

PROGRAMME REGULATIONS & CURRICULUM

2023-27

PRESIDENCY SCHOOL OF COMPUTER SCIENCE & ENGINEERING

BACHELOR OF TECHNOLOGY (B.TECH.) COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)



PRESIDENCY SCHOOL OF COMPUTER SCIENCE AND ENGINEERING

Program Regulations and Curriculum 2023-2027

B.Tech., COMPUTER SCIENCE AND ENGINEERING (Data Science)

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

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

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

Table of Contents

Clause No.	Contents	Page Number
	PART A – PROGRAM REGULATIONS	
1.	Vision & Mission of the University and the School / Department	4
2.	Preamble to the Program Regulations and Curriculum	4
3.	Short Title and Applicability	5
4.	Definitions	5
5.	Program Description	7
6.	Minimum and Maximum Duration	8
7.	Programme Educational Objectives (PEO)	8
8.	Programme Outcomes (PO) and Programme Specific Outcomes (PSO)	8
9.	Admission Criteria (as per the concerned Statutory Body)	10
10.	Lateral Entry / Transfer Students requirements	11
11.	Change of Branch / Discipline / Specialization	13
12.	Specific Regulations regarding Assessment and Evaluation	14
13.	Additional clarifications - Rules and Guidelines for Transfer of Credits from MOOC, etc.	16
	PART B: PROGRAM STRUCTURE	
14.	Structure / Component with Credit Requirements Course Baskets & Minimum Basket wise Credit Requirements	18
15.	Minimum Total Credit Requirements of Award of Degree	19
16.	Other Specific Requirements for Award of Degree, if any, as prescribed by the Statutory Bodies	19
	PART C: CURRICULUM STRUCTURE20	
17.	Curriculum Structure – Basket Wise Course List	20

18.	Practical / Skill based Courses – Internships / Thesis / Dissertation / Capstone Project Work / Portfolio / Mini project	22
19.	List of Elective Courses under various Specializations / Stream Basket	25
20.	List of Open Electives to be offered by the School / Department (Separately for ODD and EVEN Semesters).	30
21.	List of MOOC (NPTEL) Courses	39
22.	Recommended Semester Wise Course Structure / Flow including the Program / Discipline Elective Paths / Options	40
23.	Course Catalogue of all Courses Listed including the Courses Offered by other School / Department and Discipline / Program Electives	42

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.

- \cdot 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.

 \cdot Instill Entrepreneurial and Leadership Skills to address Social, Environmental and Communityneeds.

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 Industrial Based Project 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 2023-2027.
- 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 2023-2027 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 2023-2024.

4. Definitions

In these Regulations, unless the context otherwise requires:

- *a.* "Academic Calendar" means the schedule of academic and miscellaneous events as approved by the Vice Chancellor;
- b. "Academic Council" means the Academic Council of the University;
- c. "Academic Regulations" means the Academic Regulations, of the University;
- d. "Academic Term" means a Semester or Summer Term;
- e. "Act" means the Presidency University Act, 2013;
- f. "AICTE" means All India Council for Technical Education;
- g. "Basket" means a group of courses bundled together based on the nature/type of the course;
- h. "BOE" means the Board of Examinations of the University;
- *i.* "BOG" means the Board of Governors of the University;
- *j.* "BOM" means the Board of Management of the University;
- *k.* "BOS" means the Board of Studies of a particular Department/Program of Study of the University;
- I. "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. "Department" means the Department offering the degree Program(s) / Course(s) / School offering the concerned Degree Programs / other Administrative Offices;
- w. "Discipline" means specialization or branch of B.Tech. Degree Program;
- *x.* "HOD" means the Head of the concerned Department;
- *y.* "L-T-P-C" means Lecture-Tutorial-Practical-Credit refers to the teaching learning periods and the credit associated;
- z. "MOOC" means Massive Open Online Courses;
- aa. "MOU" means the Memorandum of Understanding;
- bb. "NPTEL" means National Program on Technology Enhanced Learning;
- cc. "Parent Department" means the department that offers the Degree Program that a student undergoes;
- dd. "Program Head" means the administrative head of a particular Degree Program/s;
- ee. "Program Regulations" means the Bachelor of Technology Degree Program Regulations and Curriculum, 2024-2028;
- ff. "Program" means the Bachelor of Technology (B.Tech.) Degree Program;
- gg. "PSCS" means the Presidency School of Computer Science and Engineering;
- hh. "Registrar" means the Registrar of the University;
- *ii.* "School" means a constituent institution of the University established for monitoring, supervising and guiding, teaching, training and research activities in broadly related fields of studies;
- *jj.* "Section" means the duly numbered Section, with Clauses included in that Section, of these Regulations;
- *kk.* "SGPA" means the Semester Grade Point Average as defined in the Academic Regulations.
- II. "Statutes" means the Statutes of Presidency University;
- *mm.* "Sub-Clause" means the duly numbered Sub-Clause of these Program Regulations;
- nn. "Summer Term" means an additional Academic Term conducted during the summer break (typically in June-July) for a duration of about eight (08) calendar weeks, with a minimum of thirty (30) University teaching days;
- oo. "SWAYAM" means Study Webs of Active Learning for Young Aspiring Minds.
- pp. "UGC" means University Grant Commission;
- qq. "University" means Presidency University, Bengaluru; and
- rr. "Vice Chancellor" means the Vice Chancellor of the University.

