NVidia, Samsung, Micron Technology, western Digital etc. Targeted job profiles include Memory circuit design and verification engineers, Physical system design engineer, System programmer, Fabrication engineer etc. Tools: Virtual Lab, IIT KGP Tejas – Java Based Architectural Simulator, IIT Delhi
Text Book Carl Hamacher, Zvonko Vranesic, Safwat Zaky, "Computer Organization", Fifth Edition, McGraw-Hill Higher Education, 2016 reprint.
References William Stallings, "Computer Organization & Architecture – Designing for Performance", 11th Edition, Pearson Education Inc., 2019 David A. Patterson & John L. Hennessy, "Computer Organization and Design MIPS Edition- The Hardware/Software Interface", 6th Edition, Morgan Kaufmann, Elsevier Publications, November 2020. Web References: NPTEL Course on "Computer architecture and organization" IIT Kharagpur By Prof. Indranil Sengupta, Prof. Kamalika Datta. https://nptel.ac.in/courses/106105163 NPTEL Course on "Computer Organization", IIT Madras By Prof. S. Raman. https://nptel.ac.in/courses/106106092 https://puniversity.informaticsglobal.com:2229/login.aspx
Topics relevant to "SKILL DEVELOPMENT": Generation of Computers, CISC and RISC processors, Bus Arbitration, Collaboration and Data collection for Term assignments and Case Studies for Skill Development through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

SEMESTER IV

Course Code: CSE2074	Course Title: Database Management Systems Type of Course: 1) School Core	L-T- P-C	2-0	2	3
Version No.	1.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	This course introduces the core principles and techniques required in the design and implementation of database systems. It covers concepts of relational database systems (RDBMS). More emphasis is set on how to design, develop, organize, maintain and retrieve the information efficiently. It helps the students to learn and practice data modeling and database designs. The associated laboratory is designed to implement database design using MySQL (My Structured Query Language-Open Source) in information technology applications. All the exercises will focus on the fundamentals for				

	creating, populating, sophisticated, interactive way of querying, and simultaneous execution of the transactions of database.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of Database Management Systems and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques.			
Course Outcomes:	On successful completion of the course the students shall be able to: 1] Understand core concepts of database (Knowledge) 2] Apply normalization techniques to refine database schema (Application) 3] Develop database with concurrent transactions execution feature (Application)			
Course Content				
Module 1	Introduction to Database and its Conceptual Model (Knowledge)	Assignment	Problem Solving	6 Classes
Topics: Introduction to Database: Schema, Instance, 3-shema architecture, physical and logical data independence, Data isolation problem in traditional file system, advantages of database over traditional file systems. Conceptual Data Modelling: Entity Relationship (ER) Model, ER Model to Relational Model, Examples on ER model.				
Module 2	Query Languages (Application)	Assignment	Problem Solving	7 Classes
Topics: Relational Algebra with selection, projection, rename, set operations, cartesian product, joins (inner and outer joins), and division operator. Examples on Relational Algebra Operations. MySQL Database Querying, DDL, DML, Constraints, Operators, Set Operators, Aggregate Functions, Joins, Views, Procedures, Functions and Triggers.				
Module 3	Designing and Refining Database Schema (Application)	Assignment	Programming Task	7 Classes
Topics: Schema Design: Problems in schema design, redundancy and anomalies. Schema refinement: Normal Forms based on Primary Keys-(1NF,2NF, 3NF), Boyce-Codd Normal Form, Multi valued Dependency (Fourth Normal Form), Join Dependencies (Fifth Normal Form), lossy and lossless decompositions.				
Module 4	Transaction Management and Concurrency Control (Application)	Assignment	Problem Solving	6 Classes

Topics:
Transaction: Desirable properties (ACID) of Transactions, Simultaneous Transactions and their problems like dirty read, lost update and incorrect summary, Serializability, Conflict Serializability, View Serializability;
Concurrency Control: Locking and Time-stamping concurrency schemes.

List of Laboratory Tasks:
Create Employee, Student, Banking and Library databases and populate them with required data. Do the following experiments of different lab sheets on those databases.

Labsheet-1 [3 Practical Sessions]
Experiment No 1: [1 Session]
To study and implement Data Definition Language (DDL) commands and Data Manipulation Language (DML) commands of MySQL.
Level 1: Perform operations using Data Definition Language and Data Manipulation Language commands including different variants of SELECT on Student DB.
Level 2: Identify the given requirements; valid attributes and data types and Perform DDL and DML operations on a given scenario. [Banking Databases]
Experiment No. 2: [2 Sessions]
To implement different types of MySQL constraints and relational, logical, pattern matching, BETWEEN, IS NULL, IN and NOT IN Special Operators.
Level 1: Create tables on Banking database using PRIMARY KEY, NOT NULL, UNIQUE, FOREIGN KEY and demonstrate the working of relational, logical, pattern matching, BETWEEN, IS NULL, IN and NOT IN Special Operators on Student Database.
Level 2: Enforce different types of data and referential integrity constraints. Then try queries with special operators based on the student database. [Banking Database].

Labsheet-2 [3 Practical Sessions]
Experiment No. 3: [1 Session]
To try for aggregation of data in to groups and sub-groups using Group by, HAVING clauses and sort data using Order By Clauses.
Level 1: Implement the conjugate of GROUP BY, ORDER BY and aggregate functions on Banking Database.
Level 2: Implement MySQL queries on library database using appropriate clauses and aggregate functions. Also order the data either in ascending and descending order using corresponding clause. [Library databases].

Experiment No. 4: [2 Session]
To study and implement different types of Set and Join Operations [3 Slots]
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 Banking Database.
Level 2: Use Set and Join operations to retrieve the data from two or more relations(tables) as per the given scenario. [Library databases]

Labsheet-3 [3 Practical Sessions]
Experiment No. 5: [3 sessions]
To study and implement Views, and Procedures in MySQL.
Level 1: Implement MySQL Views, and Procedures in MySQL on Employee database.

Level 2: Analyze the requirement and construct views, and Procedures on Mini Project Domain. [Banking Database] Labsheet-4 [3 Practical Sessions] Experiment No. 6: [3 Sessions] To study and implement Functions, and Triggers in MySQL. Level 1: Implement MySQL Functions and Triggers in MySQL on Employee database. Level 2: Analyze the requirement and construct Functions and Triggers on Mini Project Domain. [Banking Database]
Targeted Application & Tools that can be used: Application Area: Relational database systems for Business, Scientific and Engineering Applications. Tools/Simulator used: MySQL
Text Book 1] Elmasri R and Navathe S B, "Fundamentals of Database System", Pearson Publication, 7th Edition, 2017.
References 1] Hector Garcia Molina, Jeffery D Ullman, Jennifferwidom , "Database systems: The Complete Book", Pearson Publication, 2nd edition. 2] Avi Silberschatz, Henry F. Korth , S. Sudarshan, "Database System Concepts", McGraw-Hill ,7th Edition, 2019.
Topics relevant to development of "Skill Development": Relational database design using ER- Relational mapping, Implementation of given database scenario using MySQL for Skill development through Experiential Learning Techniques. This is attained through assessment component in the course handout.

Course Code: CSE2010	Course Title: Operating Systems Type of Course: Program Core and Theory Only	L-T- P- C	3	0	0	3
Version No.	1.0					
Course Pre-requisites	CSE2009					
Anti-requisites	NIL					
Course Description	This course introduces the concepts of operating system operations, operating system structure and its design and implementation. It covers the classical operating systems internal algorithms such as process scheduling, synchronization, deadlocks detection and recovery and memory management. The course also enhances the problem solving, systems programming ability and case studies.					
Course Object	The objective of the course is to familiarize the learners with the concepts of Operating Systems and attain Employability through Problem Solving Methodologies.					

<table>
<tr><td>Course Out Comes</td><td colspan="4">On successful completion of the course the students shall be able to:
1] Describe the fundamental concepts of operating Systems and case studies. [Knowledge]
2] Demonstrate various CPU scheduling algorithms. .[Application]
3] Apply various tools to handle synchronization problems. [Application]
4] Demonstrate deadlock detection and recovery methods [Application]
5] Illustrate various memory management techniques.[Application]</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Introduction to Operating System</td><td>Assignment</td><td>Programming</td><td>9 Hours</td></tr>
<tr><td colspan="5">Topics:
Introduction to OS , Operating-System Operations, Operating System Services, , System Calls and its types, Operating System Structure, System Program and its types, Linkers and Loaders, Overview of OS design and implementation, Open-source operating system</td></tr>
<tr><td>Module 2</td><td>Process Management</td><td>Assignment/Case Study</td><td>Programming/Simulation</td><td>11 Hours</td></tr>
<tr><td colspan="5">Topics:
Process Concept, Operations on Processes, Inter Process Communication, Communication in client-server systems (sockets, RPC, Pipes), Introduction to threads - Multithreading Models, Thread Libraries, Threading Issues, Process Scheduling– Basic concepts, Scheduling Criteria, Scheduling Algorithms: FCFS, SJF, SRTF, RR and Priority.</td></tr>
<tr><td>Module 3</td><td>Process Synchronization and Deadlocks</td><td>Assignment</td><td>Programming</td><td>11 Hours</td></tr>
<tr><td colspan="5">Topics:
The Critical-Section Problem- Peterson’s Solution, Synchronization hardware, Semaphores, Classic Problems of Synchronization with Semaphore Solution- Producer-Consumer Problem, Reader-Writer problems, Dining Philosopher’s Problem, . Introduction to Deadlocks, Necessary conditions for deadlock, Resource allocation Graph, Methods for handling deadlock: Deadlock Prevention and Implementation, Deadlock Avoidance and Implementation, Deadlock detection & Recovery from Deadlock.</td></tr>
<tr><td>Module 4</td><td>Memory Management</td><td>Assignment</td><td>Programming/Simulation</td><td>10 Hours</td></tr>
<tr><td colspan="5">Topics:
Introduction to Memory Management, Basic hardware-Base and Limit Registers, Memory Management Unit(MMU), Dynamic loading and linking, Swapping, Contiguous and Non-Contiguous Memory Allocation, Segmentation, Paging - Structure of the Page Table – Virtual Memory and Demand Paging – Page Faults and Page Replacement Algorithms, Copy-on-write, Allocation of Frames, Thrashing
Introduction to File system management: File System Interface (access methods, directory structures), File system implementation.</td></tr>
<tr><td colspan="5">Targeted Application:
Application area is traffic management system, banking system, health care and many more systems where in there are resources and entities that use and manage the resources.
Software Tools:
Oracle Virtual Box/VMWare Virtualization software [Virtual Machine Managers]. Used to install and work on multiple guest Operating Systems on top of a host OS. Intel Processor</td></tr>
</table>

identification utility: This software is used to explain about multi-core processors. It helps to identify the specifications of your Intel processor, like no of cores, Chipset information, technologies supported by the processor etc.
Project work/Assignment
Demonstrate process concepts in LINUX OS. Simulation of CPU scheduling algorithms. Develop program to demonstrate use of Semaphores in threads. Develop program to demonstrate use of deadlock avoidance algorithms. Develop program to demonstrate use of page replacement algorithms. Simulation of memory allocation strategies [first fit, best fit and worst fit].
Text Book Silberschatz A, Galvin P B and Gagne G , “Silberschatz's Operating System Concepts”, Paperback, Global Edition Wiley, 2019
References Silberschatz A, Galvin P B and Gagne G, “Operating System Concepts”, 10th edition Wiley, 2018. William Stallings, “Operating Systems”,Ninth Edition, By Pearson Paperback ,1 March 2018. Sundaram RMD, Shriram K V, Abhishek S N, B Chella Prabha, “ Cracking the Operating System skills”, Dreamtech, paperback, 2020 Remzi H. Arpaci-Dusseau Andrea C. Arpaci-dusseau , “Operating Systems: Three Easy Pieces, Amazon digital Services”, September 2018. E-resources/Weblinks https://www.os-book.com/OS9/ https://pages.cs.wisc.edu/~remzi/OSTEP/ https://codex.cs.yale.edu/avi/os-book/OS10/index.html

Course Code: CSE 3078	Cryptography and Network Security	L-T- P- C	3-0	0	3
Version No.	2.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	The Course deals with 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 above and attain Skill Development through Problem Solving methodologies.				
Course Outcomes	On successful completion of this course the students shall be able to: Describe the basic concept of Cryptography Classify different types of Cryptographic Algorithms Solve Mathematical problems required for Cryptography				

	Illustrate Network Security concepts			
Course Content:				
Module 1	Introduction to Cryptography	Assignment	Recognize the techniques	07 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 : Play-fair and Hill Cipher, Vigenere cipher, Introduction to Block Cipher and Stream Cipher, Feistel Structure, ECB modes of block cipher				
Module 2	Symmetric Encryption Algorithms	Assignment	Analysis of results	09 Sessions
Topics: Symmetric Encryption Algorithms : Data Encryption Standard, Introduction to Galois Field, Advanced Encryption Standard, Modular Arithmetic, Prime numbers, Fermat's little theorem, Applications of Fermat's little theorem in modular athematic, brief about primality testing and factorization, Euclidean and Extended Euclidean Algorithm, Euler Totient Function, Chinese remainder theorem.				
Module 3	Public Key Cryptography	Assignment	Analysis of solutions	09 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, Ei-gamal Encryption, Elliptic curve cryptography overview.				
Module 4	Network Security	Assignment	Analysis of solutions	05 Sessions
Topics: Network Security fundamentals, Network Security applications: Authentication: Kerberos, PKI, Network Security applications: e-mail security: PGP, MIME, Network Security applications: IP Security: IPSec architecture, Network Security applications: DNS Security.				
Targeted Application & Tools that can be used: Students get the knowledge about cryptography techniques followed, the algorithms used for encryption and decryptions & the techniques for authentication and confidentiality of messages.				
Textbooks: T1 William Stallings, "Cryptography and Network Security - Principles and Practices", 7th Edition, Pearson publication, ISBN: 978-93-325-8522-5, 2017				
References: R1 Bruice Schneier, "Applied Cryptography – Protocols, Algorithms and Source code in C", Second Edition, Wiley Publication, ISBN: 978-81-265-1368-0, 2017 R2 Cryptography and Network Security, Express Learning, ITL Education Solution Limited. R3 e-pg pathshala UGC lecture series				

Web references: https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=2233842&site=ehost-live https://nptel.ac.in/courses/106105031.
Topics relevant to “Skill Development”: Topics relevant to “Skill Development”: Play-fair and Hill Cipher Euclidean and Extended Euclidean Algorithm Secure Hash Algorithm Diffie-Helman Key exchange Totient Function. Fermat’s little theorem

SEMESTER V

Course Code: CSE3001	Course Title: Artificial Intelligence and Machine Learning Type of Course: Integrated	L-T-P- C	2-0	2	3
Version No.	2.0				
Course Pre-requisites	CSE1003				
Anti-requisites	NIL				
Course Description	This course introduces the basic concepts of artificial intelligence. It introduces students to the basic concepts and techniques of Machine Learning (ML), a subset of Artificial Intelligence (AI), is an important set of techniques and algorithms used for solving several business and social problems. The objective of this course is to discuss machine learning model development using Python. Topics include: Working with Collections and Data Frames; Regression algorithms; Classification algorithms; Optimization techniques – Gradient Descent algorithm, Gradient Descent for simple Linear Regression; Ensemble Learning – Random Forest, Boosting techniques – AdaBoost and Gradient Boosting; Grid Search for optimal parameters; Clustering algorithms; Forecasting with Time-Series data : Auto-Regressive Integrated Moving Average Models, Recommender Systems : Association Rule Mining, Collaborative Filtering, Text Analytics – Sentiment Classification using Naïve Bayesian model.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Artificial Intelligence and Machine Learning 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:
CO1: To develop a basic understanding of the building blocks of AI as presented in terms of intelligent
agents. [Comprehension]
CO2: Produce machine learning models for predictive
analytics. [Application]
CO3: Apply ensemble learning, optimization and hyper parameter tuning techniques for machine learning algorithms. [Application]
CO4: Demonstrate different types of clustering techniques. [Application]
CO5: Employ time series forecasting techniques/models for real world problems. [Application]</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Introduction to Artificial Intelligence and Knowledge based systems</td><td>Assignment</td><td>Theory</td><td>6 Sessions</td></tr>
<tr><td colspan="5">Topics:
Introduction to Artificial Intelligence, Definitions, foundation, History and Applications; Agents: Types of Agent, Structure of Intelligent agent and its functions, Agents and Environment; Introduction to Knowledge representation, approaches and issues in knowledge representation, Introduction to searching algorithm in AI,Conceptual graphs, Methods for Logic representation(POL, FOL).</td></tr>
<tr><td>Module 2</td><td>Supervised Machine Learning Algorithms</td><td>Assignment</td><td>Programming activity</td><td>16 Sessions</td></tr>
<tr><td colspan="5">Topics:
Introduction to the Machine Learning (ML) Framework, types of ML, types of variables/features used in ML algorithms, Feature engineering-Normalization, One-hot encoding, Simple Linear Regression, Multiple Linear Regression,Validation and Accuracy measures for Regression models. Classification models – Decision Tree algorithms using Entropy and Gini Index as measures of node impurity, model evaluation metrics for classification algorithms,Logistic regression, Naïve Bayes Classifiers and Naive Bayes model for sentiment classification – an introduction..</td></tr>
<tr><td>Module 3</td><td>Advanced Machine Learning Concepts</td><td>Assignment</td><td>Programming activity</td><td>14 Sessions</td></tr>
<tr><td colspan="5">Topics:
Nearest Neighbor techniques, Cost functions and Optimization Technique – introduction to Gradient Descent, its applications on Linear Regression. C.Ensemble Learning algorithms – Bagging (Random Forest), Boosting(AdaBoost), XGBoost.</td></tr>
<tr><td>Module 4</td><td>Clustering and Forecasting with Time-Series Data</td><td>Assignment</td><td>Programming activity</td><td>10 Sessions</td></tr>
<tr><td colspan="5">Topics:
Partitioned Clustering – K-means and Hierarchical Clustering techniques, cluster validity measures, Components of Time Series data, Basic Concepts of Forecasting , An introduction to Forecasting from Time Series Models, calculating forecast accuracy, Association Rule</td></tr>
</table>

Mining, Collaborative Filtering – User based and item based similarity, closed and maximal frequent item sets.
List of Laboratory Tasks: Lab sheet -1 Level 1: A review of Python programming - Introduction to Python Stack for Data Science, Core Python Libraries for data analysis, Anaconda platform and its installation, Executing programs on Jupyter IDE/ Colab. Level2: Programming exercises to revise variables, control statements and collections – lists, list comprehension Lab sheet -2 Level 1 - Programming exercises on Tuples Level 2- Nested data structures Lab sheet -3 Level 1: Introduction to Numpy, Pandas, Level 2: Scikit-learn and Visualization techniques. Lab sheet -4 Level 1 - Dictionaries, dictionary comprehension. Level 2 - Introduction to Data Frames using Pandas and working with frames Lab sheet -5 Level 1- Regression Models Simple linear regression, outlier detection. Level 2 - multiple linear regressions – model evaluation, multi-co linearity and handling multi-co linearity, outlier detection. Lab sheet -6 Level 1- Decision Tree Classifiers - Decision Tree classifier using Gini Index- measuring test accuracy, displaying the tree, confusion matrix and ROC. Level 2- Decision Tree Classifier using Entropy. Lab sheet -7 Level 1 - Optimization Techniques Developing a Gradient Descent Algorithm for linear regression – using NumPy and using sklearn. Level 2 - cohen_kappa_score. Lab sheet -8 Level 1- Hyper parameter Tuning methods Hyper parameter tuning using Grid Search for Nearest Neighbor Classifiers and Level 2- Hyper parameter tuning using Grid Search for Decision Tree Classifiers. Lab sheet -9 Level 1 - Hyper parameter Tuning for Ensemble models Ensemble Learning – Random Forest – Building the model, Grid Search for optimal parameters, Level 2 - Feature Importance. Ada Boost Classifiers and Gradient Boosting Classifiers Lab sheet -10 Level 2 - Clustering – Kmeans – cluster centers and interpreting the clusters, finding the optimal number of clusters using Elbow Curve method. Level 2 - Agglomerative Hierarchical Clustering – Compare the clusters formed by kmeans and Agglomerative Clustering Lab sheet -1 1 Level 1 – Probability theory(Conditional Probability) Level 2 - Naïve Bayes Model Lab sheet -12 Level 1- Models forecasting Applications Level 2 - Models for Forecasting Time Series data

Lab sheet -13 Level 1- Recommender Systems - Association Rule Mining using Apriori for frequent Itemset Generation. Level 2 - Recommender Systems – user based similarity
Targeted Application & Tools that can be used Use of PowerPoint software for lecture slides and use of Google's Colab cloud service https://www.tutorialspoint.com/google_colab/index.html for executing and sharing of lab exercises.
Project work/Assignment:
Assignment: Programming: Implementation of given scenario using Python and Colab. Assignment: Learning courses for 4 Hours from the following link https://learn.datacamp.com/courses?topics=Machine%20Learning
Text Book T1. Andreas C Muller, Sarah Guido, "Introduction to Machine Learning with Python :A Guide for Data Scientists", Oreilly, First Edition, 2016 T2. Stuart J. Russell and Peter Norvig, Artificial intelligence: A Modern Approach, 3rd edition, Upper Saddle River, Prentice Hall.
References R1. Tan P. N., Steinbach M & Kumar V. "Introduction to Data Mining", Pearson Education, 2016. R2. Giuseppe Bonaccorso, "Machine Learning Algorithms: A reference guide to popular algorithms from data science and machine learning", Packt Publishing, 2017. R3. Manaranjan Pradhan, U Dinesh Kumar, "Machine Learning Using Python", Wiley, First Edition 2019. E-References https://presiuniv.knimbus.com/user#/home
Topics relevant to development of "Skill Development": Regression Models Decision Tree Classifiers Hyper parameter Tuning methods Agglomerative Hierarchical clustering Decision tree classifiers for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE2037	Course Title: Cyber Forensics Type of Course: Program Core	L-T- P-C	2 -0	2	3
Version No.	1.0				
Course Pre-requisites	CSE3078				
Anti-requisites	NIL				

Course Description	The purpose of this course is to introduce to the students Cyber Forensic concepts. The course is both conceptual and analytical and is understood with various open-source software's. The course develops critical thinking like correctly collect and analyze computer forensic evidence, analyze and validate Forensics Data, study the tools and tactics associated with Cyber Forensics. The course involves quizzes, assignments with various open-source software.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of Cyber Forensics and attain Skill Development through Experiential Learning techniques.			
Course Outcomes	On successful completion of this course the students shall be able to: (1) understand various digital investigation terminologies and methods (knowledge) (2) understand various file formats (knowledge) (3) Recognize the importance of digital forensic duplication and various tools for analysis to achieve adequate perspectives of digital forensic investigation in various applications (Comprehension) (4) Apply techniques for forensic investigation (Application)			
Course Content:				
Module 1	DIGITAL INVESTIGATION	Quiz	MCQ/Based on Investigation process	No. of Sessions: 09
Digital Evidence and Computer Crime - History and Terminology of Computer Crime Investigation - Technology and Law - The Investigative Process -Investigative Reconstruction - Modus Operandi, Motive and Technology -Digital Evidence in the Courtroom.				
Module 2	UNDERSTANDING INFORMATION	Quiz	MCQ/Based on file format	No. of Sessions: 09
Methods of storing data: number systems, character codes, record structures, file formats and file signatures - Word processing and graphic file formats - Structure and Analysis of Optical Media Disk Formats - Recognition of file formats and internal buffers - Extraction of forensic artifacts– understanding the dimensions of other latest storage devices – SSD Devices.				
Module 3	COMPUTER BASICS FOR DIGITAL INVESTIGATORS	Assignment	Writing task	No. of Sessions: 09

Computer Forensic Fundamentals - Applying Forensic Science to computers - Computer Forensic Services - Benefits of Professional Forensic Methodology -Steps taken by computer forensic specialists.
Information warfare: Arsenal – Surveillance Tools – Hackers and Theft of Components – Contemporary Computer Crime-Identity Theft and Identity Fraud – Organized Crime &Terrorism.
Computer forensic cases: Developing Forensic Capabilities – Searching and Seizing Computer Related Evidence –Processing Evidence and Report Preparation – Future Issues.
Assignment: Computer Crime

Module 4	Computer Forensic Evidence and Data Recovery	Assignment	Writing task	No. of Sessions: 09

Data Recovery Defined, Data Backup and Recovery, The Role of Backup in Data Recovery, The Data-Recovery Solution, Hiding and Recovering Hidden Data.
Data Collection and Data seizure: why collect evidence? - Collection Options, Obstacles, Types of Evidence, The Rules of Evidence, Volatile Evidence, General Procedure, Collection and Archiving, Methods of Collection, Artifacts, Collection Steps, Controlling Contamination: The Chain of Custody. Reconstructing the Attack.
Assignment: Data Recovery

List of Laboratory Tasks:
Case Studies of Opensource Forensic Tools
FTK Forensic Tool kit for taking mirror image
Disk Forensics-
Identify digital evidences
Acquire the evidence
Authenticate the evidence
Preserve the evidence
Analyze the evidence
Report the findings
Network Forensics:
Intrusion detection
Logging
Correlating intrusion detection and logging
Device Forensics
Mobile phone
Digital Music
Printer Forensics
Scanner Forensics
Credit Card Forensics
Telecommunications Forensics
Forensic Analysis of a Virtual Machine
Forensic analysis of Cloud storage and data remnants
RAM Dumping Tool

Targeted Application & Tools that can be used:

FTK Forensic Toolkit Encase Kali Linux- Vinetto, galatta Autopsy – Disk Forensics
Project work/Assignment: Each batch of students (self-selected batch mates) will identify projects based on the content and implement with the most suitable 2 or 3 antecedents.
Textbook(s): John R. Vacca, “Computer Forensics: Computer Crime Scene Investigation”, Cengage Learning, 2nd Edition, 2019
References 1. Ravi Kumar & B Jain,2006,” Cyber Forensics - Concepts and Approaches”, icfai university press 2. ChristofPaar, Jan Pelzl,” Understanding Cryptography: A Textbook for Students and Practitioners”, Springer’s, Second Edition, 2010, 3. Ali Jahangiri,” Live Hacking: The Ultimate Guide to Hacking Techniques & Countermeasures for Ethical Hackers & IT Security Experts”, First edition, 2009 4. Computer Forensics: Investigating Network Intrusions and Cyber Crime”, Ec-Council Press, 2010. 5. C. Altheide& H. Carvey,” Digital Forensics with OpenSource Tools, Syngress”, 2011, ISBN: 781597495868.,https://esu.desire2learn.com
NPTEL: https://onlinecourses.swayam2.ac.in/cec21_ge10/preview Udemy: https://www.udemy.com/topic/digital-forensics/ E-book Link(PU): Links http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=14073&query_desc=ti%2Cwrdl%3A%20CYBER%20FORENSIC
Topics relevant to "Skill Developemnt”: Cyber Forensics techniques for Skill development through Experiential Learning techniques. This is attained through the assessment component mentioned in the course handout.

Course Code: **CSE3343**	**Course Title:** **Cloud Computing** **Type of Course:** **Theory and Lab Integrated**	**L-T- P-C**	2-0-2-3
Version No.	**2.0**		
Course Pre-requisites	**CSE2011**		
Anti-requisites	**NIL**		
Course Description	**This course provides a hands-on comprehensive study of Cloud concepts and capabilities across the various Cloud service models including Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). It dives into all of the details that a student needs to know in order to plan for developing applications on the cloud and what to look for when using applications or services hosted on a cloud.**		

Course Objective	**The course aims to impart knowledge to students that can provide easy, scalable access to computing resources and IT services. This course is designed to improve the learner's EMPLOYABILITY SKILLS using EXPERIENTIAL LEARNING techniques.**			
Course Outcomes	**Upon successful completion of the course, the students shall be able to:** 1) **Describe the significance of Cloud computing technologies [Understand]** **2) Select appropriate Virtualization techniques to virtualize infrastructures [Understand]** **3) Use Cloud mechanisms to optimize the QoS parameters [Understand]** **4) Utilize cloud platforms to develop applications [Apply]**			
Course Content:				
Module 1	**Introduction to Cloud Services**	Assignment	Theory	**No. of SESSIONS:17 (Theory: 9, Lab:8)**
Topics: A Facility for Flexible Computing, from Clusters to Web Sites and Load Balancing, Cloud Stakeholders as per NIST, Historical Developments, Cloud Computing Architecture, IaaS, PaaS, SaaS, Types of Clouds, Building Cloud Computing Environments, Computing Platforms and Technologies.				
Module 2	**Virtualization Techniques**	Lab-based Assignments	Theory	**No. of SESSIONS:15 (Theory: 7, Lab:8)**
Topics: Basics of Virtualization - Types of Virtualizations, Taxonomy of Virtualization Techniques, Implementation Levels of Virtualization.				
Module 3	**QoS and Management**	Application Development	Theory	**No. of SESSIONS:13 (Theory: 5, Lab:8)**
Topics: Cloud Infrastructure Mechanisms, Specialized Cloud Mechanisms, Cloud Management Mechanisms, Cloud Infrastructure Mechanisms, Service Level Agreements (SLAs), Specialized Cloud Mechanisms				
Module 4	**Security and advancements**	Case Study	Case Study	**No. of SESSIONS:15 (Theory: 9, Lab:6)**
Topics: Cloud Management Mechanisms, The Zero Trust Security Model, Identity Management, Privileged Access Management, AI Technologies And Their Effect on Security, Protecting Remote Access, Privacy in a Cloud Environment, Application development in Cloud, Recent trends in Cloud Computing, Fog Computing, Dew Computing, Case Studies, and Recent Advancements				
Targeted Applications & Tools that can be used: **Targeted Applications:** Developing applications on Cloud Platforms via Virtual machines **Cloud Tools:** • VMWare				

- Amazon EC2
- Google Compute Engine
- Microsoft Azure
- Cloudsim

Project work/Assignment:

1. **Automation of performance analysis of students through the Cloud**
2. **Chatbots development using Cloud resources**
3. **Blog creation using Cloud computing**

Analysis of Case Studies: When deciding to adopt cloud computing architecture, decide if the cloud is right for your requirements (for the application identified).

Suggested List of Hands-on Activities:

Sl. No	Title
1	**Cloud Services** Create a simple cloud software application and provide it as a service using any Cloud Servic Provider to demonstrate Software as a Service (SaaS).
2	**Virtualization** Create a Virtual Machine with 1 vCPU, 2GB RAM and 15GB storage disk using a Type Virtualization Software
3	**Virtualization Techniques** Create a Virtual Hard Disk and allocate the storage using VM ware Workstation
4	**Implementation Levels of Virtualization** Create a Snapshot and Cloning of a VM and Test it by loading the Previous Version/Cloned VM
5	**Cloud Infrastructure Mechanisms** Using Cloud Simulator to create a Datacenter with one host and run one cloudlet on Datacente
6	**Cloud Infrastructure Mechanisms** Create a Simple Web Application using Java or Python and host it in any Public Cloud Servic Provider to demonstrate Platform as a Service (PaaS)
7	**Specialized Cloud Mechanisms** Analyze different service broker policies that can be used in Cloud environment through CloudAnalyst Tool
8	**Specialized Cloud Mechanisms** Using Saturn Cloud (Online), execute python programs by selecting appropriate GPU processors.
9	**Application development in the Cloud** Perform the basic configuration setup for Installing Hadoop 2.x like Creating the HDUSER an SSH localhost
10	**Application development in the Cloud** Install Hadoop 2.x and configure the Name Node and Data Node.
11	**Application development in the Cloud** Configure the Name Node and Data Node.

12	**Application development in the Cloud** Launch the Hadoop 2.x and perform MapReduce Program for a Word Count problem
13	**Simulation of the Cloud Service** To simulate a cloud service with virtual machine creation and task allocation without using a real cloud provider like AWS
14	**Simulation of the Cloud Service** Write a simple Java program to simulate the creation of virtual machines for CPU-intensive tasks, storage-intensive tasks, and RAM-intensive tasks separately
15	**Simulation of the Cloud Service** Write a Java program to handle multiple user requests to a cloud service provider. Case 1: Request a CPU resource from the cloud. Case 2: Request a RAM resource from the cloud. Case 3: Request a storage resource from the cloud

Text Book(s)

1. **Douglas E. Comer, "The Cloud Computing Book: The Future of Computing Explained", Chapman and Hall/CRC; 1st edition, July 2021.**
2. **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. **Manvi, Sunilkumar, and Gopal K. Shyam. "Cloud Computing: Concepts and Technologies". CRC Press, 2021.**

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. CloudSim Resources-

https://javadoc.io/doc/org.cloudsimplus/cloudsim-plus/latest/org/cloudbus/cloudsim/resources/class-use/Resource.html

4. Journal of Network and Computer Networking- **https://www.journals.elsevier.com/journal-of-network-and-computer-applications**
5. Cloud Stakeholders as per NIST - **https://www.geeksforgeeks.org/cloud-stakeholders-as-per-nist/**

Course Code: CSE2067	Course Title: Web Technology Type of Course: Program core		L-T- P-C	3 -0	0	3
Version No.	2.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	This course highlights the basic web design using Hypertext Markup Language and Cascading Style Sheets. Students will be trained in planning and designing effective web pages by writing code using current leading trends in the web domain, enhancing web pages with the use of page layout techniques, text formatting, graphics, images, and multimedia. The focus is on popular key technologies that will help students to build Internet- and web-based applications that interact with other applications and with databases.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Web Technology and attain Skill Development through Experiential Learning techniques.				
Course Outcomes	On successful completion of this course the students shall be able to: CO1: Implement web-based application using client-side scripting languages. (Application level) CO2: Apply various constructs to enhance the appearance of a website. (Application level) CO3: Illustrate java-script concepts to demonstration dynamic web site(Application level) CO4: Apply server-side scripting languages to develop a web page linked to a database. (Application level)				
Course Content:					
Module 1	Introduction to XHTML	Quizzes and Assignments	Quizzes on various features of XHTML, simple applications	10 Sessions	

Topics: Basics: Web, WWW, Web browsers, Web servers, Internet. XHTML: Origins and Evolution of HTML and XHTML: Basic Syntax, Standard XHTML Document Structure, Basic Text Markup, Images, Hypertext Links, Lists, Tables, Forms, Frames, Syntactic Differences between HTML and XHTML.				
Module 2	Advanced CSS	Quizzes and assignments	Comprehension based Quizzes and assignments; Application of CSS in designing webpages	8 Sessions
Topics: CSS: Introduction to CSS, Defining & Applying a style, Creating style sheets, types of style sheet, selectors, CSS font properties, border properties, Box model, opacity, CSS pseudo class and pseudo-elements. Advanced CSS: Layout, Normal Flow, Positioning Elements, Floating Elements, Responsive Design, CSS Frameworks XML: Basics, demonstration of applications using XML				
Module 3	Fundamentals of JavaScript	Quizzes and assignments	Application of JavaScript for dynamic web page designing	10 Sessions
Topics: JavaScript: Introduction to JavaScript, Basic JavaScript Instructions, Functions, Methods & Objects, Decisions and Loops, Document Object Model, Event handling, handling window pop-ups, JavaScript validation.				
Module 4	PHP – Application Level	Quizzes and assignments	Application of PHP in web designing	14 Sessions
Topics: PHP: Introduction to server-side Development with PHP, Arrays, $GET and $ POST, $_Files Array, Reading/Writing Files, PHP Classes and Objects, Working with Databases, SQL, Database APIs, Managing a MySQL Database. Accessing MySQL in PHP.				
Targeted Application & Tools that can be used: Xampp web server to be used to demonstrate PHP.				
Project work/Assignment:				
Assignments are given after completion of each module which the student need to submit within the stipulated deadline.				
Textbook(s): 1] Robert. W. Sebesta, "Programming the World Wide Web", Pearson Education, 8th Edition, 2015. 2] CSS Notes for Professionals, ebook available at https://books.goalkicker.com/CSSBook/ (Retrieved on Jan. 20, 2022) 3] Deitel, Deitel, Goldberg,"Internet & World Wide Web How to Program", Fifth Edition, Pearson Education, 2021.				
References 1] Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", Pearson Education India, 1st. Edition.2016.				

2] Jeffrey C. Jackson, "Web Technologies: A Computer Science Perspective", Pearson Education, 1st Edition,2016.
Topics related to development of “FOUNDATION”: Web, WWW, Web browsers, Web servers, Internet. CSS, PHP. Designing for healthcare. for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout. E-References pu.informatics.global, https://sm-nitk.vlabs.ac.in/

SEMESTER VI

Course Code: CSE2040	Course Title: Cyber threats for IOT and Cloud Type of Course:1] Program Core	L-T- P- C	3 -0	0	3
Version No.	1.0				
Course Pre-requisites	CCS2503				
Anti-requisites	NIL				
Course Description	Objective of the course is to understand the most important cyber threats for IOT and Cloud. Cyber attackers discover new possibilities in the areas of Internet of Things and cloud services. It mainly focuses on multiple security challenges facing the IoT and cloud computing especially concerns surrounding privacy and cyber security threats of the users and the how can the cyber risks relating to them be mitigated.				
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Cyber threats for IOT and Cloud and attain Skill Development through Participative Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to: Understand the different types of cyber threats for IOT and cloud Develop a deeper understanding and familiarity with various types of cyber-attacks, cybercrimes, vulnerabilities and remedies thereto. Plan, implement, and monitor cyber security mechanisms to ensure the protection of information technology assets.				
Course Content:					
Module 1	Introduction to IOT and Cloud computing	Assignment	Programming Task	12 Sessions	
Topics What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, IoT Challenges, IOT Architecture and protocols, Various platforms for IoT, Real-Time examples of IoT, Overview of IoT components and IoT communication Technologies. Introduction to Cloud Computing, The Vision of Cloud Computing, Defining a Cloud, Cloud Computing Reference Model, Characteristics and					

Benefits, Challenges Ahead, Distributed Systems, Virtualization, Service-Oriented Computing, Utility-Oriented Computing, Building Cloud Computing Environments, Application Development, Infrastructure and System Development, Computing Platforms and Technologies.
Assignment:

Module 2	Cyber Threats	Assignment	Programming Task	8 Sessions

Topics:
What are Cyber Security Threats? Common Sources of Cyber Threats, Types of Cyber security Threats-Malware attacks, Social Engineering attacks, Supply chain attacks, Man-in-the middle Attack, Threat Detection Tools, Cyber Defense for Individuals.
Assignment:

Module 3	Cyber Threats in Internet of Things	Assignment	Programming/Data analysis task	10 Sessions

Topics:
IoT threats and vulnerabilities- IoT attack surface, Attack surface areas of the IoT, Types of IoT security threats-Botnets, Denial of service, Man-in-the-Middle, Identity and data theft, Social engineering, Advanced persistent threats, Ransomware, Remote recording, How does the IoT influence security?, Best practices to reduce risks and prevent threats. Security guidelines for IoT. Managing IoT Security Threats.
Assignment:

Module 4	Cyber Threats in Cloud computing	Assignment	Programming/Data analysis task	9 Sessions

Topics:
Cybersecurity Threats to Cloud Computing-Identity First Security, Cloud misconfiguration, Denial of Service, Insider Threats, Reduced Infrastructure Visibility, Unauthorized use of Cloud workloads, Insecure API's, Compliance and regulation issues, Mitigating cyber risks in cloud computing
Assignment:

Text Books
T1. Sunit Belapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives" ,Wiley India Pvt Ltd,2013
T2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1 st Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978- 9386873743)
T3. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi Mastering Cloud. Computing McGraw Hill Education

References

R1. Brooks, Charles J., Christopher Grow, Philip Craig, and Donald Short. Cybersecurity essentials. John Wiley & Sons,2018
R2. Ollie Whitehouse, "Security of Things: An Implementers' Guide to Cyber-Security for Internet of Things Devices and Beyond", NCC Group, 2014

R3. Securing The Cloud: Cloud Computing Security Techniques and Tactics by Vic (J.R.) Winkler (Syngress/Elsevier) - 978-1-59749-592-9 Weblinks: https://www.coursera.org/learn/cloud-security-basics https://www.imperva.com/learn/application-security/cyber-security-threats/ https://presiuniv.knimbus.com/user#/home
Topics relevant to "SKILL DEVELOPMENT": Cyber threats in IoT and Cloud Computing for skill development through Participative Learning techniques. This is attained through the assessment component mentioned in the course handout.