5. Program Description

B.Tech. Degree Programs are offered in the following branches / disciplines by the respective parent Departments under Presidency School of Computer Science and Engineering (PSCSE) as indicated in Table 1 below:

	Table 1: B.Tech. Degree Programs and respective Parent Departments				
S.No.	B.Tech. Program (Branch / Discipline)	Parent Department			
1.	B.Tech. Computer Science and Engineering	Presidency School of Computer Science			
2	B. Tech. Computer Science and Technology (Big	Presidency School of Computer Science			
۷.	Data)	and Engineering			
3.	B. Tech. Computer Science and Engineering (Block	Presidency School of Computer Science			
	Chain)	and Engineering			
4.	B. Tech. Computer Science and Technology (DevOps)	Presidency School of Computer Science and Engineering			
	B. Tech. Computer Science and Engineering (Cyber	Presidency School of Computer Science			
5.	Security)	and Engineering			
6	B. Tech. Computer Science and Engineering	Presidency School of Computer Science			
0.	(Internet of Things)	and Engineering			
7	B. Tech. Computer Science and Engineering (Data	Presidency School of Computer Science			
7.	Science)	and Engineering			
8	B. Tech. Computer Science and Technology	Presidency School of Computer Science			
0.	[Artificial Intelligence and Machine Learning]	and Engineering			
9	B. Tech. Information Science and Technology	Presidency School of Computer Science			
5.	[Artificial Intelligence and Data Science]	and Engineering			
10.	B. Tech. Computer Science and Information	Presidency School of Computer Science			
	Technology	and Engineering			
11.	B. Tech. Computer Science and Engineering	Presidency School of Computer Science			
	(Networks)	and Engineering			
12.	B. Tech. Computer Engineering	Presidency School of Computer Science			
		and Engineering			
13.	B. Tech. Information Science and Engineering	Presidency School of Computer Science			
	[Artificial Intelligence and Robotics]	and Engineering			
14.	B. Tech. Computer Science and Engineering	Presidency School of Computer Science			
	(Artificial Intelligence and Machine Learning)	and Engineering			

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

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.**Error! Reference source not found.** of Academic Regulations) in the prescribed maximum duration (Clauses 18.1 and 18.2 of Academic Regulations), shall stand terminated and no Degree shall be awarded.

7 Programme Educational Objectives (PEO)

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

- PEO 01: Demonstrate as a Computer Engineering Professional with innovative skills and moral and ethical values
- **PEO 02:** Engage in lifelong learning through research and professional development

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

8 Programme Outcomes (PO) and Programme Specific Outcomes (PSO) 8.1 Programme Outcomes (PO)

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

- **PO 1: Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- **PO 2: Problem Analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- **PO 3: 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.
- **PO 4:** 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.
- **PO 5:** Modern Tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
- **PO 6:** 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.
- **PO 7:** 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.
- **PO 8:** Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- **PO 9:** Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- **PO 10: Communication:** 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.
- **PO 11: 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.
- **PO 12: Life-long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

8.2 Program Specific Outcomes (PSOs):

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

PSO1: Employability: acquire technical and managerial skill that make them an employable graduate.

PSO2: Research: acquire theoretical background of each course that they are capable of applying it for solving real-time (Physical) problems.

PSO3: Entrepreneurship: acquire time management, strategic thinking, team work, and network though out their course study and project work enable them to be an entrepreneurship.

PSO4: Philanthropist: get experienced through SIC (Social Immersion Course), social outreach, blood donation and other social activity during their 4 year stay and enable them to be a philanthropist.

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. Computer Science and Engineering (Data Science) 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. Computer Science and Engineering in Data Science 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. , 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 10.1.1, 10.1.2 and 10.1.3.
- 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. , 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 3^{rd} 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 of Academic Regulations) shall be clearly defined in the Course Plan for every Course, and approved by the DAC.
- **12.3** Format of the End-Term examination shall be specified in the Course Plan.
- **12.4** Grading is the process of rewarding the students for their overall performance in each Course. The University follows the system of Relative Grading with statistical approach to classify the students based on the relative performance of the students registered in the concerned Course except in the following cases:
 - Non-Teaching Credit Courses (NTCC)
 - Courses with a class strength less than 30

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

Grading shall be done at the end of the Academic Term by considering the aggregate performance of the student in all components of Assessments prescribed for the Course. Letter Grades (Clause 8.10 of Academic 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

	Credit Structur		C	Α	Mid	-Term	End	-term			
S.N o	e (L-T-P- C)	Percenta ge/Marks	Theory	Practical	Theor y	Practic al	Theor y	Practic al	Project	Total	Exam Conducted by
1	3-0-0-3	Percenta ge	25%	-	25%	-	50 %	-	-	100 %	Mid-Term & End Term by CoE
		Marks	50	-	50	-	100	-	-	200	
2	2-0-2-3	Percenta ge	12.50%	12.50%	12.50 %	12.50%	25%	25%	-	100 %	Mid-Term & End Term by CoE
	Ma	Marks	25	25	25	25	50	50	-	200	
3	1-0-4-3	Percenta ge	-	50%	5%	20%	10%	15%	-	100 %	Mid-Term & End Term by School
		Marks	-	50	5	20	10	15	-	100	······
4	2-0-4-4	Percenta ge	12.50%	12.50%	10%	15%	20 %	30%	-	100 %	*Mid-Term & End Term by
		Marks	25	25	20	30	40	60	-	200	CoE
5	0-0-4-2	Percenta ge	-	50 %	-	-	-	-	50%	100 %	Project evaluated by IC
		Marks	-	50	-	-	-	-	50	100	in School level
6	0-0-2-1	Percenta ge	-	100%	-	-	-	-	-	100 %	Only CA in School Level
		Marks	-	100	-	-	-	-	-	100	
7	3-0-2-4	Percenta ge	12.50%	12.50%	15%	10%	30%	20%	-	100 %	Mid-Term & End Term by CoE
		Marks	25	25	30	20	60	40	-	200	
8	2-0-0-2	Percenta ge	25%	-	25%	-	50 %	-	-	100 %	Mid-Term & End Term by CoE
		Marks	50	-	50	-	100	-	-	200	

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

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

components, and the method of evaluation/assessment, shall be as decided and indicated in the Course Plan/PRC. The same shall be approved by the respective DAC.

12.6 Minimum Performance Criteria:

12.6.1 Theory only Course and Lab/Practice Embedded Theory Course

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

- a. A student must obtain a minimum of 30% of the total marks/weightage assigned to the End Term Examinations in the concerned Course.
- b. The student must obtain a minimum of 40% of the AGGREGATE of the marks/weightage of the components of Continuous Assessments, Mid Term Examinations and End Term Examinations in the concerned Course.

12.6.2 Lab/Practice only Course and Project Based Courses

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

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

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

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

- **13.1** The transfer of credits shall be examined and recommended by the Equivalence Committee (Refer Annexure B of Academic Regulations) and approved by the Dean Academics.
- **13.2** Students may earn credits from other Indian or foreign Universities/Institutions with which the University has an MOU, and that MOU shall have specific provisions, rules and guidelines for transfer of credits. These transferred credits shall be counted towards the minimum credit requirements for the award of the degree.