Course Code: CSE3145	Course Title: Intrusion Detection and Prevention System Type of Course:1] Program Core	L-T- P- C	3-0	0	3
Version No.	1.0				
Course Pre-requisites	CSE2011				
Anti-requisites	NIL				
Course Description	Objective of the course is to Understand when, where, how, and why to apply Intrusion Detection tools and techniques in order to improve the security posture of an enterprise. Apply knowledge of the fundamentals and history of Intrusion Detection in order to avoid common pitfalls in the creation and evaluation of new Intrusion Detection Systems and Analyze intrusion detection alerts and logs to distinguish attack types from false alarms.				
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Intrusion Detection and Prevention System and attain Skill Development through Participative Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to: Understand about the intruders. Define intrusion detection and prevention policies Explain the fundamental concepts of Network Protocol Analysis and demonstrate the skill to capture and analyze network packets. Use various protocol analyzers and Network Intrusion Detection Systems as security tools to detect network attacks and troubleshoot network problems.				
Course Content:					
Module 1	Introduction to Intrusion Detection and Prevention System	Assignment	Programming Task	10 Sessions	
Topics Understanding Intrusion Detection – Intrusion detection and prevention basics – IDS and IPS analysis schemes, Attacks, Detection approaches –Misuse detection – anomaly detection – specification based detection – hybrid detection. Internal and external threats to data, Need and					

types of IDS, Information sources,Host based information sources, Network based information sources.
Assignment: Demonstrating the skills to capture and analyze network packets using network packet analyzer.

Module 2	Intrusion Prevention System	Assignment	Programming Task	10 Sessions

Topics:
Intrusion Prevention Systems, Network IDs protocol based IDs, Hybrid IDs, Analysis schemes, thinking about intrusion. A model for intrusion analysis, techniques, Responses, requirement of responses, Types of responses, mapping responses to policy Vulnerability analysis, credential analysis, non-credential analysis. Architecture models of IDs and IPs.
Assignment: Applying Intrusion detection in security applications.

Module 3	Applications and tools	Assignment	Programming/Data analysis task	12 Sessions

Topics:
Tool Selection and Acquisition Process – Bro Intrusion Detection – Prelude Intrusion Detection – Cisco Security IDS – Snorts Intrusion Detection – NFR security. Introduction to Snort, Snort Installation Scenarios, Installing Snort, Running Snort on Multiple Network Interfaces, Snort Command Line Options. Step-By-Step Procedure to Compile and Install Snort Location of Snort Files, Snort Modes Snort Alert Modes
Assignment: Demonstrate the working with Snort Rules, Rule Headers, Rule Options and The Snort Configuration File.

Module 4	Legal issues and organizations standards	Assignment	Programming/Data analysis task	9 Sessions

Law Enforcement / Criminal Prosecutions – Standard of Due Care – Evidentiary Issues, Organizations and Standardizations.

Assignment: Addressing common legal concerns and myths about Intrusion Detection system

Textbooks
T1. Carl Endorf, Eugene Schultz and Jim Mellander " Intrusion Detection & Prevention", 1st Edition, Tata McGraw-Hill, 2004.
T2. Earl Carter, Jonathan Hogue, "Intrusion Prevention Fundamentals", Pearson Education, 2006.

References

R1. Rafeeq Rehman : " Intrusion Detection with SNORT, Apache, MySQL, PHP and ACID," 1st Edition,
Prentice Hall , 2003.
R2. Christopher Kruegel, Fredrik Valeur, Giovanni Vigna: "Intrusion Detection and Correlation Challenges and Solutions", 1st Edition, Springer, 2005.
R3. Paul E. Proctor, "The Practical Intrusion Detection Handbook ",Prentice Hall , 2001.

Weblinks: https://www.youtube.com/watch?v=RYB4cG8G2xo https://www.coursera.org/lecture/detecting-cyber-attacks/intrusion-detection-systems-UeDqJ
Topics relevant to "SKILL DEVELOPMENT": Agent development for intrusion detection for Skill Development through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE3097	**Course Title:** Web Security **Type of Course:** Integrated course	**L- T-P-C**	2	0	2	3
Version No.	1.0					
Course Pre-requisites	**CSE3070**					
Anti-requisites	**NIL**					
Course Description	The purpose of this course is to introduce you to the field of web security by understanding web functionality and various security validations. The web is our gateway to many critical services and is quickly evolving as a platform to connect all our devices. Web vulnerabilities are growing on a year-to-year basis and designing secure web applications is challenging. The course covers fundamental concepts of web security principles, web vulnerability and exploitation, various attacks on web applications, and a few basic topics on web encryption.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Web Security and attain Skill Development through Experiential Learning techniques.					
Course Outcomes	**On successful completion of this course the students shall be able to:** 1. **Define** the fundamentals of Web applications and validation. (Remember) 2. **Recognize** the significance of password and authentication in web applications. (Understand) 3. **Explain** the importance of session management in web. (Understand) 4. **Apply** web attack techniques to find vulnerabilities in web applications. (Apply)					
Course Content:						

Module 1	**Introduction to Web Security**	Quiz	Knowledge		**14 Sessions - L[08]+P[06]**
Topics: Web Functionality, Encoding Schemes, Mapping the Application - Enumerating the Content and Functionality, Analyzing the Application Bypassing, Client-Side Controls: Transmitting Data Via the Client, Capturing User Data, Handling Client-Side Data Securely - Input Validation, Blacklist Validation, Whitelist Validation. The Defense in-Depth Approach - Attack Surface Reduction, Rules of Thumb, Classifying and Prioritizing Threats.					
Module 2	**Web Application Authentication**	Assignments	Comprehension		**16 Sessions L[08] +P[08]**
Topics: Authentication Fundamentals- Two Factor and Three Factor Authentication - Password Based, Built-in, HTTP, Single Sign-on Custom Authentication- Secured Password Based Authentication: Attacks against Password, Importance of Password Complexity, Design Flaws in Authentication Mechanisms - Implementation, Flaws in Authentication Mechanisms - Securing Authentication.					
Module 3	**Session Management &Web Security Principles**	Quiz	Comprehension		**16 Sessions L[08] +P[08]**
Topics: Need for Session Management, Weaknesses in Session Token Generation, Weaknesses in Session Token Handling, Securing Session Management; Access Control: Access Control Overview, Common Vulnerabilities, Attacking Access Controls, Securing Access Control. Origin Policy, Exceptions, Browser security Principles- Cross Site Scripting and Cross Site Request Forgery, File Security Principles: Source Code Security, Forceful Browsing, Directory Traversals.					
Module 4	**Web Application Vulnerability**	Assignment	Application		**14 Sessions L[06] +P[08]**
Topics: Attacking data-stores and backend components- Injecting into Interpreted Contexts, injecting into SQL, NoSQL, XPath, LDAP, Injecting OS Commands, Manipulating File Paths, Injecting into XML Interpreters, Injecting into Back-end HTTP Requests, Injecting into Mail Services, Attacking application logic-real world logic flaws, Attacking users-Cross site scripting-varieties of XSS,XSS attacks in action, finding and exploiting XSS vulnerabilities, preventing XSS attacks, Other techniques-cookie based Attacks, HTTP Header Injection					

List of Laboratory Tasks:

1. Practical knowledge of known vulnerabilities in CGI, LAMP stacks, REST APIs cross-site scripting

Practical knowledge of known vulnerabilities in CGI, LAMP stacks, REST APIs cross-site scripting: Use the **Nessus tool** to scan the network for vulnerabilities.

i. Basic Network scanning
ii. Advanced scanning in general search
iii. Ntstat port scanning:
iv. Vulnerability Mapping
v. Policies:
vi. Plugins:
vii. General Scanning
viii. Port Scanning

Level 1: Identification of vulnerabilities
Level 2: Apply the concept

2. HTTP and setting up stacks, the various types of databases Access Controls, Vulnerabilities

HTTP and setting up stacks

i. Create a simple web application that can store information sent to it. For example, you could create a web application that will store to a text file anything provided in a URL parameter
ii. Write or modify an existing application that legitimately needs access to a sensitive resource ,but uses it at a time when it does not actually need it

Various types of databases Access Controls

i. Role-Based Access Control (RBAC)
iii. Mandatory Access Control (MAC)

Vulnerability: Study and work with KF Sensor

STEP1: Download **KF** Sensor tool Evaluation Setup File from KF Sensor Website.
STEP-2: Install with License Agreement and appropriate directory path.

STEP-3: Reboot the Computer now. The KF Sensor automatically starts during Windows boot.
STEP-4: Click Next to setup wizard.
STEP-5: Select all port classes to include and Click Next.
STEP-6: "Send the email and Send from email", enter the ID and Click Next.
STEP-7: Select the options such as Denial of Service[DOS], Port Activity, Proxy Emulsion, Network Port Analyzer, Click Next.
STEP-8: Select Install as System service and Click Next.

Level 1: Identification of vulnerabilities
Level 2: Apply the concept

3. Study of web authoring tools (any 2-3 tools)

i. Study and work with Net Stumbler tool
ii. Study and work with Snort
iii. Study and work with Nmap

Level 1: Install the tools required
Level 2: Apply the concept

4. Testing web applications

Study and work with Word press tool

i. Create an Online Community website and test the website
ii. Showcase Your Work Online and test its worth
iii. Create a Local Business Website and test the website.

Level 1: Define the test cases
Level 2: Apply the concept to test the web application

5. SQL injection and prevention

From the given data set ,

i. Put limits on all result sets
ii. Cleanse and Validate Freeform User Input
iii. Remove Freeform User Input When Possible
iv. Validate Data Prior to Processing
v. Ensure Errors are Not User-Facing
vi. Use Stored Procedures to Abstract Business Logic and Control parameters
vii. Use LIKE Operators Carefully
viii. Limit Use of xp_cmdshell and Other Extended Stored Procedures
ix. Perform Penetration Tests
x. Code Review
xi. Minimizing the Impact of SQL Injection
xii. Principle of Least Privilege & Login Security
xiii. Secure Linked Servers and Data Sources

Level 1: Recognize and acquire the data
Level 2: Apply the concept

6. Cross site request forgery attack lab

	With the usage of Virtual Machines i. Configure the Virtual Machines: ii. Observing HTTP Request in Victim VM iii. CSRF Attack using GET Request iv. CSRF Attack using POST Request v. Implementing a countermeasure **Level 1:** Identify and acquire the data **Level 2:** Apply the concept **7. Web tracking** Tracking the Web based scenario by • Environment Configuration • clear history and cookies • open a new private window in Firefox Task 1: Understand the basic working of the web tracking Task 2: Importance of cookie in Web tracking Task 3: Tracked user interests and data Task 4: How ads are displayed in a website Task 5: Tracking in a Private browser window Task 6: Real world tracking Task 7: Countermeasures **Level 1: Identify and acquire the data logs** **Level 2: Apply the concept**
	Targeted Application & Tools that can be used: **(1) Word press tool can be used for building websites with possible vulnerabilities.** **(2) Tools such as Nmap and Nessus can be used for web attack demonstration.** **(3) KF Sensor advanced 'honeypot' intrusion and insider threat detection system for Windows networks** **(4) Snort can be used for network intrusion detection system and intrusion prevention system** **(5) Net Stumbler tool for Windows that facilitates detection of Wireless LANs using the 802.11b, 802.11a and 802.11g WLAN standards.**
	Textbook(s): T1. Dafydd Stuttard, Marcus Pinto, "The Web Application Hacker's Handbook", Willey Publishing Inc. ,2008

References:

R1. B. Sullivan, V. Liu, and M. Howard, *"Web Application Security"*, A B Guide. New York: McGraw-Hill Education, 2011.

R2. *Web Application Security:* Exploitation and Countermeasure for Modern Web Applications, byAndrew Hoffman.

E-book Links

T1: https://www.oreilly.com/library/view/web-application-security/9780071776165/
T2: https://www.oreilly.com/library/view/web-application-security/9781492053101/

Web links-

1. **NPTEL course** : Introduction to Information Security I, IIT Madras https://nptel.ac.in/courses/106106129
2. **Coursera Link** : https://www.coursera.org/learn/security-and-authentication

Topics related to development of "Skills":

Web technology fundamentals, web security measures and webvulnerability/attacks.

Topics related to development of "Experimental Learning":

Writing different web exploits to demonstratevulnerabilities in web applications.

Course Code: CSE 1004	**Course Title: Problem Solving Using C** **Type of Course: School Core & Practical Only.**	**L- T-P-C 2-0-2-3**	2	2	3
Version No.	1.0				
Course Pre-requisites	**NIL**				
Anti-requisites	**NIL**				
Course Description	The course is designed to provide complete knowledge of C language. Students will be able to develop logics which will help them to create programs and applications in C. Also by learning the basic programming constructs they can easily switch over to any other language in future.				
Course Outcomes	**On successful completion of this course the students shall be able to:** 1. Write algorithms and to draw flowcharts for solving problems 2. Demonstrate knowledge and develop simple applications in C programming constructs 3. Develop and implement applications using arrays and strings 4. Decompose a problem into functions and develop modular reusable code 5. Solve applications in C using structures and Union				

	6. Design applications using Sequential and Random Access File Processing.			
Course Content:				
Module 1	Introduction to C Language	Quiz	Problem Solving	**9 Hrs.**
Topics: Introduction to Programming – Algorithms – Pseudo Code - Flow Chart – Compilation – Execution – Preprocessor Directives (#define, #include, #undef) - Overview of C – Constants, Variables and Data types – Operators and Expressions – Managing Input and Output Operations – Decision Making and Branching - Decision Making and Looping.				
Module 2	Introduction to Arrays and Strings	Quiz	Problem Solving	**9 Hrs.**
Topics: **Arrays:** Introduction – One Dimensional Array – Initialization of One Dimensional Arrays – Example Programs – Sorting (Bubble Sort, Selection Sort) – Searching (Linear Search) - Two Dimensional Arrays – Initialization of Two Dimensional Arrays. Example Programs – Matrix operations. **Strings:** Introduction – Declaring and Initializing String Variables – Reading Strings from Terminal – Writing String to Screen – String Handling Functions.				
Module 3	Functions and Pointers	Quiz	Problem Solving	**9 Hrs.**
Topics: **Functions:** Introduction – Need for User-defined functions – Elements of User-Defined Functions: declaration, definition and function call–Categories of Functions – Recursion. **Pointers:** Introduction – Declaring Pointer Variables – Initialization of Variables – Pointer Operators – Pointer Arithmetic – Arrays and Pointers – Parameter Passing: Pass by Value, Pass by Reference.				
Module 4	Structures and Union	Quiz	Problem Solving	**9 Hrs.**
Topics: **Structures:** Introduction – Defining a Structure – Declaring Structure Variable – Accessing Structure Members – Array of Structures – Arrays within Structures – **Union:** Introduction – Defining and Declaring Union – Difference Between Union and Structure.				
Module 5	File handling	Case Study	Problem Solving	**9 Hrs.**
Topics: Files: Defining and Opening a File – Closing a File – Input / Output Operations on File – Random Access Files				
List of Practical Tasks **Lab Sheet 1 (Module I)** Programs using IO Statements, Conditional Statements and Looping Statements				

Lab Sheet 2 (Module II) Programs using Arrays and Strings **Lab Sheet 3 (Module III)** Programs using Functions and Pointers **Lab Sheet 4 (Module IV)** Programs using Structures and Unions **Lab Sheet 5 (Module V)** Programs using Files
Text Book(s): 1. E. Balaguruswamy, "Programming in ANSI C", 8th Edition, 2019, McGraw Hill Education, ISBN: 978-93-5316-513-0. By
Reference Book(s): 1. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020. 2. ReemaThareja, "Programming in C", Oxford University Press, Second Edition, 2016. 3. Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2015 4. Schildt Herbert, "C: The Complete Reference", Tata McGraw Hill Education, 4th Edition, 2014. 5. Stephen G. Kochan, "Programming in C", Addison-Wesley Professional, 4th Edition, 2014.
Web Links and Video Lectures: 1. https://nptel.ac.in/courses/106/105/106105171/ 2. https://archive.nptel.ac.in/courses/106/104/106104128/

Course Code: **CSE 1004**	**Course Title: Problem Solving Using C** **Type of Course: School Core & Practical Only.**	**L- T-P-C 2-0-2-3**	2	2	3
Version No.	1.0				
Course Pre-requisites	**NIL**				
Anti-requisites	**NIL**				
Course Description	The course is designed to provide complete knowledge of C language. Students will be able to develop logics which will help them to create programs and applications in C. Also by learning the basic programming constructs they can easily switch over to any other language in future.				
Course Outcomes	**On successful completion of this course the students shall be able to:** 7. Write algorithms and to draw flowcharts for solving problems 8. Demonstrate knowledge and develop simple applications in C programming constructs 9. Develop and implement applications using arrays and strings 10. Decompose a problem into functions and develop modular reusable code 11. Solve applications in C using structures and Union 12. Design applications using Sequential and Random Access File Processing.				

Course Content:				
Module 1	Introduction to C Language	Quiz	Problem Solving	**9 Hrs.**
Topics: Introduction to Programming – Algorithms – Pseudo Code - Flow Chart – Compilation – Execution – Preprocessor Directives (#define, #include, #undef) - Overview of C – Constants, Variables and Data types – Operators and Expressions – Managing Input and Output Operations – Decision Making and Branching - Decision Making and Looping.				
Module 2	Introduction to Arrays and Strings	Quiz	Problem Solving	**9 Hrs.**
Topics: **Arrays:** Introduction – One Dimensional Array – Initialization of One Dimensional Arrays – Example Programs – Sorting (Bubble Sort, Selection Sort) – Searching (Linear Search) - Two Dimensional Arrays – Initialization of Two Dimensional Arrays. Example Programs – Matrix operations. **Strings:** Introduction – Declaring and Initializing String Variables – Reading Strings from Terminal – Writing String to Screen – String Handling Functions.				
Module 3	Functions and Pointers	Quiz	Problem Solving	**9 Hrs.**
Topics: **Functions:** Introduction – Need for User-defined functions – Elements of User-Defined Functions: declaration, definition and function call–Categories of Functions – Recursion. **Pointers:** Introduction – Declaring Pointer Variables – Initialization of Variables – Pointer Operators – Pointer Arithmetic – Arrays and Pointers – Parameter Passing: Pass by Value, Pass by Reference.				
Module 4	Structures and Union	Quiz	Problem Solving	**9 Hrs.**
Topics: **Structures:** Introduction – Defining a Structure – Declaring Structure Variable – Accessing Structure Members – Array of Structures – Arrays within Structures – **Union:** Introduction – Defining and Declaring Union – Difference Between Union and Structure.				
Module 5	File handling	Case Study	Problem Solving	**9 Hrs.**
Topics: Files: Defining and Opening a File – Closing a File – Input / Output Operations on File – Random Access Files				
List of Practical Tasks **Lab Sheet 1 (Module I)** Programs using IO Statements, Conditional Statements and Looping Statements **Lab Sheet 2 (Module II)** Programs using Arrays and Strings **Lab Sheet 3 (Module III)** Programs using Functions and Pointers				

Lab Sheet 4 (Module IV) Programs using Structures and Unions **Lab Sheet 5 (Module V)** Programs using Files
Text Book(s): 2. E. Balaguruswamy, "Programming in ANSI C", 8th Edition, 2019, McGraw Hill Education, ISBN: 978-93-5316-513-0. By
Reference Book(s): 6. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020. 7. ReemaThareja, "Programming in C", Oxford University Press, Second Edition, 2016. 8. Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2015 9. Schildt Herbert, "C: The Complete Reference", Tata McGraw Hill Education, 4th Edition, 2014. 10. Stephen G. Kochan, "Programming in C", Addison-Wesley Professional, 4th Edition, 2014.
Web Links and Video Lectures: 3. https://nptel.ac.in/courses/106/105/106105171/ 4. https://archive.nptel.ac.in/courses/106/104/106104128/

Course Code: CAI3428	**Course Title: Practical Deep Learning with TensorFlow** **Type of Course: Discipline Elective - Theory & Integrated Laboratory**	**L- T-P- C**	**2**	**0**	**2**	**3**
Version No.	1.0					
Course Pre-requisites	CSE 3001					
Anti-requisites	NIL					
Course Description	This course introduces students to the concepts of deep neural networks and state of the art approaches to develop deep learning models. In this course students will be given an exposure to the details of neural networks as well as deep learning architectures and to develop end-					

	to-end models for such tasks. It will help to design and develop an application-specific deep learning models and also provide the practical knowledge handling and analyzing end user realistic applications.
Course Objective	This course is designed to improve the learners EMPLOYABILITY SKILLS by using EXPERIENTIAL LEARNING techniques.
Course Outcomes	On successful completion of this course the students shall be able to: 1. Implement backpropagation and gradient descent techniques to train neural networks effectively. (Apply) 2. Build and train deep learning models using Python libraries such as TensorFlow and Keras for real-world applications. (Apply) 3. Utilize deep learning techniques for image classification, object detection, sentiment analysis, and language modeling. (Apply)

Course Content:

Module 1	**Basics of Neural Networks**	Assignment		**18[8L+10P] Sessions**

Topics:
Understanding Perceptron with Excel, Understanding Multilayer Perceptron with Excel, From Multilayer Perceptron to Deep Learning, Error Backpropagation and Gradient Descent to reduce errors, Activation Functions, Deep Learning, Problems with Deep Learning with solutions.

Module 2	**TensorFlow Basics**	Assignment		**14[7L+7P] Sessions**

Topics:
Introduction to TensorFlow, TensorFlow dataset, Machine Learning with TensorFlow

Module 3	**Deep Learning methods with Tensor Flow and Keras**	Assignment		**14[6L+8P] Sessions**

Topics:
Main Features of TensorFlow, Keras basics, AI with Keras.

Project work/Assignment:

1. **Assignment 1 on (Module 1 and Module 2)**
2. **Assignment 2 on (Module 3)**

List of Laboratory Tasks:

Lab 1: Working with Deep Learning Frameworks
Objective: Explore various Deep Learning Frameworks
Tasks: Identify deep learning frameworks (Keras, Tensorflow, Matplotlib, etc)
Activity: Practice with various methods available in DL Frameworks to develop a Model.

Lab 2: Build a Basic Artificial Neural Network
Objective: Create a ANN with DL frameworks.
Task: Identify suitable ANN Layers using Keras and Tensorflow.
Activity: Design a basic Artificial Neural Networks using Keras with TensorFlow (pima-indians-diabetes)

Lab 3: Build a MultiLayer Perceptron
Objective: Create a MLP for classification task.
Task: Identify suitable model for house price prediction.
Activity: Design a MLP for implementing classification and fine-tuning using House price.csv

Lab 4: Create a Tensor in TensorFlow using List or Numpy array.
Objective: To understand how to create a tensor in TensorFlow using a Python list or NumPy array
Task: Create a simple tensor using both a Python list and a NumPy array in TensorFlow.
Activity: Create a tensor using a Python list and Numpy array

Lab 5: Apply math operations on tensor using various mathematical functions.
Objective: To learn how to apply mathematical operations on tensors using various TensorFlow mathematical functions.
Task: Perform basic mathematical operations (addition, subtraction, multiplication, division) and advanced functions (square, square root, exponential) on tensors.
Activity: Perform basic math operations: Add, Subtract, Multiply, Divide and Apply advanced math functions: Square, Square root, Exponential.

Lab 6: Connecting two tensors in dataset.
Objective: Combine two tensors using concatenation and stacking operations in TensorFlow.
Task: Combine two tensors using concatenation and stacking operations in TensorFlow
Activity: Concatenate them along a specific axis and Stack them along a new axis.

Lab 7: Building dataset from a file stored in a local drive
Objective: To learn how to build a dataset in TensorFlow from a file stored in a local drive.
Task: Load a dataset from a CSV file stored on the local drive and process it using TensorFlow
Activity: Load the file using TensorFlow's tf.data API and Process the dataset (e.g., convert it into tensors)

Lab 8: Loading Dataset from TensorFlow.dataset Library
Objective: To learn how to load a dataset from the tensorflow_datasets library and use it in machine learning models.
Task: Load a dataset from TensorFlow Datasets (tfds), preprocess it, and display sample data

Activity: Load a dataset (e.g., MNIST, CIFAR-10, IMDB Reviews) and Split the dataset into training and testing sets.

Lab 9: Build a Convolutional Neural Network
Objective: Create a CNN model.
Task: Build CNN architecture for Dog-Cat classification problem.
Activity: Implement a Convolution Neural Network (CNN) for dog/cat classification problem using keras.

Lab 10: **Build a Time-Series Model**
Objective: Create a RNN and LSTM Model
Task: Build RNN/LSTM Model for predicting time series data.
Activity Train a sentiment analysis model on IMDB dataset, use RNN layers with LSTM/GRU notes.

REFERENCE MATERIALS:

TEXTBOOKS

1. François Chollet, "Deep Learning with Python", 2nd Edition, Manning Publications, 2022
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2017.

REFERENCES

1. Amlan Chakrabarti Amit Kumar Das, Saptarsi Goswami, Pabitra Mitra , "Deep Learning", Pearson Publication, 2021.
2. David Foster, "Generative Deep Learning" O'Reilly Publishers, 2020.
3. John D Kellehar, "Deep Learning", MIT Press, 2020.

JOURNALS/MAGAZINES

1. IEEE Transactions on Neural Networks and Learning Systems https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=5962385
2. IEEE Transactions on Pattern Analysis and Machine Intelligence https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=34http://ijaerd.com/papers/special_papers/IT032.pdf
3. International Journal of Intelligent Systems https://onlinelibrary.wiley.com/journal/1098111x

SWAYAM/NPTEL/MOOCs:

4. Swayam Nptel – Deep Learning – IIT Ropar https://onlinecourses.nptel.ac.in/noc21_cs35/preview
5. Coursera – Neural Networks and Deep Learning Andrew Ng
6. Coursera - Neural Networks for Machine Learning by Geoffrey Hinton in Coursera

Course Code: UG COURSE: CAI3429	**Course Title: Deep Learning Techniques for Computer Vision Type of Course: Discipline Elective - Theory & Integrated Laboratory**	L-T-P-C	2	0	2	3
Version No.	1.0					
Course Pre-requisites	MAT1003					
Anti-requisites	NIL					
Course Description	This course covers the fundamentals and advanced concepts of deep learning for computer vision applications. Students will explore convolutional neural networks (CNNs), object detection, image segmentation, and generative models. Hands-on lab experiments will reinforce theoretical concepts using frameworks like TensorFlow and PyTorch.					
Course Out Comes	**On successful completion of the course the students shall be able to:** 1. Understand the Fundamentals of Deep Learning for Vision Explain the core concepts of neural networks and deep learning architectures for image processing. Implement and optimize convolutional neural networks (CNNs) for classification tasks. 2. Apply Object Detection and Image Segmentation Techniques Implement and analyze state-of-the-art object detection algorithms such as YOLO, Faster R-CNN, and SSD. Develop and evaluate image segmentation models like U-Net and Mask R-CNN. 3. Explore Advanced Deep Learning Techniques for Vision Utilize Vision Transformers (ViTs) and attention mechanisms for image classification. Generate and manipulate images using Generative Adversarial Networks (GANs).					

	4. Deploy and Optimize Deep Learning Models for Real-World Applications			
Course Content:				
Module 1	Fundamentals of Deep Learning for Vision	Assignment	Practical	No. of Classes:8
Introduction to Deep Learning & Neural Networks, Convolutional Neural Networks (CNNs) Architecture Backpropagation & Optimization in CNNs, Transfer Learning & Pretrained Models.				
Module 2	Object Detection & Image Segmentation	Assignment	Practical	No. of Classes:14
Introduction to Object Detection (R-CNN, SSD, YOLO), Region Proposal Networks (Faster R-CNN) Semantic & Instance Segmentation (U-Net, Mask R-CNN), Real-time Object Detection Applications				
Module 3	Advanced Topics in Vision	Assignment	Practical	No. of Classes:8
Attention Mechanisms & Vision Transformers (ViTs), Generative Adversarial Networks (GANs) for Image Generation, Self-supervised Learning for Vision, Multi-modal Learning (CLIP, DALL·E)				
Module 4	Applications & Deployment	Assignment	Practical	No. of Classes:8
Edge AI & Mobile Deployment (TensorFlow Lite, ONNX), Adversarial Attacks & Robustness in Vision Models, Explainability & Interpretability of Vision Models, Case Studies & Industry Applications				

Lab Experiments are to be conducted on the following topics:-

Lab Sheet 1:

Keras Sequential API model

1. Read in the data and explore
2. Define a Sequential API model
3. Define the hyperparameters and optimizer
4. Train the model and visualize the history
5. Testing

Keras Functional API model:

1. Define a Functional API model
2. Train the model and visualize the history

Lab Sheet 2:

Softmax regression with Keras

1. Read in the data and prepare

2. Define a Sequential API model
3. Define the hyperparameters and optimizer
4. Train the model and visualize the history
5. Testing

Lab Sheet 3:

Convolutional Neural Network with Keras (grayscale images)

1. Read in the data:
2. Visualize the data:
3. Prepare the data:
4. Define a CNN model:
5. Define the hyperparameters and optimizer:
6. Train the model and visualize the history:
7. Testing:

Lab Sheet 4:

Convolutional Neural Network with Keras (color images):

1. Read in the data:
2. Visualize the data:
3. Prepare the data:
4. Define a CNN model:
5. Define the hyperparameters and optimizer:
6. Train the model and visualize the history:
7. Testing:

Lab Sheet 5:

Time series and prediction:

1. Read in the data and explore:
2. Apply the exponential smoothing method and predict

Recurrent neural network (RNN):

1. Pre-processing:
2. Do the necessary definitions: (Hyper parameters, Model,
3. Train the model:
4. Predict the future:

Lab Sheet 6:

Document classification with LSTM network:

1. Read in the data:
2. Explore the data:
3. Data preprocessing:
4. Define the model:
5. Define the optimizer and compile:
6. Train the model and visualize the history:
7. Testing:

Lab Sheet 7:

Document classification with LSTM network (Binary):

1. Read in the data:
2. Explore the data:
3. Data preprocessing:
4. Define the model:

5. Define the optimizer and compile:
6. Train the model and visualize the history:
7. Testing:

Lab Sheet 8:

Document classification with LSTM + CNN network (Binary):

1. Read in the data:
2. Explore the data:
3. Data preprocessing:
4. Define the model:
5. Define the optimizer and compile:
6. Train the model and visualize the history:
7. Testing:

Lab Sheet 9:

Softmax regression to recognize the handswritten digits:

1. Download the MNIST data:
2. Take a look at the dataset:
3. Do the necessary definitions:
4. Training and Testing:

Multi-layer neural network to recognize the handswritten digits:

1. Download the MNIST data:
2. Take a look at the dataset:
3. Do the necessary definitions:

Training and Testing:

Lab Sheet 10:

Object Detection using YOLOv5

Lab Sheet 11:

Image Segmentation using U-Net
Custom Object Detection using Faster R-CNN

Lab Sheet 12:

Implementing Vision Transformers for Image Classification
Generating Images using GANs (DCGAN, StyleGAN)

(Group Project)

8. Object Detection and Recognition:
    a. Haar cascade object detection (e.g., face detection or object detection using pre-trained classifiers).
    b. Feature-based object detection using techniques like Speeded-Up Robust Features (SURF) or Scale-Invariant Feature Transform (SIFT).
    c. Deep learning-based object detection using Convolutional Neural Networks (CNNs) or You Only Look Once (YOLO) algorithm.
9. Optical Character Recognition (OCR):
    a. Preprocessing of text images (e.g., binarization, noise removal, or skew correction).
    b. Text localization using techniques like connected component analysis or Stroke Width Transform (SWT).
    c. Character recognition using machine learning algorithms like Support Vector Machines (SVM) or Convolutional Neural Networks (CNNs).
10. Gesture Recognition:

a. Hand segmentation using techniques like background subtraction or skin color detection.
b. Feature extraction from hand regions (e.g., finger counting, hand shape descriptors).
c. Classification of gestures using machine learning algorithms (e.g., k-Nearest Neighbors or Support Vector Machines).

Tools/Software Required :

1. OpenCV 4
2. Python 3.7
3. MATLAB

Text Books

1. "Deep Learning for Computer Vision Image Classification, Object Detection and Face Recognition in Python" **Jason Brownlee (2019)**

2. "Deep Learning for Computer Vision with python" **Adrian Rosebrock (2017)**

References

3. **Goodfellow, I., Bengio, Y., & Courville, A. (2016).** *Deep Learning.* MIT Press.

   A foundational book covering deep learning principles, including CNNs, optimization, and generative models.
4. **Raschka, S., & Mirjalili, V. (2022).** *Machine Learning with PyTorch and Scikit-Learn.* Packt Publishing.

   Covers practical deep learning techniques using PyTorch, including CNNs and transfer learning.
5. **Geron, A. (2022).** *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow (3rd Edition).* O'Reilly Media.

   Provides hands-on implementations of deep learning for computer vision using TensorFlow and Keras.
6. **Zhang, A., Lipton, Z. C., Li, M., & Smola, A. J. (2021).** *Dive into Deep Learning.* Available online (https://d2l.ai).

   Open-access book covering CNNs, object detection, and advanced vision techniques with PyTorch and TensorFlow.
7. **Chollet, F. (2021).** *Deep Learning with Python (2nd Edition).* Manning Publications.

   Explains deep learning fundamentals and applications with Keras, including image classification and segmentation.
8. **Ballé, J., Laparra, V., & Simoncelli, E. P. (2017).** *Deep Learning for Computer Vision: A Brief Introduction.*

   A concise introduction to CNNs, object detection, and generative models.

Course Code: CAI3427	**Course Title: Language Models for Text Mining** **Type of Course: Discipline Elective - Theory & Integrated Laboratory**	**L-T-P-C**	2	0	0	2
Version No.	1.0					
Course Pre-requisites	CSE3001					
Anti-requisites	NIL					
Course Description	This course introduces the basics of Text Mining and Natural Language Processing. The course will teach students different concepts such as text mining, NLP, Sequence Labeling, etc. Topics: Text Mining, NLP, Tokenization, Lemmatization, Stemming, One-hot encoding, Language modelling, Bag-of-words, Term-document Matrix, Cosine similarity, Viterbi Algorithm, etc.					
Course Objectives	The objective of the course is EMPLOYBILITY of student by using EXPERIENTIAL LEARNING techniques.					
Course Out Comes	On successful completion of this course the students shall be able to: 1. **Process** text data to derive information from text. [Apply] 2. **Apply** insights from textual information to real-world business. [Apply] 3. **Develop** solutions for a particular NLP problem using different machine learning and deep learning techniques. [Apply] 4. **Utilize** different NLP tools and packages. [Apply]					

Course Content:				
Module 1	**Text Mining**	**Adversarial Quiz Tests**	**Module Tests**	**No. of Sessions: 09**
Introduction to Text Mining. Text Mining vs. NLP. Text Mining Algorithms. Steps in Text Mining - Extraction, Preprocessing, Analysis and Evaluation. Lexical Resource Creation (NEW). Data collection. String Manipulation to Clean Data. Natural Language Processing. Research Paradigms in NLP. Sequential Data. Sequence Labeling (NEW). Viterbi Algorithm (NEW). Corpus. Building a HMM using a Corpus (NEW). Unknown word handling (NEW).				
Module 2	**Text Preprocessing**	**Adversarial Quiz Tests**	**Module Tests**	**No. of sessions: 06**

Introduction to Preprocessing. Tokenization. Stop Words Removal. Lemmatization and Stemming. PoS Tagging. Integer Encoding. Padding. One-Hot Encoding.				
Module 3	**Text Representations**	**Adversarial Quiz Tests**	**Module Tests**	**No. of sessions: 08**
Language Modeling. N-Gram Language Model. Bag-of-Words Model. Term-Document Matrix. Term Frequency. Inverse Document Frequency. TF-IDF. Cosine Similarity. Naive Bayes Classifier using Bag-of-Words. Topic Modeling. Latent Semantic Analysis. Singular Value Decomposition. Truncated SVD and Topic Vector. LDA Algorithm.				
Module 4	**Natural Language Processing with Keras**	**Adversarial Quiz Tests**	**Module Tests**	**No. of Sessions: 06**
Word Embeddings vs. One-Hot Encoding. Contextual Bag of Words (CBOW). Skipgram. Deep Learning for Document Classification.				

List of Laboratory Tasks:

Experiment No. 1: File Handling

Level 1: Read text files using Python and extract meaningful content.

Level 2: Parse text files using Python to preprocess the data for NLP tasks.

Experiment No. 2: Introduction to NLP Tools

Level 1: Install and use NLTK for basic text processing.

Level 2: Install and use SpaCy for tokenization, PoS tagging, and Named Entity Recognition.

Experiment No. 3: Corpus Cleaning Techniques

Level 1: Use NLTK for corpus cleaning techniques such as tokenization, stopword removal, and stemming.

Level 2: Prepare cleaned text data for downstream NLP tasks like classification or translation.

Experiment No. 4: Word Vector Usage

Level 1: Download and use pre-trained word vectors (e.g., Word2Vec, GloVe, or FastText).

Level 2: Compute similarity between two words, find the most similar word, and complete word analogies (e.g., king - man + woman = queen).

Experiment No. 5 & 6: Language Identification

Level 1: Build a simple language identifier using Bag-of-Words (BoW) features.

Level 2: Predict the language of a given text using the trained model.

Experiment No. 7 & 8: Lexical Simplification

Level 1: Implement a lexical simplifier to replace complex words with simpler alternatives.

Level 2: Generate a simplified version of a given word or sentence while preserving meaning.

Experiment No. 9 & 10: Sentiment Analysis

Level 1: Implement a basic sentiment classifier using a lexicon-based or machine learning approach.

Level 2: Compare the performance of an existing sentiment classifier (e.g., VADER, TextBlob, or a pre-trained Transformer model).

Experiment No. 11: Named Entity Recognition (NER)
Level 1: Extract named entities from a text using NLTK.
Level 2: Extract named entities using SpaCy and compare results.

Experiment No. 12 & 13: Implement a Hidden Markov Model (HMM)
Level 1: Implement a generic HMM for sequence prediction.
Level 2: Calculate the forward probability of a given sequence using HMM.

Experiment No. 14: Linguistic HMM
Level 1: Develop a Hidden Markov Model (HMM) for NLP tasks such as PoS tagging.
Level 2: Evaluate the performance of the HMM on a specific NLP task (e.g., Named Entity Recognition or Chunking).

Experiment No. 15: Machine Translation
Level 1: Implement Machine Translation (MT) using a pre-trained model from Hugging Face Transformers.
Level 2: Evaluate the quality of MT output via Round-Trip Translation (translate text to another language and back to check accuracy).

Targeted Application & Tools that can be used:

1. Google Colab
2. Python IDEs like PyCharm

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

1. Group project on some NLP Task like text classification (Creating a Simple Text Classifier: Use Scikit-learn to classify positive vs. negative reviews from a dataset), sentiment analysis, etc.

Textbook(s):

1. Daniel Jurafsky, James H. Martin. "Speech and Language Processing: An Introduction to Natural Language Processing", Computational Linguistics and Speech, Pearson Publication, 2025 (3rd Edition Draft).
2. Aditya Joshi, Pushpak Bhattacharyya. "Natural Language Processing", Wiley Publication, 2023 (1st Edition).

References:

R1. Chris Manning and Hinrich Schutze, "Foundations of Statistical Natural Language Processing", 1st Edition, MIT Press. 1999.

R2. Pawan Goyal. "Natural Language Processing". 1st Edition, 2016.

Weblinks

W1. E-Book link or R2: https://drive.google.com/file/d/10nbwAJd-dv6htOOZVBgAvLd1WscI0RqC/view
W2. Web Resource for T1: https://web.stanford.edu/~jurafsky/slp3/ - VERY VERY IMPORTANT!!!
W3. NPTEL Courses: https://nptel.ac.in/courses/106106211 CMI), https://nptel.ac.in/courses/106105158 (IIT Kgp), https://nptel.ac.in/courses/106101007 (IITB), https://nptel.ac.in/courses/106105572 (IIT Kgp - NEW)

<table>
<tr><td>Course Code: CSE 3039</td><td colspan="3">Course Title: Social Media Analytics
Type of Course: Integrated</td><td>L-T- P-C</td><td>2-0</td><td>2</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="7">1.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="7">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="7"></td></tr>
<tr><td>Course Description</td><td colspan="7">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.</td></tr>
<tr><td>Course Objective</td><td colspan="7">The objective of the course is to familiarize the learners with the concepts of Social Media Analytics and attain Employability through Experiential Learning techniques.</td></tr>
<tr><td>Course Out Comes</td><td colspan="7">On successful completion of the course the students shall be able to:
• Introduce the idea of social media analytics to the students and assist them in comprehending its importance.
• Introduce the learners to the social media analytics tools.
• Give the students the tools they need to learn how to analyse the efficiency of social media for business.</td></tr>
<tr><td>Course Content:</td><td colspan="7"></td></tr>
<tr><td>Module 1</td><td colspan="2">Introduction to Social Media Analytics</td><td>Assignment</td><td colspan="2">Data Collection/Interpretation</td><td colspan="2">10 Sessions</td></tr>
<tr><td colspan="8">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</td></tr>
<tr><td>Module 2</td><td colspan="2">Making connections: & Web analytics tools:</td><td>Case studies / Case let</td><td colspan="2">Case studies / Case let</td><td colspan="2">10 Sessions</td></tr>
<tr><td colspan="8">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</td></tr>
<tr><td>Module 3</td><td colspan="2">Network Data Analytics:</td><td>Quiz</td><td colspan="2">Case studies / Case let</td><td colspan="2">11 Sessions</td></tr>
<tr><td colspan="8">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)</td></tr>
</table>

Module 4	Processing and Visualizing Data	Quiz	Case studies / Case let	08 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** **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 "EMPLOYABILITY SKILLS": Handling Unstrucuted Data for Employability skills through Experiential Learning techniques. This is attained through the assessment component mentioned in the course handout.				

Course Code: CSE3035	Course Title: R Programming For Data Science Type of Course: Integrated	L- T-P-C	1 -0	4	3
Version No.	1				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	This course is designed to provide the core concepts of data analytics in the R environment. Initially train them with basic R, then progressively increase the difficulty as they move along in the course, capping with advanced techniques through case studies. Mastering the core concepts and techniques of data analytics in R, will help the students to apply their knowledge to a wide range of Data Analytics. R is now considered one of the most popular analytics tools in the world.				

Course Objective	The objective of the course is to familiarize the learners with the concepts of R Programming For Data Science and attain Skill Development through Experiential Learning techniques.			
Course Out Comes	**On successful completion of this course the students shall be able to:** • Apply basic R functions pertaining to fundamental data analysis. [**Application**] • Interpret data using appropriate statistical methods [**Application**] • Demonstrate the decision trees concept with the given dataset. [**Application**] • Demonstrate the Mining concepts for both Data and Text. [**Application**]			
Course Content:				
Module 1	**Introduction**	Assignment	Data Collection/Interpretation	**6 Sessions**
Topics: **Introduction to R, Overview of data analysis, Working with directory in R, Loading and handling data in R, Data Visualization with ggplot2, Data Transformation with dplyr.**				
Module 2	**Exploratory Data Analysis**	Coding Assignment	Case Study	**11 Sessions**
Topics: **Exploring a new dataset, Anomalies in numerical data, Visualizing relations between variables, Assumptions of Linear Regression, Validating Linear Assumption, Missing Values, Covariation, Patterns and Models, gglot2 Calls.**				
Module 3	**Regression Analysis**	Coding Assignment	Project	**12 Sessions**
Topics: **Introduction, Types of Regression Analysis Models, Linear Regression, Simple Linear Regression, Non-Linear Regression, Regression Analysis with Multiple Variables, Cross Validation, Principal Component Analysis, Factor Analysis.**				
Module 4	**Classification**	Quiz	Project	**8 Sessions**
Topics: **Introduction, Different types of Classification, Logistic Regression, Support Vector Machines, K-Neatest Neighbors, Naïve Bayes Classifier, Decision Tree Classification, Random Forest Classification, Evaluation.**				
List of Laboratory Tasks: 1. Using with and without R objects on console 2. Using mathematical functions on console 3. Write an R script, to create R objects for calculator 4. Write an R script to find basic descriptive statistics using summary, str, quartile function on mtcars& cars datasets. 5. Reading different types of data sets (.txt, .csv) from Web and disk and writing in file in specific disk location. b. Reading Excel data sheet in R 6.Find the data distributions using box and scatter plot. 7. Find the outliers using plot. 8. Plot the histogram, bar chart and pie chart on sample data 9.Find the correlation matrix. 10. Plot the correlation plot on dataset and visualize giving an overview of relationships among data on iris data 11.Create a regression model for a given dataset				

12.Install relevant package for classification. 13. Choose classifier for classification problem. c. Evaluate the performance of classifier. 14.Install relevant package for classification. 15. Choose classifier for classification problem. c. Evaluate the performance of classifier.
Targeted Application & Tools that can be used **Tools: RStudio / Google Colab**
Project work/Assignment:
Assignment: **During the course, students would need to do coding assignments to learn to train and use different models. Sample coding assignments include:** **Analysis of Sales Report of a Clothes Manufacturing Outlet.** **Comcast Telecom Consumer Complaints.** **Web Data Anslysis**
Text Book **T1 Hadley Wickham and Garrett Grolemund, "R for Data Science", O'reilly, 2017.**
References **R1 Dr. Bharati Motwani, "Data Analytics using R", Wiley, 2019.** **Web resources:** 1. **https://www.geeksforgeeks.org/r-programming-for-data-science/** 2. **https://r4ds.had.co.nz/**
Topics relevant to "SKILL DEVELOPMENT": Regression model, classifier for **Skill Development** through **Experiential Learning** techniques. This is attained through assessment component mentioned in course handout.

Course Code: **CSE 3002**	**Course Title:** Big Data Technologies **Type of Course: Program Core** **Theory and Lab Integrated Course**	**L-T-P- C**	2-0	2	3
Version No.	1.0				
Course Pre-requisites	CSE2012 CSE1001				
Anti-requisites	**NIL**				
Course Description	The purpose of the course is to provide the fundamentals of Big data technology, to emphasize the importance of choosing suitable tools for processing and analyzing big data to gain insights. The student should have knowledge and skill to select and use most appropriate big data tools to solve business problems. The associated laboratory provides an opportunity to implement the concepts and enhance critical thinking and analytical skills. With a good knowledge in the fundamentals of Big data technology the student can gain practical experience in implementing them, enabling the student to be an effective solution provider for applications that involve huge volume of data.				
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Big Data Technologies and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques.				

Course Outcomes	On successful completion of the course the students shall be able to: • Apply Map-Reduce programming on the given datasets to extract required insights. (Application). • Employ appropriate Hadoop Ecosystem tools such as scoop, Hbase, Hive, to perform data analytics for a given problem. (Application). • Use Spark tool to analyze the given dataset for a given problem. (Application).			
Course Content:				
Module 1	Introduction to Hadoop	Programming Assignment	Data Collection and Analysis	**10 Classes**
Introduction to Big Data and its importance: 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, 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, Need for Flume and Sqoop. **Anatomy of a YARN:** Hadoop 2.0 Features, Name Node High Availability, YARN Architecture, Introduction to Schedulers, YARN scheduler policies, FIFO, Fair And Capacity scheduler.				
Module 2	Hadoop Ecosystem Tools	Programming Assignment	Data Collection and Analysis	**8 Classes**
Introduction to SQOOP: SQOOP features, Sqoop Architecture, Sqoop Import All Tables, Sqoop Export All Tables, Sqoop Connectors, Sqoop Import from MySQL to HDFS, Sqoop vs flume. **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 3	Spark	Programming Assignment	Data analysis	**8 Classes**
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. Spark SQL: Linking with Spark SQL, Using Spark SQL in Applications, Loading and Saving Data, JDBC/ODBC Server, User-defined functions, Spark SQL Performance. Scala: The Basics, Control Structures and functions, Working with arrays, Maps and Tuples.				
List of Laboratory Tasks: 1. **Level 1:** To install the Hadoop in pseudo cluster mode. **Level 1:** HDFS Shell Commands – Files and Folders. **Level 2:** HDFS Shell Commands – Management. 2. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm. **Level 1:** Find the number of occurrence of each word appearing in the input file(s) **Level 2:** Performing a Map Reduce Job for word search count (look for specific keywords in a file).				

3. Write a Map Reduce program that mines weather data. Weather sensors collecting data every hour at many locations across the globe gather large volume of log data, which is a good candidate for analysis with Map Reduce, since it is record-oriented. Data available at: https://github.com/tomwhite/hadoopbook/tree/master/input/ncdc/all.

Level 1: Find average, max and min temperature for each year in NCDC data set?

Level 2: Programming assignment to analyze the social media data for business analytics.

4. **Level 1:** Finding out Number of Products Sold in Each Country using map reduce with sample dataset

Level 2: Find matrix multiplication using map reduce

5. **Level 1:** Installation of Hive, working on basic hive commands. (Create, Alter and Drop tables)

Level 2: Apply Hive commands to student database/employee database.

6. **Level 1:** Working on advance hive commands. (Static Partitioning & Dynamic partitioning)

Level 2: Continue the previous experiment, select and apply suitable partitioning technique.

7. **Level 1:** Working on advance hive commands-2. (Bucketing)

Level 2: Continue the previous experiment, apply bucketing technique to bring out the difference between partitioning and bucketing.

8. **Level 1:** Installing Ecosystem tools such as Scoop, Hbase.

Level 2: Scoop – Move Data into Hadoop.

9. **Level 1:** Working on basic Hbase commands (General commands, DDL Commands)

Level 2: Apply Hbase commands on Insurance database/employee dataset.

10. **Level 1:** Working on advanced Hbase commands. (DML).

Level 2: Continue the previous experiment to demonstrate CRUD operations.

11. **Level 1:** Install, Deploy & configure Apache Spark.

Level 2: Using RDD and FlatMap count how many times each word appears in a file and write out a list of words whose count is strictly greater than 4 using Spark

12. **Level 1:** Write a program in Apache spark to count the occurrences words in a given text file and display only those words starting with 'a' in ascending order of count.

Level 2: Apache access logs are responsible for recording data for all web page requests processed by the Apache server. An access log record written in the Common Log Format will look something like this: 127.0.0.1 - Scott [10/Dec/2019:13:55:36 – 0700] "GET /server-status HTTP/1.1" 200 2326 Where, HTTP 200 status response code indicates that the request has succeeded. Write a program to read the records of

access log file log.txt and display the number of successful requests using Spark.

13. **Level 1:** Chess king moves horizontally, vertically or diagonally to any adjacent cell. Given two different cells of the chessboard, determine whether a king can go from the first cell to the second in one move.
Write a scala program that receives input of four numbers from 1 to 8, each specifying the column and row number, first two - for the first cell, and then the last two - for the second cell. The program should output YES if a king can go from the first cell to the second in one move, or NO otherwise.

Level 2: Data analytics using Apache Spark on Amazon food dataset, find all the pairs of items frequently reviewed together.
Write a single Spark application that:

- Transposes the original Amazon food dataset, obtaining a Pair RDD of the type:
- Counts the frequencies of all the pairs of products reviewed together;
- Writes on the output folder all the pairs of products that appear more than once and their frequencies. The pairs of products must be sorted by frequency.

Targeted Application & Tools that can be used:

- **Business Analytical Applications**
- **Social media Data Analysis**
- **Predictive Analytics**

Tools: Hadoop Framework tools like map reduce, Hive, Hbase, Scoop, Spark.

Text Book

Seema Acharya, Subhashini Chellappan. 2015. *Big Data and Analytics*. Wiley Publication.
Matei Zaharia, Bill Chambers. 2018. *SPARK: The Definitive Guide*. Oreilly.

References

Tom White. 2016. *Hadoop: The Definitive Guide*. O'Reilley.
Cay S. Horstmann. 2017. *Scala for the Impatient*. Wesley.

Topics relevant to development of "Skill Development": Real time application development using Hadoop Ecosystem tools through Experiential Learning as mentioned in the course handout.

Course Code: CSE3125/CSE265	**Course Title: Service Oriented Architecture** **Type of Course: Program Core**	**L-T-P- C**	3-0	0	3
Version No.	2.0				
Course Pre-requisites	CSE207,CSE264				
Anti-requisites	NIL				
Course Description	The study of the course is to enable the students to understand the different architectural styles and XML based web applications which is required to explore the basics of service-oriented Architecture(SOA) in two approaches i.e. Web Services (WS) and Representational State Transfer (REST) architecture.				

Course Objective	The objective of the course is to familiarize the learners with the concepts of Service Oriented Architecture and attain Skill Development through Participative Learning techniques.			
Course Out Comes	On successful completion of this course the students shall be able to: 1.Discuss the XML Fundamentals and to manipulate the data using XML. [Comprehension] 2.Define the key principles of SOA [Knowledge] 3.Discuss the web services technology elements for realizing SOA[Comprehension] 4. Illustrate the various Web Service Standards[Application]			
Course Content:				
Version No.	2.0			
Module 1	**Introduction to XML**	**Assignment**	**Programming Task**	**08 Sessions**
Topics: XML document structure ,Well formed and valid documents ,Namespaces – DTD – xml Schema – X-Files,Parsing XML – using DOM, SAX – XML Transformation and XSL Formatting – Modelling Databases in XML.				
Module 2	**Service Oriented Architecture**	**Assignment**	**Architectural study**	**10 Sessions**
Topics: Types of Architecture,Objectives of Software architecture,SOA Planning and analysis,Architecture patterns and styles ,Characteristics of SOA, Comparing SOA with Client-Server and Distributed architectures – Benefits of SOA ,Security and implementation ,Principles of Service orientation ,Service Layers, Application development process,SOA methodology for Enterprise.				
Module 3	**Web Services**	**Quiz**	**Data patterns**	**08 Sessions**
Topics: Service Descriptions – WSDL – Messaging with SOAP – Service Discovery – UDDI – Message Exchange Patterns – Orchestration – Choreography – WS Transactions.				
Module 4	**Building SOA based Applications**	**Quiz**	**Security aspects**	**11 Sessions**
Topics: Business Process Design,Business case for SOA, Stake holder objectives, Service Oriented Analysis and Design – Service Modeling – Design standards and guidelines – Composition – WS-BPEL – WS-Coordination – WS-Policy – WS-Security , Tools available for implementing SOA, SOA Security, approach for enterprise wide SOA implementation,Trends in SOA,Technologies in Relation to SOA, Advances in SOA, SOA Support in J2EE.				
Targeted Application & Tools that can be used: **Basic HTML and XML**				
Textbook(s): 1. Thomas Erl, "*Service Oriented Architecture: Concepts, Technology, and Design*", Pearson Education, 2016. http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=6532 2. Ron Schmelzer et al. "*XML and Web Services*", Pearson Education, 2013				

http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=6645

References

1. Frank P.Coyle, "*XML, Web Services and the Data Revolution*", Pearson Education, 2002
   http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=6647

2. Eric Newcomer, Greg Lomow, "*Understanding SOA with Web Services*", Pearson Education, 2005
   http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=6619

3. Sandeep Chatterjee and James Webber, "*Developing Enterprise Web Services: An Architect's Guide*", Prentice Hall, 2004.
   http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=5906

4. James McGovern, Sameer Tyagi, Michael E.Stevens, Sunil Mathew, "*Java Web Services Architecture*", Morgan Kaufmann Publishers, 2003.
   https://www.elsevier.com/books/java-web-services-architecture/mcgovern/978-1-55860-900-6

Web Resources:

1. https;//presiuniv.knimbus.com/user#/home
2. https://www.coursera.org/learn/service-oriented-architecture
3. https://nptel.ac.in/courses/soa

Topics relevant to "SKILL DEVELOPMENT": Based on an understanding of architectural styles, understanding web applications based on XML, review architectures for web applications, Service-Oriented Architecture (SOA) in two approaches: Web Services (WS*) and Representational State Transfer (REST) architecture for Skill Development through Participative Learning techniques. This is attained through the Presentation as mentioned in the assessment component.

Course Code: CSE 2058	Course Title: Firewall and Internet security Type of Course: Integrated	L-T- P-C	2-0	2	3
Version No.	1				
Course Pre-requisites	CSE2011				
Anti-requisites					
Course Description	This course provides an in-depth study of various network attacks techniques and methods to defend against them. A number of threats and vulnerabilities of the Internet will be covered, including various vulnerabilities of TCP/IP protocols, denial of service (DOS), attacks on routing, attacks on DNS servers, TCP session hijacking, and so on. This course will also cover defending mechanisms, including intrusion detection, firewalls, tracing the source of attacks, anonymous communication, IPsec, virtual private network, and PKI. To make it easy for				

	students to understand these attacks, basics of the TCP/IP protocols will also be covered in the course.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of Firewall and Internet security and attain Skill Development through Problem Solving Methodologies.			
Course Out Comes	On successful completion of the course the students shall be able to: To identify elements of firewall design, types of security threats and responses to security attacks. Examine security incident postmortem reporting and ongoing network security activities. Construct code for authentication algorithms. Develop a signature scheme using Digital signature standard. Demonstrate the network security system using open source tools			
Course Content:				
Module 1	Introduction to Firewall	Assignment	Data Collection/Interpretation	12 Sessions
Introduction of Firewall in computer network,Categories of firewall,How firewall works,Types of firewall, Firewall location and Configuration,Firewall Policies,Firewall Biasing,Network Architecture,Net masks,Packet filters,Stateful firewalls,Resources				
Module 2	Computer security	Case studies / Case let	Case studies / Case let	12 Sessions
Topics: Attacks on Computers and Computer Security: Need for Security, Security Approaches, Principles of Security Types of Attacks. Transport Level Security: Web Security Considerations, Secure Sockets Layer, Transport Layer Security, HTTPS, Secure Shell (SSH)				
Module 3	Network Security	Quiz	Case studies / Case let	10 Sessions
Topics: Overview of Network Security:Elements of Network Security , Classification of Network Attacks ,Security Methods ,Symmetric-Key Cryptography :Data Encryption Standard (DES),Advanced Encryption Standard (AES) , Public-Key Cryptography :RSA Algorithm ,Diffie-Hellman Key-Exchange Protocol , Authentication :Hash Function , Secure Hash Algorithm (SHA) , Digital Signatures.				
Module 4	Cyber laws and Compliance Standards	Quiz	Case studies / Case let	11 Sessions
Topics: Kerberos:Working ,ASS,TGS,SS-Internet security protocols-AH,ESP,Models-Transport and tunnel-Email security,Public key Infrasturcture,Certificates,certificates authority.Cyber Crime: Introduction,Hacking,Digital forgery,Cyber Stalking,Identify theft and Fraud,Cyber terrorism,Cyber defamation,Crime against individual,Government,Property.				
List of Laboratory Tasks:				

Perform encryption, decryption using the following substitution techniques (i) Ceaser cipher, (ii) playfair cipher iii) Hill Cipher iv) Vigenere cipher Perform encryption and decryption using following transposition techniques i) Rail fence ii) row & Column Transformation Apply DES algorithm for practical applications. Apply AES algorithm for practical applications. Implement RSA Algorithm using HTML and JavaScript Implement the Diffie-Hellman Key Exchange algorithm for a given problem. Calculate the message digest of a text using the SHA-1 algorithm. Implement the SIGNATURE SCHEME – Digital Signature Standard. Demonstrate intrusion detection system (ids) using any tool eg. Snort or any other s/w. Automated Attack and Penetration Tools Exploring N-Stalker, a Vulnerability Assessment Tool Defeating Malware i) Building Trojans ii) Rootkit Hunter
Targeted Application & Tools that can be used
Text Book T1 : Behrouz A Forouzan, Data and Communications and Networking, Fifth Edition, McGraw Hill, Indian Edition T2: James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth edition, Pearson,2017
References R1: Andrew S Tanenbaum, Computer Networks, fifth edition, Pearson Edition R2: Nader F Mir, Computer and Communication Networks, 2nd Edition, Pearson, 2014. Web resources: https://networklessons.com/cisco/asa-firewall https://www.udemy.com/course/cisco-asa-firewall-lab-guide https://geekflare.com/learn-network-security
Topics relevant to development of “Skill Development”: AES, Network Security for Skill Development through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.

Course Code: CSE3095	Course Title: Cloud Security Type of Course: Theory	L-T-P- C	3 -0	0	3
Version No.	1.0				
Course Pre-requisites	CSE2069				
Anti-requisites	NIL				

Course Description	This course provides ground-up coverage on the high-level concepts of cloud landscape, architectural principles, and techniques. It describes the Cloud security architecture and explores the guiding security for Infrastructure and Softwares.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of Cloud Security and attain Employability through Participative Learning techniques.			
Course Outcomes	On successful completion of this course the students shall be able to: Describe fundamentals of cloud computing [Knowledge]. Explain cloud computing security architecture and associated challenges [Comprehension]. Discuss cloud computing software security essentials [Comprehension]. Apply infrastructure security and data security in cloud computing enviroment. [Application].			
Course Content:				
Module 1:	Fundamentals of Cloud Computing	Quiz	Knowledge based Quiz	10 Sessions
Topics: Cloud Computing at a Glance, Building Cloud Computing Environments, Computing Platforms and Technologies, Cloud Computing Architecture: Cloud Delivery Models, The SPI Framework, Cloud Software as a Service (SaaS), Cloud Platform as a Service (PaaS), Cloud Infrastructure as a Service (IaaS), Cloud Deployment Models, Expected Benefits.				
Module 2:	Cloud Security Challenges and Cloud Security Architecture	Quiz	Comprehension based Quiz	10 Sessions
Topics: Security Policy Implementation, Computer Security Incident Response Team, Virtualization Security Management. Architectural Considerations, Identity Management and Access Control, Autonomic Security.				
Module 3	Cloud Computing Software Security Essentials	Assignment	Batch-wise Assignments	9 Sessions
Topics: Cloud Information Security Objectives, Cloud Security Services, Secure Cloud Software Requirements, Cloud Security Policy Implementation, Secure Cloud Software Testing, Cloud Computing and Business Continuity Planning/Disaster Recovery.				
Module 4:	Infrastructure Security and Data Security	Assignment and Presentation	Batch-wise Assignment and Presentations	9 Sessions
Topics: Infrastructure Security: The Network Level, The Host Level, The Application Level. Data Security : Aspects of Data Security, Data Security Mitigation, Provider Data and its Security.				
Targeted Application & Tools that can be used: Use of CloudSim simulator.				
Project work/Assignment: Survey on Cloud Service Providers				
Text Book Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, “Mastering Cloud Computing”, McGraw Hill Education, July 2017.				

Roland L Krutz and Russell Dean Vines, “Cloud Security - A Comprehensive Guide to Secure Cloud Computing”, Wiley Publishing, Inc. 2010.
References Sushil Jajodia, Krishna Kant, Pierangela Samarati, Anoop Singhal, Vipin Swarup, Cliff Wang, “Secure Cloud Computing”, Springer, ISBN 978-1-4614-9278-8 (eBook). John Rittinghouse and James Ransome, “Cloud Computing, Implementation, Management and Security”, CRC Press, 2010. Tim Mather, Subra Kumaraswamy and Shahed Latif”, “Cloud Security and Privacy – An Enterprise Perspective on Risks and Compliance”, Oreily Publication, 2009. WEB RESOURCES: https://presiuniv.knimbus.com/user#/home
Topics relevant to “EMPLOYABILITY SKILLS”: Cloud computing architecture, Security policy implementation, Infrastructure security and Data security for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE3096	Course Title: Cyber Digital Twin Type of Course: Theory Only Course		L-T- P-C	3-0	0	3
Version No.	1.0				
Course Pre-requisites	CSE2013				
Anti-requisites	NIL				
Course Description	This course is designed to improve the learners 'Skill Development' by using modeling, optimizing, and risk management approach. The course objective is to get familiar with the Cyber digital twin-working principal, Development considerations, Data-Modelling Environment, Digital Twin Optimization, Risk Management and Applications.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Cyber Digital Twin and attain Employability through Participative Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to: Understand the basic concepts of Cyber Digital twin, and its working principle. [KNOWLEDGE] Explain Data modeling and development consideration in digital twin model for cloud and IoT technology.[COMPREHENSION] Observe digital twin-human behavior modeling in digital twin-optimization [COMPREHENSION] Show Risk Assessment-Digital twin reference model-Implementation. [APPLICATION] Apply Digital twin in various area like Manufacturing, Automotive and Healthcare.[APPLICATION]				
Course Content:					
Module 1	Introduction	Assignment	Theory	No. of Classes:09	
Introduction- Cyber Digital twin-definition-uses and benefits-need for digital twin-working principal Technology Digital thread-digital shadow-building blocks of digital twin-digital twin technology drivers and enablers.					
Module 2	Data Modelling Environment	Assignment	Theory	No. of Classes:10	
Types of digital twin-Based on Product and Process-Based on Functionality-Based on Maturity. Development considerations-Overview of Data-Modelling Environment. Modelling-model and data management-Managing data-implementing the model- Cloud and IOT technologies.					
Module 3	Digital Twin Optimization	Assignment	Theory	No. of Classes:10	
Cyber range vs digital twin-human behavior modeling in digital twin-optimization using digital twin-digital twin and cyber security-Techniques. Technologies-Industrial IOT and Digital Twin-simulation and digital twin-Machine learning and digital twin-virtual reality and digital twin-cloud technology and digital twin.					
Module 4	Risk Management and Applications	Assignment	Case Study	No. of Classes:10	
Digital twin and Risk Assessment-Digital twin reference model-Implementation-Development of risk assessment plan-Development of communication and control system-Development of digital twin tools-Integration-platform validation-Difficulties-Practical implications. Applications:					

Digital Twin in Manufacturing-Digital Twin in Automotive-Digital Twin in Healthcare-Digital Twin in Utilities-Digital Twin in Construction
Targeted Application & Tools that can be used: Ansys Twin Builder is a powerful solution for building, validation and deploying simulation-based systems and digital twins: Build, validate, and deploy digital twins. Digital twin models integrate real-world data. Increase efficiency with digital twins.
Project work/Assignment:
Project Assignment:
Text Book Clint Bodungen, Bryan Singer, Aaron Shbeeb, Kyle Wilhoit, and Stephen Hilt," Hacking Exposed Industrial Control Systems: ICS and SCADA Security Secrets & Solutions",1st Edition, ISBN: 978-1259589713. Eric D. Knapp and Raj Samani," Applied Cyber Security and the Smart Grid: Implementing Security Controls into the Modern Power Infrastructure ",1st Edition. Kevin Mitnick," The Art of Invisibility",2017.
References Michael E. AuerKalyan Ram B. Digital," Cyber-physical System and Digital Twins - Part of the Lecture Notes in Networks and Systems book series". Nassim Khaed, Bibin Pattel and Affan Siddiqui," Development and Deployment on the Cloud", Elsevier, 2020. Weblinks: https://puniversity.informaticsglobal.com/login?qurl=https://search.ebscohost.com%2flogin.aspx%3fdirect%3dtrue%26db%3dnlebk%26AN%3d1223875%26site%3dehost-live%26ebv%3dEB%26ppid%3dpp_xiii https://www.udemy.com/course/digital-twin-a-comprehensive-overview/
Topics relevant to "EMPLOYABILITY SKILLS":Digital thread-digital shadow-building blocks of digital twin, Digital Twin in Manufacturing-Digital Twin in Automotive, Cyber range vs digital twin-human behavior modeling in digital twin-optimization for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE3094	Course Title: Cyber Security Type of Course:1] Discipline	L- T-P- C	3-0	0	3
Version No.	1.1				
Course Pre-requisites	CSE3078				
Anti-requisites	NIL				

Course Description	This is a foundation program geared towards generating and enhancing awareness about cyber security challenges and the concept of Cyber Security and Cyber Ethics among the stakeholders to help them become responsible Cyber Citizens and participate safely and securely in the rapidly evolving information-age society. The important topics include: Network Security model, attacks, malware, firewall, IT act and Cyber forensics
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Cyber Security and attain Employability through Participative Learning techniques.
Course Out Comes	On successful completion of the course the students shall be able to: 1) Describe the basic concept of Cyber Security [Knowledge] 2)Classify different types of attacks for a scenario [Comprehension] 3) Prepare a mitigation policy for security threat [Comprehension] 4) Demonstrate Cyber Security tools [Application]
Course Content:	

Module 1	Introduction to Cyber Security	Quiz	Knowledge	10 Sessions

Topics
History of Internet, Cyber Crime, Information Security, Computer Ethics and Security Policies, Guidelines to choose web browsers, Securing web browser, Antivirus, Email security, Guidelines for setting up a Secure password , Cyber Security Threat Landscape, Emerging Cyber Security Threats, Cyber Security Techniques .

Module 2	Security in Networks	Assignment	Comprehension	10 Sessions

Topics:
Security in Networks – Concepts, threats in Network, website vulnerabilities, man in the middle attack, denial of Service attack, distributed denial of service attack, Firewalls – introduction and design, types of firewalls, personal firewalls, Program Security – non malicious program errors, malicious program flaws, virus and other malicious code, prevention of virus infection.
Assignment: Program Security – non malicious program errors.

Module 3	Smartphone Security	Assignment	Comprehension	12 Sessions

Topics:
Introduction to mobile phones, Smartphone Security, Android Security, IOS Security, Cyber Security Exercise, Cyber Security Incident Handling, Cyber Security Assurance, Guidelines for social media security, Tips and best practices for safer Social Networking ,Basic Security for Windows, User Account Password
Assignment: Social Media Security

Module 4	Ethical Issues in Cyber Security	Assignment	Programming/Data analysis task	9 Sessions

Legal and ethical issues in Cyber Security – protecting program and data, copyright, patents and trade secrets, IT Act, EDP audit, Overview of CISA, Privacy in computing, Cyber Forensic Tools – types and categories, Cyber forensic suite. Forensic tools: types, categories, open source proprietary

Assignment: Cyber Forensic Tools
Textbooks T1. Charles P. Pfleeger and Shari Lawrence Pfleeger, “Security in Computing”, Pearson Education, 5th Edition,2012 T2. Brooks, Charles J., Christopher Grow, Philip Craig, and Donald Short. Cybersecurity essentials. John Wiley & Sons, 2018 . T3. Dejey and Murugan, “Cyber Forensics”, Oxford University Press, 2018.
References R1. Charles P. Pfleeger, Shari Lawrence Pfleeger, Jonathan Margulies, Security in Computing, 5th Ed, Pearson Education, 2015. R2. Behrouz A Forouzan and Debdeep Mukhopadhyay, Cryptography and Network Security, 3rd Edition, Mc Graw Hill Publication, ISBN 13: 978-93-392-2094-5.2008. Web links: W1. https://www.youtube.com/watch?v=RYB4cG8G2xo W2. https://www.coursera.org/lecture/detecting-cyber-attacks/Cyber Security-UeDqJ ,https://presiuniv.knimbus.com/user#/home
Topics relevant to “EMPLOYABILITY SKILLS”: Mobile Security for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE 3101	Course Title: Digital Watermarking and Steganography Type of Course: Theory Only	L-T- P- C	3-0	0	3
Version No.	1.1				
Course Pre-requisites	CSE3078				
Anti-requisites	NIL				
Course Description	The purpose of this course is to enable the students to Comprehend the need for Digital Watermarking and Steganography and to develop the basic abilities of design and use Digital Watermarking and Steganography- information hiding technique. The course is both conceptual in nature and needs fair knowledge of Mathematical and computing. The course develops critical thinking and analytical skills. The course also enhances the abilities through assignments.				
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Digital Watermarking and Steganography and attain Employability through Participative Learning techniques.				

Course Out Comes	On successful completion of the course the students shall be able to: Discuss the Introduction of Digital Watermarking Classify the various Digital Watermarking techniques. Explain the Fundamentals of Steganography. Summarize the Steganographic Techniques.			
Course Content:				
Module 1	Introduction to digital watermarking	Assignment	Programming Task	7 Sessions
Topics Introduction to Digital Watermarking, Digital Steganography differences, brief History, Watermarking Applications, Classification in Digital Water Marking- Classification based on Characteristics, Classification based on Applications.				
Module 2	Types and tools of digital watermarking	Assignment	Programming Task	14 Sessions
Topics: Digital Watermarking Fundamentals, Least Significant bit substitution, Discrete Fourier Transform, Discrete Cosine Transform, Discrete Wavelet Transform, Random Sequence Generation, Chaotic Map, Error Detection Code. Spatial domain watermarking, frequency Domain watermarking, Fragile Watermark, Robust Water Mark, Watermarking attacks and Tools, Image processing techniques, Water Mark (software Analysis).				
Module 3	Introduction to Steganography	Assignment	Programming/Data analysis task	8 Sessions
Topics: Steganography, Watermarking vs Steganography, Need for Steganography, Application of Steganography, Methods of Hiding, properties of Steganography, Performance measure of Steganography Approaches, Mathematical Notation and Terminology, Steganography Software (S-tools, StegoDos, EzStezo, JSteg,Jpeg,).				
Module 4	Techniques of Steganography	Assignment	Programming/Data analysis task	7 Sessions
Substitution Systems and Bit-plane Tools- Least Significant Bit Substitution, Pseudorandom Permutations, Image Downgrading and Covert Channels, Practical Approach towards Steganography, Embedding of a secret Message.				
Textbooks T1. Frank Y Shih. Digital Water marking and Steganography Fundamentals and Techniques, 2017, CRC Press, second edition. T2. Jsjit. S. Suri Shivendra Shivani, Suneeth Agarwal, Handbook on Image based Security Techniques, CRC Press, 2018.				

References R1. Abid Yahya, Steganography Techniques for Digital Images, Springer, 2019. Weblinks: W1. Digital Watermarking | ScienceDirect (informaticsglobal.com) W2. Digital Watermarking and Steganography | ScienceDirect (informaticsglobal.com)
Topics relevant to "EMPLOYABILITY SKILLS": Building a data warehouse, data mining tools, for developing Employability Skills through Participative Learning Techniques. This is attained through assessment components mentioned in course handout.

Course Code: CSE3102	Course Title: Malware Analysis Type of Course:Discipline Elective in Cyber Security Basket		L-T- P-C	3 -0	0	3
Version No.	1.0					
Course Pre-requisites	CSE3078					
Anti-requisites	NIL					
Course Description	The purpose of the course is to explore malware analysis tools and techniques in depth. Understanding the capabilities of malware is critical to an organization's ability to derive threat intelligence, respond to information security incidents, and fortify defenses. This course builds a strong foundation for reverse-engineering malicious software using a variety of system and network monitoring utilities, a disassembler, a debugger, and other tools useful for turning malware inside-out.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Malware Analysis and attain Employability through Participative Learning techniques.					
Course OutComes	On successful completion of this course the students shall be able to: Understanding the nature of malware, its capabilities, and how it is combated through detection and classification. Apply the methodologies and tools to perform static and dynamic analysis on unknown executables. Analyze scientific and logical limitations on society's ability to combat malware.. Apply techniques and concepts to unpack, extract, decrypt, or bypass new anti analysis techniques in future malware samples.					
Course Content:						
Module 1	Introduction to MALWARE ANALYSIS		Assignment	Programming activity	12 Hours	
Topics: Introduction to malware, OS security concepts, malware threats, evolution of malware, malware typesviruses, worms, rootkits, Trojans, bots, spyware, adware, logic bombs, malware analysis, static malware analysis, dynamic malware analysis. Assignment: Brief study on types of spyware						

Module 2	Static Analysis		Assignment	Programming activity	11 Hours
Topics: X86 Architecture- Main Memory, Instructions, Opcodes and Endianness, Operands, Registers, Simple Instructions, The Stack, Conditionals, Branching, Rep Instructions, C Main Method and Offsets. Antivirus Scanning, Fingerprint for Malware, Portable Executable File Format, The PE File Headers and Sections, The Structure of a Virtual Machine, ReverseEngineering- x86 Architecture Assignment: Static analysis on malware (PeStudio & ProcMon)					
Module 3	Dynamic Analysis		Assignment	Programming activity	11 Hours
Topics: Live malware analysis, dead malware analysis, analyzing traces of malware- system-calls, api-calls, registries, network activities. Anti-dynamic analysis techniques anti-vm, runtime-evasion techniques, , Malware Sandbox, Monitoring with Process Monitor, Packet Sniffing with Wireshark Assignment: Demonstration of wireshark					
Module 4	Malware Functionality and Detection Techniques		Assignment	Programming activity	12 Hours
Topics: Downloader, Backdoors, Credential Stealers, Persistence Mechanisms, Privilege Escalation, Covert malware launching- Launchers, Process Injection, Process Replacement, Hook Injection, Detours, APC injection. Signature-based techniques: malware signatures, packed malware signature, metamorphic and polymorphic malware signature Non-signature based techniques: similarity-based techniques, machine-learning methods, invariant inferences Assignment: Packet malware signature					
Targeted Application & Tools that can be used: eCMAP (Certified Malware Analysis Professional)					
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course					
Any appropriate tool can be given to demonstrate.					
Text Book Michael Sikorski and Andrew Honig, 2012: " Practical Malware Analysis", No Starch Press. E-Resources W1. https://www.geeksforgeeks.org/introduction-to-malware-analysis/ W2. https://ine.com/learning/courses/malware-analysis W3: https://sm-nitk.vlabs.ac.in/					

References Jamie Butler and Greg Hoglund, 2005: “Rootkits: Subverting the Windows Kernel”, Addison-Wesley. Dang, Gazet and Bachaalany, 2014: “Practical Reverse Engineering”,Wiley. Reverend Bill Blunden, 2012: “The Rootkit Arsenal: Escape and Evasion in the Dark Corners of the System” Second Edition,Jones& Bartlett.
Topics relevant to “EMPLOYABILITY SKILLS”: X86 Architecture, Packet Sniffing, Wireshark, for development of Employability Skills through Participative Learning Techniques. This is attained through assessment components mentioned in course handout.

Course Code: CSE3063	Course Title: Privacy and Security in IoT Type of Course: Program Core & Theory only		L-T-P- C	3-0	0	3
Version No.	1.0				
Course Pre-requisites	CSE3078				
Anti-requisites	NIL				
Course Description	The purpose of this course is to enable the students to appreciate the need for cryptography and to identify the applications of cryptography in Internet of Things (IoT). The course is both conceptual and analytical in nature and needs fair knowledge of mathematics and computing. The course develops the critical thinking and analytical skills. The course also enhances the programming abilities through assignments.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Privacy and Security in IoT and attain Skill Development through Problem Solving Methodologies.				
Course Outcomes	On successful completion of this course the students shall be able to: Explain benefits of modern cryptographic algorithms Apply the Elliptic curve Diffie Hellman and digital signature algorithms to encrypt-decrypt , generate and verify the signatures Estimate the performance of ECC with other traditional cryptography algorithms.				
Course Content:					
Module 1	Introduction to Elliptic Curves	Quiz	Comprehension based Quizzes and assignments;	15 Classes	
Topics: Elliptic Curve Cryptosystems (ECC): Introduction to ECC, Method of Diophantus, Elliptic curves in Cryptography, Discrete Logarithms in Finite Fields, Elliptic Curve on a finite set of Integers, Definition of Elliptic curves,General form of a EC, Weierstrass Equation, Points on the Elliptic Curve (EC),The Abelian Group, Operations on ECC- Point addition, Point doubling.					

Module 2	Elliptic Curve Cryptosystems	Quizzes and assignments	Comprehension based Quizzes and assignments;	15 Classes
Topics: Elliptic Curve Cryptosystems (ECC): Public-Key Cryptosystems, Public-Key Cryptography, What Is Elliptic Curve Cryptography (ECC)?,Using Elliptic Curves In Cryptography, Generic Procedures of ECC, Example – Elliptic Curve Cryptosystem Analog to El Gamal, Diffie-Hellman (DH) Key Exchange, ECC Diffie-Hellman, Example – Elliptic Curve Diffie-Hellman Exchange, Elliptic Curve Digital Signature Algorithm (ECDSA) Why use ECC?, Security of ECC, Applications of ECC, Benefits of ECC.				
Module 3	IOT Protocols	Assignment and Lab projects with presentation	Project implementations in software, batch wise presentations	10 Classes
Topics: IoT Communication model and Protocols : Communication/Transport Protocols: Bluetooth. Data Protocols: Message Queue Telemetry Transport (MQTT), Constrained Application Protocol (COAP), Advanced Message Queuing Protocol (AMQP), Extensible Messaging and Presence Protocol (XMPP), Introduction, Principle of RFID, Components of an RFID system.				
Targeted Application & Tools that can be used: Application areas are to secure crypto currency- Bitcoin, Ethereum and Ripple using ECC in key agreement, digital signatures. Professionally Used Software: elliptic2 : https://www.graui.de/code/elliptic2/				
Project work/Assignment:				
Each batch of students (self-selected batch mates) will identify projects from searching on Google, and implement with the most suitable 2 or 3 NIST /SECP curves Project Assignment: Assignment: 1] Collect the running time of ECC on different standard NIST curves. Assignment 2: Prepare a compressive report on the efficiency of NIST Vs SECP curves.				
Textbook(s): I. Blake, G. Seroussi, N. Smart, Elliptic Curves in Cryptography , Cambridge University 2020 Arshdeep Bagha, Vijay Madisetti, “Internet of Things - A hands on approach”, Universities Press, 2021.				
References Joseph H Silver man The Arithmetic of Elliptic Curves: Springer; 2nd Edition April 2016 Darrel Hankerson, Scott Vanstone, Alfred J. Menezes Guide to Elliptic Curve Cryptography Springer 2018				
Topics related to development of “SKILL DEVELOPMENT”: IOT Protocols, Elliptic Curve Cryptosystem, for Skill Development through Participative Learning Techniques. This is attained through assessment components as mentioned in the course handout.				