- **13.3** Students may earn credits by registering for Online Courses offered by *Study Web of Active Learning by Young and Aspiring Minds* (SWAYAM) and *National Program on Technology Enhanced Learning* (NPTEL), or other such recognized Bodies/ Universities/Institutions as approved by the concerned BOS and Academic Council from time to time. The concerned School/Parent Department shall publish/include the approved list of Courses and the rules and guidelines governing such transfer of credits of the concerned Program from time to time. The Rules and Guidelines for the transfer of credits specifically from the Online Courses conducted by SWAYAM/ NPTEL/ other approved MOOCs are as stated in the following Sub-Clauses:
 - **13.3.1** A student may complete SWAYAM/NPTEL/other approved MOOCs as mentioned in Clause 17.3 (as per the Academic Regulations) and transfer equivalent credits to partially or fully complete the mandatory credit requirements of Discipline Elective Courses and/or the mandatory credit requirements of Open Elective Courses as prescribed in the concerned Curriculum Structure. However, it is the sole responsibility of the student to complete the mandatory credit requirements of the Discipline Elective Courses and the Open Elective Courses as prescribed by the Curriculum Structure of the concerned Program.
 - **13.3.2** SWAYAM/NPTEL/ other approved MOOCs as mentioned in Clause 17.3 (as per the Academic Regulations) shall be approved by the concerned Board of Studies and placed (as Annexures) in the concerned PRC.
 - **13.3.3** Parent Departments may release a list of SWAYAM/NPTEL/other approved MOOCs for Pre-Registration as per schedule in the Academic Calendar or through University Notification to this effect.
 - **13.3.4** Students may Pre-Register for the SWAYAM/NPTEL/other approved MOOCs in the respective Departments and register for the same Courses as per the schedule announced by respective Online Course Offering body/institute/ university.
 - **13.3.5** A student shall request for transfer of credits only from such approved Courses as mentioned in Sub-Clause 13.3.2 above.
 - **13.3.6** SWAYAM/NPTEL/other approved MOOCs Courses are considered for transfer of credits only if the concerned student has successfully completed the SWAYAM/NPTEL/other approved MOOCs and obtained a certificate of successful/satisfactory completion.
 - **13.3.7** A student who has successfully completed the approved SWAYAM/NPTEL/ other approved MOOCs and wants to avail the provision of transfer of equivalent credits, must submit the original Certificate of Completion, or such similar authorized documents to the HOD concerned, with a written request for the transfer of the equivalent credits. On verification of the Certificates/Documents and approval by the HOD concerned, the Course(s) and equivalent Credits shall forwarded to the COE for processing of results of the concerned Academic Term.
 - **13.3.8** The credit equivalence of the SWAYAM/NPTEL/other approved MOOCs are based on Course durations and/or as recommended by the Course offering

body/institute/university. The Credit Equivalence mapped to SWAYAM/ NPTEL approved Courses based on Course durations for transfer of credits is summarised in Table shown below. The Grade will be calculated from the marks received by the Absolute Grading Table 8.11 in the Academic Regulations.

Ta Crea	Table 2: Durations and Credit Equivalence for Transfer ofCredits from SWAYAM-NPTEL/ other approved MOOC Courses					
SI. 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. Computer Science and Engineering(CSD) Program Structure (2023-2027) totalling 160 credits. Table 3 summarizes the type of baskets, number of courses under each basket and the associated credits that are mandatorily required for the completion of the Degree.

Table Co	e 3.0: B.Tech. (Data Science) <mark>2023-2027</mark> : Summ ourses and Minimum Credit Contribution from va	ary of Mandatory arious Baskets
SI. No.	Baskets	Credit Contribution
1	Humanities and Social Sciences including Management Courses (HSMC)	12
2	Basic Science Courses (BSC)	14
3	Engineering Science Courses (ESC)	28

Table Co	e 3.0: B.Tech. (Data Science) <mark>2023-2027</mark> : Summ ourses and Minimum Credit Contribution from va	ary of Mandatory arious Baskets
SI. No.	Baskets	Credit Contribution
4	Professional Core Courses (PCC)	60
5	Professional Elective Courses (PEC)	21
6	Open Elective Courses (OEC)	9
7	Project Work (PRW)	16
8	Mandatory Courses (MAC)	0
	Total Credits	160 (Minimum)

In the entire Program, the practical and skill based course component contribute to an extent of approximately 57% out of the total credits of 160 for B.Tech. (CSD) 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 19.2.1 of Academic Regulations;
 - c. No dues to the University, Departments, Hostels, Library, and any other such Centers/ Departments of the University; and
 - d. No disciplinary action is pending against her/him.

PART C – CURRICULUM STRUCTURE

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

List of Courses Tabled – aligned to the Program Structure

(Course Code, Course Name, Credit Structure (LTPC), Contact Hours, Course Basket, Type of Skills etc., as applicable).