Course Code: CSE2038	Course Title: Privacy and Security in Online Social Media	L-T- P-C	3	0	0	3
Version No.	1.0					
Course Pre-requisites	CSE3078					
Anti-requisites	NIL					
Course Description	Objective of this course is to make students learn the basics of privacy and security in online social media and develop ability to understand the importance of privacy in anyone's life and their consequences if it is in peril. This course is both conceptual and analytical in nature that would help the student to predict the effects of any activity on Social Media. The students should have prior knowledge of some Social media platforms. After successful completion of the Course, the students would acquire knowledge to protect themselves from the online data theft on social media from attacker.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Privacy and Security in Online Social Media and attain Employability through Participative Learning techniques.					
Course Out Comes	On successful completion of the course the students shall be able to: 1] Recognize the significance of the Privacy and how to protect it [Knowledge] 2] Summarize the privacy and security Encryption for Peer to Peer Social Networks. [Comprehension] 3] Understand the function of stealing Reality and K-Anonymity. [Knowledge] 4]Use the Link Reconstruction attack in privacy Social Networks. [Application]					
Course Content:						
Module 1	ANALYSIS OF PRIVACY IN SOCIAL NETWORKS	Assignment	Knowledge			8 Sessions
Topics: Three-Layered Framework-Characteristics Used to Analyze Social Web Privacy-Privacy Issues Related to Social Web Users-Privacy Issues Related to Service Providers-Security and Privacy for Digital Facets-Identifiable Facets-Private Facets. Assignment: Find real world problems and suggest solutions.						

Module 2	ENCRYPTION FOR PEER-TO-PEER SOCIAL NETWORKS	Assignment	Comprehension	8 Sessions

Topics:
Essential Criteria for the P2P Encryption Systems-Existing P2P OSN Architectures-Evaluations of Existing Encryption Schemes Based on Our Criteria-Broadcast Encryption-Predicate Encryption.
Assignment: - Survey of Unethical Behavior and Influencing factors.

Module 3	STEALING REALITY AND K-ANONYMITY	Quiz	Comprehension	11 Sessions

Topics:
Stealing Reality- Social Attack Model- Social Learnability- k-Anonymity- k-Degree Anonymity- k-Neighborhood
Anonymity- k- Automorphism- k-Isomorphism-L-diversity- Attack Model and Privacy Guarantee- Insights from an ℓ-Diversified Graph.

Module 4	PRIVACY IN SOCIAL NETWORKS- LINKS RECONSTRUCTION ATTACK	Assignment/Case study	Application	11 Sessions

Privacy in Social Networks- Link Prediction- Feature Extraction- Communities Datasets- Electronic Currencies- Anonymity- The Bit coin System- The Transaction Network- The User Network- Anonymity Analysis- Integrating Off-Network Information. Use Case and the Threat Model- Use Case for Private Record Linkage- Use Case for Privacy-Preserving Record Linkage- Assignment: - The Bit coin Faucet- Voluntary Disclosures- TCP/IP Layer Information- Context Discovery- Flow and Temporal Analyses.

Text Book / References

T1. Yaniv Altshuler, Yuval Elovici, Armin B. Cremers Nadav Aharony, Alex Pentland," Security and Privacy in Social Networks", Springer Publisher,2012,1st Edition

Online Resources: -

W1: https://presiuniv.knimbus.com/user#/searchresult?searchId=Privacy%20and%20Security%20in%20Online%20Social%20Media%20&curPage=0&layout=list&sortFieldId=none&topresult=false

W2: https://onlinecourses.nptel.ac.in/noc21_cs28/preview

Topics relevant to "EMPLOYABILITY SKILLS": Link Prediction, features extraction, for developing Employability Skills through Participative Learning Techniques. This is attained through the assessment component mentioned in the course handout.

Course Code: CSE 2010	Course Title: Operating Systems Type of Course: Theory Only		L-T-P- C	3-0	0	3
Version No.	2.0				
Course Pre-requisites	CSE2019				
Anti-requisites	Nil				
Course Description	Operating systems being central to computing activities, this Course provide understanding of the functions and functional modules of operating systems. The design and implementation of Operating systems is also covered.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Operating Systems and attain SKILL DEVELOPMENT through PARTICIPATIVE LEARNING techniques				
Course Out Comes	On successful completion of the course the students shall be able to: CO1: Describe the fundamental concepts of operating Systems [Knowledge Level] CO2: Demonstrate various CPU scheduling algorithms. [Application Level] CO3: Apply synchronization tools to a given problem. [Application Level] CO4: Discuss various memory management techniques.[Comprehension Level]				
Course Content:					
Module 1	Introduction	Assignment	Data Analysis task	7 Sessions	
Topics: Overview of OS and design, Introduction- Computer System Architecture, Operating System Structure, Operations, Computing environments, OS implementation, Operating System Services, User and OS interface, System Calls and its types, System Programs [loaders, linkers], UNIX/LINUX commands: System Programs[CLI/SHELL, loaders, linkers]					
Module 2	Process Management	Assignments	Analysis, Data Collection	10 Sessions	
Topics: Process Concept, Operations on Processes, Inter Process Communication, Introduction to threads - Multithreading Models, Process Scheduling– Basic concepts, Scheduling Criteria, Scheduling Algorithms: FCFS, SJF, RR, Priority, Multilevel Queue, Linux Scheduler, CASE STUDY: Linux Scheduler					
Module 3	Process Synchronization and Deadlocks	Quiz	Case studies / Case let	10 Sessions	
Topics: The Critical-Section Problem- Peterson's Solution, Synchronization hardware, Test and Set, Mutex locks, Semaphores, Advanced Synchronization Problems-IBM Quality and implementation, Monitors. Introduction to Deadlocks, Deadlock Characterization, Methods for handling deadlock: Deadlock Prevention and Implementation, Deadlock Avoidance and Implementation Deadlock detection & Recovery from Deadlock.					

Module 4	Memory Management and File Systems	Assignment	Case Studies / Case let	11 Sessions
Topics: Introduction to Memory Management, Swapping, Contiguous and Non-Contiguous Memory Allocation, Segmentation, Paging - Structure of the Page Table – Demand Paging – Page Replacement, Allocation of Frames – Thrashing. RAID Structures: Disk Scheduling, RAID LEVELS				
Targeted Application & Tools that can be used: UNIX				
Project work/Assignment: Mini Project: Demonstration of File Handling techniques/Memory and Disk Management.				
Text Book T1: Silberschatz A, Galvin P B and Gagne G, “Operating System Concepts”, 9th edition Wiley, 2013.				
References R1. William Stallings, “Operating systems”, Prentice Hall, 7th Edition, Pearson, 2013. R2. Andrew S Tanenbaum and Albert S Woodhull, “Operating Systems Design and Implementation”, 3rd Edition, Pearson, 2015. E book link R1: Details for: Operating systems : internals and design principles › Koha online catalog E book link R2: Details for: Operating systems : design and implementation › Koha online catalog R3 Web resources: 1)https://www.youtube.com/watch?v=vBURTt97EkA&list=PLBlnK6fEyqRiVhbXDGLXDk_OQAeuVcp2O 2)https://www.youtube.com/watch?v=3-ITLMMeeXY&list=PL3pGy4HtqwD0n7bQfHjPnsWzkeR-n6mkO 3)https://www.youtube.com/watch?v=HW2Wcx-ktsc 4)https://www.youtube.com/watch?v=MYgmmJJfdBg 5) https://puniversity.informaticsglobal.com:2229/login.aspx				
Topics relevant to “Skill Development”: Page replacement algorithms, Scheduling policies, Deadlocks for Skill Development through Participative Learning techniques. This is attained through the assessment component mentioned in the course handout.				

Course Code: CSE2003	Course Title: Discrete Mathematics Type of Course: Program Core& Theory Only	L-T- P-C	4-0	0	4
Version No.	2.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	This course highlights the basics of discrete structures and develop ability to solve problems involving mathematical logic, sets, functions, relations, principles of counting, pigeonhole principles, recurrence relations, Principles of Inclusion and Exclusion. forces, and moments with their applications in allied subjects. It is a prerequisite for several Courses involving Compiler Design, Artificial Intelligence. This course is both conceptual and analytical in nature that would help the student to use the concepts of discrete structures to solve and prediction of data analytics. The students should have prior knowledge of basic mathematics pursue the Course. After successful completion of the Course, the students would acquire knowledge to solve problems involving mathematical logic, sets, functions, relations, principles of counting, pigeon hole principles, recurrence relations, Principles of Inclusion and Exclusion with an emphasis on real-world engineering applications and problem solving.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Discrete Mathematics and attain SKILL DEVELOPMENT through PROBLEM SOLVING Methodologies techniques.				
Course Out Comes	On successful completion of the course the students shall be able to: 1] Describe a logic sentence in terms of predicates, quantifiers, and logical connectives. 2] Solve problems on Functions and Relations using basic principles of Set Theory. 3] Explain the concepts of Boolean Algebra. 4] Apply basic counting techniques to combinatorial problem.				
Course Content:					
Module 1	Foundations of Logics and Proofs	Assignment	Problem Solving	10 Sessions	
Topics: Propositional Logic, Propositional Logic Equivalences, Inference rules, Normal forms, Introduction to Proofs, Resolution by Refutation, Predicates and Quantifiers, Introduction to Proofs. Assignment: Problems.					

Module 2	Basic Structures: Sets, Functions, Relations	Assignment	Problem Solving	10 Sessions
Topics: Sets and set-operations, Venn Diagram, Cardinality of Sets, Functions: Types, Invertible Functions, Composition, Sequences and Summations, Relations and their properties & representations, Equivalence Relations, Closure of Relations. Assignment: Problems and applications				
Module 3	Posets, Lattices and Boolean Algebra	Assignment	Problem Solving	10 Sessions
Topics: Partial ordering, Posset, Hasse Diagram, Lattices & Algebraic structures, Basic properties of algebraic systems by lattices, Distributive lattices, complement of an element in a lattice, Boolean lattice & Boolean algebra,Topological Sorting. Assignment: Problems and Applications				
Module 4	Principles of Counting Techniques	Assignment	Problem Solving	12 Sessions
Topics: Number Theory: Integers and Division, GCD, Chinese Remainder Theorem, Solving Congruences, Pigeon Hole Principle, Mathematical Induction, Generalized Permutations and Combinations, Recurrence Relations, Applications of Recurrence Relations, Generating Functions, Principle of Inclusion and Exclusion, Applications of Inclusion and Exclusion. Assignment: Problems and Applications				
Targeted Application & Tools that can be used: NIL				
Project work/Assignment:				
Problems on all the topics and relevance with field of computer science				
Text Book T1. Kenneth H. Rosen, “Discrete Mathematics and its Applications”, McGraw-Hill,s 7th Edition,2018.				
References R1: Susanna EPP, “Discrete Mathematics with Applications”, Cengage Learning, 4th Edition, 2010 R2. Thomas Koshy, “Discrete Mathematics with Applications”, Elsevier, India, 2009. R3: Discrete mathematics for Computer Scientists and Mathematicians, Paperback (Rs. 533), Joel Mott, Abraham Kandel, Theodore Baker; Pearson Education India; 2 edition (2015), ISBN-13: 978-9332550490 Weblinks: W1: https://puniversity.informaticsglobal.com:2229/login.aspx W2: https://www.youtube.com/playlist?list=PLBlnK6fEyqRhqJPDXcvYlLfXPh37L89g3				
Topics relevant to development of “SKILL”: Mathematical Logic, Permutation and Combinations for Skill Development through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.				

<table>
<tr><td>Course Code: CSE3006</td><td>Course Title: Artificial Intelligence and Neural Networks

Type of Course: Theory only</td><td>L-T- P-C</td><td>3 -0</td><td>0</td><td>3</td></tr>
<tr><td>Version No.</td><td colspan="5">2.0</td></tr>
<tr><td>Course Pre-requisites</td><td colspan="5">NIL</td></tr>
<tr><td>Anti-requisites</td><td colspan="5">NIL</td></tr>
<tr><td>Course Description</td><td colspan="5">This Course highlights the basic principles in Artificial Intelligence. It will cover representation schemes, problem solving paradigms, , search strategies, knowledge representation, probabilistic reasoning, elements of Artificial Neural Network.
Topics include: AI methodology and fundamentals, intelligent agents, search algorithms, game playing, probabilistic reasoning in AI, Elements of Artificial Neural Network, models of neuron, architecture and learning laws. Several assignments will be given to enable the student to gain practical experience in using these techniques.</td></tr>
<tr><td>Course Objective</td><td colspan="5">The objective of the course is to familiarize the learners with the concepts of Artificial Intelligence and Neural Networks and attain EMPLOYABILITY SKILLS through PROBLEM SOLVING techniques</td></tr>
<tr><td>Course Out Comes</td><td colspan="5">On successful completion of the course the students shall be able to:
CO 1: Apply techniques of Knowledge Representation [Application]
CO 2: Apply Artificial Intelligence techniques for problem solving [Application]
CO3: Understand the models of Neuron [Knowledge]
CO4: Explain the basic elements of Artificial Neural Network [Comprehension]</td></tr>
<tr><td>Course Content:</td><td colspan="5"></td></tr>
<tr><td>Module 1</td><td>Introduction to Artificial Intelligence and Knowledge Based Systems</td><td>Assignment</td><td>Theory</td><td colspan="2">14 Sessions</td></tr>
<tr><td colspan="6">Topics: Introduction to Artificial Intelligence, Definitions, foundation, History and Applications; Agents: Types of Agent, Structure of Intelligent agent and its functions; Introduction to Knowledge representation, approaches, Knowledge-Based Systems;Frame Structures, Conceptual graphs. Logic- Propositional Logic, First order Logic</td></tr>
<tr><td>Module 2</td><td>Problem Solving by Searching</td><td>Assignment</td><td>Theory</td><td colspan="2">13 Sessions</td></tr>
<tr><td colspan="6">Topics: Introduction to Problem space and state space, State space search techniques solving problems by searching: Classical Search, Adversarial Search, and Constraint Satisfaction Problems, Introduction to reasoning. Probabilistic reasoning in AI, Bayesian networks, Hidden Markov Model, Certainty factors, rule-based systems and Demster Shafer Theory.</td></tr>
</table>

Module 3	Introduction to Artificial Neural Network	Assignment	Theory	9 Sessions
Topics :Introduction to learning, Forms of Learning: Statistical learning, Supervised Learning, Unsupervised Learning, Reinforcement Learning, Learning rules of AI, Learning Laws. Historical Development of Neural Network Principles, Characteristics of Neural Networks and Artificial Neural Networks: Terminology, Models of Neuron				
Module 4	Essentials of Artificial Neural Network	Assignment	Theory	07 Sessions
Topics: Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Single-Layer Feed forward Networks, Multilayer Feed forward Networks, Types of Application				
Targeted Application & Tools that can be used: Use of PowerPoint software for lecture slides and use of Google's Colab cloud service https://www.tutorialspoint.com/google_colab/index.html for executing and sharing of lab exercises.				
Text Books Stuart J. Russell and Peter Norvig, Artificial intelligence: A Modern Approach, (2002) 3rd edition, Upper Saddle River, Prentice Hall. Yegnanarayana, Bayya. Artificial neural networks. PHI Learning Pvt. Ltd., 2009.				
References N J Nilsson (1997).Artificial Intelligence- A new synthesis, Elsevier Publications. N J Nilsson (1982). Principles of Artificial Intelligence, Springer. Elaine Rich, Kevin Knight and ShivashankarB.Nair, "Artificial Intelligence", TataMcGraw-Hill, Third Edition, 2009[R.N.]. Patterson, D. W. (1990). Introduction to artificial intelligence and expert systems. Englewood Cliffs, Prentice Hall. Luger, G. F. (2002). Artificial intelligence: Structures and strategies for complex problem solving, Harlow, Pearson Education. Simon Haykin(2009),Neural Networks and Learning Machines ,Third Edition, PHI LaureneFausett(2004) , Fundamentals Of Neural Networks, Prentice-Hall, Inc,USA E-References https://presiuniv.knimbus.com/user#/home				
Topics relevant to development of "EMPLOYABILITY SKILLS": Statistical Concepts for Knowledge representation. Classical Search Constraint Satisfaction Problems Conceptual graphs Multilayer Feed forward Networks for developing Employability Skills through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.				

Course Code: CSE1001	Course Title: Problem Solving using JAVA Type of Course: Integrated		L-T- P-C	2-0	2	3
Version No.	2.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	This course introduces the core concepts of object-oriented programming. This course has theory and lab component which emphasizes on understanding the implementation and application of object-oriented programming paradigm. It helps the student to build real time secure applications by applying these concepts and also for effective problem solving. The students interpret and understand the need for object oriented programming to build applications.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Problem-Solving using JAVA and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques				
Course Out Comes	On successful completion of the course the students shall be able to: C.O. 1: Describe the basic programming concepts. [Knowledge] C.O. 2: Apply the concept of classes, objects and methods to solve problems. [Application] C.O. 3: Apply the concept of arrays and strings. [Application] C.O. 4: Implement inheritance and polymorphism building secure applications. [Application] C.O. 5: Apply the concepts of interface and error handling mechanism. [Application]				
Course Content:					
Module 1	Basic Concepts of Programming and Java	Assignment	Data Collection/Interpretation	12 Sessions	
Topics: Introduction to Principles of Programming: Process of Problem Solving, Java program structure, Download Eclipse IDE to run Java programs, Sample program, Data types, Identifiers, Variables, Constants in java, Operators, Assignments and Expression, Basic Input/ Output functions, Control Statements: Branching and Looping.					
Module 2	Classes, objects, methods and Constructors	Case studies / Case let	Case studies / Case let	12 Sessions	
Topics: Classes, Objects and Methods: Introduction to object Oriented Principles, defining a class, adding data members and methods to the class, access specifiers, instantiating objects, reference variable, accessing class members and methods. Static Polymorphism: Method overloading, constructors, constructor overloading, this keyword, static keyword, Nested classes, Accessing members in nested classes.					
Module 3	Arrays, String and String buffer	Quiz	Case studies / Case let	14 Sessions	
Topics: Arrays: Defining an Array, Initializing & Accessing Array, Multi –Dimensional Array, Array of objects. String: Creation & Operation. String builder class, methods in String Buffer.					
Module 4	Inheritance and Polymorphism	Quiz	Case studies / Case let	14 Sessions	
Topics: Inheritance: Defining a subclass, Types of Inheritance, super keyword. Dynamic Polymorphism: Method overriding. Final keyword: with data members, with member functions					

and with class. Abstract keyword: with data members, with member functions and with class, Exception handling.				
Module 5	Input & Output Operation in Java	Quiz	Case studies / Case let	14 Sessions
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.				
List of Laboratory Tasks: P1 - Problem Solving using Basic Concepts. P2 - Problem Solving using Basic Concepts and Command Line Arguments. P3 - Programming assignment with class, objects, methods and Constructors. P4 - Programming assignment with method overloading. P5 - Programming assignment with constructor overloading. P6 - Programming assignment with Static members and static methods. P7 - Programming assignment with Nested classes. P8 - Programming assignment using Arrays. P9 - Programming assignment using Strings. P10 - Programming assignment using String Builder. P11 - Programming assignment using Inheritance and super keyword. P12 - Programming assignment using Method overriding and Dynamic method invocation. P13 - Programming assignment using Final keywords. P14 - Programming assignment using Abstract keywords. P15 - Programming assignment using Interface. P16 - Programming assignment using Interface. P17 - Programming assignment CharacterStream Classes P18 - Programming assignment Read/Write Operations with File Channel				
Targeted Application & Tools that can be used : JDK /eclipse IDE/ net Beans IDE.				
Text Book T1 Herbert Schildt, “The Complete Reference Java 2”, Tata McGraw Hill Education.				
References R1: Cay S Horstmann and Cary Gornell, “CORE JAVA volume I-Fundamentals”, Pearson R2: James W. Cooper, “Java TM Design Patterns – A Tutorial”, Addison-Wesley Publishers. E book link R1: http://rmi.yaht.net/bookz/core.java/9780134177373-Vol .pdf E book link R2: Java(tm) Design Patterns: A Tutorial([PDF] [7qmsenjl97t0] (vdoc.pub) Web resources https://youtube.com/playlist?list=PLu0W_9lII9agS67Uits0UnJyrYiXhDS6q https://puniversity.informaticsglobal.com:2229/login.aspx				
Topics relevant to development of “Skill Development”: Static Polymorphism Method overloading, constructors constructor overloading this keyword static keyword and Inner classes Inheritance and Polymorphism. for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.				

Course Code: CSE 1002	Course Title: Innovation Project-Arduino Using Embedded C Type of Course: Lab only		L-T-P- C	0 -0	4	2
Version No.	2.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	The course deals with the fundamental concepts of 'C' and Embedded C, problem-solving using C in a systematic way to read and write the C code and to implement them on an Arduino prototype board. The course will also demonstrate how to assemble various sensory devices and program them using the Arduino platform as a basis. Students will have the opportunity of gaining real-world experience in handling IOT devices involving hardware and software combinations. The course also offers in-depth knowledge of designing, developing, coding, and implementing Arduino projects.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Innovation Project-Arduino Using Embedded C and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques				
Course Out Comes	On successful completion of the course the students shall be able to: Write a program using Arduino programming language using Embedded 'C'. Explain the main features of the Arduino prototype board Demonstrate the hardware interfacing of the peripherals to Arduino system. Demonstrate the functioning of live various projects carried out using Arduino system.				
Course Content:					
Module 1	Basics of C, Branching and looping	Quiz	Problem Solving	9 Sessions	
Topics: Structure of C programs, Variables, Keywords, Datatypes, declaration, and Initialization Decision Making and Branching: if, if-else, else-if ladder, switch statement. Decision making and looping: for, while, and do-while statements.					
Module 2	Arrays, functions, strings	Quiz	Problem Solving	8 Sessions	
Topics: Arrays: Introduction ,one dimensional array, two dimensional array, Functions: User defined functions, Categories, searching and sorting Strings: Introduction, string handling functions.					
Module 3	Structures and Pointers		Problem Solving	7 Sessions	
Topics: Structure definition, syntax and application of structures, definition of pointers ,syntax, pass –by-reference.					

Module 4	Introduction to Arduino and Sensory Devices	Project Development	Modeling and Simulation task	6 Sessions

Topics:
Introduction to Arduino, Pin configuration and architecture, Device and platform features, Concept of digital and analog ports, Familiarizing with Arduino Interfacing Board, API's , Introduction to Embedded C and Arduino platform, Arduino Datatypes and variables, Arduino i/o Functions, Arduino Communications, Arduino IDE, Various Cloud Platforms.

List of Laboratory Tasks

Targeted Application & Tools that can be used:
Making it a reality (Arduino Projects) :
Projects will include but not limited to :
1) Intelligent home locking system.
2) Intelligent water level management system.
3) Home automation using RFID.
4) Real time clock-based home automation.
5) Intelligent Automatic Irrigation System
Professionally Used Software: Arduino IDE.

Project work/Assignment:

Quiz1- Fundamentals of C-Programs,
Quiz2- Basics of Embedded C and Arduino
Project work

Text Book
T1 E Balagurusamy "Programming in ANSI C" , Mc Graw Hill Publications,7th Edition.
T2 Monk Simon "Programming Arduino: Getting Started with Sketches", Mc Graw Hill Publications Second Edition.

References
R1 https://www.tutorialspoint.com/arduino/index.html.
R2 https://create.arduino.cc/projecthub/projects/tags/sensor.

Web resources: https://3dprinting.com/what-is-3d-printing.

hthttps://puuniversity.informaticsglobal.com

Topics relevant to the development of "Skill Development":
Basic Concepts of C-Programming
Embedded 'C' and Arduino
Problem solving
Creative Thinking
Team work
Prototype Development.
for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE 2066	Course Title: Computer Graphics	L-T- P-C	3 - 0	0	3
Version No.	2.0				
Course Pre-requisites					
Anti-requisites	NIL				
Course Description	This course demonstrates the basics of graphics and visualization in computer science, enabling students to appreciate how the computer system displays graphics and visual effects on a display device. The course uses assignments to develop visualization skills of the students. The key topics covered in this course include algorithms for drawing basic primitives, transformations, viewing and clipping for both 2D and 3D objects along with Bezier curves and Surfaces.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Computer Graphics and attain Skill Development through Participative Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to: CO 1: Illustrate algorithms for drawing basic primitives like Point, Line and Polygon. CO 2: Illustrate algorithms for performing 2D Geometric Transformations, viewing and clipping. CO 3: Illustrate algorithms for performing 3D Geometric Transformations, clipping. CO 4: Describe plane Bezier curves and Bezier surfaces.				
Course Content:					
Module 1	Overview: Basics of Computer Graphics	Assignment	No. of Sessions 13		
Topics: An Introduction Graphics System: Computer Graphics and Its Types, Application of computer graphics. Graphics Systems: Video Display Devices, Raster Scan Systems, Random Scan Systems, Raster graphics Vs. Random Graphics, Flat panel Displays – emissive and non-emissive displays, Input Devices, logical inputs, Graphics tools and software Line drawing algorithms - Midpoint, DDA, Bresenham's. Circle generation algorithms - Midpoint circle drawing algorithm, Bresenham's circle algorithm. Basics of 2D and 3D objects. Assignment: Numerical problems based on Line and circle drawing algorithm					
Module 2	2D Geometric Transformations, viewing and clipping	Assignment	No. of Sessions : 12		
2D Geometric Transformations: Basics of translation, scaling, rotation, reflection and shearing. Matrix representations and homogeneous coordinates for translation, scaling, rotation, reflection and shearing. 2D Composite transformations, General pivot point rotation and scaling. Introduction to OpenGL concepts and libraries. OpenGL geometric transformations functions. Basics of 2D viewing and Clipping: Basics of viewing and Clipping, 2D viewing pipeline, Viewing Transformation systems, Normalization and Viewport Transformation					

Types of clipping: point, Line and polygon clipping, 2D line clipping algorithms: cohen-sutherland line clipping, Liang-Barsky line clipping algorithm, polygon fill area clipping: Sutherland-Hodgeman polygon clipping algorithm, OpenGL 2D viewing and clipping functions. Assignment: Numerical problems based on 2D transformations.			
Module 3	3D Geometric Transformations, clipping:	Mini-project	No. of Sessions : 11
3D Geometric Transformations: 3D translation, rotation, scaling, reflection and shearing, composite 3D transformations, OpenGL 3D geometric transformations functions, Transformations between 3D Coordinate Systems. Basics of 3D Viewing and Clipping: 3D viewing concepts, 3D viewing coordinate parameters, Transformation from world to viewing coordinates, Projection transformation, parallel projections - orthogonal projections and oblique projections, parallel-Projection Transformation Matrix, perspective projections, Perspective-Projection Transformation Matrix Assignment: Based on the activities in the link: pu.informatics.global			
Module 4	Plane curves and surfaces	Quiz	No. of Classes : 9
Plane Curves: Plane Curves representation, Nonparametric Curves, Parametric Curves, Curved Surfaces, Quadric Surfaces. Basics of Curves and surfaces: Interpolation and Approximation Splines, Parametric Continuity Conditions, Geometric Continuity Conditions, Spline Specifications. Representation of Space Curves, Cubic Splines, Bezier Curves, Parametric Cubic Curves, Quadric Surfaces, Bezier Surfaces. OpenGL Quadric-Surface and Cubic-Surface Functions			
Targeted Application & Tools that can be used: Application Area: Game design and Animation Tools/Simulator/Software used: Visual Studio 17.0 / CodeBlock			
Text Book: T1: Donald D. Hearn, M. Pauline Baker and Warren Carither, Computer Graphics with OpenGL, Pearson Education, 4th Edition, 2021			
Reference Books: R1. John F Hughes, Andries van Dam, Steven K. Feiner, James D. Foley, Morga, Computer Graphics: Principles and Practice, Pearson Education India, Third Edition, 2013 R2. John Kessenich, Graham Sellers, Dave Shreiner , OpenGL Programming guide , Addison-Wesley Ninth Edition,2016 R3. Edward Angel and Dave shreiner, Interactive Computer Graphics, A top down approach with shader based OpenGL, Pearson Education, 6th Edition, 2018 E-References https://presiuniv.knimbus.com/user#/home			
Topics relevant to development of “Skill Development”: Line drawing algorithms (DDA, Bresenham’s) Graphics tools and software Liang-Barsky line clipping algorithm cohen-sutherland line clipping OpenGL 2D viewing and clipping functions for Skill Development through Participative Learning techniques. This is attained through assessment component mentioned in course handout.			

Course Code: CSE2027	Course Title: Fundamentals of Data Analytics Type of Course: Theory only		L-T- P-C	3-0	0	3
Version No.	2.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	Fundamentals of Data Analytics is designed for inspecting, cleansing, transforming, and modeling data with the goal of discovering useful information, and supports in decision-making. The course begins by covering Data extraction, pre-processing, and transformation. It delivers the basic statistics and taught in an intuitive way to analysis the data. This course will help the students to apply the knowledge on data analysis to a wide range of applications.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Fundamentals of Data Analytics and attain SKILL DEVELOPMENT through PROBLEM SOLVING Methodologies.					
Course Out Comes	On successful completion of the course the students shall be able to: 1) Explain different types of data and variables. 2) Interpret data using appropriate statistical methods. 3) Demonstrate the collection, processing and analysis of data for any given application and Illustrate various charts using visualization methods. 4) Apply the Data Analysis techniques by MAT Lab					
Course Content:						
Module 1	Introduction to Data Analysis	Assignment	Data Collection , data analysis	6 Sessions		
Topics: Introducing Data, overview of data analysis: Data in the Real World, Data vs. Information, The Many “Vs” of Data, Structured Data and Unstructured Data, Types of Data, Data Analysis Defined, Types of Variables, Central Tendency of Data, Scales of Data, Sources of Data, Data preparation: Cleaning the data, Removing variables, Data Transformations.						
Module 2	Statistical functions	Assignment	Data analysis	8 Sessions		
Topics: Descriptive Statistics, Inferential Statistics (T test, Z test,), Probability Uses In Business and Calculating Probability from a Contingency Tables.						
Module 3	Data Collection, Processing and Analysis	Project based MAT Lab	MAT LAB	6 Sessions		
Topics: Collection of Primary Data(Observation Method, Interview Method, Collection of Data through Questionnaires ,Collection of Data through Schedule) Difference between Questionnaires and Schedules, Some Other Methods of Data Collection, Collection of						

Secondary Data ,Difference between Survey and Experiment Processing Operations, correlation. Introduction: Overview, Classification, Regression, Building a prediction model				
Module 4	Data Visualization and Charting Prediction	Project MAT Lab	Data Collection, visualization and data analysis	6 Sessions
Topics: Types of charts and their significance, Organize data interactively with tables , Visualizing data with charts, Analyzing data with pivot tables, Build presentation ready dashboards and turn real world data into business insights, Tracking trends and making forecasts, Interpretation and report writing				
Module 5	Introduction to MATLAB	Project MAT Lab	Data analysis with optimization	12 Sessions
Topics: Defining Categories of Data, Analyzing Groups within Data, Importing Data from Multiple Files, Review Project ,Images and 3-D Surface Plots, Importing Unstructured Data				
Targeted Application & Tools that can be used: Application Area are Decision making in business, health care, financial sector, Medical diagnosis etc... MAT Lab				
Text Books Glenn J. Myatt and Wayne P. Johnson, “Making Sense of Data I: A Practical Guide to Exploratory Data Analysis and Data Mining Paperback”, Import, 22 July 2014. William Menke And Joshua Menke,”Environmental Data Analysis with MAT Lab”, Elsevier, 2012. https://matlabacademy.mathworks.com/details/matlab-for-data-processing-and-visualization/mlvi				
References Paul McFedries , “Excel Data Analysis-visual blue print”,Wiley 4th Edition September 2019. Gerald Knight, “Analyzing Business Data with Excel”,O′Reilly; 1st Edition,13 January 2006. https://people.highline.edu/mgirvin/AllClasses/348/348/AllFilesBI348Analytics.htm Hansa Lysander,”Data Analysis and business modelling using Microsoft Excel”, PHI, 2017. Web Links: https://presiuniv.knimbus.com/user#/home				
Topics relevant to development of “FOUNDATION SKILLS”: Statistical Concepts for data, visualization techniques. Data collection for project based assignments. Inferential Statistics (T test, Z test) Probability Calculation for Skill Development through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.				

Course Code: CSE2008	Course Title: Programming in Java (Object Oriented Programming) Type of Course: Program Core	L-T-P- C	1 -0	4	3

	Theory and Laboratory Integrated				
Version No.	1.0				
Course Pre-requisites	-.				
Anti-requisites	NIL				
Course Description	This course introduces the core concepts of object-oriented programming by using Java. This course has theory and lab component which emphasizes on understanding the implementation and application of object-oriented programming paradigm. It helps the student to build real time secure applications by applying these concepts and also for effective problem solving. The students interpret and understand the need for object oriented programming to build applications				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Programming in Java and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques.				
Course Out Comes	On successful completion of the course the students shall be able to: Write programs using basic concepts in JAVA Apply the concept of arrays, strings, polymorphism & inheritance for building desktop Implement interface & packages for building secure applications Apply the concepts of error handling mechanism and multithreading. Apply the concepts of Collections to develop high performance applications.				
Course Content:					
Module 1	INTRODUCTION	Assignment	Programming	No. of Classes:10	
Topics: Introduction to Object Oriented Programming, Java Evolution, and How Java differs from C++, Features of Java, Java Environment: Installing JDK (JVM, JRE), Java Source File Structure, Compilation and Execution of Java Programs. TOKENS: Data types, Variables, Operators, Control Statements, Command Line Arguments. CLASSES, OBJECTS, AND METHODS: Defining a class, access specifiers, instantiating objects, reference variable, accessing class members and methods, constructors, method overloading, static members, static methods, inner class, Wrapper class , Autoboxing and Unboxing,					
Module 2	Arrays, Strings, inheritance and Polymorphism	Assignment	Programming	No. of Classes:6	
Topics:Defining an Array, Initializing & Accessing Array, Multi –Dimensional Array. Operation on String, Mutable & Immutable String, Creating Strings using StringBuffer or StringBuilder. Defining a subclass, types of Inheritance, method overriding, super keyword, dynamic method invocation, dynamic polymorphism, usage of final abstract and this keyword.					
Module 3	Interfaces, Packages and Exception Handling	Assignment	Programming	No. of Classes:8	

Topics:Defining interfaces, extending an interface, Implementing interfaces. Organizing Classes and Interfaces in Packages, Package as Access Protection, Defining a Package, Library Packages, import packages.
Exception handling: Introduction to Exceptions, Difference between Exceptions & Errors, Types of Exception. Handling Exceptions: Use of try, catch, finally, throw, throws. User Defined Exceptions, Checked and Un-Checked Exceptions.

Module 4	MULTITHREADED PROGRAMMING:	Assignment	Programming	No. of Classes:12

Topics: Introduction to threads, life cycle of a thread, creating threads, extending the Thread Class, Implementing the "runnable" interface. Thread Priority, Thread synchronization, Inter communication of Threads

Module 5	Collections and Graphic Programming(AWT,Swings)	Assignment	Mini Project	No. of Classes:12

Introduction to Collections, Classification of Collection. Introduction to List, Map and Set Interface, Introduction to Applets.
Introduction to the abstract window toolkit (AWT), Frames, Event-driven programming: Mouse and Key Event handling.
Introduction to Swings, JFC, Swing GUI Components and Layout Manager.

List of Laboratory Tasks:
Experiment N0 1: Programming assignment with class, objects and basic control structures. (Application:
Build a basic menu driven application)
Level 1: Programming scenarios which use control structures to solve simple case scenarios (Eg: Check if a number is odd or even)

Level 2: Programming assignment which will build menu driven application by identifying the class and its relevant methods.

Experiment No. 2: Programming assignment using Arrays and Strings. (Application: Develop application on Matrices, build String based application like Telephone directory)

Level 1: Programming scenarios which build single dimensional and multidimensional array, apply the different methods to operate on strings.

Level 2: Programming assignment which will manipulate the data stored in matrices and identify the appropriate usage String methods.

Experiment No. 3: Programming assignment using Inheritance and Polymorphism

Level 1: Programming scenarios which use the concept the polymorphism for method overloading. Scenarios which apply the concept of inheritance (identifying parent, child class and its relationship)
Level 2: Programming assignment which build application which have same functions in different forms.
Experiment No. 4: Programming assignment using Exception Handling
Level 1: Programming assignment on building applications using built in Exceptions.
Level 2: Programming assignment on building application using user defined Exceptions.

Experiment No. 5: Programming assignment using Multithreading. (Eg: Building an application which performs different arithmetic operations and sharing the resources using threads) Level 1: Programming scenarios to build a thread, assign priority and use the thread methods to perform operations Level 2: Programming scenarios for building synchronized applications. Experiment No. 8: Programming assignment using Collections Level 1: Programming Scenarios to apply and use the Collection framework (List, SET, Map, Interface) Experiment No. 9: Programming assignment to build GUI Applications. Level 1: Programming Scenarios to build GUI for a given scenario using AWT and Swings concepts.
Targeted Application & Tools that can be used: Platform independent Application Development Secure Application Development Data Mining Operating Systems. Database Management Systems Banking software Automobiles Mobile Applications Tools: JDK (Java Development Tool kit), Integrated Development Environment (IDE), Apache NetBeans, Eclipse.
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course
After completion of each module a programming based Assignment/Assessment will be conducted. A scenario will be given to the student to be developed as a Java Application. On completion of Module 5, student will be asked to develop a Mini Project using the GUI functionalities.
Text Book Cay S Horstmann and Cary Gornell, “CORE JAVA volume I-Fundamentals”, Pearson. Cay S Horstmann and Cary Gornell, “CORE JAVA volume II-Advanced Features”, Pearson.
References 1)Herbert Schildt, “The Complete Reference Java 2”, Tata McGraw Hill Education. 2)James W. Cooper, “Java TM Design Patterns – A Tutorial”, Addison-Wesley Publishers.
Topics relevant to development of “Skill Development”: Real time application development using OOPs concept, Naming and coding convention for Project Development for Skill development through Experiential Learning Techniques. This is attained through assessment component mentioned in the course handout.

Course Code: CSE3066	Course Title: Mobile Application for IoT Type of Course: Program Core& Theory Only	L-T- P-C	3-0	0	3
Version No.	1.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	Mobile Application is the essential part for IoT infrastructure, which helps in understanding the architectural overview of IOT. The purpose of this course is to expose the students to understand the IoT Reference Architecture and Real World Design Constraints along with various IOT protocols. This course is both conceptual and analytical in nature that would help the student to predict the effects of forces and its motion while carrying out creative design functions.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Mobile and Application for IoT and attain Skill Development through Participative Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to: Able to understand the application areas of IOT Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks Able to understand building blocks of Internet of Things and characteristics. Learn about android application development				
Course Content:					
Module 1	Overview	Assignment	Programming Task	9 Sessions	
Topics: IoT-An Architectural Overview Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management					
Assignment: Case study on Business processes in IoT.					
Module 2	Basic Design	Assignment	Data Collection/Excel	10 Sessions	

Topics:
Introduction Basics of embedded systems design Embedded OS - Design constraints for mobile applications, both hardware and software related Architecting mobile applications user interfaces for mobile applications touch events and gestures Achieving quality constraints performance, usability, security, availability and modifiability.
Assignment: Recent trends In mobile application development

Module 3	IOT mobile apps	Assignment	Programming/Data analysis task	9 Sessions

Topics:
IoT Mobile App Development Trends In 2020 - Role of Mobile Apps in revolutionizing the world of IoT - UX / UI design for IoT Mobile apps - challenges of UX/UI design for IoT applications - practice tips on design for IoT mobile apps IoT App Design Solutions
Assignment: Challenges faced during mobile application development

Module 4	TECHNOLOGY I-ANDROID	Assignment	Programming/Data analysis task	10 Sessions

Topics:
Introduction Establishing the development environment Android architecture Activities and views Interacting with UI Persisting data using SQLite Packaging and deployment Interaction with server side applications Using Google Maps, GPS and Wifi Integration with social media applications.

Targeted Protocols & Tools that can be used:
Bluetooth, ZigBee, LoRa, NBIoT, WiFi, and Thread

Text Book
T1: “From machine to machine to the internet of things: Introduction to the new age of intelligence”, 1st edition, Academic press, 2014.
T2: Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012

References
R1: Bernd Scholz- -3-642-19156-5 e-ISBN 978-3- 642-19157-2, Springer
R2: Andrea Goldsmith, “Android in practice,” Cambridge University Press, 2005
Weblinks:
W1: https://relevant.software/blog/mobile-iot-apps/
W2: https://medium.com/@its.mattfitzgerald/top-14-iot-mobile-app-development-trends-to-expect-in-2020-7fd7718155dc
W3:https://puniversity.informaticsglobal.com/login?qurl=https://search.ebscohost.com%2flogin.aspx%3fdirect%3dtrue%26db%3dnlebk%26AN%3d1223875%26site%3dehost-%2520live%26ebv%3dEB%26ppid%3dpp_xiii

Topics relevant to “SKILL DEVELOPMENT”:
Wifi integration and social media analysis for developing Skill Development through Participative Learning Techniques. This is attained through the assessment component mentioned in the course handout.

Course Code: CSE3055	Course Title: Wireless communication in IOT Type of Course: Program Core& Theory Only	L-T- P-C	3 -0	0	3
Version No.	1.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	Wireless communication system is the essential part for IoT infrastructure, which acts as the bridge for dual directional communication for data collection and control message delivery. The purpose of this course is to expose the students to understand the fundamentals of wireless network and problems related to real-world scenarios. This course is both conceptual and analytical in nature.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Wireless communication in IOT and attain Skill Development through Participative Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to: To understand the fundamentals of wireless networks Analyze the standards of IoT which employed for wireless networks Explain the use of various wireless technologies in IoT Design and develop various applications of IoT				
Course Content:					
Module 1	Cellular standards	Assignment	Programming Task		9 Sessions
Topics: Cellular carriers and Frequencies, Channel allocation, Cell coverage, Cell Splitting, Microcells, Picocells, Handoff, 1st, 2nd, 3rd and 4th Generation Cellular Systems (GSM, CDMA, GPRS, EDGE,UMTS), Mobile IP, WCDMA					
Assignment: Case study on generation cellular systems.					
Module 2	Radio Frequency (RF) Fundamentals	Assignment	Data Collection/Excel		10 Sessions

Topics:
Introduction to RF & Wireless Communications Systems, RF and Microwave Spectral Analysis, Communication Standards, Understanding RF & Microwave Specifications. Spectrum Analysis of RF Environment, Protocol Analysis of RF Environment, Units of RF measurements, Factors affecting network range and speed, Environment, Line-of-sight, Interference, Defining differences between physical layers- OFDM.
Assignment: Determination of RF and Microwave spectral Analysis

Module 3	WLAN: Wi-Fi Organizations and Standards	Assignment	Programming/Data analysis task	9 Sessions

Topics:
IEEE, Wi-Fi Alliance, WLAN Connectivity, WLAN QoS & Power-Save, IEEE 802.11 Standards,802.11- 2007,802.11a/b/g, 802.11e/h/I,802.11n
Assignment: Protocols on WLAN connectivity

Module 4	Wi-Fi Hardware & Software	Assignment	Programming/Data analysis task	10 Sessions

Topics:
Access Points, WLAN Routers, WLAN Bridges, WLAN Repeaters, Direct-connect Aps, Distributed connect Aps, PoE Infrastructure, Endpoint, Client hardware and software, Wi-Fi Applications

Targeted Protocols & Tools that can be used:
Bluetooth, ZigBee, LoRa, NBIoT, WiFi, and Thread

Text Book
T1: Wireless Communications – Principles and Practice; by Theodore S Rappaport, Pearson Education Pte. Ltd.
T2: Wireless Communications and Networking; By: Stallings, William; Pearson Education Pte. Ltd.

References
R1:Bluetooth Revealed; By: Miller, Brent A, Bisdikian, Chatschik; Addison Wesley Longman Pte Ltd., Delhi 4. R2:Wilson , “Sensor Technology hand book,” Elsevier publications 2005. 5.
R3: Andrea Goldsmith, “Wireless Communications,” Cambridge University Press, 2005
Weblinks:
W1: https://pianalytix.com/wireless-communication-protocols-in-iot/
W2: https://behrtech.com/blog/6-leading-types-of-iot-wireless-tech-and-their-best-use-cases/

Topics relevant to “SKILL DEVELOPMENT”:
GSM, CDMA for developing Skill Development through Participative Learning Techniques. This is attained through the assessment component mentioned in the course handout.

Course Code: CSE 3053	Course Title: Big Data Analytics for IoT	L-T-P- C	1-0	4	3
Version No.	1.0				
Course Pre-requisites					
Anti-requisites	NIL				
Course Description	The course covers basic concepts for IOT Analytics, collection of data for IOT, Integration of IOT with Cloud, Big Data Environments. Students can learn about applying geospatial analytics and applying machine learning to the IOT data. The course also covers the organization of the IOT data, cost benefits of using IOT and review of IOT in various sectors.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Big Data Analytics for IoT and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques.				
Course Outcomes	On successful completion of the course the students shall be able to: CO1: Demonstrate IOT Data Analytics and machine learning application in IOT (Apply) CO2: Apply appropriate Hadoop Ecosystem tools to perform data analytics for a given problem (Apply) CO3: Examine concepts of cloud based IOT, Big data and IOT (Apply) CO4: Illustrate techniques and strategies for data collection and Geospatial Analytics to IOT Data (Apply)				
Course Content:					
Module 1	IOT Analytics	Assignment		5 sessions	
Introduction – IOT Data, Challenges of IOT analytics Applications – IOT analytics Lifecycle and Techniques. IOT Cloud and Big Data Integration – Cloud based IOT platform – Data Analytics for IOT, IOT devices in different domains. IOT Analytics for the Cloud.					
Module 2	Hadoop Ecosystem Tools			5 sessions	
Introduction – Big Data and Big Data Analytics – Hadoop Ecosystem – Hadoop Distributed File System (HDFS) – MapReduce – YARN Architecture – PIG Architecture – Apache HIVE – Mahout – Apache Spark – Apache HBase –Apache Zookeeper.					
Module 3	Overview of AWS and Thingworx	Assignment		5 sessions	
AWS overview - AWS key services for IOT analytics. Thingworx overview. Creating an AWS Cloud Analytics environment.					
Module 4	Geospatial Analytics to IOT Data	Case Study	Data Collection and Analysis		

Strategies and Techniques in Data collection: Designing data processing for analytics – Applying big data to storage for Geospatial.

List of Practical Tasks:

Experiment 1:[Module 1]

Level 1: Installation of Raspbian OS,working basic commands on raspberry pi

Level 2: Demonstrate to obtain the temperature using DHT22 sensors .

Experiment 2: [Module 1]

Level 1: Design and Simulate the RADAR SYSTEM Using Arduino and display on the serial monitor using ultrasonic sensor/PIR WITH &WITH OUT BUZZER/Servo motor

Level 2: using a raspberry pi to Demonstrate to find the distance using ultrasonic sensor hc- sr04

Experiment 3: [Module 1]

Level 1 : using a raspberry pi Set the connections of healthcare sensors

Level 2: using a raspberry pi to Demonstrate to find the ECG, Temperature, etc using Healthcare sensors

Experiment 4: [Module 2]

Level 1: Hadoop Single node cluster installation on ubuntu

Level 2: Hadoop Multiple node cluster installation, windows installation

Experiment 5: [Module 2]

Level 1: Basic hadoop commands and Word count analysis for given dataset

Level 2: Analysis on particular matching word on huge dataset

Experiment 6: [Module 2]

Level 1: Basic hadoop commands and Stock analysis on given dataset

Level 2: Analysis with max, min, average functions on particular field with missing values

Experiment 7: [Module 2]

Level 1: Basic hadoop commands and Temperature analysis on given dataset

Level 2: Analysis with max, min, average functions on particular field with missing values

Experiment 8: [Module 3]

Level 1: Working on hive commands

Level 2: Apply bucketing technique to bring out the difference between partitioning and bucketing

Experiment 9: [Module 3]

Level 1: Working on Hbase commands .

Level 2: Apply Hbase commands on Insurance database/employee dataset.

Experiment 10: [Module 3]

Level 1: Installation of spark and word count analysis

Level 2: Using RDD and FlatMap count how many times each word appears in a file and write out a list of words whose count is strictly greater than 4 using Spark

Experiment 11: [Module 4]

Level 1: Temperature Data stored in cloud through IoT devices

Level 2: Retrieve the data set for cloud and Apply data analytics techniques

Experiment 12: [Module 4]

Level 1: Healthcare Data stored through IoT sensors in Cloud

Level 2: Retrieve the data set for cloud and Apply data analytics techniques

Targeted Application & Tools that can be used: Hadoop ecosystem tools, Thingworx , AWS Cloud
Project work/Assignment:
Student will be asked to carry out a mini project integrating IoT & data Analytics.
Text Book T1. Big Data Analytics, Seema Acharya, Subhashini Chellappan, Wiley., 2nd Edition, 2019. T2. Analytics for the Internet of things,Andrew Minteer. Packt publishing, 1st Edition,2017. T3. Big Data and the Internet of Things, Robert Stackowiak, Art Licht, Venu Mantha and Louis Nagode, Apress, 2nd Edition, 2020
References R1. IOT and Analytics in Agriculture.,Prasant Kumar Pattnaik, Raghvendra Kumar, Souvik Pal, S. N. Panda. Springer, First Edition, 2020. R2. Building blocks for IOT Analytics. Internet-of-Things Analytics. John Soldatos (Editor). River Publisher Series in Signal Image and Speech Processing.2020 (iii) web resources W1. NPTEL: https://onlinecourses.nptel.ac.in/noc20_cs92/preview W2. Coursera: https://www.coursera.org/learn/big-data-introduction W3. EDX: https://www.edx.org/course/big-data-fundamentals W4. E-book Link : https://www.wiley.com /en-us/Internet+of+Things+and+ Data+ Analytics + Handbook -p-9781119173625 https://presiuniv.knimbus.com/user#/home
Topics relevant to “SKILL DEVELOPMENT”: Organize IOT data – Linked analytics datasets – Managing data lakes for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: CSE2032	Course Title: Introduction to Fog Computing	L-T-P- C	3-0	0	3
Version No.	1.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	The course will provide a solid base for understanding the challenges and problems underlying the design and development of fog computing systems and applications. Thus, this course will teach how to specify, design, program, analyze and implement such systems and applications. Fog computing is a decentralized computing infrastructure in which data, compute, storage and applications are located somewhere between the data source and the cloud. Like edge computing, fog computing brings the advantages and power of the cloud closer to where data is created and acted upon. Many people use the terms fog computing and edge computing interchangeably because both involve bringing intelligence and processing closer to where the data is created. This is often done to improve efficiency, though it might also be done for security and compliance reasons.				
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Introduction to Fog Computing and attain SKILL DEVELOPMENT through Problem Solving techniques.				
Course Out Comes	On successful completion of this course the students shall be able to: Understand the basic principles and concepts of fog computing systems and their relation to other models such as Cloud Computing and Near-Far computing. Understand the challenges of developing fog based applications and middleware, and the possible solutions. Specifically, understand the issues mostly related to fog computing, namely: introduction to the fog programming model and related models, security, offloading, Software Defined Network, load balancing, communication, containers and orchestration, application areas. Able to decide which is the best approach for a particular problem regarding the design and development of a fog computing system. Able to design and implement an application using containers. Able to measure and analyze the performance of a fog computing application.				
Course Content:					
Module 1	INTRODUCTION TO FOG COMPUTING	Assignment	Programming activity	11 Sessions	
Topics: Fog Computing, Characteristics, Application Scenarios, Issues and challenges. Fog Computing, Internet of Things-Pros and Cons-Myths of Fog Computing -Need and Reasons for Fog Computing Fog Computing and Edge Computing-IoT , FOG, CloudBenefits.					
Module 2	ARCHITECTURE	Assignment	Programming activity	10 Sessions	

Topics: Communication and Network Model, Programming Models, Fog Architecture for smart cities, healthcare and vehicles. Fog Computing Communication Technologies: Introduction ,IEEE 802.11,4G,5G standards, WPAN, Short-Range Technologies, LPWAN and other medium and Long-Range Technologies.				
Module 3	FOG PROTOCOLS AND COMMUNICATION TECHNOLOGIES	Assignment	Programming activity	10 Sessions
Topics: Fog Protocol-Fog Kit- Proximity Detection Protocols- DDS/RTPS computing protocols, Introduction ,IEEE 802.11,4G,5G standards, WPAN, Short-Range Technologies, LPWAN and other medium and Long-Range				
Module 4	MANAGEMENT AND ORCHESTRATION	Assignment	Programming activity	11 Sessions
Topics: Management and Orchestration of Network Slices in 5G, Fog, Edge, and Clouds: Introduction, Background , Network Slicing in 5G , Network Slicing in Software-Defined Clouds, Network Slicing Management in Edge and Fog , Middleware for Fog and Edge Computing, Need for Fog and Edge Computing Middleware, Clusters for Lightweight Edge Clouds , IoT Integration , Security Management for Edge Cloud Architectures. Fog Computing Realization for Big Data Analytics: Introduction to Big Data Analytics, Data Analytics in the Fog, Prototypes and Evaluation.				
Module 5	FOG COMPUTING REQUIREMENTS WHEN APPLIED TO IOT	Assignment	Programming activity	11 Sessions
Topics: Fog computing requirements when applied to IoT: Scalability,Interoperability,Fog-IoT: architectural model, Challenges on IoT Stack Model via TCP/IP Architecture, DataManagement,filtering,EventManagement,DeviceManagement,cloudification,virualization, security and privacy issues. Integrating IoT,Fog, Cloud Infrastructures: Methodology , Integrated C2F2T Literature by Modeling Technique re by Use-Case Scenarios , Integrated C2F2T Literature by Metrics.				
Targeted Application & Tools that can be used: Case Study: Wind Farm - Smart Traffic Light System, Wearable Sensing Devices, Wearable Event Device ,Wearable System, Demonstrations , Post Application Example . . Event Applications Example.				
Text Book Fog Computing: Theory and Practice by Assad Abbas, Samee U. Khan, Albert Y. Zomaya. Fog and Edge Computing: Principles and Paradigms (Wiley Series on Parallel and Distributed Computing) by RajkumarBuyya and Satish Narayana Srirama. Sensors, Cloud, and Fog: The Enabling Technologies for the Internet of Things Paperback by SudipMisra , Subhadeep Sarkar , Subarna Chatterjee. Web Links: Fog Computing: Theory and Practice by Assad Abbas, Samee U. Khan, Albert Y. Zomaya. Fog Computing | Wiley Online Books				

Fog and Edge Computing: Principles and Paradigms (Wiley Series on Parallel and Distributed Computing) by RajkumarBuyya and Satish Narayana Srirama.
Fog and Edge Computing: Principles and Paradigms | Wiley

Sensors, Cloud, and Fog: The Enabling Technologies for the Internet of Things Paperback by SudipMisra , Subhadeep Sarkar , Subarna Chatterjee.

Sensors, Cloud, and Fog: The Enabling Technologies for the Internet of (routledge.com)

References

FlavioBonomi, Rodolfo Milito, Jiang Zhu, SateeshAddepalli, ―Fog Computing and Its Role in the Internet of Things‖, MCC'12, August 17, 2012, Helsinki, Finland. Copyright 2012 ACM 978- 1-4503-1519-7/12/08... $15.00.
Shanhe Yi, Cheng Li, Qun Li, ―A Survey of Fog Computing: Concepts, Applications and Issues‖, Mobidata'15, ACM 978-1-4503-3524-9/15/06, DOI: 10.1145/2757384.2757397, June 21, 2015, Hangzhou, China..
Amir M. Rahmani ,PasiLiljeberg, Preden, Axel Jantsch, ―Fog Computing in the Internet of Things - Intelligence at the Edge‖, Springer International Publishing, 2018.
Ivan Stojmenovic, Sheng Wen, "The Fog Computing Paradigm: Scenarios andSecurity Issues", Proceedings, Federated Conference on Computer Science and Information Systems, pp. 1–8, 2014
Fog Computing: Helping the Internet of Things Realize its Potential Amir VahidDastjerdi and RajkumarBuyya, University of Melbourne.
Multi-Dimensional payment Plan in Fog Computing with Moral Hazar,YanruZhang,Nguyen H. Tran,DusitNiyato, and Zhu Han,IEEE,2016

Topics relevant to "SKILL DEVELOPMENT":
Fog Computing requirements for SKILL DEVELOPMENT through Problem Solving Techniques. This is attained through the assessment component mentioned in course handout.

Course Code: CSE3217	**Course Title: Data Structure and Web Development with Python** **Type of Course: Lab Integrated**	**L- T- P- C**	0	0	2	1
Version No.	1.0					
Course Pre-requisites	CSE1005					
Anti-requisites	NIL					

Course Description	Data Structure and Web Development with Python course provides students with a comprehensive understanding of fundamental data structures and their implementation using Python, alongside essential web development skills. It begins with an exploration of core data structures such as arrays, stacks, queues, linked lists, trees, and graphs, focusing on their design, applications, and efficiency. Students gain hands-on experience in implementing these data structures to manage and manipulate data effectively. In the second half, the course delves into web development, teaching students to create dynamic and interactive web applications using frameworks like Flask and Django. By combining data structures with web development techniques, this course equips students with the knowledge and practical experience necessary for real-world software development and data management applications.			
Course Objectives	The course aims to equip students with a comprehensive understanding of fundamental data structures and their implementation in Python, alongside essential web development skills using frameworks like Flask and Django, to solve real-world software and data management challenges and to improve the learners' EMPLOYABILITY SKILLS through PROBLEM SOLVING METHODOLOGIES			
Course OutComes	1. Illustrate Linear Data Structures application. [Apply] 2. Examine Non-Linear Data Structures application. [Apply] 3. Design Web Applications Using Python Frameworks. [Create]			
Course Content:				
Module 1	**Linear Data Structures using Python**	Quiz and Assignment	Applications	**10 Sessions**
	Topics: Linked Lists: Introduction, Definition, Types, Implementing Singly-Linked List, Inserting Nodes, Traversing, Deleting Nodes, Representing Doubly-Linked List, Implementing Doubly-Linked List, Inserting and Deleting Nodes in Doubly-Linked List Stacks: Defining Stack, Operations, Implementing Stacks (Array and Linked List), Applications, Function Calls, UNDO List, Checking Parentheses, Evaluating Expressions, Infix to Postfix Conversion. Queues: Defining Queue, Operations, Implementing Queue (Array and Linked List), Inserting and Deleting in Linked Queue, Circular Queue, Double-Ended Queue (Deque), Priority Queue.			
Module 2	**Non Linear Data Structures using Python**	Quiz and Assignment	Applications	**10 Sessions**
	Topics: Trees: Definitions, Terminology, Binary Trees, Representing and Traversing Binary Trees (Inorder, Preorder, Postorder), Binary Search Trees: Implementation, Searching, Inserting, Deleting, Iterative Traversals, Problem Solving with Trees, Introduction to Graphs:			

	Components and Representation, Graph Traversals: BFS and DFS, Graph Operations: Cycles and Shortest Path, Problem Solving with Graphs.			
Module 3	**Web Development using Python**	Project based assignment	Applications	**10 Sessions**
	Topics: Django Framework Overview, Setting Up Django, Models and ORM, Views and Templates Integration, Static Files, Mini Project in Django, Flask Framework Overview			
	Targeted Application & Tools that can be used: Application areas: Decision-making in business, Healthcare applications, Financial sector analysis, Medical diagnosis. Tools: Python, R Studio, Microsoft Excel, Flask, Django, Graphana, Dashbuilder			
	Project work/Assignment: Mention the Type of Project /Assignment proposed for this course			
1.	2. Implement various data structures such as stacks, queues, and linked lists in Python. 3. Develop a Python program to create a binary search tree, perform insertions and deletions, and solve shortest path problems using graphs. 4. Create a simple Django-based web application for managing student records, including adding, updating, and deleting student information. 5. Use Flask and Python to collect and visualize COVID-19 data using dynamic charts and graphs. 6. Collect data on agricultural production and sales, and predict future trends using linear regression in Python.			
	Text Book: 1. Data Structures and Algorithms in Python, Wiley, Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, 2021. 2. Django for Beginners, William S. Vincent, 2020. 3. Flask Web Development, O'Reilly, Miguel Grinberg, 2nd Edition, 2018.			
	References: 1. Problem Solving with Algorithms and Data Structures Using Python, Franklin, Beedle & Associates, Bradley N. Miller, David L. Ranum, 1st Edition, 2013. 2. Introduction to Algorithms, MIT Press, Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, 3rd Edition, 2022. 3. Python Web Development with Django, Addison-Wesley, 2009.			

Course Code: CSE 3097	Course Title: Web Security Type of Course: Integrated	L-T-P- C	2-0	2	3
Version No.	1				
Course Pre-requisites	CSE2011				
Anti-requisites	NIL				
Course Description	The purpose of this course this course is to introduce you to the field of web security by understanding web functionality and various security validations. The web is our gateway to many critical services and is quickly evolving as a platform to connect all our devices. Web vulnerabilities are growing on a year-to-year basis and designing secure web applications is challenging. The course covers fundamental concepts of web security principles, web vulnerability and exploitation, various attacks on web applications, and a few basic topics on web encryption.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Web Security and attain Skill Development through Experiential Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to: Define the fundamentals of web applications and validation [Knowledge] Recognize the significance of password and authentication in web applications [Comprehension] Explain the importance of session management in web [Comprehension] Apply web attack techniques to find vulnerabilities in web applications [Application]				
Course Content:					
Module 1	Introduction	Quiz	Comprehension based Quiz on web fundamentals	10 Sessions	
Topics: Web Functionality, Encoding Schemes, Mapping the Application - Enumerating the Content and Functionality, Analyzing the Application Bypassing, Client-Side Controls: Transmitting Data Via the Client, Capturing User Data, Handling Client-Side Data Securely - Input Validation, Blacklist Validation - Whitelist Validation - The Defense in-Depth Approach - Attack Surface Reduction, Rules of Thumb, Classifying and Prioritizing Threats.					
Module 2	Web Application Authentication	Assignment	Comprehensive based assignment on Web authentication	11 Sessions	
Topics: Authentication Fundamentals- Two Factor and Three Factor Authentication, Web Application Authentication- Password Based, Built-in, HTTP, Single Sign-on, Custom Authentication, Validating credentials - Secured Password Based Authentication: Attacks against Password, Importance of Password Complexity - Design Flaws in Authentication Mechanisms - Implementation Flaws in Authentication Mechanisms - Securing Authentication.					

Module 3	Session Management &Web Security Principles	Quiz	Comprehension based Quiz on web security techniques.	11 Sessions
Topics: Need for Session Management, Weaknesses in Session Token Generation, Weaknesses in Session Token Handling, Securing Session Management; Access Control: Access Control Overview, Common Vulnerabilities, Attacking Access Controls, Securing Access Control. Origin Policy, Exceptions, Browser security Principles- Cross Site Scripting and Cross Site Request Forgery, File Security Principles: Source Code Security, Forceful Browsing, Directory Traversals.				
Module 4	Web Application Vulnerability	Assignment	Comprehension based assignment on web vulnerabilities	10 Sessions
Topics: Attacking data-stores and backend components- Injecting into Interpreted Contexts, injecting into SQL, NoSQL, XPath, LDAP, Injecting OS Commands, Manipulating File Paths, Injecting into XML Interpreters, Injecting into Back-end HTTP Requests, Injecting into Mail Services, Attacking application logic-real world logic flaws, Attacking users-Cross site scripting-varieties of XSS,XSS attacks in action, finding and exploiting XSS vulnerabilities, preventing XSS attacks, Other techniques-cookie based Attacks, HTTP Header Injection				
List of Laboratory Tasks: Task 01: Practical knowledge of known vulnerabilities in CGI, LAMP stacks, REST APIs cross-site scripting Task 02: HTTP and setting up stacks, the various types of databases Access Controls, Vulnerabilities Task 03: SQL injection and prevention Task 04: Study of web authoring tools Task 05: Testing web applications Task 06: Cross site request forgery attack lab Task 07: Web tracking				
Targeted Application & Tools that can be used Wordpress tool can be used for building websites with possible vulnerabilities. Tools such as Nmap and Nessus can be used for web attack demonstration.				
Project work/Assignment:				
Assignment: Group assignment to identify and write different web exploits to demonstrate vulnerabilities in web applications.				
Text Book T1 Dafydd Stuttard, Marcus Pinto, “The Web Application Hacker’s Handbook”, Willey Publishing Inc.				
References				

R1 B. Sullivan, V. Liu, and M. Howard, “Web Application Security”, A B Guide. New York: McGraw-Hill Education, 2011. R2 Web Application Security: Exploitation and Countermeasure for Modern Web Applications, by Andrew Hoffman E book link R1: https://presiuniv.knimbus.com/user#/home E book link R2 : https://presiuniv.knimbus.com/user#/home R3 Web resources: NPTEL / Swayam Link : Introduction to Information Security I, IIT Madras https://nptel.ac.in/courses/106106129 PU Library Link : https://puniversity.informaticsglobal.com/login
Topics relevant to “EMPLOYABILITY SKILLS”: Session Management &Web Security Principles and Web Application vulnerability for Skill Development through Experiential Learning Techniques. This is attained through the assessment component mentioned in the course handout.

	Course Code: CSE3342	**Course Title: Ethical Hacking Type of Course: Core Subject**	**L-T-P-C**	1	0	4	3
Version No.	1.3						
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 and attain to improve the learners' Employability Skills by using Experiential Learning techniques.						
Course Out Comes	On successful completion of this course the students shall be able to: 1] Extrapolate the importance of ethical hacking. 2] Determine the various techniques for performing reconnaissance 3] Categorize various types of system scanners and their functions. 4] Identify the function of sniff on a network.						

Course Content:					
Module 1	**Introduction to Hacking**	Assignment		Programming activity	**12 Hours**
Topics: Introduction to Hacking-Important Terminologies - Asset - Vulnerability - Penetration Test - Vulnerability Assessments versus Penetration Test - Penetration Testing Methodologies - Categories of Penetration Test. **Assignment:** Different phase methodologies on penetration testing					
Module 2	**Linux Basics**	Assignment		Programming activity	**10 Hours**
Topics: Major Linux Operating Systems - File Structure inside of Linux - BackTrack - Changing the Default Screen Resolution - Some Unforgettable Basics. **Assignment:** Penetration testing distribution					
Module 3	**Information Gathering Techniques**	Assignment		Programming activity	**11 Hours**
Topics: Sources of Information Gathering - Copying Websites Locally - NeoTrace - Xcode Exploit Scanner - Interacting with DNS Servers - DNS Cache Snooping - DNS Lookup with Fierce - SNMP - SMTP. **Assignment:**Domain internet groper					
Module 4	**Target Enumeration and Port Scanning Techniques**	Assignment		Programming activity	**13 Hours**
Topics: Target Enumeration and Port Scanning Techniques - Host Discovery - Scanning for Open Ports and Services - Types of Port Scanning - Vulnerability Assessment. **Assignment:** Demonstrations for port scanning					

List of Laboratory Tasks:
Experiments:

1. Command Prompt
2. Wireshark
3. Netscantool
4. OWZAP
5. Neotrace
6. NMAP
7. AngryIPScanner
8. Maltigo
9. Readnotify
10. HTTRACK
11. Yougetsignal

12. CAPSA Portable Network Analyzer 13. Samspade 14. Shodan 15. Oputils 16. Brupsuit 17. Zenmap 18. OSINT 19. John the ripper
Targeted Application & Tools that can be used: Application Software and open source tools like SQL Injection and NIDS,HIDS.
Text Book 1.Rafay Baloch, 2014: "Ethical Hacking and Penetration Testing Guide" Apple Academic Press Inc**.**
References 1.Gary Hall, Rrin Watson, 2016: "Hacking: Computer Hacking, Security Testing,Penetration Testing, and Basic Security". 2.James Corley, Kent Backman, Michael Simpson, 2010: "Hands-On Ethical Hacking and Network Defense", 2nd Edition, Cengage Learning. **E-Resources**: (1) Ethical Hacking in 12 Hours - Full Course - Learn to Hack! - YouTube
Topics relevant to "EMPLOYABILITY SKILLS": CEH Certification Ethical hacking techniques for **Employability skills** through **Experiential Learning techniques**. This is attained through the assessment component mentioned in course handout.

Course Code: CSE 2007	Course Title: Analysis of Algorithms Type of Course: THEORY Only	L- T-P-C	3	0	0	3
Version No.	2.0					
Course Pre-requisites	NIL					
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 Analysis of Algorithms and attain Skill Development through Problem Solving Methodologies.					

Course Out Comes	On successful completion of the course the students shall be able to: 1. Classify the types of asymptotic notations. 2. Discuss the Brute Force Technique used for solving a problem. 3. Explain divide and conquer technique for searching and sorting problems. 4. Discuss the Dynamic Programming Algorithm used for solving a problem. 5. 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. 2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson. 3. Donald E. Knuth, "The Art of Computer Programming", Volumes 1and 3 Pearson. E-Resources NPTEL course – https://onlinecourses.nptel.ac.in/noc19_cs47/preview https://www.coursera.org/learn/analysis-of-algorithms https://puuniversity.informaticsglobal.com				
Topics relevant to "SKILL DEVELOPMENT": knapsack, prims, kruskals algorithm, quick sort, binary search for Skill Development through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.				

Course Code: CSE2011	Course Title: Data Communications and Computer Networks Type of Course: Program Core - Theory	L-T-P- C	3-0	0	3
Version No.	1				
Course Pre-requisites	NIL				
Anti-requisites					
Course Description	This is the first course on data communication and computer networks. 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 also covers necessary foundational topics pertaining to data communications. 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 Operating Systems and attain SKILL DEVELOPMENT through PARTICIPATIVE LEARNING techniques				
Course Outcomes	1. Explain the concepts of Computer Networks and Working Principles of Application Layer and Transport Layer (Comprehension) 2. Apply the Knowledge of IP Addressing and Routing Mechanism in Computer Networks. (Application) 3. Discuss the functionalities of Data Link Layer (Comprehension) 4. Explain the Basic Concepts of Data communication. (Comprehension)				
Course Content:					
Module 1	Overview, Application and Transport Layers.	Assignment	Comprehension	13 Sessions	
Introduction: Computer Networks, Topologies, OSI Reference Model, 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, Connection-less Transport: UDP, Principles of Reliable Data Transfer, Connection-Oriented Transport: TCP, Principles of Congestion Control, TCP Congestion Control.					
Module 2	Network Layer	Assignment	Application	12 Sessions	
Overview of Network Layer, Forwarding and Routing, The Data and Control Planes.The Internet Protocol (IP): IPv4, Addressing, IPv6, IPv4 Datagram Format, IPv4 Addressing, 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	Comprehension	10 Sessions	

Introduction to the Link Layer, The Services Provided by the Link Layer, Error-Detection and -Correction Techniques, Parity Checks, Check summing Methods, Cyclic Redundancy Check (CRC), Multiple Access Links and Protocols. Switched Local Area Networks, Link-Layer Addressing and ARP, Ethernet, Link-Layer Switches, Virtual Local Area Networks (VLANs),DHCP,UDP,IP and Ethernet.				
Module 4	Physical Layer with Data Communication	Assignment	Comprehension	O7 Sessions
Data communications: Components, Data Representation, Data Flow, Analog and Digital Signals, Periodic Analog Signals: Sine Wave, Phase, Wavelength, Time and Frequency Domains, Composite Signals, Bandwidth, Digital Signals, Transmission Impairment, Data Rate Limits: Noiseless Channel, Nyquist Bit Rate, Noisy Channel: Shannon Capacity, Performance: Bandwidth, Throughput, Latency (Delay), Bandwidth-Delay Product, Parallel/Serial Transmission, Multiplexing: Frequency-Division Multiplexing, Wavelength-Division Multiplexing, Synchronous Time-Division Multiplexing.				
Targeted Application & Tools that can be used: Instant Messaging Telnet File Transfer Protocol Video Conferencing				
Project work/Assignment:				
Project Assignment: Assignment 1: Data Flow Directions Assignment 2: Types of Topology				
Textbooks: T1. James F. Kurose, Keith W. Ross, “Computer Networking A Top down Approach”, 8th Edition, Pearson, 2021. T2. Behrouz A. Forouzan, “Data Communications and Networking”, 6th Edition, Tata McGraw-Hill, 2021.				
References: R1. William Stallings: “Data and Computer Communication”, 10th Edition, Pearson Education, 2017. R2. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2012. Web references: Digital Learning Resources (Library Resources) W1. https://puniversity.informaticsglobal.com/login https://nptel.ac.in/courses/105106053				
Topics relevant to “Skill Development”: Virtual Local Area Networks (VLANs), DHCP, UDP, IP and Ethernet for Skill Development through Participative Learning techniques. This is attained through the assessment component mentioned in the course handout.				

Course Code: CSE2015	Course Title: Data Analysis and Visualization Type of Course:1] Program core 2] Lab Integrated Course	L-T-P- C	2	4	4
Version No.	1.0				
Course Pre-requisites	CSE1005				
Anti-requisites	NIL				
Course Description	The purpose of the course is to instill a strong foundation of scientific process orientation that is the cornerstone of effective data handling, and creative design thinking appended with strong programming skills to create meaningful visualizations of data. The student should have prior knowledge of python programming and basic knowledge of data concepts. The associated laboratory provides an opportunity to strengthen student's skillset in the arena of Data Preprocessing and Visualization. With a good knowledge in the fundamental concepts of the various libraries for handling and visualizing data the student can gain a stronghold in Data Science enabling the student to be an effective analyst for prospective employers.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Data Analysis and Visualization and attain EMPLOYABILITY through Experiential Learning techniques.				
Course Out Comes	On successful completion of this course the students shall be able to: Understand the various types of data, apply and evaluate the principles of data visualization. Acquire skills to apply visualization techniques to a problem and its associated dataset. Create interactive visualization for better insight using various visualization tools. Handle data occurring in large volumes Implement the visualization concepts practically using Python				
Course Content:					
Module 1	Introduction to Data Visualization (Comprehension)	Assignment	Programming activity	10 Hours	
Topics: Data collection, Data Preparation Basic Models- Overview of data visualization - Data Abstraction - Task Abstraction - Analysis: Four Levels for Validation, Interacting with Databases, Data Cleaning and Preparation, Handling Missing Data, Data Transformation. Python Libraries: NumPy, pandas, matplotlib, GGplot,Introduction to pandas Data Structures					

Module 2	Data Visualization Techniques (Application)	Assignment	Programming activity	10 Hours
Topics: Scalar and point techniques – vector visualization techniques – matrix visualization, Visualization Techniques for Trees, Graphs, and Networks, Multidimensional data, Visual Variables- Networks and Trees - Map Color and Other Channels- Manipulate View- Heat Map.				
Module 3	Visual Analysis of data from various domain (Application)	Assignment	Programming activity	10 Hours
Topics: Time-oriented data visualization – Spatial data visualization, Text data visualization – Multivariate data visualization and case studies, Finance- marketing-insurance-healthcare etc.				
Module 4	Visualization of Streaming Data (Application)	Assignment	Programming activity	10 Hours
Topics: Guidelines for designing successful visualizations, Data visualization dos and don'ts, Best practices of Data Streaming, processing streaming data for visualization, presenting streaming data, streaming visualization techniques, streaming analysis.				
List of Laboratory Tasks: Labsheet -1 [4 Practical Sessions] Working with Numpy Functions and Pandas functions Acquiring and plotting data. Labsheet -2 [4 Practical Sessions] Practicals based on Data Cleaning and Preparation Practicals based on Data Wrangling Statistical Analysis – such as Multivariate Analysis, PCA, LDA, Correlation regression and analysis of variance Labsheet – 3 [4 Practical Sessions] Practicals based on Data Visualization using matplotlib Visualization of various massive dataset - Finance - Healthcare - Census Labsheet – 4 [4 Practical Sessions] Practical based on Time Series Data Analysis-stock market Market-Basket Data analysis-visualization Text visualization using web analytics Labsheet -5 [4 Practical Sessions] Financial analysis using Clustering, Histogram and HeatMap Visualization on Streaming dataset (Stock market dataset, weather forecasting)				
Targeted Application & Tools that can be used: Anaconda/Google Colab, Google Data Studio, Deep Note				

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course
Problem Solving: Choose an appropriate set of visualization elements and design for a dashboard. Programming: Implementation of the chosen dashboard
Text Book McKinney, W.(2017). Python for Data Analysis: Data Wrangling with Pandas, NumPy and IPython. 2nd edition. O'Reilly Media. Tamara Munzer, Visualization Analysis and Design, CRC Press 2014. Aragues, Anthony. Visualizing Streaming Data: Interactive Analysis Beyond Static Limits. O'Reilly Media, Inc., 2018 Dr. OssamaEmbarak,"Data Analysis andVisualization Using Python", Apress,(2018)
References R1. Dr.Chun-hauh Chen, W.K.Hardle, A.Unwin, Handbook of Data Visualization, Springer publication, 2016. R2. Christian Toninski, Heidrun Schumann, Interactive Visual Data Analysis, CRC press publication,2020 3. Alexandru C. Telea, Data Visualization: Principles and Practice, AK Peters, 2014. R3. García Salvador, LuengoJulián, & Herrera, F. "Data preprocessing in Data Mining", Springer,(2015) R4. Stephen Few, "Information Dashboard Design: the effective visual communication of data", Oreilly, 2006 R5. Belorkar, A, "Interactive Data Visualization with Python" - [S.l.]: Packt Publishing, Second Edition. (2018) Web links R1. https://pythonprogramming.net/live-graphs-data-visualization-application-dash-python-tutorial/ R2. Google Data Analytics Professional Certificate | Coursera R3. Learning Python for Data Analysis and Visualization Ver 1 | Udemy R4. Data Science, Analytics and Visualization (DS) Courses | Chaminade University - PROD [Integrated] Catalog R5. Data Visualization Training and Certification Courses | Koenig Solutions (koenig-solutions.com)
Topics relevant to "Employability": Visual Analysis and Streaming of Data for Employability through Experiential Learning techniques. This is attained through the assessment component mentioned in the course handout.