	Та	ble 3.1 : List of Humanities and So	cial Scienc	es includi	ing Man	agement		
		Courses (HSMC)						
S.No		Course Name	L	Т	Р	С		
1	ENG1002	Technical English	1	0	2	2		
2	PPS1001	Introduction to soft skills	0	0	2	1		
3	PPS1011	Introduction to Verbal Ability	0	1	0	0		
4	ENG2001	Advanced English	1	0	2	2		
5	PPS1002	Soft Skills for Engineers	0	0	2	1		
6	PPS4002	Introduction to Aptitude	0	0	2	1		
7	PPS4004	Aptitutde Training Intermediate	0	0	2	1		
8	PPS4006	Logical and Critical Thinking	0	0	2	1		
9	PPS4005	Aptitude for Employability	0	0	2	1		
10	PPS3018	Preparedness for Interview	0	0	2	1		
			Tota	al No. of (Credits	11		

		Table 3.2 : List of Basic Science Courses (BSC)							
S.No		Course Name	L	Т	Р	С			
1	MAT1001	Calculus and Linear Algebra	3	0	2	4			
2	PHY1002	Optoelectronics and Device Physics	2	0	2	3			
3	MAT1003	Applied Statistics	1	0	2	2			
4	MAT1002	Transform Techniques, Partial Differential Equations and Their Applications	3	0	0	3			
5	MAT2004	Discrete Mathematical Structures	3	0	0	3			
6	MAT2003	Numerical Methods for Engineers	1	0	2	2			
			Tota	al No. of	Credits	14			

	Table	3.3 : List of Engineering Science Course	es (ESC)			
S.N		Course Name	L	Т	Р	С
0						
1	ECE1001	Elements of Electronics Engineering	3	0	2	4
2	CSE1004	Problem Solving Using C	1	0	4	3
3	ECE2007	Digital Design	2	0	2	3
4	CIV1008	Basic Engineering Sciences	2	0	0	2
5	MEC100	Engineering Graphics	2	0	0	2
	6	Engineering Graphics	2	0	0	2
6	CSE1006	Problem Solving using JAVA	1	0	4	3
7	ECE2010	Innovative Projects Using Arduino	-	-	-	1
8	CSE1005	Programming in Python	1	0	4	3

9	CSE3216	Mastering Object-Oriented Concepts in Python	0	0	2	1
	Total	No. of Credits				28

		Table 3.4 : List of Professional Core Courses (PCC)				
SI No	Course Code	Course Name	L	т	Р	С
1	CSE3155	Data Communications and Computer Networks	3	0	2	4
2	CSE2009	Computer Organization and Architecture	3	0	0	3
3	CSE3190	Fundamentals of Data Analytics	2	0	2	3
4	CSE2014	Software Engineering	3	0	0	3
5	CSE2007	Design and Analysis of Algorithms	3	0	0	3
6	CSE3156	Database Management System	3	0	2	4
7	CSE3351	Operating Systems	3	0	0	3
8	CSE3078	Cryptography and Network Security	3	0	0	3
9	CSE1700	Essentials of AI using Python	3	0	0	3
10	CSD1712	Statistical Foundations of Data Science	3	0	0	3
11	CSD1703	Introduction to Data Science	3	0	0	3
12	CSE3412	Data Mining	3	0	0	3
13	CSE1701	Essentials of AI Lab	0	0	4	2
14	CSD1713	Statistical Foundations of Data Science Lab	0	0	2	1
15	AID1701	Machine Learning for Intelligent data Science	2	0	0	2
16	CSD1714	Predictive Analytics	2	0	0	2
17	CSD2001	Applied Data Science	2	0	0	3
18	CSD1701	Social Media Analytics	3	0	0	3
19	CSE1705	Cloud Computing for Data Science	2	0	0	2
20	CSD1709	Edge AI and IoT Analytics	3	0	0	3
21	CSD1715	Predictive Analytics Lab	0	0	2	1
22	CSD2002	Applied Data Science Lab	0	0	2	1
23	CSD1702	Social Media Analytics Lab	0	0	2	1
24	CSE1706	Cloud Computing for Data Science Lab	0	0	2	1
25	CSE3155	Data Communications and Computer Networks	3	0	2	4

26	CSE2009	Computer Organization and Architecture	3	0	0	3
27	CSE3190	Fundamentals of Data Analytics	2	0	2	3
28	CSE2014	Software Engineering	3	0	0	3
29	CSE2007	Design and Analysis of Algorithms	3	0	0	3
30	CSE3156	Database Management System	3	0	2	4
31	CSE3351	Operating Systems	3	0	0	3
32	CSE3078	Cryptography and Network Security	3	0	0	3
33	CSE1700	Essentials of AI using Python	3	0	0	3
34	CSD1712	Statistical Foundations of Data Science	3	0	0	3
		Total No. of Credits				<mark>63</mark>

	Table 3.5 : List of course in Project Work basket (PRW)							
S.No	Course	Course Name	L	Т	Р	С		
	Code							
1	CSE7000	Mini Project	-	-	-	2		
2	CSE7100	Internship	-	-	-	4		
3	CSE7300	Capstone Project	-	-	-	10		
			Tota	l No. of	Credits	16		

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 4-6 weeks in an industry / company or academic / research institution during the Semester Break between 4th and 5th Semesters or 6th and 7th Semesters, subject to the following conditions:

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

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

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

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

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

18.2 Mini Project

A student may opt to do a Mini Project for a period of 4-6 weeks in an Industry / Company or academic / research institution or the University Department(s) as an equivalence of Internship during the Semester Break between 4th and 5th Semesters or 6th and 7th Semesters or during the 5th / 6th / 7th Semester as applicable, subject to the following conditions:

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

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

18.3 Capstone Project

A student may undergo a Capstone Project for a period of 12-14 weeks in an industry / company or academic / research institution in the 7^{th} / 8^{th} Semester as applicable, subject to the following conditions:

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

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

18.3.3 The number of Capstone Project available for the concerned Academic Term. Further, the available number of Capstone Project shall be awarded to the students by the University on the basis of merit using the CGPA secured by the student. Provided further, the student fulfils the criteria, as applicable, specified by the Industry / Company or academic / research institution providing the Capstone Project, as stated in Sub-Clause **18.3.2** above.

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

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

18.3 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:

18.3.3.1 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 18.4.1). Provided further, that the Industry / Company or academic / research institution offering such Research Project / Dissertation confirms to the University that the Research Project / Dissertation work will be conducted in accordance with the Program Regulations and requirements of the University.

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

rack 1 - A	rtificial Intelligence and Machine I	_earning E	Basket		
S.No	Course Name	L	Т	Р	С
1	Artificial Intelligence in Practice	2	0	2	3
2	Applied Artificial Intelligence	3	0	0	3
3	Neural Networks and Fuzzy Logic	3	0	0	3
4	Applied Machine Learning	2	0	2	3
5	Optimization Techniques for Machine Learning	3	0	0	3
6	Deep Learning	2	0	2	3
7	Reinforcement Learning	2	0	2	3
8	Time Series Analysis	2	0	2	3
9	Natural Language Processing	2	0	2	3
10	Advanced Natural Language Processing	2	0	2	3
11	Autonomous Navigation and Vehicles	3	0	0	3
12	Digital Health and Imaging	3	0	0	3
13	Stochastic Decision Making	3	0	0	3
14	Business Intelligence and Analytics	3	0	0	3
15	Cognitive Science & Analytics	3	0	0	3
16	Expert Systems	3	0	0	3
17	Generative AI	2	0	2	3
18	Frontend Development for AI	2	0	2	3
19	AI for IoT	2	0	2	3
20	Advanced Machine Learning	3	0	2	4
21	Bayesian Methods	3	0	2	4
22	AI Ethics & Fairness	3	0	0	3
23	Cognitive Robotics	3	0	0	3
24	Quantum Computing and AI	3	0	0	3
25	Computational Intelligence Research	3	0	0	3
26	Prompt Engineering	3	0	2	4
27	Business Analysis with Automation Solutions	3	0	0	3
28	Advanced Automation Design and Development	2	0	2	3

Track 2 - Big Data Basket

S.No	Course Name	L	Т	Р	С
1	Data Mining	3	0	0	3
2	Domain Specific Predictive Analytics	3	0	0	3
3	Data Warehousing and its Applications	3	0	0	3
4	No SQL Databases	2	0	2	3
5	Big Data Technologies	2	0	2	3
6	Mining Massive Datasets	2	0	2	3
7	Web Intelligence and Analytics.	2	0	2	3
8	Streaming Data Analytics	2	0	2	3
9	Information Visualization	2	0	2	3
10	10 Big Data Security and Privacy.		0	0	3
Track 3 – Blo	ck Chain Basket				
S.No	Course Name	L	Т	Р	С
1	Blockchain for Public Sector	3	0	0	3
2	Cryptocurrency Technology	3	0	0	3
3	Emerging Areas in Blockchain	3	0	0	3
4	Industry Use Cases using Blockchain	3	0	0	3
5	Modern Cryptography	3	0	0	3
Track 4 – Cyl	ber Security Basket		_	-	
S.No	Course Name	L	Т	Р	С
1	Cyber Forensics	2	0	2	3
2	Privacy and Security in Online Social Media	3	0	0	3
3	Ethical Hacking	1	0	4	3
4	Cyber Threats for IoT and Cloud	3	0	0	3
5	Intrusion Detection and Prevention System	3	0	0	3
6	Cyber Security	3	0	0	3
7	Cyber Digital Twin	3	0	0	3
8	Web Security	2	0	2	3
9	Vulnerability Assessment and Penetration Testing	3	0	0	3
10	Digital and Mobile Forensics	2	0	2	3
11	Security Assessment and	2	0	2	3