Course Code: CSE3098	Course Title: Vulnerability Assessment and Penetration Testing Type of Course: Theory Only Course	L-T-P- C	3	0	3
Version No.	1.0				
Course Pre-requisites	CSE3078				
Anti-requisites	NIL				
Course Description	This course explores the tools that can be used to perform information gathering. This course also covers how vulnerability can be carried out by means of tools or manual investigation, and analysis of common attacks in data, mobile applications and wireless networks				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Vulnerability Assessment and Penetration Testing and attain Employability through Problem Solving Methodologies.				
Course Out Comes	On successful completion of the course the students shall be able to: Understand the basic principles for information gathering and detecting vulnerabilities in the system. Determine the security threats and vulnerabilities in SDN networks and web applications. Able to use the exploits in mobile applications and wireless networks Understand the metasploit and metrepreter are used to automate the attacks and penetration testing techniques.				
Course Content:					
Module 1	Information Gathering, Host Discovery and Evading Techniques	Assignment	Theory	9 Sessions	
Topics: Introduction - Terminologies - Categories of Penetration Testing - Phases of Penetration Test -Penetration Testing Reports - Information Gathering Techniques - Active, Passive and Sources of Information Gathering – Approaches, Host discovery - Scanning for open ports and services- Types of Port, Vulnerability Scanner Function, pros and cons - Vulnerability Assessment with NMAP - Testing, SCADA environment with NMAP					
Module 2	Vulnerability Scanner in SDN Networks and Web application	Quiz	Theory	10 Sessions	
Topics: Nessus Vulnerability Scanner - Safe check – Silent dependencies - Port Range Vulnerability Data Resources, SDN Data plane, Control Plane, Application Plane. SDN security attack vectors and SDN Harderning, Authentication Bypass with Insecure Cookie Handling - XSS Vulnerability - File inclusion vulnerability - Remote file Inclusion -Patching file Inclusions - Testing a website for SSI Injection.					
Module 3	Mobile Application Security and wireless	Quiz	Theory	11 Sessions	

	network Vulnerability analysis			
Topics: Types of Mobile Application Key challenges in Mobile Application and Mobile application penetration testing methodology, Android and ios Vulnerabilities - OWASP mobile security risk - Exploiting WM - BlackBerry Vulnerabilities - Vulnerability Landscape for Symbian - Exploit Prevention -Handheld Exploitation, WLAN and its inherent insecurities Bypassing WLAN Authentication uncovering hidden SSIDs MAC Filters Bypassing open and shard authentication - Advanced WLAN Attacks Wireless eavesdropping using MITM session hijacking over wireless – WLAN Penetration Test Methodology.				
Module 4	Exploits	Quiz	Theory	8 Sessions
Topics: Architecture and Environment- Leveraging Metasploit on Penetration Tests, Understanding - Metasploit Channels, Metasploit Framework and Advanced Environment configurations – Understanding the Soft Architecture, Configuration and Locking, Advanced payloads and add on modules Global datastore, module datastore, saved environment Meterpreter.				
Targeted Application & Tools that can be used: This course helps the students to understand the threats and vulnerabilities using NMAP.				
Project work/Assignment:				
Project Assignment:				
Text Book Rafay Baloch, Ethical Hacking and Penetration Testing Guide, CRC Press, 2015. ISBN : 78-1-4822-3161-8. Dr. Patrick Engebretson, The Basics of Hacking and Penetration Testing Ethical Hacking and Penetration Testing made easy , Syngress publications, Elsevier, 2013. ISBN :978-0-12-411644-3. Mayor, K.K.Mookey, Jacopo Cervini, Fairuzan Roslan, Kevin Beaver, Metasploit Toolkit for Penetration Testing, Exploit Development and Vulnerability Research, Syngress publications, Elsevier, 2007. ISBN : 978-1-59749-074-0				
References Mastering Modern Web Penetration Testing By Prakhar Prasad,October 2016 PacktPublishing. SQL Injection Attacks and Defense 1st Edition, by Justin Clarke-Salt, Syngress Publication Web resources: https://onlinecourses.nptel.ac.in/noc19_cs68/preview - IIT Kharagpur, Prof. Indranil Sen Gupta				
Topics relevant to development of “EMPLOYABILITY SKILLS”: Exploitation, Penetration testing techniques, for development of Employability skills through the Participative Learning Techniques. This is attained through the assessment components mentioned in course handout.				

Course Code: CSE 1003	Course Title: Innovation Project-Raspberry Pi Using Python Type of Course: School Core & Practical Only.	L-T-P- C	0	4	2
Version No.	1.0				
Course Pre-requisites	NIL				
Anti-requisites	NIL				
Course Description	The Raspberry Pi is an amazing single board computer (SBC) capable of running Linus and a whole host of applications. Python is a beginner-friendly programming language that is used in schools, web development, scientific research, and in many other industries. This course will enable students in writing own programs with Python to blink lights, respond to button pushes, read sensors, log data on the Raspberry Pi and many more. The course also offers in-depth knowledge of designing, developing, coding and implementing projects using Raspberry Pi.				
Course Outcomes	On successful completion of this course the students shall be able to: Write a program in Python. Explain the main features of the Raspberry Pi board Demonstrate the hardware interfacing of the peripherals to Raspberry Pi system. Demonstrate the functioning of live various projects carried out using Raspberry Pi system.				
Course Content:					
Module 1	Basics of Python, functions	Quiz	Problem Solving	4 Lab Sessions	
Topics: Introduction, Structure of Python Program, Data Types and Variables, Input and Output, Operators, Importing libraries, Functions, Development Tool. Concepts will be taught by solving problems through programs.					
Module 2	Python Programming	Quiz	Problem Solving	4 Lab Sessions	
Control statements, Lists and Dictionaries, Problem solving using Python. Concepts will be taught by solving problems through programs.					
Module 3	Overview of Raspberry Pi	Project Development	System Design Task and Analysis	4 Lab Sessions	
Topics: An exploration of GPIO pins, LED and switch control. Installation of libraries, PuTTY SSH. Raspberry Pi to interface with more complicated sensors and actuators like Pi Camera, servo motor ADS51115 through PIP libraries. Arduino with Raspberry-pi					
Module 4	Interaction with API Services	Project Development	Modeling and Simulation task	3 Lab Sessions	
Topics:					

Raspberry Pi interact with online API services through the use of public APIs and SDKs using Firebase, Gspread API. Node-RED – a programming tool for wiring together hardware devices, MQTT. Android/Case study.	
Targeted Application & Tools that can be used: Making it a reality (Raspberry Pi Projects) : Projects will include but not limited to : 1) Intelligent home locking system. 2) Intelligent water level management system. 3) Home automation using RFID. 4) Real time clock-based home automation. 5) Intelligent Automatic Irrigation System Professionally Used Software: Raspberry Pi.	
Project work/Python Lab Test:	
Project work Python test.	
Text Book(s): 1) Ashok Namdev Kamthane, Amit Ashok Kamthane, "Problem Solving and Python Programming", Mc Graw Hill Education, 2018.	
Reference(s): https://github.com/thibmaek/awesome-raspberry-pi MagPi magazine	
Topics relevant to development of "Foundation Skills": Basic Concepts of Python-Programming, and Raspberry Pi. Topics related to development of "Employability Skills": Problem solving, Creative Thinking, Team work, Prototype Development. Topics related to development of "Entrepreneurship": Effective Communication, Strategic Thinking, Creative Thinking.	
Evaluation:	Review-1-20%, Review-2-25%, Python test-25%, Project Expo-30%

Course Code: CSE502	Course Title: Technical Skills in Java Open Elective Type of Course: Lab Integrated Course	L-T-P-C	0	0	6	3
Version No.	1.0					
Course Pre-requisites	Basic knowledge of programming and data structure concepts.					
Anti-requisites	NIL					
Course Description	This Course is designed for students who have prior programming experience. It provides assistance to prepare for placements and extensive exposure to object-oriented programming features. It helps to develop robust solutions for real world applications.					
Course Objective	The objective of the course is SKILL DEVELOPMENT and EMPLOYABILITY of students by using participative learning techniques.					
Course Out Comes	On successful completion of this course the students shall be able to: 1. Summarize the Object-oriented concepts with example program. 2. Implement Arrays and Strings to solve real world problems. 3. Apply the concept of polymorphism & inheritance to solve real time problems. 4. Illustrate programs on Interface, Packages 5. Demonstrate runtime errors using Exception handling.					
Course Content:						
Module 1	Introduction to Object-oriented programming	Assignment	Practical Task		14 Hours	
Topics: Introduction to object oriented programming, Java Evolution, How Java differs from C++, Features of Java, Java Environment: Installing Java, Java Program Development, Java Source File Structure, Compilation, Executions, JDK, JVM, JRE. Java Tokens: Datatypes, Variables, Operators, Control Statements, Command Line Arguments. Classes, Objects, and Methods: Defining a class, Access Specifiers, instantiating objects, Reference variable, Accessing class members and methods, constructors, method overloading, static members, static methods, inner class, Wrapper class, Auto-boxing and Unboxing.						

Module 2	Arrays, Strings	Assignment	Practical Task	11 Hours
Topics: Defining an Array, Initializing & Accessing Array, Multi –Dimensional Array Strings: Operation on String, Mutable & Immutable String, Creating Strings using String Buffer or StringBuilder. Assignment: Test 1,Quiz1				
Module 3	Inheritance and Polymorphism	Assignment	Practical Task	12 Hours
Inheritance and Polymorphism: Defining a subclass, Types of Inheritance, Method overriding, super keyword, Dynamic method invocation, Dynamic polymorphism, Final, Abstract, this keyword. Forms of inheritance specialization, specification, construction, extension, limitation, combination, benefits of inheritance, costs of inheritance.				
Module 4	Interface and Package	Assignment	Practical task	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, Making JAR Files for Library Packages Import and Static Import, Naming Convention for Packages. Assignment: Test 2				
Module 5	Exception Handling	Assignment	Theory task	6 Hours
Topics: Exception Handling: Introduction to Exceptions, Difference between Exceptions & Errors, Types of Exception, Handling of Exceptions: Use of try, nested try statements, catch, finally, throw, throws, built in exceptions, User Defined Exceptions, Checked and Un-Checked Exceptions				
Text Book Text Books: Cay S Horstmann and Cary Gornell, “CORE JAVA volume I-Fundamentals”, Pearson 2016. Cay S Horstmann and Cary Gornell, “CORE JAVA volume II-Advanced Features”, Pearson 2017.				

References

Herbert Schildt, “The Complete Reference Java 2”, Tata McGraw Hill Education, 10th Edition 2017.

James W. Cooper, “Java TM Design Patterns – A Tutorial”, Addison-Wesley Publishers 2000.

Web resources:

1. https://www.udemy.com/course/object-oriented-programming-oops-concepts-in-english/
2. https://archive.nptel.ac.in/courses/106/105/106105191/

Course Code: CSE503	Course Title: Technical Skills in Python Open Elective Type of Course: Lab Integrated Course	L-T-P- C	0	0	6	3
Version No.	1.0					
Course Pre-requisites	Basic knowledge of programming and data structure concepts.					
Anti-requisites	NIL					
Course Description	This Course is designed for students who have prior programming experience. It provides assistance to prepare for placements and extensive exposure to Programming in Python. It helps to develop robust solutions for real world applications.					
Course Objective	The objective of the course is SKILL DEVELOPMENT and EMPLOYABILITY of students by using participative learning techniques.					
Course Out Comes	On successful completion of this course the students shall be able to: 1. Summarize the Object-oriented concepts using Python with example program. 2. Implement Lists, Tuples, Dictionary and Strings to solve real world problems. 3. Apply the concept of polymorphism & inheritance to solve real time problems. 4. Illustrate programs by using Python Library 5. Demonstrate runtime errors using Exception handling.					
Course Content:						
Module 1	Introduction to Python and Basics	Assignment	Practical Task		11 Hours	
Topics: Introduction to Python programming, Python Evolution, Features of Python, Python Environment: Installing Python, Python Program Development, Python Source File Structure, Interpretation, Executions. Python Data Structures & Data Types Looping, I/O Formatting, Functions, Lambda Functions						
Module 2	Classes, Files and Exception handling	Assignment	Practical Task		8 Hours	

Topics:
New Style Classes □ Creating File handling Modes □ Reading Files □ Writing& Appending to Files
□ Handling File Exceptions
Classes □ Instance Methods □ Inheritance □ Polymorphism □ Exception Classes & Custom Exceptions
Assignment: Test 1,Quiz1

Module 3	Data Structures, Collections, generators and Iterators	Assignment	Practical Task	11 Hours

List Comprehensions □ Nested List Comprehensions □ Dictionary Comprehensions named tuple() □ deque □ ChainMap □ Counter □ OrderedDict
Iterators □ Generators □ The Functions any and all □ With Statement

Module 4	GUIs, Date and time, Regular expressions	Assignment	Practical task	11 Hours

Topics:
Components and Events □ An Example GUI □ The root Component □ Adding a Button □ Entry Widgets □ Text Widgets
sleep □ Program execution time □ more methods on date/time
Filter □ Map □ Reduce □ Decorators □ Frozen set
Split □ Working with special characters, date, emails □ Quantifiers □ Match and find all
Assignment: Test 2

Module 5	Threads, API, Django	Assignment	Theory task	10 Hours

Topics:
Class and threads □ Multi-threading □ Synchronization □ Treads Life cycle
Introduction □ Facebook Messenger □ Openweather
Django Overview □ Django Installation □ Creating a Project □ Usage of Project in depth Discussion □ Creating an Application □ Understanding Folder Structure

Text Book
Text Books:
Python Programming – A Modular Approach Pearson 2021.
Martin C Brown “The Complete reference Python”, McGraw Hill 2021.

References
Mark Lutz, “Learning Python”, OReilly 2021.

Web resources:

1 https://developers.google.com/edu/python/
2 https://www.educative.io/courses/learn-python-3-from-scratch?affiliate_id=5073518643380224

Course Code: CSE 1004	Course Title: Problem Solving Using C Type of Course: School Core Lab Integrated.		L- T-P-C	1	0	4	3
Version No.	1.0					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	The course is designed to provide complete knowledge of C language. Students will be able to develop logics which will help them to create programs and applications in C. Also by learning the basic programming constructs they can easily switch over to any other language in future.					
Course Object	The objective of the course is to familiarize the learners with the concepts of Problem Solving Using C and attain Employability through Problem Solving Methodologies.					
Course Outcomes	On successful completion of this course the students shall be able to: Write algorithms and to draw flowcharts for solving problems Demonstrate knowledge and develop simple applications in C programming constructs Develop and implement applications using arrays and strings Decompose a problem into functions and develop modular reusable code Solve applications in C using structures and Union Design applications using Sequential and Random Access File Processing.					
Course Content:						
Module 1	Introduction to C Language	Quiz	Problem Solving	9 Hrs.		
Topics: Introduction to Programming – Algorithms – Pseudo Code - Flow Chart – Compilation – Execution – Preprocessor Directives (#define, #include, #undef) - Overview of C – Constants, Variables and Data types – Operators and Expressions – Managing Input and Output Operations – Decision Making and Branching - Decision Making and Looping.						
Module 2	Introduction to Arrays and Strings	Quiz	Problem Solving	9 Hrs.		
Topics: Arrays: Introduction – One Dimensional Array – Initialization of One Dimensional Arrays – Example Programs – Sorting (Bubble Sort, Selection Sort) – Searching (Linear Search) - Two Dimensional Arrays – Initialization of Two Dimensional Arrays. Example Programs – Matrix operations. Strings: Introduction – Declaring and Initializing String Variables – Reading Strings from Terminal – Writing String to Screen – String Handling Functions.						
Module 3	Functions and Pointers	Quiz	Problem Solving	9 Hrs.		
Topics: Functions: Introduction – Need for User-defined functions – Elements of User-Defined Functions: declaration, definition and function call–Categories of Functions – Recursion.						

Pointers: Introduction – Declaring Pointer Variables – Initialization of Variables – Pointer Operators – Pointer Arithmetic – Arrays and Pointers – Parameter Passing: Pass by Value, Pass by Reference.				
Module 4	Structures and Union	Quiz	Problem Solving	9 Hrs.
Topics: Structures: Introduction – Defining a Structure – Declaring Structure Variable – Accessing Structure Members – Array of Structures – Arrays within Structures – Union: Introduction – Defining and Declaring Union – Difference Between Union and Structure.				
Module 5	File handling	Case Study	Problem Solving	9 Hrs.
Topics: Files: Defining and Opening a File – Closing a File – Input / Output Operations on File – Random Access Files				
List of Practical Tasks Lab Sheet 1 (Module I) Programs using IO Statements, Conditional Statements and Looping Statements Lab Sheet 2 (Module II) Programs using Arrays and Strings Lab Sheet 3 (Module III) Programs using Functions and Pointers Lab Sheet 4 (Module IV) Programs using Structures and Unions Lab Sheet 5 (Module V) Programs using Files				
Text Book(s): E. Balaguruswamy, “Programming in ANSI C”, 8th Edition, 2019, McGraw Hill Education, ISBN: 978-93-5316-513-0. By				
Reference Book(s): Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020. ReemaThareja, “Programming in C”, Oxford University Press, Second Edition, 2016. Kernighan, B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2015 Schildt Herbert, “C: The Complete Reference”, Tata McGraw Hill Education, 4th Edition, 2014. Stephen G. Kochan, “Programming in C”, Addison-Wesley Professional, 4th Edition, 2014.				
Web Links and Video Lectures: https://nptel.ac.in/courses/106/105/106105171/ https://archive.nptel.ac.in/courses/106/104/106104128/				

Course Code: CSE2069	Course Title: Cloud Computing Type of Course: Theory and Lab Integrated	L- T-P-C	2	0	2	3
Version No.	2.0					
Course Pre-requisites	CSE2011					
Anti-requisites	NIL					
Course Description	This course provides a hands-on comprehensive study of Cloud concepts and capabilities across the various Cloud service models including Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). It dives into all of the details that a student needs to know in order to plan for developing applications on the cloud and what to look for when using applications or services hosted on a cloud.					
Course Objective	The course aims to impart knowledge to students that can provide easy, scalable access to computing resources and IT services. This course is designed to improve the learner's EMPLOYABILITY SKILLS using EXPERIENTIAL LEARNING techniques.					
Course Outcomes	Upon successful completion of the course, the students shall be able to: Comprehend the significance of Cloud computing technologies Describe appropriate Virtualization techniques to virtualize infrastructures Apply Cloud mechanisms to optimize the QoS parameters Interpret recent technologies on Cloud					
Course Content:						
Module 1	Introduction to Cloud Services	Assignment	Theory	No. of Hours:10 (Theory: 6, Lab:4)		
Topics: A Facility for Flexible Computing, The Start of Cloud: The Power Wall and Multiple Cores, From Multiple Cores to Multiple Machines, From Clusters to Web Sites and Load Balancing, Racks of Server Computers, The Economic Motivation for a Centralized Data Center, Cloud Computing Architecture, IaaS, PaaS, SaaS, Types of Clouds, and Cloud Computing Environments.						
Module 2	Virtualization Techniques	Lab-based Assignments	Theory	No. of Hours:10 (Theory: 6, Lab:4)		
Topics: Basics of Virtualization - Types of Virtualizations, Taxonomy of Virtualization Techniques, Implementation Levels of Virtualization.						
Module 3	QoS and Management	Application Development	Theory	No. of Hours:10 (Theory: 6, Lab:4)		
Topics: Quality of Service (QoS) in the Cloud, Cloud Infrastructure Mechanisms, Service Level Agreements (SLAs), Specialized Cloud Mechanisms, Cloud Management Mechanisms, Application development in the Cloud						

Module 4	Security and advancements	Case Study	Case Study	No. of Hours:10 (Theory: 6, Lab:4)

Topics: The Zero Trust Security Model, Identity Management, Privileged Access Management, AI Technologies And Their Effect on Security, Protecting Remote Access, Privacy in a Cloud Environment, Application development in Cloud, Latest trends in Cloud Computing, Fog Computing, Dew Computing, Case Studies, and Recent Advancements

Targeted Applications & Tools that can be used:

Targeted Applications:
Developing applications on Cloud Platforms via Virtual machines
Cloud Tools:
VMWare
Amazon EC2
Google Compute Engine
Microsoft Azure
Cloudsim

Project work/Assignment:

Automation of performance analysis of students through the Cloud
Chatbots development using Cloud resources
Blog creation using Cloud computing

Analysis of Case Studies: When deciding to adopt cloud computing architecture, decide if the cloud is right for your requirements (for the application identified).

Suggested List of Hands-on Activities:

Sl. No	Title
1	Install Virtualbox/VMware Workstation with different flavors of Linux or Windows OS on top of windows 11
2	Install a C compiler in the virtual machine created using a virtual box and execute Simple Programs.
3	Install Google App Engine (GAE). Create a “hello world” application and other simple web applications using python/java
4	Use GAE launcher to launch the web applications.
5	Simulate a cloud scenario using CloudSim and run a scheduling algorithm
6	Find a procedure to transfer the files from one virtual machine to another virtual machine.
7	Find a procedure to launch a virtual machine using Openstack
8	Demonstrate Migration, Cloning, and Snapshots within and across VMs
9	Demonstrate on the Virtual Environment on hypervisor. a) Communication between the VM’s. b) The backup and restore mechanism.

10	Implement and Evaluate the performance of MapReduce program on word count for different file size.

Text Book(s)

Douglas E. Comer, "The Cloud Computing Book: The Future of Computing Explained", Chapman and Hall/CRC; 1st edition, July 2021.

References

Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, “Mastering Cloud Computing”, McGraw Hill Education, 2013 edition.
Thomas Erl, Zaigham Mahmood, and Ricardo Puttini, “Cloud Computing Concepts, Technology & Architecture”, PHI publisher 2013 edition.
Anthony T Velte, Toby J Velte, Robert Elsenpeter, “Cloud Computing: A Practical Approach”, Tata McGraw-Hill, 2010 edition.
David E.Y. Sarna, “Implementing and Developing Cloud Applications”, CRC Press, 2018 edition.
Manvi, Sunilkumar, and Gopal K. Shyam. “Cloud Computing: Concepts and Technologies”. CRC Press, 2021.

Web Resources and Research Articles links:

IEEE Transactions on Cloud Computing- https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=6245519

International Journal of Cloud Computing- https://www.inderscience.com/jhome.php?jcode=ijcc
CloudSim Resources- https://javadoc.io/doc/org.cloudsimplus/cloudsim-plus/latest/org/cloudbus/cloudsim/resources/class-use/Resource.html

Journal of Network and Computer Networking- https://www.journals.elsevier.com/journal-of-network-and-computer-applications

Course Code: CSE3035	Course Title: R Programming for Data Science Type of Course: Program Core Lab Integrated Course		L-T- P-C	1	4	3
Version No.	1.0				
Course Pre-requisites	Nil				
Anti-requisites	Nil				
Course Description	R Programming for Data Science is designed for inspecting, cleansing, transforming, and modeling data with the goal of discovering useful information, and supports in decision-making. The course begins by covering Data extraction, pre-processing, and transformation. It delivers the basic statistics and taught in an intuitive way to analysis the data. This course will help the students to apply the knowledge on Data Analytics to a wide range of applications.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of R Programming for Data Science and attain Employability through Problem Solving Methodologies.				
Course Out Comes	On successful completion of the course the students shall be able to: 1) Describe the R programming for Data Analytics.[Knowledge] 2) Generalize the appropriate visualization methods.[Comprehension] 3) Demonstrate the various statistical testing methods.[Application] 4) Apply the probability and complex distribution functions for the analysis of data.[Application]				
Course Content:					
Module 1	Introduction to R Programming	Case studies	Programming	8 Sessions	
R Studio: Base R-R Studio IDE-Introduction to R Projects and R Markdown. Basic R: R as a calculator-Scripts and Comments-R Variables. Data I/O: Working Directories-Importing Data-Exporting Data-More ways to save-Data I/O in Base R. Subsetting Data in R: Selecting specific elements-Renaming Columns-Subsetting Columns - Subsetting Rows – Adding/Removing Columns-Ordering Columns - Ordering Rows					
Module 2	Data Analysis	Case studies	Programming	10 Sessions	
Data Summarization: One Quantitative and Categorical Variable. Data Classes: One Dimensional Data Classes-Data Frames and Matrices-Lists. Data Cleaning: Dealing with Missing Data-Strings and Recoding Variables. Manipulating Data in R: Reshaping Data-Merging Datasets. Data Visualizations: Plotting with ggplot2- Plotting with Base R					
Module 3	Statistical Analysis in R	Case studies	Programming	8 Sessions	

Proportion tests-Chi squared test-Fisher exact test-Correlation-T test-Wilcoxon Rank sum tests-Wilcoxon signed rank test- One Way ANOVA- Kruskal Wallis Test-Linear Regression-Logistic Regression and Generalized Linear Models-Poisson Regression.				
Module 4	Simulations	Case studies	Programming	10 Sessions
Functions: Writing your own function-Loops. Simulations: Standard Probability Distributions-Sampling from more Complex Distributions-The Accept and Reject Algorithm-The Metropolis Hasting Algorithm. R Markdown: Exploratory Analysis-Multiple Facets-Linear Models- Grabbing coefficients-Pander-Multiple Models-Data Extraction				
Targeted Applications & Tools that can be used: Tools: R Programming				
Lab:				
Exp 1. Level 1: create a new variable called my.num that contains 6 numbers multiply my.num by 4 create a second variable called my.char that contains 5 character strings combine the two variables my.num and my.char into a variable called both what is the length of both? what class is both? divide both by 3, what happens? Level 2: create a vector with elements 1 2 3 4 5 6 and call it x create another vector with elements 10 20 30 40 50 and call it y what happens if you try to add x and y together? why? append the value 60 onto the vector y (hint: you can use the c() function) add x and y together multiply x and y together. pay attention to how R performs operations on vectors of the same length. Exp 2. Level 1: Read in the Youth Tobacco study, Youth_Tobacco_Survey_YTS_Data.csv and name it youth. Install and invoke the readxl package. RStudio > Tools > Install Packages. Type readxl into the Package search and click install. Load the installed library with library(readxl). Level 2: Download an Excel version of the Monuments dataset, Monuments.xlsx, from CANVAS. Use the read_excel() function in the readxl package to read in the dataset and call the output mon. Write out the mon R object as a CSV file using readr::write_csv and call the file “monuments.csv”. Write out the mon R object as an RDS file using readr::write_rds and call it “monuments.rds”. Exp 3: Level 1: Check to see if you have the mtcars dataset by entering the command mtcars. What class is mtcars?				

How many observations (rows) and variables (columns) are in the mtcars dataset?
Copy mtcars into an object called cars and rename mpg in cars to MPG. Use rename().
Convert the column names of cars to all upper case. Use rename_all, and the toupper command (or colnames).
Convert the rownames of cars to a column called car using rownames_to_column. Subset the columns from cars that end in "p" and call it pvars using ends_with().
Create a subset cars that only contains the columns: wt, qsec, and hp and assign this object to carsSub. What are the dimensions of carsSub? (Use select() and dim().)

Level 2:

Convert the column names of carsSub to all upper case. Use rename_all(), and toupper() (or colnames()).
Subset the rows of cars that get more than 20 miles per gallon (mpg) of fuel efficiency. How many are there? (Use filter().)
Subset the rows that get less than 16 miles per gallon (mpg) of fuel efficiency and have more than 100 horsepower (hp). How many are there? (Use filter().)
Create a subset of the cars data that only contains the columns: wt, qsec, and hp for cars with 8 cylinders (cyl) and reassign this object to carsSub. What are the dimensions of this dataset?
Re-order the rows of carsSub by weight (wt) in increasing order. (Use arrange().)
Create a new variable in carsSub called wt2, which is equal to wt^2, using mutate() and piping %>%.

Exp 4:
Level 1:
How many bike lanes are currently in Baltimore? You can assume that each observation/row is a different bike lane.
How many (a) feet and (b) miles of total bike lanes are currently in Baltimore? (The length variable provides the length in feet.)
How many types (type) bike lanes are there? Which type (a) occurs the most and (b) has the longest average bike lane length?

Level 2:

How many different projects (project) do the bike lanes fall into? Which project category has the longest average bike lane length?
What was the average bike lane length per year that they were installed? (Be sure to first set dateInstalled to NA if it is equal to zero.)
Numerically and graphically describe the distribution of bike lane lengths (length).
Describe the distribution of bike lane lengths numerically and graphically after stratifying them by (a) type and then by (b) number of lanes (numLanes).
Exp 5:

Level 1:
Get all the different types of bike lanes from the type column. Use sort(unique()). Assign this to an object btypes. Type dput(btypes).

By rearranging vector btypes and using dput, recode type as a factor that has SIDEPATH as the first level. Print head(bike$type). Note what you see. Run table(bike$type) afterwards and note the order.
Make a column called type2, which is a factor of the type column, with the levels: c("SIDEPATH", "BIKE BOULEVARD", "BIKE LANE"). Run table(bike$type2), with the options useNA = "always". Note, we do not have to make type a character again before doing this.

Level 2:

- Reassign dateInstalled into a character using as.character. Run head(bike$dateInstalled).

Reassign dateInstalled as a factor, using the default levels. Run head(bike$dateInstalled).
Do not reassign dateInstalled, but simply run head(as.numeric(bike$dateInstalled)). We are looking to see what happens when we try to go from factor to numeric.
Do not reassign dateInstalled, but simply run head(as.numeric(as.character(bike$dateInstalled))). This is how you get a “numeric” value back if they were incorrectly converted to factors.

- Convert type back to a character vector. Make a column type2 (replacing the old one), where if the type is one of these categories c("CONTRAFLOW", "SHARED BUS BIKE", "SHARROW", "SIGNED ROUTE") call it "OTHER". Use %in% and ifelse. Make type2 a factor with the levels c("SIDEPATH", "BIKE BOULEVARD", "BIKE LANE", "OTHER").
- Parse the following dates using the correct lubridate functions:

“2014/02-14”
“04/22/14 03:20” assume mdy
“4/5/2016 03:2:22” assume mdy
Exp 6:
Level 1:

Count the number of rows of the bike data and count the number of complete cases of the bike data. Use sum and complete.cases.
Create a data set called namat which is equal to is.na(bike). What is the class of namat? Run rowSums and colSums on namat. These represent the number of missing values in the rows and columns of bike. Don’t print rowSums, but do a table of the rowSums.
Filter rows of bike that are NOT missing the route variable, assign this to the object have_route. Do a table of the subType variable using table, including the missing subTypes. Get the same frequency distribution using group_by(subType) and tally() or count().
Filter rows of bike that have the type SIDEPATH or BIKE LANE using %in%. Call it side_bike. Confirm this gives you the same number of results using the | and ==.
Do a cross tabulation of the bike type and the number of lanes (numLanes). Call it tab. Do a prop.table on the rows and columns margins. Try as.data.frame(tab) or broom::tidy(tab).
Read the Property Tax data into R and call it the variable tax.
How many addresses pay property taxes? (Assume each row is a different address.)
What is the total (a) city (CityTax) and (b) state (SateTax) tax paid? You need to remove the $ from the CityTax variable, then you need to make it numeric. Try str_replace, but remember $ is “special” and you need fixed() around it.
Using table() or group_by and summarize(n()) or tally().
How many observations/properties are in each ward (Ward)?
What is the mean state tax per ward? Use group_by and summarize.
What is the maximum amount still due (AmountDue) in each ward? Use group_by and summarize with ’max`.
What is the 75th percentile of city and state tax paid by Ward? (quantile)

Make boxplots showing CityTax (y-variable) by whether the property is a principal residence (x = ResCode) or not. You will need to trim some leading/trailing white space from ResCode.
Level 2:

Subset the data to only retain those houses that are principal residences. Which command subsets rows? Filter or select?
How many such houses are there?
Describe the distribution of property taxes on these residences. Use hist/qplot with certain breaks or plot(density(variable)).
Make an object called health.sal using the salaries data set, with only agencies (JobTitle) of those with “fire” (anywhere in the job title), if any, in the name remember fixed("string_match", ignore_case = TRUE) will ignore cases.
Make a data set called trans which contains only agencies that contain “TRANS”.
What is/are the profession(s) of people who have “abra” in their name for Baltimore’s Salaries? Case should be ignored.
What does the distribution of annual salaries look like? (use hist, 20 breaks) What is the IQR? Hint: first convert to numeric. Try str_replace, but remember $ is “special” and you need fixed() around it.
Convert HireDate to the Date class - plot Annual Salary vs Hire Date. Use AnnualSalary ~ HireDate with a data = sal argument in plot or use x, y notation in scatter.smooth. Use the lubridate package. Is it mdy(date) or dmy(date) for this data - look at HireDate.
Create a smaller dataset that only includes the Police Department, Fire Department and Sheriff’s Office. Use the Agency variable with string matching. Call this emer. How many employees are in this new dataset?
Create a variable called dept in the emer data set, dept = str_extract(Agency, ".*(ment|ice)"). E.g. we want to extract all characters up until ment or ice (we can group in regex using parentheses) and then discard the rest. Replot annual salary versus hire date and color by dept (not yet - using ggplot). Use the argument col = factor(dept) in plot.
(Bonus). Convert the ‘LotSize’ variable to a numeric square feet variable in the tax data set. Some tips: a) 1 acre = 43560 square feet b) The hyphens represent a decimals. (This will take a lot of searching to find all the string changes needed before you can convert to numeric.)

Exp 7:

Level 1:

Read in the Bike_Lanes_Wide.csv dataset and call is wide.
Reshape wide using pivot_longer. Call this data long. Make the key lanetype, and the value the_length. Make sure we gather all columns but name, using -name. Note the NAs here.
Read in the roads and crashes .csv files and call them road and crash.
Replace (using str_replace) any hyphens (-) with a space in crash$Road. Call this data crash2. Table the Road variable.
How many observations are in each dataset?
Separate the Road column (using separate) into (type and number) in crash2. Reassign this to crash2. Table crash2$type. Then create a new variable calling it road_hyphen using the unite function. Unite the type and number columns using a hyphen (-) and then table road_hyphen.
Which and how many years were data collected in the crash dataset?

Read in the dataset Bike_Lanes.csv and call it bike.

Level 2:

Keep rows where the record is not missing type and not missing name and re-assign the output to bike.
Summarize and group the data by grouping name and type (i.e for each type within each name) and take the sum of the length (reassign the sum of the lengths to the length variable). Call this data set sub.
Reshape sub using pivot_wider. Spread the data where the key is type and we want the value in the new columns to be length - the bike lane length. Call this wide2. Look at the column names of wide2 - what are they? (they also have spaces).
Join data in the crash and road datasets to retain only complete data, (using an inner join) e.g. those observations with road lengths and districts. Merge without using by argument, then merge using by = "Road". call the output merged. How many observations are there?
Join data using a full_join. Call the output full. How many observations are there?
Do a left join of the road and crash. ORDER matters here! How many observations are there?
Repeat above with a right_join with the same order of the arguments. How many observations are there?

Exp 8
Level 1:
Plot average ridership (avg data set) by date using a scatterplot.
Color the points by route (orange, purple, green, banner)
Add black smoothed curves for each route
Color the points by day of the week
Replot 1a where the colors of the points are the name of the route (with banner –> blue)
pal = c("blue", "darkgreen","orange","purple")
Plot average ridership by date with one panel per route

Level 2:

Plot average ridership by date with separate panels by day of the week, colored by route
Plot average ridership (avg) by date, colored by route (same as 1a). (do not take an average, use the average column for each route). Make the x-label "Year". Make the y-label "Number of People". Use the black and white theme theme_bw(). Change the text_size to (text = element_text(size = 20)) in theme.
Plot average ridership on the orange route versus date as a solid line, and add dashed “error” lines based on the boardings and alightings. The line colors should be orange. (hint linetype is an aesthetic for lines - see also scale_linetype and scale_linetype_manual. Use Alightings = "dashed", Boardings = "dashed", Average = "solid")

Exp 9
Level 1:

Compute the correlation between the 1980, 1990, 2000, and 2010 mortality data. No need to save this in an object. Just display the result to the screen. Note any NAs. Then compute using use = "complete.obs".

Compute the correlation between the Myanmar, China, and United States mortality data. Store this correlation matrix in an object called country_cor
Extract the Myanmar-US correlation from the correlation matrix.
Is there a difference between mortality information from 1990 and 2000? Run a paired t-test and a Wilcoxon signed rank test to assess this. Hint: to extract the column of information for 1990, use mort$"1990"

Level 2:

Using the cars dataset, fit a linear regression model with vehicle cost (VehBCost) as the outcome and vehicle age (VehicleAge) and whether it's an online sale (IsOnlineSale) as predictors as well as their interaction. Save the model fit in an object called lmfit_cars and display the summary table.
Create a variable called expensive in the cars data that indicates if the vehicle cost is over $10,000. Use a chi-squared test to assess if there is a relationship between a car being expensive and it being labeled as a "bad buy" (IsBadBuy).
Fit a logistic regression model where the outcome is "bad buy" status and predictors are the expensive status and vehicle age (VehicleAge). Save the model fit in an object called logfit_cars and display the summary table. Use summary or tidy(logfit_cars, conf.int = TRUE, exponentiate = TRUE) or tidy(logfit_cars, conf.int = TRUE, exponentiate = FALSE) for log odds ratios
Exp 10
Level 1:

- Write a function, sqdif, that does the following:

takes two numbers x and y with default values of 2 and 3.
takes the difference
squares this difference
then returns the final value
checks that x and y are numeric and stops with an error message otherwise

Level 2:

- Try to write a function called top() that takes a matrix or data.frame and a number n, and returns the first n rows and columns, with the default value of n=5.
- Write a function that will calculate a 95% one sample t interval. The results will be stored in a list to be returned containing sample mean and the confidence interval. The input to the functions is the numeric vector containing our data. For review, the formula for a 95% one sample t interval is $\bar{x} \pm 1.96 * s/\sqrt{n}$.

Exp 11

Level 1:
Simulate a random sample of size n=100

- from

a normal distribution with mean 0 and variance 1. (see rnorm)
a normal distribution with mean 1 and variance 1. (see rnorm)
a uniform distribution over the interval [-2, 2]. (see runif)

- Run a simulation experiment to see how the type I error rate behaves for a two sided one sample t-test when the true population follows a Uniform distribution over [-10,10]. Modify the function t.test.sim that we wrote to run this simulation by

changing our random samples of size n to come from a uniform distribution over [-10,10] (see runif).

performing a two sided t-test instead of a one sided t-test.

performing the test at the 0.01 significance level.

choosing an appropriate value for the null value in the t-test. Note that the true mean in this case is 0 for a Uniform(-10,10) population. Try this experiment for n=10,30,50,100,500. What happens the estimated type I error rate as n changes? Is the type I error rate maintained for any of these sample sizes?

Level 2:

- From introductory statistics, we know that the sampling distribution of a sample mean will be approximately normal with mean μ and standard error $\sigma/\sqrt{n}$ if we have a random sample from a population with mean μ and standard deviation σ and the sample size is "large" (usually at least 30). In this problem, we will build a simulation that will show when the sample size is large enough.

Generate N=500 samples of size n=50 from a Uniform[-5,5] distribution.

For each of the N=500 samples, calculate the sample mean, so that you now have a vector of 500 sample means.

Plot a histogram of these 500 sample means. Does it look normally distributed and centered at 0?

Turn this simulation into a function that takes arguments N the number of simulated samples to make and n the sample size of each simulated sample. Run this function for n=10,15,30,50. What do you notice about the histogram of the sample means (the sampling distribution of the sample mean) as the sample size increases.

Text Book

Introduction to R- Robert Parker, John Mushcelli and Andrew Jaffe, Johns Hopkins University, 2020

References

1. Making Sense of Data I: A Practical Guide to Exploratory Data Analysis and Data Mining Paperback, Glenn J. Myatt and Wayne P. Johnson, Import, 22 July 2014.

2. The R Software-Fundamentals of Programming and Statistical Analysis -Pierre Lafaye de Micheaux, Remy Drouilhet, Benoit Liquet, Springer 2013.

Topics relevant to Development skills

Topics relevant to development of "Employability": Real time application development using R Programming Tools.

Topics relevant to "Human Values & Professional Ethics"

Course Code: CSE3155	Course Title: Data Communications and Computer Networks Type of Course: Program Core Theory–Laboratory integrated	L-T-P-C 3-0-2-4	3	0	2	4
Version No.	1.0					
Course Pre-requisites	ECE2011					
Anti-requisites	NIL					
Course Description	The objective of this course is to provide knowledge in data communications and computer networks, its organization and its implementation, and gain practical experience in the installation, monitoring, and troubleshooting of LAN systems. . The associated laboratory is designed to implement and simulate various networks using Cisco packet tracer, NS2. All the lab exercises will focus on the fundamentals of creating multiple networks, topologies and analyzing the network traffics.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Data Communications and Computer Networks and attain Employability through Problem Solving Methodologies.					
Course Out Comes	On successful completion of the course, the students shall be able to: 1] I llustrate the Basic Concepts Of Data Communication and Computer Networks. 2] Analyze the functionalities of the Data Link Layer. 3] Apply the Knowledge of IP Addressing and Routing Mechanisms in Computer Networks. 4] Demonstrate the working principles of the Transport layer and Application Layer.					
Course Content:						
Module 1	Introduction and Physical Layer-CO1	Assignment	Problem Solving	07 Classes		
Introduction to Computer Networks and Data communications, Network Components – Topologies, Transmission Media –Reference Models -OSI Model – TCP/IP Suite. Physical Layer -Analog and Digital Signals – Digital and Analog Signals – Transmission - Multiplexing and Spread Spectrum.						
Module 2	Reference Models and Data Link Layer – CO2	Assignment	Problem Solving	7 Classes		

Data Link Layer - Error Detection and Correction – Parity, LRC, CRC, Hamming Code, Flow Control and Error Control, Stop and Wait, ARQ, Sliding Window, Multiple Access Protocols, CSMA/CD,CSMA/CA, IEEE 802.3, IEEE 802.11 Ethernet.				
Module 3	Network Layer – CO 3	Assignment	Problem Solving	10 Classes
Network Layer Services - Network Layer Services, Switching Techniques, IP Addressing methods- IPv4 IPV6 – Subnetting. Routing, - Distance Vector Routing – RIP-BGP-Link State Routing –OSPF-Multi cast Routing-MOSPF- DVMRP – Broad Cast Routing. EVPN-VXLAN, VPLS, ELAN.				
Module 4	Transport and Application Layer -CO3	Assignment	Problem Solving	10 Classes
Transport Layers - Connection management – Flow control – Retransmission, UDP, TCP, congestion control, – Congestion avoidance (DECbit, RED) The Application Layer: Domain Name System (DNS), Domain Name Space, SSH, FTP, Electronic Mail (SMTP, POP3, IMAP, MIME) – HTTP – – SNMP, Web Services, Virtual Networking.				
List of Laboratory Tasks: Lab sheet -1, M-1, 3 [2 Hours] Experiment No 1: Level 1: Study of basic network commands and network configuration commands. Lab sheet -2, M-1[2 Hours] Experiment No 1: Level 1: Identify and explore Network devices, models and cables. Introduction to Cisco packet tracer. Experiment No. 2: Level 2 – Create various network topologies using a cisco packet tracer. Lab sheet -3, M-2,3 [2 Hours] Experiment No. 1: Level 2 - Basic Configuration of switch/router using Cisco packet tracer. Experiment No. 2: Level 2 -Configure the privilege level password and user authentication in the switch/router. Lab sheet – 4, M-3 [2 Hours] Experiment No. 1: Level 2 - Configure the DHCP server and wireless router and check the connectivity Lab sheet – 5, M-3 [2 Hours] Experiment No. 1: Level 2 - Configure the static routing in the Cisco packet tracer. Experiment No. 2: Level 2 - Configure the dynamic routing protocol in the Cisco packet tracer.				