Digital Watermarking and

Testing

Steganography

Malware Analysis

14	Incident Response and Threat Hunting	3	0	0	3
15	AI and ML in Cybersecurity	3	0	0	3
16	Machine Learning for Cyber Security	3	0	0	3
17	Quantum Cryptography	3	0	0	3
Track 5 – Da	ata Science Basket				
S.No	Course Name	L	Т	Р	С
1	Business Continuity and Risk Analysis	3	0	0	3
2	Web Data Analytics	2	0	2	3
3	Optimization for Data Science	2	0	2	3
4	E-Business and Marketing Analytics	3	0	0	3
5	Text Mining and Analytics	3	0	0	3
6	Data Handling and Visualization	2	0	2	3
7	Business Intelligence and Analytics	3	0	0	3
Track 6 – De	evops Basket				
S.No	Course Name	L	Т	Р	С
1	Agile Structures and Frameworks	3	0	0	3
2	Applied DevOps	2	0	2	3
3	Automated Test Management	2	0	2	3
4	Build and ReleaseManagement	3	0	0	3
5	Development Automation	2	0	2	3
6	DevOps Tools Internals	2	0	2	3
7	Software Project Management	3	0	0	3
8	System Monitoring	3	0	0	3
9	System Provisioning and Configuration Management	3	0	0	3
10	Continuous Integration and Continuous Delivery (CI/CD)	3	0	0	3
11	Machine Learning for DevOps	3	0	0	3
12	Mobile DevOps	3	0	0	3
13	DevOps for IoT	3	0	0	3
14	Edge Computing	3	0	0	3
Track 7 – Io	T Basket				
S.No	Course Name	L	Т	Р	С
1	Introduction to Fog Computing	3	0	0	3
2	Big Data Analytics for IoT	1	0	4	3
3	Wireless Communication in IoT	3	0	0	3
4	Privacy and Security in IoT	3	0	0	3

5	Mobile Application for IoT	3	0	0	3					
6	IoT: Architecture and Protocols	3	0	0	3					
7	IoT Platforms and Application	2	0	2	3					
	Development									
8	Industrial Internet of Things (IIoT)	3	0	0	3					
9	Internet of Medical Things(IoMT)	3	0	0	3					
10	Cyber-Physical Systems	3	0	0	3					
11	Architecting Smart IoT Devices	3	0	0	3					
12	Intelligent Sensors and Systems	3	0	0	3					
13	IoT Architecture and Protocols	3	0	0	3					
Track 8 – Cloud Computing Basket										
S.No	Course Name	L	Т	Р	С					
1		3	0	0	3					
	Edge Computing	_	_							
2	Cloud Security	3	0	0	3					
3	Data Center Design	3	0	0	3					
4	Cloud Application Development	3	0	0	3					
5	Middleware Technologies	3	0	0	3					
6	Cloud Infrastructure and Systems Software	3	0	0	3					
7	Virtualization and	3	0	0	3					
Track 9 – Ger	neral Basket									
S.No	Course Name	L	Т	Р	С					
1	Go Programming	3	0	0	3					
2	Computer Graphics	3	0	0	3					
3	Advanced Java Programming	1	0	4	3					
4	Programming in C++	1	0	4	3					
5	Advanced Database	2	0	2	3					
	Management Systems									
6	Introduction to Bioinformatics	3	0	0	3					
7	Computer Vision	2	0	2	3					
8	Game Design and Development	3	0	0	3					
9	Microprocessors and	3	0	0	3					
	Microcontrollers									
10	Mobile ApplicationDevelopment	1	0	4	3					
11	Compiler Design	2	0	2	3					
12	Parallel Computing	3	0	0	3					
13	Quantum Computing	3	0	0	3					
14	Digital Image Processing	2	0	2	3					
15	Object Oriented Analysis and	3	0	0	3					
	Design									
16	Advanced ComputerArchitecture	3	0	0	3					