Lab sheet – 6, M-4 [2 Hours]
Experiment No. 1: Configuration of DNS Server with Recursive & Integrative approach in Cisco packet tracer.
Lab sheet – 7, M-4 [2 Hours]
Experiment No. 1:
Configure the telnet protocol in the router using the Cisco packet tracer.
Lab sheet – 8, M-4[2 Hours]
Experiment No. 1:
Level1- Introduction to NS2 and basic TCL program.
Lab sheet – 9, M-4 [2 Hours]
Experiment No. 1:
Level 1: Simulate three node Point to point network using UDP in NS2.
Experiment No. 2:
Simulate transmission of Ping message using NS2.
Lab sheet – 10, M-4[2 Hours]
Experiment No. 1:
Simulate Ethernet LAN using N-node in NS2.
Experiment No. 2:
Simulate Ethernet LAN using N-node using multiple traffic in NS2
Lab sheet –11, M-3,4 [2 Hours]
Experiment No. 1:
Level 1- Introduction to Wire Shark.
Experiment No. 2:
Level 2- Demonstration of packet analysis using wire shark.
Lab sheet –12, M-1,2,3 [2 Hours]
Experiment No. 1:
Level 2- Demonstration of switch and router configuration using real devices

Targeted Application & Tools that can be used: Cisco Packet Tracer, Wireshark, and NS2.

Case Study/Assignment: Choose and analyze a network from any organization/Assignment proposed for this course in CO1-CO4

Problem Solving: Choose and appropriate devices and implement various network concepts.
Programming: Simulation of any network using NS2.

Text Book
Behrouz A. Forouzan, “Data Communications and Networking 5E”, 5th Edition, Tata McGraw-Hill, 2017.
Andrew S Tanenbaum, Nick Feamster & David J Wetherall, “Computer Networks” Sixth Edition, Pearson Publication, 2022

References
“Computer Networking: A Top-Down Approach”, Eighth Edition, James F. Kurose, Keith W. Ross, Pearson publication, 2021.

William Stallings, Data and Computer Communication, 8th Edition, Pearson Education, 2007.
Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.
E-Resources:
1.https://archive.nptel.ac.in/courses/106/105/106105183/
2. http://www.nptelvideos.com/course.php?id=393
3.https://www.youtube.com/watch?v=3DZLItfbqtQ
4.https://www.youtube.com/watch?v=_fIdQ4yfsfM
5. https://www.digimat.in/keyword/106.html
https://puniversity.informaticsglobal.com/login

Course Code: **CCS3413**	**Course Title:** Security Auditing and Governance	**L- T - P- C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	CSE3078					
Anti-requisites	**NIL**					
Course Description	This course covers security auditing principles, governance frameworks, and compliance regulations essential for organizational cybersecurity. It includes risk assessment, vulnerability management, and security controls while aligning with standards like ISO 27001, NIST, PCI-DSS, and GDPR. Students will explore governance, risk, and compliance (GRC) models, audit methodologies, and hands-on log analysis, security assessments, and incident response. By the end, they will be equipped to conduct audits, ensure compliance, and strengthen enterprise security.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of security auditing and governance post-quantum cryptographic algorithms to attain **Skill Development** through **Participative Learning** techniques.					
Course Outcomes	**On successful completion of this course the students shall be able to:** CO1: **Define** key concepts of security auditing, governance, and compliance frameworks**.** [**Remember**] CO2: **Explain** risk assessment methodologies and the role of governance in cybersecurity. [**Understand**]					

	CO3: **Perform** security audits, log analysis, and compliance checks using industry standards. [**Apply**] CO4: **Assess** vulnerabilities, security controls, and risk management strategies in IT environments. [**Analysis**]	
Course Content:		
Module 1	The Principles of Auditing	**12 hours**
Topics: The Principles of Auditing - Security Fundamentals: The Five Pillars - Building a Security Program - Security Controls - Managing Risk - The Auditing Process		
Module 2	Information Security and the Law	**12 hours**
Topics: IT Security Laws - Hacking, Cracking, and Fraud Laws - Intellectual Property Laws - CAN-SPAM Act of 2003 - State and Local Laws - Reporting a Crime - Regulatory Compliance Laws		
Module 3	Information Security Governance, Frameworks, and Standards	**11 hours**
Topics: Understanding Information Security Governance - Process: Security Governance Frameworks - Technology: Standards Procedures and Guidelines - Auditing Tools and Techniques - Evaluating Security Controls - Auditing Security Practices - Testing Security Technology - Security Testing Frameworks		
Module 4	**Auditing**	**10 hours**
Topics: Auditing Cisco Security Solutions - Policy, Compliance, and Management - Infrastructure Security		
Assignment:		
1. Book/Article review: At the end of each module a book reference or an article topic will be given to an individual or a group of students. They need to refer the library resources and write a report on their understanding about the assigned article in appropriate format. Presidency University Library Link .		

2. Presentation: Group presentation, where the students will be given a topic. They will have to explain/demonstrate the working and discuss the applications for the same.

Text Book(s):

1. **Chris Jackson**, *Network Security Auditing*, Cisco Press, 2010

Reference(s):

Reference Book(s):

1. Russell Dean Vines, *Wireless Security Audit Methods and Tools*, McGraw-Hill, 2002.
2. Eric Cole, Ronald Krutz, and James Conley, *Network Security Bible*, Wiley, 2009.
3. Richard Bejtlich, *The Practice of Network Security Monitoring: Understanding Incident Detection and Response*, No Starch Press, 2013.
4. William Stallings, *Network Security Essentials: Applications and Standards*, Pearson, 2020.

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

Weblinks:

https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=1223875&site=ehost-live&ebv=EB&ppid=pp_xiii

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Topics related to development of "FOUNDATION": Information Security and the Law

Topics related to development of "EMPLOYABILITY": Security Governance, Frameworks, and Standards

Course Code: **CCS3403**	**Course Title: AI and ML for Cyber Security**	**L- T-P-C**	**3**	0	**0**	**3**
Version No.	1.0					
Course Pre-requisites	CSE3078					
Anti-requisites	**NIL**					
Course Description	This course provides an in-depth exploration of how Artificial Intelligence (AI) and Machine Learning (ML) techniques are applied to modern cybersecurity challenges. Students will learn about					

	various cyber threats, attack classifications, and vulnerabilities while developing hands-on experience with ML-based threat detection and anomaly detection. The course covers supervised and unsupervised learning techniques for malware classification, time-series analysis for behavior monitoring, deep learning models for intrusion detection, and adversarial AI threats. Through case studies, research paper discussions, and practical implementations, learners will develop a solid foundation in AI-powered cybersecurity solutions.			
Course Objective	Machine Learning (ML) is increasingly used in sensitive and time-critical systems such as autonomous driving, cyber physical systems etc. to deliver higher performance and protect the confidentiality of the systems. Though ML based systems can be used to classify various malware attacks and develop intrusion detection systems, these systems are also susceptible to several adversarial attacks. This course covers a systematic approach on developing ML based cybersecurity methodologies. It will also cover adversarial attacks which intentionally forces ML systems to behave unexpectedly.			
Course Out Comes	**On successful completion of the course the students shall be able to:** CO1:Students will be able to develop ML models to classify malwares. CO2:Able to implement simple intrusion detection systems using deep neural networks. CO3:They will be able to demonstrate the vulnerabilities in ML systems and state methods to address adversarial attacks.			
Course Content:				
Module 1		Assignment	Theory	**12 Sessions**
Topics: Overview on Machine Learning with use cases from cybersecurity, classification of threats, attacks, vulnerabilities, malware, trojans etc.				
Module 2		Assignment	Programming activity	**16 Sessions**
Topics: Classification of malware using supervised/unsupervised learning based on signatures and profiling. Decision Tree and context based malicious event detection				

Module 3		Assignment	Programming activity	**16 Sessions**
Topics: Time Series Analysis and Ensemble modelling to detect deviation from normal behaviour, case studies in Reconnaissance detection .				
Module 4		Assignment	Programming activity	**16 Sessions**
Topics: Efficient Network Anomaly detection; familiarize with various stages of network attack and address using deep neural networks, develop intrusion detection systems				
Module 5				
Topics: Adversarial attacks on ML systems, model poisoning, black box attacks, white box attacks, state-of-art research paper reading on deep learning systems				
Targeted Application & Tools that can be used Use of PowerPoint software for lecture slides and **Jupyter Notebook** – Interactive environment for coding and analysis. **Scikit-Learn** – Machine learning library for classification and anomaly detection. **Wireshark** – Network traffic analysis and packet inspection.				
Project work/Assignment:				
Assignment: AI-Based Intrusion Detection System (IDS). Phishing URL & Email Detection Using NLP. AI-Powered Fake News & Social Engineering Detection.				
Text Book T1. A. Hands-on Machine Learning for Cyber Security by Soma Halder, ISBN139781788992282				
References : 1. Machine Learning and Security by David Freeman, Clarence Chio Publisher: O'Reilly Media, Inc. Release Date: February 2018 ISBN: 9781491979891 2. Malware Data Science by Joshua Saxe with Hillary Sanders, ISBN-10: 1-59327-859-4 ISBN-13: 978-1-59327-859-5 Publisher: William Pollock				

Course Code: **CCS3411**	**Course Title:** Security Information and Event Management (SIEM) **Type of Course:** Core subject Cyber Security	**L- T - P- C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	**CSE3078**					
Anti-requisites	**NIL**					
Course Description	This course provides a comprehensive understanding of Security Information and Event Management (SIEM), focusing on its role in real-time threat detection, incident response, and compliance monitoring. It covers key concepts such as log collection, event correlation, and security analytics, enabling students to detect and mitigate cyber threats effectively. Through hands-on experience with industry-leading SIEM tools like Splunk, IBM QRadar, and Elastic SIEM, students will learn to investigate security incidents and automate threat detection. The course also explores threat intelligence integration, regulatory compliance (GDPR, PCI-DSS, HIPAA), and SOC operations, equipping learners with the skills needed for enterprise security monitoring and cybersecurity defense.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Security Information and Event Management (SIEM) solutions for real-time threat detection, incident response, compliance monitoring and attain **Skill Development** through **Participative Learning** techniques.					
Course Outcomes	**On successful completion of this course the students shall be able to:** CO1: **Identify** the fundamental components and functions of Security Information and Event Management (SIEM) systems [**Remember**] CO2: **Classify** the process **of** log collection, normalization, and event correlation in a SIEM environment. [**Understand**] CO3: **Configure** a SIEM system to ingest logs from various security devices and generate alerts for suspicious activities [**Apply**]					
Course Content:						
Module 1	Introduction to SIEM: Threat Intelligence for IT Systems					**13 hours**

Topics:

Introduction to SIEM: Threat Intelligence for IT Systems - Business Models - Threat Models - Regulatory Compliance

Module 2	IT Threat Intelligence Using SIEM Systems		**15 hours**

Topics:

SIEM Concepts: Components for Small and Medium-size Businesses - The Anatomy of a SIEM - Incident Response - Using SIEM for Business Intelligence

Module 3	SIEM Tools	Case study	Kerberos configuration for ecosystem tools		**15 hours**

Topics:

AlienVault OSSIM Implementation - AlienVault OSSIM Operation - Cisco Security: MARS Implementation - Cisco MARS Advanced Techniques

Assignment:

1. Book/Article review: At the end of each module a book reference or an article topic will be given to an individual or a group of students. They need to refer the library resources and write a report on their understanding about the assigned article in appropriate format. Presidency University Library Link .

2. Presentation: Group presentation, where the students will be given a topic. They will have to explain/demonstrate the working and discuss the applications for the same.

Text Book(s):

1. Security Information and Event Management (SIEM) Implementation by David R. Miller, Shon Harris, Allen Harper, Stephen VanDyke, and Chris Blask, McGrawHill.
2. Ben Spivey, Joey Echeverria, “Hadoop Security Protecting Your Big Data Problem”, O’Reilly Media, 2015.

Reference(s):

Reference Book(s):

1. Joseph Muniz, Security Information and Event Management (SIEM) Fundamentals, Cisco Press.
2. Matthew Hubbard, The Security Analyst’s Guide to SIEM, Apress.

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

Weblinks: https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=1223875&site=ehost-live&ebv=EB&ppid=pp_xiii https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=2706929&site=ehost-live
Topics related to development of “FOUNDATION”: Introduction to SIEM, Log Collection & Management Topics related to development of “EMPLOYABILITY”: Configuring SIEM for Security Monitoring, Incident Response & Compliance

Course Code: **CCS3413**	**Course Title:** Security Auditing and Governance	**L- T - P- C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	CSE3078					
Anti-requisites	**NIL**					
Course Description	This course covers security auditing principles, governance frameworks, and compliance regulations essential for organizational cybersecurity. It includes risk assessment, vulnerability management, and security controls while aligning with standards like ISO 27001, NIST, PCI-DSS, and GDPR. Students will explore governance, risk, and compliance (GRC) models, audit methodologies, and hands-on log analysis, security assessments, and incident response. By the end, they will be equipped to conduct audits, ensure compliance, and strengthen enterprise security.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of security auditing and governance post-quantum cryptographic algorithms to attain **Skill Development** through **Participative Learning** techniques.					
Course Outcomes	**On successful completion of this course the students shall be able to:**					

	CO1: **Define** key concepts of security auditing, governance, and compliance frameworks**.** [**Remember**] CO2: **Explain** risk assessment methodologies and the role of governance in cybersecurity. [**Understand**] CO3: **Perform** security audits, log analysis, and compliance checks using industry standards. [**Apply**] CO4: **Assess** vulnerabilities, security controls, and risk management strategies in IT environments. [**Analysis**]	
Course Content:		
Module 1	The Principles of Auditing	**12 hours**
Topics: The Principles of Auditing - Security Fundamentals: The Five Pillars - Building a Security Program - Security Controls - Managing Risk - The Auditing Process		
Module 2	Information Security and the Law	**12 hours**
Topics: IT Security Laws - Hacking, Cracking, and Fraud Laws - Intellectual Property Laws - CAN-SPAM Act of 2003 - State and Local Laws - Reporting a Crime - Regulatory Compliance Laws		
Module 3	Information Security Governance, Frameworks, and Standards	**11 hours**
Topics: Understanding Information Security Governance - Process: Security Governance Frameworks - Technology: Standards Procedures and Guidelines - Auditing Tools and Techniques - Evaluating Security Controls - Auditing Security Practices - Testing Security Technology - Security Testing Frameworks		
Module 4	**Auditing**	**10 hours**
Topics: Auditing Cisco Security Solutions - Policy, Compliance, and Management - Infrastructure Security		
Assignment:		
1. Book/Article review: At the end of each module a book reference or an article topic will be given to an individual or a group of students. They need to refer the library resources and write a report on their understanding about the assigned article in appropriate format. Presidency University Library Link .		

2. Presentation: Group presentation, where the students will be given a topic. They will have to explain/demonstrate the working and discuss the applications for the same.

Text Book(s):

1. **Chris Jackson**, *Network Security Auditing*, Cisco Press, 2010

Reference(s):

Reference Book(s):

1.Russell Dean Vines, *Wireless Security Audit Methods and Tools*, McGraw-Hill, 2002.

2. Eric Cole, Ronald Krutz, and James Conley, *Network Security Bible*, Wiley, 2009.
3. Richard Bejtlich, *The Practice of Network Security Monitoring: Understanding Incident Detection and Response*, No Starch Press, 2013.
4. William Stallings, *Network Security Essentials: Applications and Standards*, Pearson, 2020.

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Topics related to development of "FOUNDATION": Information Security and the Law

Topics related to development of "EMPLOYABILITY": Security Governance, Frameworks, and Standards

Course Code: CCS3404	**Course Title:** Incident Response with Threat Intelligence **Type of Course:** Core subject Cyber Security	**L- T - P- C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	**CSE3078**					
Anti-requisites	**NIL**					

Course Description	This course covers the fundamentals of incident response and threat intelligence, focusing on identifying, analyzing, and mitigating cybersecurity threats. Students will learn the incident response lifecycle, threat actor profiling, and the use of tools like TheHive, Security Onion, and Velociraptor. The course also explores frameworks such as MITRE ATT&CK and emphasizes hands-on skills in evidence collection, threat hunting, and intelligence-driven response. By the end, learners will be equipped to manage incidents and enhance organizational security using actionable threat intelligence.	
Course Objective	The objective of the course is to familiarize the learners with the concepts of security in IR&TI to attain **Skill Development** through **Participative Learning** techniques.	
Course Outcomes	**On successful completion of this course the students shall be able to:** CO1: **Describe** key concepts of incident response, threat intelligence, and common cyber-attack techniques. [Understand] CO2: **Explain** the incident response lifecycle and threat intelligence concepts, including attacker tactics, techniques, and procedures (TTPs) [**Understand**] CO3: **Perform** appropriate tools and techniques to investigate, respond to, and document cybersecurity incidents. [**Apply**]	
Course Content:		
Module 1	Foundations of Incident Response and Threat Landscape	**15 hours**
Topics: Threat Landscape and Cybersecurity Incidents - Concepts of Digital Forensics and Incident Response - Basics of the Incident Response and Triage Procedures - Applying First Response Procedures - Identifying and Profiling Threat Actors - Understanding the Cyber Kill Chain and the MITRE ATT&CK Framework		
Module 2	Strategic Planning and Program Development	**13 hours**
Topics: - Creating Incident Response Plans and Playbooks - Developing an Incident Response Program - Implementing and Using TheHive and Cortex for Incident Management		
Module 3	Tools, Techniques, and Threat Hunting	**15 hours**
Topic: Collecting Evidence with Velociraptor and KAPE - Integrating ELK Stack into Incident Response - Utilizing Security Onion for Network Monitoring and Detection - Threat Hunting with Sigma and YARA Rules - Automating Detection and Response with MITRE ATT&CK and TRAM		
Assignment:		
1. Book/Article review: At the end of each module a book reference or an article topic will be given to an individual or a group of students. They need to refer the library resources and write a report on their understanding about the assigned article in appropriate format. Presidency University Library Link . 2. Presentation: Group presentation, where the students will be given a topic. They will have to explain/demonstrate the working and discuss the applications for the same.		

Text Book(s):

1. Roberto Martínez*, Incident Response with Threat Intelligence: A practical guide to catching attackers and defending your organization,* Packt Publishing, 2022.

Reference(s):
Reference Book(s):

1. **Jason Luttgens, Matthew Pepe, and Kevin Mandia**, *Incident Response & Computer Forensics*, McGraw Hill, 2014.
2. **Chris Sanders and Jason Smith**, *Practical Packet Analysis: Using Wireshark to Solve Real-World Network Problems*, No Starch Press, 2017.

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

Weblinks:

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Topics related to development of "FOUNDATION": Introduction to incident response and thread intelligence

Topics related to development of "EMPLOYABILITY": `Tools, Techniques and Thread Hunting`

Course Code: CSE3102	Course Title: Malware Analysis	L-T-P- C	3-0	0	3
Version No.	1.0				
Course Pre-requisites	CSE3078				
Anti-requisites	NIL				
Course Description	The purpose of the course is to explore malware analysis tools and techniques in depth. Understanding the capabilities of malware is critical to an organization's ability to derive threat intelligence, respond to information security incidents, and fortify defenses. This course builds a strong foundation for reverse-engineering malicious software using a variety of system and network monitoring utilities, a disassembler, a debugger, and other tools useful for turning malware inside-out.				

Course Objective	To study the fundamentals of malwares. To know about different malicious programs and their behavior To know how to work on linux systems. To learn, analyze and demonstrate network hacking tools				
Course OutComes	On successful completion of this course the students shall be able to: Understanding the nature of malware, its capabilities, and how it is combated through detection and classification. Apply the methodologies and tools to perform static and dynamic analysis on unknown executables. Analyze scientific and logical limitations on society's ability to combat malware.. Apply techniques and concepts to unpack, extract, decrypt, or bypass new anti analysis techniques in future malware samples.				
Course Content:					
Module 1	Introduction to MALWARE ANALYSIS (Application)		Assignment	Programming activity	12 Hours
Topics: Introduction to malware, OS security concepts, malware threats, evolution of malware, malware typesviruses, worms, rootkits, Trojans, bots, spyware, adware, logic bombs, malware analysis, static malware analysis, dynamic malware analysis.					
Module 2	Static Analysis (Application)		Assignment	Programming activity	11 Hours
Topics: X86 Architecture- Main Memory, Instructions, Opcodes and Endianness, Operands, Registers, Simple Instructions, The Stack, Conditionals, Branching, Rep Instructions, C Main Method and Offsets. Antivirus Scanning, Fingerprint for Malware, Portable Executable File Format, The PE File Headers and Sections, The Structure of a Virtual Machine, ReverseEngineering- x86 Architecture					
Module 3	Dynamic Analysis (Application)		Assignment	Programming activity	11 Hours
Topics: Live malware analysis, dead malware analysis, analyzing traces of malware- system-calls, api-calls, registries, network activities. Anti-dynamic analysis techniques anti-vm, runtime-evasion techniques, , Malware Sandbox, Monitoring with Process Monitor, Packet Sniffing with Wireshark					
Module 4	Malware Functionality and Detection Techniques (Comprehension)		Assignment	Programming activity	12 Hours

Topics: Downloader, Backdoors, Credential Stealers, Persistence Mechanisms, Privilege Escalation, Covert malware launching- Launchers, Process Injection, Process Replacement, Hook Injection, Detours, APC injection. Signature-based techniques: malware signatures, packed malware signature, metamorphic and polymorphic malware signature Non-signature based techniques: similarity-based techniques, machine-learning methods, invariant inferences
Targeted Application & Tools that can be used: eCMAP (Certified Malware Analysis Professional)
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course
Problem Solving: Choose an appropriate data structure and implementation of programs. Programming: Implementation of given scenario using Java
Text Book Michael Sikorski and Andrew Honig, 2012: " Practical Malware Analysis", No Starch Press.
References Jamie Butler and Greg Hoglund, 2005: "Rootkits: Subverting the Windows Kernel", Addison-Wesley. Dang, Gazet and Bachaalany, 2014: "Practical Reverse Engineering",Wiley. Reverend Bill Blunden, 2012: "The Rootkit Arsenal: Escape and Evasion in the Dark Corners of the System" Second Edition,Jones& Bartlett.

Course Code: **CSE3095**	**Course Title:** **Cloud Security** **Type of Course:** **Theory**	**L-T- P- C**	3 -0-0-3
Version No.	1.0		
Course Pre-requisites	**CSE2069**		
Anti-requisites	**NIL**		
Course Description	This course provides ground-up coverage on the high-level concepts of cloud landscape, architectural principles, and techniques. It describes the Cloud security architecture and explores the guiding security for Infrastructure and Softwares.		
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Cloud Security** and attain **Employability** through **Participative Learning** techniques.		

<table>
<tr><td>Course Outcomes</td><td colspan="4">On successful completion of this course the students shall be able to:
1. Describe fundamentals of cloud computing [Knowledge].
2. Explain cloud computing security architecture and associated challenges [Comprehension].
3. Discuss cloud computing software security essentials [Comprehension].
4. Apply infrastructure security and data security in cloud computing enviroment. [Application].</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1:</td><td>Fundamentals of Cloud Computing</td><td>Quiz</td><td>Knowledge based Quiz</td><td>10 Sessions</td></tr>
<tr><td colspan="5">Topics: Cloud Computing at a Glance, Building Cloud Computing Environments, Computing Platforms and Technologies, Cloud Computing Architecture: Cloud Delivery Models, The SPI Framework, Cloud Software as a Service (SaaS), Cloud Platform as a Service (PaaS), Cloud Infrastructure as a Service (IaaS), Cloud Deployment Models, Expected Benefits.</td></tr>
<tr><td>Module 2:</td><td>Cloud Security Challenges and Cloud Security Architecture</td><td>Quiz</td><td>Comprehension based Quiz</td><td>10 Sessions</td></tr>
<tr><td colspan="5">Topics: Security Policy Implementation, Computer Security Incident Response Team, Virtualization Security Management. Architectural Considerations, Identity Management and Access Control, Autonomic Security.</td></tr>
<tr><td>Module 3</td><td>Cloud Computing Software Security Essentials</td><td>Assignment</td><td>Batch-wise Assignments</td><td>9 Sessions</td></tr>
<tr><td colspan="5">Topics: Cloud Information Security Objectives, Cloud Security Services, Secure Cloud Software Requirements, Cloud Security Policy Implementation, Secure Cloud Software Testing, Cloud Computing and Business Continuity Planning/Disaster Recovery.</td></tr>
<tr><td>Module 4:</td><td>Infrastructure Security and Data Security</td><td>Assignment and Presentation</td><td>Batch-wise Assignment and Presentations</td><td>9 Sessions</td></tr>
<tr><td colspan="5">Topics: Infrastructure Security: The Network Level, The Host Level, The Application Level.
Data Security : Aspects of Data Security, Data Security Mitigation, Provider Data and its Security.</td></tr>
<tr><td colspan="5">Targeted Application & Tools that can be used: Use of CloudSim simulator.</td></tr>
<tr><td colspan="5">Project work/Assignment:
Survey on Cloud Service Providers</td></tr>
<tr><td colspan="5">Text Book
1. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, “Mastering Cloud Computing”, McGraw Hill Education, July 2017.
2. Roland L Krutz and Russell Dean Vines, “Cloud Security - A Comprehensive Guide to Secure Cloud Computing”, Wiley Publishing, Inc. 2010.</td></tr>
</table>

References

1. Sushil Jajodia, Krishna Kant, Pierangela Samarati, Anoop Singhal, Vipin Swarup, Cliff Wang, "*Secure Cloud Computing*", Springer, ISBN 978-1-4614-9278-8 (eBook).
2. John Rittinghouse and James Ransome, "*Cloud Computing, Implementation, Management and Security*", CRC Press, 2010.
3. Tim Mather, Subra Kumaraswamy and Shahed Latif", "Cloud Security and Privacy – An Enterprise Perspective on Risks and Compliance", Oreily Publication, 2009.

WEB RESOURCES:

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

Topics relevant to "EMPLOYABILITY SKILLS": Cloud computing architecture, Security policy implementation, Infrastructure security and Data security **for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout.**

Course Code: CCS3408	Course Title: Privacy and Security in Online Social Media	L-T-P-C	3	0	0	3
Version No.	1.0					
Course Pre-requisites						
Anti-requisites	NIL					
Course Description	Objective of this course is to make students learn the basics of privacy and security in online social media and develop ability to understand the importance of privacy in anyone's life and their consequences if it is in peril. This course is both conceptual and analytical in nature that would help the student to predict the effects of any activity on Social Media. The students should have prior knowledge of some Social media platforms. After successful completion of the Course, the students would acquire knowledge to protect themselves from the online data theft on social media from attacker.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Privacy and Security in Online Social Media** and attain **Employability** through **Participative Learning** techniques.					

Course Out Comes	On successful completion of the course the students shall be able to: 1] Recognize the significance of the Privacy and how to protect it **[Knowledge]** 2] Summarize the privacy and security Encryption for Peer to Peer Social Networks. **[Comprehension]** 3] Understand the function of stealing Reality and K-Anonymity. **[Knowledge]** 4]Use the Link Reconstruction attack in privacy Social Networks. **[Application]**

Course Content:

Module 1	ANALYSIS OF PRIVACY IN SOCIAL NETWORKS	Assignment	Knowledge	**8 Sessions**

Topics:
Three-Layered Framework-Characteristics Used to Analyze Social Web Privacy-Privacy Issues Related to Social Web Users-Privacy Issues Related to Service Providers-Security and Privacy for Digital Facets-Identifiable Facets-Private Facets.
Assignment: Find real world problems and suggest solutions.

Module 2	ENCRYPTION FOR PEER-TO-PEER SOCIAL NETWORKS	Assignment	Comprehension	**8 Sessions**

Topics:
Essential Criteria for the P2P Encryption Systems-Existing P2P OSN Architectures-Evaluations of Existing Encryption Schemes Based on Our Criteria-Broadcast Encryption-Predicate Encryption.
Assignment: - Survey of Unethical Behavior and Influencing factors.

Module 3	STEALING REALITY AND K-ANONYMITY	Quiz	Comprehension	**11 Sessions**

Topics:
Stealing Reality- Social Attack Model- Social Learnability- k-Anonymity- k-Degree Anonymity- k-Neighborhood
Anonymity- k- Automorphism- k-Isomorphism-L-diversity- Attack Model and Privacy Guarantee-Insights from an ℓ-Diversified Graph.

Module 4	PRIVACY IN SOCIAL NETWORKS- LINKS RECONSTRUCTION ATTACK	Assignment/Case study	Application	**11 Sessions**

Privacy in Social Networks- Link Prediction- Feature Extraction- Communities Datasets- Electronic Currencies- Anonymity- The Bit coin System- The Transaction Network- The User Network- Anonymity Analysis- Integrating Off-Network Information. Use Case and the Threat Model- Use Case for Private Record Linkage- Use Case for Privacy-Preserving Record Linkage-

Assignment: - The Bit coin Faucet- Voluntary Disclosures- TCP/IP Layer Information- Context Discovery- Flow and Temporal Analyses**.**
Text Book / References T1. Yaniv Altshuler, Yuval Elovici, Armin B. Cremers Nadav Aharony, Alex Pentland," Security and Privacy in Social Networks", Springer Publisher,2012,1st Edition **Online Resources: -** W1: https://presiuniv.knimbus.com/user#/searchresult?searchId=Privacy%20and%20Security%20in%20Online%20Social%20Media%20&curPage=0&layout=list&sortFieldId=none&topresult=false W2: https://onlinecourses.nptel.ac.in/noc21_cs28/preview
Topics relevant to "EMPLOYABILITY SKILLS": Link Prediction, features extraction, for developing Employability Skills through Participative Learning Techniques. This is attained through the assessment component mentioned in the course handout.

Course Code: CCS3400	**Course Title: Digital and Mobile Forensics** **Type of Course: Integrated**	**L- T-P- C**	2	0	2	3
Version No.	1.0					
Course Pre-requisites	**CSE3155**					
Anti-requisites	Nil					
Course Description	This course demonstrates the use of Mobile phones and digital devices across the globe has increased dramatically. These devices are more susceptible to information security attacks and thus they also possess huge evidences which shall be used during crime scene investigation. This makes the Course on mobile and digital forensics an inevitable one for the security professionals. This Course on mobile and digital forensics will provide a better understanding on different forms of evidences in many digital devices, collection and interpretation of the same. Topics include: Wireless technologies and security-wireless protocols, wireless threats, cell phones and GPS, SMS and data interception in GSM. Mobile phone forensics - files present in SIM card, device data, external memory dump, Android forensics. Digital forensics: - evaluating digital evidence, Digital forensics examination principles.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Database Management Systems and attain EMPLOYABILITY SKILLS through PARTICIPATIVE Learning techniques					
Course Outcomes	On successful completion of this course the students shall be able to: CO 1: Outline the basic concepts of Cybercrime and digital Forensics. (Remember) CO 2: Employ various digital Forensic tools to perform Forensic investigation (Apply) CO 3: Interpret security challenges and Forensic examination process of wireless devices. (Understand)					

	CO 4: Produce digital evidence through the usage of mobile device Forensic tools (Understand)				
Course Content:					
Module 1	Cybercrime and Digital Forensic Principles	Assignment	Cybercrime	Bloom's level selected: Remember	**13 Sessions - L[07] + P[06]**
	Cybercrime: Definition, Nature and Scope of Cybercrime, Types of cybercrime, Categories of cybercrime, Investigating Cybercrime, Digital Evidence, Prevention of cybercrime, Case studies on Cyber Crimes. **Overview of Digital Forensics:** Phases of Digital Forensics, Digital devices in society, Evidential Potential of Digital Devices, closed and open systems.				
Module 2	Digital Forensics examination process	Case Studies	Digital Evidence	Bloom's level selected: Apply	**16 Sessions - L[08] + P[08]**
	Language of Computer crime investigation, preparing a Digital Forensics Investigation, challenging aspects of digital evidence, presenting digital evidence, Device usage. **Digital forensics examination principles**: Previewing, Imaging, Continuity and hashing, Evidence locations, A seven-element security model.				
Module 3	Wireless technologies and Wireless threats	Certification	GSM, Paraben's Cell Seizure	Bloom's level selected: Understand	**15 Sessions - L[07] +P[08]**
	Overview of Modern Wireless Technology: Wireless Crime Prevention Techniques, War-Driving, War-Chalking, War Flying, Voice SMS, GSM and Identification, Cell Phone Hacking and Phreaking, Cell Phone Forensics, Forensic Rules for Cellular Phones.				
Module 4	Mobile phone Forensics	Presentation	Forensic Tools	Bloom's level selected: Understand	**16 Sessions - L[08]]+P[08]**
	Importance and Motivation behind Mobile Forensics, Mobile Phone Forensics: Crime and Mobile Phones, Evidence, Forensic Procedures of mobile phones, The SIM Card, Files Present in SIM Card, SMS Spam, Mobile Phone Forensics Tools and Methods, Social Media Forensics on Mobile Devices.				
	Targeted Application & Tools that can be used: Wireless Security Digital Forensics Android Forensics				
	Textbooks: **T1:** Gregory Kipper, "Wireless Crime and Forensic Investigation", Auerbach Publications, 1st Edition, September 19, 2019.				
	References: **R1:** Losif I. Androulidakis, "Mobile phone security and forensics: A practical approach", Springer publications, 2nd Edition, 2016.				

	R2: Andrew Hoog, "Android Forensics: Investigation, Analysis and Mobile Security for Google Android", Elsevier publications, 1st Edition, 15th June 2011. **R3:** Angus M. Marshall, "Digital forensics: Digital evidence in criminal investigation", John – Wiley and Sons, November 2008, p 180. **Web references:** https://presiuniv.knimbus.com/user#/home
	Topics relevant to "Employability": Prevention of cybercrime preparing a Digital Forensics Investigation Mobile Phone Forensics: Crime and Mobile Phones. Mobile Phone Forensics Tools for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: **CIT2502**	**Course Title: Wireless communication in IOT** **Type of Course: Program Core& Theory Only**		**L-T-P-C**	3 -0-0-3
Version No.	1.0			
Course Pre-requisites	**NIL**			
Anti-requisites	**NIL**			
Course Description	Wireless communication system is the essential part for IoT infrastructure, which acts as the bridge for dual directional communication for data collection and control message delivery. The purpose of this course is to expose the students to understand the fundamentals of wireless network and problems related to real-world scenarios. This course is both conceptual and analytical in nature.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Wireless communication in IOT** and attain **Skill Development** through **Participative Learning** techniques.			
Course Out Comes	On successful completion of the course the students shall be able to: To understand the fundamentals of wireless networks Analyze the standards of IoT which employed for wireless networks Explain the use of various wireless technologies in IoT Design and develop various applications of IoT			
Course Content:				
Module 1	Cellular standards	Assignment	Programming Task	**9 Sessions**

Topics:

Cellular carriers and Frequencies, Channel allocation, Cell coverage, Cell Splitting, Microcells, Picocells,

Handoff, 1st, 2nd, 3rd and 4th Generation Cellular Systems (GSM, CDMA, GPRS, EDGE,UMTS), Mobile IP, WCDMA

Assignment: Case study on generation cellular systems.

Module 2	Radio Frequency (RF) Fundamentals	Assignment	Data Collection/Excel	**10 Sessions**

Topics:

Introduction to RF & Wireless Communications Systems, RF and Microwave Spectral Analysis, Communication Standards, Understanding RF & Microwave Specifications. Spectrum Analysis of RF Environment, Protocol Analysis of RF Environment, Units of RF measurements, Factors affecting network range and speed, Environment, Line-of-sight, Interference, Defining differences between physical layers- OFDM.

Assignment: Determination of RF and Microwave spectral Analysis

Module 3	WLAN: Wi-Fi Organizations and Standards	Assignment	Programming/Data analysis task	**9 Sessions**

Topics:

IEEE, Wi-Fi Alliance, WLAN Connectivity, WLAN QoS & Power-Save, IEEE 802.11 Standards,802.11- 2007,802.11a/b/g, 802.11e/h/I,802.11n

Assignment: Protocols on WLAN connectivity

Module 4	Wi-Fi Hardware & Software	Assignment	Programming/Data analysis task	**10 Sessions**

Topics:

Access Points, WLAN Routers, WLAN Bridges, WLAN Repeaters, Direct-connect Aps, Distributed connect Aps, PoE Infrastructure, Endpoint, Client hardware and software, Wi-Fi Applications

Targeted Protocols & Tools that can be used:

Bluetooth, ZigBee, LoRa, NBIoT, WiFi, and Thread

Text Book

T1: Wireless Communications – Principles and Practice; by Theodore S Rappaport, Pearson Education Pte. Ltd.

T2: Wireless Communications and Networking; By: Stallings, William; Pearson Education Pte. Ltd.

References

R1:Bluetooth Revealed; By: Miller, Brent A, Bisdikian, Chatschik; Addison Wesley Longman Pte Ltd., Delhi 4. R2:Wilson , "Sensor Technology hand book," Elsevier publications 2005. 5.

R3: Andrea Goldsmith, "Wireless Communications," Cambridge University Press, 2005

Weblinks:

W1: https://pianalytix.com/wireless-communication-protocols-in-iot/

W2: https://behrtech.com/blog/6-leading-types-of-iot-wireless-tech-and-their-best-use-cases/

Topics relevant to "SKILL DEVELOPMENT":

GSM, CDMA for developing **Skill Development** through **Participative Learning Techniques.** This is attained through the assessment component mentioned in the course handout.

Course Code: CCS3402	**Course Title:** Identity and Access Management	**L- T - P- C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	CSE2011					
Anti-requisites	**NIL**					
Course Description	This course introduces the principles and practices of Identity and Access Management (IAM), including authentication, authorization, access control models, and identity lifecycle management. Students will learn to implement IAM solutions using technologies like SSO, MFA, and directory services, gaining hands-on experience in securing user access and managing identities in compliance with organizational policies.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of security in IAM to attain **Skill Development** through **Participative Learning** techniques.					
Course Outcomes	**On successful completion of this course the students shall be able to:** CO1: **Recall** key concepts of identity, authentication, authorization, and access control models. [**Remember**] CO2: **Explain** the components and workflow of IAM systems, including identity lifecycle management and federation protocols. [**Understand**] CO3: A**pply** IAM technologies such as Single Sign-On (SSO), Multi-Factor Authentication (MFA), and directory services to secure user access. [**Apply**]					
Course Content:						

Module 1	Introduction to IAM and Access Control Models	**15 hours**
Topics: Fundamentals of Identity and Access Management - Key IAM Concepts: Authentication, Authorization, Accounting (AAA) - Identity lifecycle and governance - Access control models: DAC, MAC, RBAC, ABAC - Principles of least privilege and zero trust architecture		
Module 2	**IAM Technologies and Infrastructure**	**13 hours**
Topics: - Directory Services: LDAP, Active Directory - Authentication protocols: Kerberos, RADIUS, TACACS+ - Identity Federation: SAML, OAuth, OpenID Connect - Single Sign-On (SSO) and Multi-Factor Authentication (MFA) - Cloud IAM services (e.g., AWS IAM, Azure AD)		
Module 3	Implementation, Governance and Compliance	**15 hours**
Topic: IAM solution design and deployment strategies - Identity provisioning and de-provisioning - Role and policy management - IAM governance and risk compliance (GRC) - Auditing, access reviews, and reporting - Case studies and industry best practices		

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):

Ertem Osmanoglu, *Identity and Access Management: Business Performance Through Connected Intelligence*, Syngress, 2013.

Reference(s):

Reference Book(s):

David B. Stirling, *Effective Cybersecurity: A Guide to Using Best Practices and Standards*, Apress, 2020.

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

Weblinks:

https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=1223875&site=ehost-live&ebv=EB&ppid=pp_xiii

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

Topics related to development of "FOUNDATION": Introduction to IAM

Topics related to development of "EMPLOYABILITY": SSO & MFA

Course Code: CCS3401	**Course Title:** Post-Quantum Cryptography	**L- T - P- C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	**CSE3078**					
Anti-requisites	**NIL**					
Course Description	This course explores the principles, algorithms, and challenges of **Post-Quantum Cryptography (PQC)—a** field dedicated to developing cryptographic systems that can resist attacks from quantum computers. As quantum computing advances, traditional encryption methods such as RSA and ECC become vulnerable, necessitating the adoption of quantum-resistant cryptographic techniques.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of post-quantum cryptographic algorithms to attain **Skill Development** through **Participative Learning** techniques.					
Course Outcomes	**On successful completion of this course the students shall be able to:** CO1: **Identify** the vulnerabilities of traditional cryptographic algorithms against quantum attacks. [**Remember**] CO2: **Explain** the principles and security assumptions behind post-quantum cryptographic algorithms. [**Understand**] CO3: **Implement** post-quantum cryptographic schemes using tools like Open Quantum Safe (OQS). [**Apply**]					
Course Content:						
Module 1	Introduction to post-quantum cryptography					**13 hours**
Topics: Is cryptography dead? - A taste of post-quantum cryptography - Challenges in post-quantum cryptography - Comparison to quantum cryptography - Quantum computing - Classical cryptography and quantum computing - The computational model - The quantum Fourier transform - The hidden subgroup problem - Search algorithms						
Module 2	Hash-based Digital Signature Schemes					**15 hours**
Topics: Hash-based Digital Signature Schemes - Merkle's tree authentication scheme - One-time key-pair generation using an PRNG - Authentication path computation - Tree chaining -Distributed signature generation - Security of the Merkle Signature Scheme - Code-based cryptography -						
Module 3	Lattice-based Cryptography					**15 hours**
Topics: Lattice-based Cryptography - Multivariate Public Key Cryptography – Introduction - The Basics of Multivariate PKCs- Examples of Multivariate PKCs - Basic Constructions and Variations - Standard Attacks – The Future. AlienVault OSSIM Implementation - AlienVault OSSIM Operation - Cisco Security: MARS Implementation - Cisco MARS Advanced Techniques						
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): Daniel J. Bernstein, Johannes Buchmann, "Post-Quantum Cryptography"Springer.
Reference(s): **Reference Book(s):** **Daniel J. Bernstein, Johannes Buchmann, Erik Dahmen**, *Post-Quantum Cryptography*, Springer, 2009. **Nicolas Sendrier**, *An Introduction to Post-Quantum Cryptography*, NIST Reports, 2019. **Carlos Aguilar Melchor, Jean-Christophe Deneuville**, *Mathematical Foundations of Post-Quantum Cryptography*, Springer, 2021. **Online Resources (e-books, notes, ppts, video lectures etc.):** Weblinks: https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=1223875&site=ehost-live&ebv=EB&ppid=pp_xiii https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=2706929&site=ehost-live
Topics related to development of "FOUNDATION": Introduction to Post-Quantum Cryptography (PQC), Quantum Threats to Classical Cryptography Topics related to development of "EMPLOYABILITY": Cryptanalysis and Security Evaluation, Industry Standards and Compliance

Course Code: CCS3404	**Course Title:** Incident Response with Threat Intelligence	**L- T - P- C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	**CSE3078**					
Anti-requisites	**NIL**					

Course Description	This course covers the fundamentals of incident response and threat intelligence, focusing on identifying, analyzing, and mitigating cybersecurity threats. Students will learn the incident response lifecycle, threat actor profiling, and the use of tools like TheHive, Security Onion, and Velociraptor. The course also explores frameworks such as MITRE ATT&CK and emphasizes hands-on skills in evidence collection, threat hunting, and intelligence-driven response. By the end, learners will be equipped to manage incidents and enhance organizational security using actionable threat intelligence.	
Course Objective	The objective of the course is to familiarize the learners with the concepts of security in IR&TI to attain **Skill Development** through **Participative Learning** techniques.	
Course Outcomes	**On successful completion of this course the students shall be able to:** CO1: **Describe** key concepts of incident response, threat intelligence, and common cyber-attack techniques. [Understand] CO2: **Explain** the incident response lifecycle and threat intelligence concepts, including attacker tactics, techniques, and procedures (TTPs) [**Understand**] CO3: **Perform** appropriate tools and techniques to investigate, respond to, and document cybersecurity incidents. [**Apply**]	
Course Content:		
Module 1	Foundations of Incident Response and Threat Landscape	**15 hours**
Topics: Threat Landscape and Cybersecurity Incidents - Concepts of Digital Forensics and Incident Response - Basics of the Incident Response and Triage Procedures - Applying First Response Procedures - Identifying and Profiling Threat Actors - Understanding the Cyber Kill Chain and the MITRE ATT&CK Framework		
Module 2	Strategic Planning and Program Development	**13 hours**
Topics: - Creating Incident Response Plans and Playbooks - Developing an Incident Response Program - Implementing and Using TheHive and Cortex for Incident Management		
Module 3	Tools, Techniques, and Threat Hunting	**15 hours**
Topic: Collecting Evidence with Velociraptor and KAPE - Integrating ELK Stack into Incident Response - Utilizing Security Onion for Network Monitoring and Detection - Threat Hunting with Sigma and YARA Rules - Automating Detection and Response with MITRE ATT&CK and TRAM		
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): Roberto Martínez, *Incident Response with Threat Intelligence: A practical guide to catching attackers and defending your organization,* Packt Publishing, 2022.		

Reference(s):
Reference Book(s):

Jason Luttgens, Matthew Pepe, and Kevin Mandia, *Incident Response & Computer Forensics*, McGraw Hill, 2014.

Chris Sanders and Jason Smith, *Practical Packet Analysis: Using Wireshark to Solve Real-World Network Problems*, No Starch Press, 2017.

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

Weblinks:
https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=1223875&site=ehost-live&ebv=EB&ppid=pp_xiii
https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=2706929&site=ehost-live

Topics related to development of "FOUNDATION": Introduction to incident response and thread intelligence

Topics related to development of "EMPLOYABILITY": Tools, Techniques and Thread Hunting

Course Code: CSS3413	**Course Title:** Security Auditing and Governance	**L- T - P- C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	**CSE3078**					
Anti-requisites	**NIL**					
Course Description	This course covers security auditing principles, governance frameworks, and compliance regulations essential for organizational cybersecurity. It includes risk assessment, vulnerability management, and security controls while aligning with standards like ISO 27001, NIST, PCI-DSS, and GDPR. Students will explore governance, risk, and compliance (GRC) models, audit methodologies, and hands-on log analysis, security assessments, and incident response. By the end, they will be equipped to conduct audits, ensure compliance, and strengthen enterprise security.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of security auditing and governance post-quantum cryptographic algorithms to attain **Skill Development** through **Participative Learning** techniques.					

Course Outcomes	**On successful completion of this course the students shall be able to:** CO1: **Define** key concepts of **security auditing, governance, and compliance frameworks.** [**Remember**] CO2: **Explain risk assessment methodologies** and the role of governance in cybersecurity. [**Understand**] CO3: **Perform security audits, log analysis, and compliance checks** using industry standards. [**Apply**] CO4: **Assess vulnerabilities, security controls, and risk management strategies** in IT environments. [**Analysis**]	
Course Content:		
Module 1	The Principles of Auditing	**12 hours**
Topics: The Principles of Auditing - Security Fundamentals: The Five Pillars - Building a Security Program - Security Controls - Managing Risk - The Auditing Process		
Module 2	Information Security and the Law	**12 hours**
Topics: IT Security Laws - Hacking, Cracking, and Fraud Laws - Intellectual Property Laws - CAN-SPAM Act of 2003 - State and Local Laws - Reporting a Crime - Regulatory Compliance Laws		
Module 3	Information Security Governance, Frameworks, and Standards	**11 hours**
Topics: Understanding Information Security Governance - Process: Security Governance Frameworks - Technology: Standards Procedures and Guidelines - Auditing Tools and Techniques - Evaluating Security Controls - Auditing Security Practices - Testing Security Technology - Security Testing Frameworks		
Module 4	**Auditing**	**10 hours**
Topics: Auditing Cisco Security Solutions - Policy, Compliance, and Management - Infrastructure Security		
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): **Chris Jackson**, *Network Security Auditing*, Cisco Press, 2010		

Reference(s):

Reference Book(s):

Russell Dean Vines, *Wireless Security Audit Methods and Tools*, McGraw-Hill, 2002.

Eric Cole, Ronald Krutz, and James Conley, *Network Security Bible*, Wiley, 2009.

Richard Bejtlich, *The Practice of Network Security Monitoring: Understanding Incident Detection and Response*, No Starch Press, 2013.

William Stallings, *Network Security Essentials: Applications and Standards*, Pearson, 2020.

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

Weblinks:

https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=1223875&site=ehost-live&ebv=EB&ppid=pp_xiii

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Topics related to development of "FOUNDATION": Information Security and the Law

Topics related to development of "EMPLOYABILITY": Security Governance, Frameworks, and Standards

Course Code: CCS3411	**Course Title:** Security Information and Event Management (SIEM)	**L- T - P- C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	**CSE3078**					
Anti-requisites	**NIL**					
Course Description	This course provides a comprehensive understanding of Security Information and Event Management (SIEM), focusing on its role in real-time threat detection, incident response, and compliance monitoring. It covers key concepts such as log collection, event correlation, and security analytics, enabling students to detect and mitigate cyber threats effectively. Through hands-on experience with industry-leading SIEM tools like Splunk, IBM QRadar, and Elastic SIEM, students will learn to investigate security incidents and automate threat detection. The course also explores threat intelligence integration, regulatory compliance (GDPR, PCI-DSS, HIPAA), and SOC operations, equipping learners with the skills needed for enterprise security monitoring and cybersecurity defense.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Security Information and Event Management (SIEM)** solutions for **real-time threat detection, incident response, compliance monitoring** and attain **Skill Development** through **Participative Learning** techniques.					

Course Outcomes	**On successful completion of this course the students shall be able to:** CO1: **Identify** the fundamental components and functions of **Security Information and Event Management (SIEM)** systems [**Remember**] CO2: **Classify** the process **of log collection, normalization, and event correlation** in a SIEM environment. [**Understand**] CO3: **Configure** a SIEM system to **ingest logs from various security devices** and generate alerts for suspicious activities [**Apply**]				
Course Content:					
Module 1	Introduction to SIEM: Threat Intelligence for IT Systems				**13 hours**
Topics: Introduction to SIEM: Threat Intelligence for IT Systems - Business Models - Threat Models - Regulatory Compliance					
Module 2	IT Threat Intelligence Using SIEM Systems				**15 hours**
Topics: SIEM Concepts: Components for Small and Medium-size Businesses - The Anatomy of a SIEM - Incident Response - Using SIEM for Business Intelligence					
Module 3	SIEM Tools	Case study	Kerberos configuration for ecosystem tools		**15 hours**
Topics: AlienVault OSSIM Implementation - AlienVault OSSIM Operation - Cisco Security: MARS Implementation - Cisco MARS Advanced Techniques					
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): **Security Information and Event Management (SIEM) Implementation** by **David R. Miller, Shon Harris, Allen Harper, Stephen VanDyke, and Chris Blask, McGrawHill.** Ben Spivey, Joey Echeverria, "Hadoop Security Protecting Your Big Data Problem", O'Reilly Media, 2015.					

Reference(s):

Reference Book(s):

Joseph Muniz, Security Information and Event Management (SIEM) Fundamentals, Cisco Press.

Matthew Hubbard, The Security Analyst's Guide to SIEM, Apress.

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

Weblinks:

https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=1223875&site=ehost-live&ebv=EB&ppid=pp_xiii

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

Topics related to development of "FOUNDATION": Introduction to SIEM, Log Collection & Management

Topics related to development of "EMPLOYABILITY": Configuring SIEM for Security Monitoring, Incident Response & Compliance

Course Code: CCS3410	Course Title: Digital Watermarking and Steganography Type of Course: Theory Only	L-T-P-C	3 -0	0	3
Version No.	1.1				
Course Pre-requisites	CSE3078				
Anti-requisites	NIL				
Course Description	The purpose of this course is to enable the students to Comprehend the need for Digital Watermarking and Steganography and to develop the basic abilities of design and use Digital Watermarking and Steganography- information hiding technique. The course is both conceptual in nature and needs fair knowledge of Mathematical and computing. The course develops critical thinking and analytical skills. The course also enhances the abilities through assignments.				
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Digital Watermarking and Steganography and attain Employability through Participative Learning techniques.				
Course Out Comes	On successful completion of the course the students shall be able to: Discuss the Introduction of Digital Watermarking Classify the various Digital Watermarking techniques. Explain the Fundamentals of Steganography. Summarize the Steganographic Techniques.				
Course Content:					

Module 1	Introduction to digital watermarking	Assignment	Programming Task	7 Sessions

Topics
Introduction to Digital Watermarking, Digital Steganography differences, brief History, Watermarking Applications, Classification in Digital Water Marking- Classification based on Characteristics, Classification based on Applications.

Module 2	Types and tools of digital watermarking	Assignment	Programming Task	14 Sessions

Topics:
Digital Watermarking Fundamentals, Least Significant bit substitution, Discrete Fourier Transform, Discrete Cosine Transform, Discrete Wavelet Transform, Random Sequence Generation, Chaotic Map, Error Detection Code. Spatial domain watermarking, frequency Domain watermarking, Fragile Watermark, Robust Water Mark, Watermarking attacks and Tools, Image processing techniques, Water Mark (software Analysis).

Module 3	Introduction to Steganography	Assignment	Programming/Data analysis task	8 Sessions

Topics:
Steganography, Watermarking vs Steganography, Need for Steganography, Application of Steganography, Methods of Hiding, properties of Steganography, Performance measure of Steganography Approaches, Mathematical Notation and Terminology, Steganography Software (S-tools, StegoDos, EzStezo, JSteg,Jpeg,).

Module 4	Techniques of Steganography	Assignment	Programming/Data analysis task	7 Sessions

Substitution Systems and Bit-plane Tools- Least Significant Bit Substitution, Pseudorandom Permutations, Image Downgrading and Covert Channels, Practical Approach towards Steganography, Embedding of a secret Message.

Textbooks
T1. Frank Y Shih. Digital Water marking and Steganography Fundamentals and Techniques, 2017, CRC Press, second edition.
T2. Jsjit. S. Suri Shivendra Shivani, Suneeth Agarwal, Handbook on Image based Security Techniques, CRC Press, 2018.

References
R1. Abid Yahya, Steganography Techniques for Digital Images, Springer, 2019.
Weblinks:
W1. Digital Watermarking | ScienceDirect (informaticsglobal.com)
W2. Digital Watermarking and Steganography | ScienceDirect (informaticsglobal.com)

Topics relevant to “EMPLOYABILITY SKILLS”: Building a data warehouse, data mining tools, for developing Employability Skills through Participative Learning Techniques. This is attained through assessment components mentioned in course handout.

Course Code: CCS3414	Course Title: Security In IOT Type of Course: Theory	L- T- P- C	3	0	0	3
Version No.	1.0					
Course Pre-requisites	CSE3078					
Anti-requisites	NIL					
Course Description	This course provides a comprehensive understanding of security challenges and solutions in the Internet of Things (IoT) and cloud computing environments. Students will explore IoT system design, hardware and software security, cryptographic approaches, cloud computing fundamentals, and security concepts related to virtualization. The course covers security threats specific to IoT devices and cloud infrastructure, along with countermeasures against cyberattacks, including system-specific vulnerabilities such as guest hopping, VM-based attacks, and hyper jacking. By the end of this course, students will gain practical knowledge of securing IoT ecosystems and cloud services while understanding emerging threats in these domains.					
Course Objective	To learn about the security issues in IoT and cloud computing. To learn about the cryptography solutions and issues in IoT. To learn about the security measures taken in IoT and Cloud systems to improve security.					
Course Out Comes	On completion of the course, student will be able to CO1 - Understand the fundamental security issues in Internet of things. CO2 - Demonstrate different Frameworks and Hardware Architecture of IoT Device. CO3 - Analyze different IoT Protocols and Layer Functioning. CO4 - Protect and secure the network connecting IoT devices to back-end systems on the internet. CO5 - Demonstrate different authentication mechanism such as digital certificates, biometrics, etc.					
Course Content:						
Module 1	**FUNDAMENTALS OF IoT ECOSYSTEM**	Assignment	Theory	**9 Sessions**		
Topics: IoT security issues, how to design an IoT system, Hardware, software and network security related to IoT systems - Basics of cryptographic solutions to IoT systems.						
Module 2	OVERVIEW OF CLOUD COMPUTING AND ITS SERVICES	Assignment	Programming activity	**9 Sessions**		

Topics: Cloud Computing Fundamental: Cloud computing definition, private, public and hybrid cloud. Cloud types; IaaS, PaaS, SaaS				
Module 3	CHALLENGES IN CLOUD COMPUTING	Assignment	Programming activity	**9 Sessions**
Topics: Benefits and challenges of cloud computing - Public vs. Private clouds, Role of virtualization in enabling the cloud.				
Module 4	SECURITY CONCEPTS IN CONTEXT TO IoT DEVICES	Assignment	Programming activity	**9 Sessions**
Topics: Security Concepts: Confidentiality, privacy, integrity, authentication, non-repudiation, Virtualization.				
Module 5	**IoT SECURITY THREATS AND COUNTERMEASURES**	Assignment	Programming activity	**9 Sessions**
Topics: System-Specific Attacks: Guest hopping, attacks on the VM (delete the VM, attack on the control of the VM, code or file injection into the virtualized file structure), VM migration attack, hyper jacking				
Targeted Application & Tools that can be used				
Project work/Assignment:				
Assignment:				
Text Book T1. David Etter, " IoT Security: Practical guide book " Create Space, 1st Edition, 2016.				
References : 1.Drew Van Duren, Brian Russell, "Practical Internet of Things Security", Packt, 1st Edition, 2016. 2. Sean Smith, "The Internet of Risky Things", O'Reilly Media, 1st Edition, 2017. 3. Brian Russell, Drew Van Duren, "Practical Internet of Things Security: Design a security framework for an Internet connected ecosystem", 2nd Edition, 2018.				

Course Code: **CSE2510**	**Course Title:** Competitive Programming and Problem Solving **Type of Course: Program Core**	L-T-P-C	0	0	4	2
Version No.	1.0					

Course Pre-requisites	NIL
Anti-requisites	**NIL**
Course Description	The **Competitive Programming and Problem Solving** course equips students with efficient problem-solving skills for coding competitions and real-world challenges. Starting with brute-force solutions, students learn to optimize time and space complexity using advanced techniques like dynamic programming, greedy algorithms, and backtracking. Hands-on practice on platforms like CodeChef and Codeforces helps tackle problems involving number theory, data structures, and algorithmic paradigms. By understanding CP constraints and fostering a strategic mindset, students gain the confidence to excel in competitions, technical interviews, and practical applications.
Course Out Comes	On successful completion of the course the students shall be able to: CO1 : Understanding the issues of online platforms and Competitive Programming (CP) and developing brute force coding for commonly asked CP problems. CO2 : Analyzing the space and time complexity of brute force solutions and designing efficient solutions. CO3 : Evaluating the applicability of suitable algorithmic approaches to solve relevant CP problems. CO4: Creating efficient solutions of CP problems using the learnt algorithmic approaches.
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Competitive Programming and Problem Solving** and attain **Skill Development** through **Experiential Learning** techniques.

Module 1: Introduction to Competitive Programming

Overview of Efficient Coding for Problem Solving and CP: Introduction to competitive programming (CP); revisit of complexity analysis; introduction to online platforms such as codechef, codeforces etc and online submission; constraints during CP, online testing process and common errors such as TLE; use of STL

Module 2: Number Theory for Problem-Solving

Use of Number Theory for problem-solving: reducing time/space complexity of brute force coding solution of Sieve Method, Inverse Module, Euclidian Method of factorization; efficient coding
for Permutation Combination; XORing based and pattern-based solutions.

Module 3: Optimizing Time & Space Using Sequential Storage

Coding for Optimizing time and Space using Sequential Storage: two pointer approach; problem-solving using arrays and strings such as rotation on sorted arrays, duplicate removal, string
matching algorithms; Kadane's algo, stacks, priority-queues and hashing based efficient coding; median based problems and alternate solutions.

Module 4: Non-Linear Data Structures

Applying Non-Linear Data Structures for real-life problems: design of efficient solutions for problems such as finding loops in a linked list, memory efficient DLL, block reversal in LL; problem
solving using trees and binary trees, Catalan numbers, applications of graphs, spanning tree and path
algos for CP problems with reduced time/space complexity.

Module 5: Problem Solving using Advanced Topics

CP Problem Solving using Advanced Topics: concept of disjoint sets and their efficient representation, algorithmic approaches such as Greedy, Backtracking, Dynamic Programming and
applying them for CP problems using bottom-up dynamic programming.

List of Laboratory Tasks:

- You are given the finishing times of 'N' runners in a marathon. Write a program to find the runner who finished in the third position. **Focus:** Basic data structures (arrays), sorting algorithms (e.g., insertion sort, selection sort), and basic input/output.
- In the same marathon, you are given the finishing times of 'N' runners and their bib numbers. Write a program to efficiently find the top 10 runners and their corresponding bib numbers. **Focus:** Efficient sorting algorithms (e.g., merge sort, quick sort), data structures like priority queues, and optimizing for large datasets.
- A library maintains a list of books with their unique IDs. Write a program to check if a given book ID is present in the library. Focus: Searching algorithms (linear search), basic data structures (arrays or lists).
- The library wants to implement a system to quickly find books by their titles. Suggest an efficient data structure (e.g., a hash table or a trie) and explain how to implement it to achieve fast book lookups. Focus: Understanding the trade-offs between different data structures, choosing the most appropriate data structure for a specific problem, and implementing efficient search operations.
- An online store sells products with different prices. Write a program to calculate the total cost of a given list of products. **Focus:** Basic arithmetic operations, working with arrays or lists to store product prices.
- The online store offers discounts based on the total purchase amount. Design an algorithm to efficiently calculate the final cost of an order, considering different discount rules (e.g., percentage discounts, fixed amount discounts, tiered discounts). Focus: Algorithmic design, conditional statements, handling complex scenarios with multiple rules, and potentially using dynamic programming techniques for optimization.
- You are given two integers, 'a' and 'm'. Calculate 'a' raised to the power 'm' modulo a large prime number 'p'. **Focus:** Basic modular arithmetic operations (modular exponentiation), understanding the modulo operator.
- In a secure communication system, you need to efficiently compute the modular exponentiation for very large values of 'm'. Implement and analyze the efficiency of the binary exponentiation algorithm for this task. **Focus:** Efficient algorithms for modular exponentiation (binary exponentiation), time complexity analysis, and understanding the importance of efficient algorithms in cryptography.

You have a deck of 'N' cards. Calculate the total number of possible hands of size 'K' that can be drawn from the deck. **Focus:** Basic combinatorics (combinations), factorial calculations.

In a card game, you need to calculate the probability of drawing certain combinations of cards (e.g., a pair, a three-of-a-kind) from a shuffled deck. Design an efficient algorithm to calculate these probabilities. **Focus:** Advanced combinatorics (permutations and combinations with repetitions), probability calculations, and optimizing calculations to avoid overflows.

You are given a network of devices represented as a graph. Determine if there is a path between two given devices in the network. **Focus:** Graph traversal algorithms (depth-first search or breadth-first search).

In a secure network, you need to detect and isolate compromised devices. Design an algorithm that efficiently identifies devices that exhibit anomalous behavior (e.g., unusual traffic patterns) using XOR-based techniques for data comparison and pattern matching. **Focus:** Applying XOR operations for data comparison and pattern recognition, understanding the properties of XOR (e.g., commutative, associative), and designing algorithms for network anomaly detection.

You are given an array representing the speeds of cars on a highway. Find the minimum time required for all cars to pass a certain point. **Focus:** Basic array traversal, finding the minimum element in an array.

In a more realistic scenario, cars have different lengths. Implement a two-pointer approach to simulate the movement of cars and determine the minimum time for all cars to pass a given point. **Focus:** Two-pointer technique, simulating real-world scenarios with arrays, optimizing time complexity.

Given a string, find the number of occurrences of a specific substring within the string. **Focus:** Basic string manipulation, string matching (brute-force approach).

Implement the KMP (Knuth-Morris-Pratt) string matching algorithm to efficiently find all occurrences of a given pattern within a large text document. **Focus:** Advanced string matching algorithms, understanding the concept of the "next" array in KMP, optimizing for large input sizes.

An online auction platform receives bids for different items. Implement a data structure (e.g., a priority queue) to efficiently track the highest bid for each item. **Focus:** Priority queues, insertion and extraction operations on priority queues, basic implementation of a priority queue using an array or a suitable library.

The auction platform needs to handle a large number of bids concurrently. Design and implement a system that efficiently processes bids, updates the highest bid for each item, and handles potential race conditions. **Focus:** Concurrent data structures and algorithms, thread safety, handling race conditions, optimizing for high-throughput scenarios.

A social network can be represented as a graph where users are nodes, and connections between users are edges. Write an algorithm to find if two given users are connected in the network. **Focus:** Graph traversal algorithms (depth-first search or breadth-first search), basic graph representation (adjacency list or adjacency matrix).

In a large social network, efficiently finding the shortest path between two users is crucial. Implement Dijkstra's algorithm to find the shortest paths between users in the network, considering edge weights (e.g., representing the strength of connections). **Focus:** Shortest

path algorithms (Dijkstra's algorithm), graph algorithms with weighted edges, optimizing for large graphs.

A file system can be modeled as a tree structure. Implement a function to traverse the file system and print the names of all files and directories. **Focus:** Tree traversal algorithms (depth-first search or breadth-first search), basic tree representation (using nodes and pointers).

Design and implement a file system that supports efficient operations like creating directories, deleting files, and finding files based on their names or paths. Consider using a combination of tree structures and hash tables for efficient indexing and searching. **Focus:** Designing and implementing file system structures, using multiple data structures together, optimizing for common file system operations.

An online shopping cart can be represented as a tree, where each node represents an item or a category of items. Write an algorithm to calculate the total price of all items in the shopping cart. **Focus:** Tree traversal, calculating sums within a tree structure.

Implement a system that allows customers to apply discounts and coupons to their shopping carts. Consider using a combination of trees and other data structures (e.g., hash tables) to efficiently apply discounts and calculate the final price. **Focus:** Applying discounts and promotions to tree-like structures, efficient implementation of discount rules, optimizing for complex pricing scenarios.

In a social network, users can form groups. Given a list of friendships, determine if all users in a specific group are connected (directly or indirectly) through friendships. **Focus:** Disjoint set union (DSU) data structure, basic connectivity checks.

Design an efficient algorithm to find the minimum number of new friendships needed to connect all users in the social network into a single, connected component. **Focus:** Applying DSU for finding connected components, greedy algorithms, optimization for minimizing connections.

A treasure hunt involves a series of clues leading to the final treasure. Given a list of possible paths and their associated costs, find the cheapest path to reach the treasure. **Focus:** Greedy algorithms (e.g., Dijkstra's algorithm for shortest paths), basic graph representation.

In a more complex treasure hunt, there are time constraints associated with each path. Design an algorithm to find the fastest path to the treasure while considering both path costs and time constraints.

Focus: Combining greedy approaches with other techniques (e.g., priority queues), handling multiple constraints, optimizing for time-critical scenarios.

In a simplified chess game with only rooks, determine the minimum number of moves required for a rook to reach a specific target square on an empty board. **Focus:** Breadth-first search (BFS) on a graph (the chessboard), basic graph traversal.

In a more realistic chess game with multiple pieces and obstacles, implement a minimax algorithm with alpha-beta pruning to determine the best move for a player. **Focus:** Game tree search, minimax algorithm, optimization techniques like alpha-beta pruning, handling complex game states.

Targeted Application & Tools that can be used:

C or C++ Compiler (g++): The standard compiler for CP. Familiarize students with compilation flags (e.g., -O2 for optimization).

IDE (Integrated Development Environment): Code:: Blocks, Visual Studio, CLion, or similar IDEs. These provide debugging capabilities, code completion, and other helpful features.

Online Judges (CodeChef, Codeforces, LeetCode, HackerRank): Essential for practicing and submitting solutions.

Debugger (gdb): Crucial for understanding code execution and finding bugs. Origin, excel and Mat lab soft wares for programming and data analysis.

Number Theory Libraries: Some libraries provide pre-built functions for number theory operations (though often it's better to implement them yourself for learning).

Wolfram Alpha: A useful tool for verifying number theory calculations and exploring concepts.

String Libraries: Familiarize students with the string manipulation functions available in C++.

Graph Visualization Tools: Tools like Graphviz can be helpful for visualizing graphs and understanding graph algorithms.

DP Debugging Techniques: Practice debugging DP solutions, as they can be complex. Visualizing the DP table can be helpful.

Text Books:

Guide to Competitive Programming: Learning and Improving Algorithms Through Contests" (3rd Edition), ***Antti Laaksonen, springer, 2024***

"Data Structures and Algorithms in Java: A Project-Based Approach" – ***Dan S. Myers, Cambridge University Press***

Reference Books:

Data Structures and Algorithmic Thinking with Python/C++/Java", ***Narasimha Karumanchi, 5th Edition, Career Monk, 2017.***

Introduction to Algorithms, Thomas H. Cormen (Author), Charles E. Leiserson (Author), Ronald L. Rivest , fourth edition April 2022

Web Resources

https://nptel.ac.in/courses/106106231

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

Assessment Type

Midterm exam

Assignment (review of digital/ e-resource from PU link given in references section - mandatory to submit screen shot accessing digital resource.)

Quiz

End Term Exam

Self-Learning

Course Code: CSE702	**Course Title: Internship** **Type of Course:**	**L- T-P-C**	-	-	-	8
Version No.	**1.0**					
Course Pre-requisites	**NIL**					
Anti-requisites	**NIL**					
Course Description	Students observe science and technology in action, develop an awareness of the method of scientific experimentation, and often get an opportunity to see, study and operate sophisticated and costly equipment. They also learn about the implementation of the principles of management they have learnt in class, when they observe multidisciplinary teams of experts from engineering, science, economics, operations research, and management deal with techno-economic problems at the micro and macro levels. Finally, it enables them to develop and refine their language, communication and inter-personal skills, both by its very nature, and by the various evaluation components, such as seminar, group discussion, project report preparation, etc. The broad-based core education, strong in mathematics and science and rich in analytical tools, provides the foundation necessary for the student to understand properly the nature of real-life problems.					
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: Identify the engineering problems related to local, regional, national or global needs. (Understand) Apply appropriate techniques or modern tools for solving the intended problem. (Apply) Design the experiments as per the standards and specifications. (Analyze) Interpret the events and results for meaningful conclusions. (Evaluate)					

Course Code: CSE701	**Course Title: Capstone Project** **Type of Course:**	**L- T-P-C**	0	0	0	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	Students observe science and technology in action, develop an awareness of the method of scientific experimentation, and often get an opportunity to see, study and operate sophisticated and costly equipment. They also learn about the implementation of the principles of management they have learnt in class, when they observe multidisciplinary teams of experts from engineering, science, economics, operations research, and management deal with techno-economic problems at the micro and macro levels. Finally, it enables them to develop and refine their language, communication and inter-personal skills, both by its very nature, and by the various evaluation components, such as seminar, group discussion, project report preparation, etc. The broad-based core education, strong in mathematics and science and rich in analytical tools, provides the foundation necessary for the student to understand properly the nature of real-life problems. The students have options to pursue this course as either Project Work and Dissertation at the university, or Project Work in an Industry/ Company/ Research Laboratory, or Internship Program in an Industry/Company.

Course Code: UG COURSE: CAI3429	**Course Title:** Deep Learning Techniques for Computer Vision **Type of Course: Discipline Elective - Theory & Integrated Laboratory**	L-T-P-C	2	0	2	3
Version No.	1.0					
Course Pre-requisites	MAT1001					
Anti-requisites	NIL					
Course Description	This course covers the fundamentals and advanced concepts of deep learning for computer vision applications. Students will explore convolutional neural networks (CNNs), object detection, image segmentation, and generative models. Hands-on lab experiments will reinforce theoretical concepts using frameworks like TensorFlow and PyTorch.					
Course Out Comes	**On successful completion of the course the students shall be able to:** 5. Understand the Fundamentals of Deep Learning for Vision Explain the core concepts of neural networks and deep learning architectures for image processing. Implement and optimize convolutional neural networks (CNNs) for classification tasks. 6. Apply Object Detection and Image Segmentation Techniques Implement and analyze state-of-the-art object detection algorithms such as YOLO, Faster R-CNN, and SSD.					

	Develop and evaluate image segmentation models like U-Net and Mask R-CNN. **7. Explore Advanced Deep Learning Techniques for Vision** Utilize Vision Transformers (ViTs) and attention mechanisms for image classification. Generate and manipulate images using Generative Adversarial Networks (GANs). **8. Deploy and Optimize Deep Learning Models for Real-World Applications**			
Course Content:				
Module 1	Fundamentals of Deep Learning for Vision	Assignment	Practical	No. of Classes:8
Introduction to Deep Learning & Neural Networks, Convolutional Neural Networks (CNNs) Architecture Backpropagation & Optimization in CNNs, Transfer Learning & Pretrained Models.				
Module 2	Object Detection & Image Segmentation	Assignment	Practical	No. of Classes:14
Introduction to Object Detection (R-CNN, SSD, YOLO), Region Proposal Networks (Faster R-CNN) Semantic & Instance Segmentation (U-Net, Mask R-CNN), Real-time Object Detection Applications				
Module 3	Advanced Topics in Vision	Assignment	Practical	No. of Classes:8
Attention Mechanisms & Vision Transformers (ViTs), Generative Adversarial Networks (GANs) for Image Generation, Self-supervised Learning for Vision, Multi-modal Learning (CLIP, DALL·E)				
Module 4	Applications & Deployment	Assignment	Practical	No. of Classes:8
Edge AI & Mobile Deployment (TensorFlow Lite, ONNX), Adversarial Attacks & Robustness in Vision Models, Explainability & Interpretability of Vision Models, Case Studies & Industry Applications				

Lab Experiments are to be conducted on the following topics:-

Lab Sheet 1:

Keras Sequential API model

6. Read in the data and explore
7. Define a Sequential API model
8. Define the hyperparameters and optimizer
9. Train the model and visualize the history
10. Testing

Keras Functional API model:

3. Define a Functional API model
4. Train the model and visualize the history

Lab Sheet 2:

Softmax regression with Keras

6. Read in the data and prepare
7. Define a Sequential API model
8. Define the hyperparameters and optimizer
9. Train the model and visualize the history
10. Testing

Lab Sheet 3:

Convolutional Neural Network with Keras (grayscale images)

8. Read in the data:
9. Visualize the data:
10. Prepare the data:
11. Define a CNN model:
12. Define the hyperparameters and optimizer:
13. Train the model and visualize the history:
14. Testing:

Lab Sheet 4:

Convolutional Neural Network with Keras (color images):

11. Read in the data:
12. Visualize the data:
13. Prepare the data:
14. Define a CNN model:
15. Define the hyperparameters and optimizer:
16. Train the model and visualize the history:
17. Testing:

Lab Sheet 5:

Time series and prediction:

3. Read in the data and explore:

4. Apply the exponential smoothing method and predict

Recurrent neural network (RNN):

5. Pre-processing:
6. Do the necessary definitions: (Hyper parameters, Model,
7. Train the model:
8. Predict the future:

Lab Sheet 6:

Document classification with LSTM network:

8. Read in the data:
9. Explore the data:
10. Data preprocessing:
11. Define the model:
12. Define the optimizer and compile:
13. Train the model and visualize the history:
14. Testing:

Lab Sheet 7:

Document classification with LSTM network (Binary):

8. Read in the data:
9. Explore the data:
10. Data preprocessing:
11. Define the model:
12. Define the optimizer and compile:
13. Train the model and visualize the history:
14. Testing:

Lab Sheet 8:

Document classification with LSTM + CNN network (Binary):

8. Read in the data:
9. Explore the data:
10. Data preprocessing:
11. Define the model:
12. Define the optimizer and compile:
13. Train the model and visualize the history:
14. Testing:

Lab Sheet 9:

Softmax regression to recognize the handswritten digits:

5. Download the MNIST data:
6. Take a look at the dataset:
7. Do the necessary definitions:
8. Training and Testing:

Multi-layer neural network to recognize the handswritten digits:

4. Download the MNIST data:
5. Take a look at the dataset:
6. Do the necessary definitions:

Training and Testing:

Lab Sheet 10:

Object Detection using YOLOv5

Lab Sheet 11:

Image Segmentation using U-Net
Custom Object Detection using Faster R-CNN

Lab Sheet 12:

Implementing Vision Transformers for Image Classification
Generating Images using GANs (DCGAN, StyleGAN)

(Group Project)

18. Object Detection and Recognition:
    a. Haar cascade object detection (e.g., face detection or object detection using pre-trained classifiers).
    b. Feature-based object detection using techniques like Speeded-Up Robust Features (SURF) or Scale-Invariant Feature Transform (SIFT).
    c. Deep learning-based object detection using Convolutional Neural Networks (CNNs) or You Only Look Once (YOLO) algorithm.
19. Optical Character Recognition (OCR):
    a. Preprocessing of text images (e.g., binarization, noise removal, or skew correction).
    b. Text localization using techniques like connected component analysis or Stroke Width Transform (SWT).
    c. Character recognition using machine learning algorithms like Support Vector Machines (SVM) or Convolutional Neural Networks (CNNs).
20. Gesture Recognition:
    a. Hand segmentation using techniques like background subtraction or skin color detection.
    b. Feature extraction from hand regions (e.g., finger counting, hand shape descriptors).
    c. Classification of gestures using machine learning algorithms (e.g., k-Nearest Neighbors or Support Vector Machines).

Tools/Software Required :

1. OpenCV 4
2. Python 3.7
3. MATLAB

Text Books

1. Deep Learning for Computer Vision Image Classification, Object Detection and Face Recognition in Python" **Jason Brownlee (2019)**
2. "Deep Learning for Computer Vision with python" **Adrian Rosebrock (2017)**

References

1. **Goodfellow, I., Bengio, Y., & Courville, A. (2016).** *Deep Learning.* MIT Press.A foundational book covering deep learning principles, including CNNs, optimization, and generative models.

2. **Raschka, S., & Mirjalili, V. (2022).** *Machine Learning with PyTorch and Scikit-Learn.* Packt Publishing.Covers practical deep learning techniques using PyTorch, including CNNs and transfer learning.

3. **Geron, A. (2022).** *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow (3rd Edition).* O'Reilly Media.Provides hands-on implementations of deep learning for computer vision using TensorFlow and Keras.

4. **Zhang, A., Lipton, Z. C., Li, M., & Smola, A. J. (2021).** *Dive into Deep Learning.* Available online (https://d2l.ai).Open-access book covering CNNs, object detection, and advanced vision techniques with PyTorch and TensorFlow.

5. **Chollet, F. (2021).** *Deep Learning with Python (2nd Edition).* Manning Publications. Explains deep learning fundamentals and applications with Keras, including image classification and segmentation.

6. **Ballé, J., Laparra, V., & Simoncelli, E. P. (2017).** *Deep Learning for Computer Vision: A Brief Introduction.*A concise introduction to CNNs, object detection, and generative models.