17	Software Quality Assurance	2	0	2	3
18	Real Time Operating System	3	0	0	3
19	Information Theory and Coding	3	0	0	3
20	Software Architecture	3	0	0	3
21	Programming in C# and .NET	1	0	4	3
22	Distributed Systems	3	0	0	3
23	Front End Full Stack Development	2	0	2	3
24	Java Full Stack Development	2	0	2	3
25	.Net Full Stack Development	2	0	2	3
26	Front End Full Stack Development	1	0	4	3
27	Java Full Stack Development	1	0	4	3
28	.Net Full Stack Development	1	0	4	3
29	Business Skills in Front End Full	1	0	4	3
	Stack Development				
30	Industry Skills in Java Full Stack	1	0	4	3
-	Development				
Track 10 – In	formation Science and Enginee	ering Basket			
S.No	Course Name	L	Т	Р	С
1	System Software	3	0	0	3
2	Information Retrieval	3	0	0	3
3	Enterprise Network Design	3	0	0	3
4	Operating System with	2	0	2	3
	Linux Internals				
5	Pattern Recognition	2	0	2	3
6	Search Engine Optimization	3	0	0	3
7	Service Oriented	3	0	0	3
	Architecture				
8	E-Commerce	3	0	0	3
Track 11 – In	formation Science and Technol	logy Basket			
S.No	Course Name	L	Т	Р	С
1	Storage Area Networks	3	0	0	3
2	Information System Audit	3	0	0	3
3	Web 2.0	2	0	2	3
4	Cloud Computing and	3	0	0	3
	Virtualization				
5	Mobile Networking	2	0	2	3
6	Information Security and	3	0	0	3
	Mangement				
7	Human Computer Interaction	3	0	0	3
8	Infrastructure Management	3	0	0	3
9	Web 3.0-Blockchain and Al	3	0	0	3
10	Quantum Artificial Intelligence	3	0	0	3
11	Bio-Inspired Optimization	3	0	0	3
10					
12	UI/UX Design	3	υ	υ	3

1	Firewall and Internet	2	0	2	3
	Security				
2	Wireless Sensor Networks	3	0	0	3
3	5G Networking	3	0	0	3
4	Advanced Computer	3	0	0	3
	Networks				
5	Network Management	3	0	0	3
	Systems				
6	Network Security and	2	0	2	3
	Auditing				
7	Network Administration and	2	0	2	3
	security				
8	Scaling Networking	2	0	2	3
9	Quantum Networking	2	0	2	3

20.List of Open Electives to be offered by the School / Department (Separately for ODD and EVEN Semesters.: Minimum Credits to be earned from this basket = 9 Credits

Tabl	Table 3.7 OPEN ELECTIVE BASKETS										
SI. N o.	Course Code	Course Name	L	т	Ρ	С	Type of Skill/ Focus	Course Caters to	Prereq uisites / Coreq uisites	Antir equi sites	Future Cours es that need this as Prere quisit e
Cher	nistry Bask	et									
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		I
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		

· · · · · · · · · · · · · · · · · · ·			1						I	1	-
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	Engineerin	g Basket									
1	CIV1001	Disaster mitigation and management	3	0	0	3	S	ES / HP			
2	CIV1002	Environment Science and Disaster Management	3	0	0	3	F	ES			
3	CIV2001	Sustainablility Concepts in Engineering	3	0	0	3	S	ES			
4	CIV2002	Occupational Health and Safety	3	0	0	3	S				
5	CIV2003	Sustainable Materials and Green Buildings	3	0	0	3	EM	ES			
6	CIV2004	Integrated Project Management	3	0	0	3	EN	HP/G S			
7	CIV2005	Enviornmental Impact Assessment	3	0	0	3	EN	ES			
8	CIV2006	Infrastructure Systems for Smart Cities	3	0	0	3	EN	ES			
9	CIV2044	Geospatial Applications for Engineers	2	0	2	3	ЕМ	ES			
10	CIV2045	Environmental Meteorology	3	0	0	3	S	ES			
11	CIV3046	Project Problem Based Learning	3	0	0	3	S	ES			
12	CIV3059	Sustainability for Professional Practice	3	0	0	3	S	ES			
Com	merce Bask	et								1	
1	COM20 0 1	Introduction to Human Resource Management	2	0	0	2	F	HP/G S			
2	COM20 0 2	Finance for Non Finance	2	0	0	2	S				
3	COM20 0 3	Contemporay Management	2	0	0	2	F				
4	COM20 0 4	Introduction to Banking	2	0	0	2	F				

5	COM20 0 5	Introduction to Insurance	2	0	0	2	F			
6	COM20 0 6	Fundamentals of Management	2	0	0	2	F			
7	COM20 0 7	Basics of Accounting	3	0	0	3	F			
Com	outers Bask	cet								
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/E N			
5	CSE3111	Artificial Intelligence : Search Methods For Problem Solving	3	0	0	3	S/ EM/E N			

6	CSE3112	Privacy And Security In Online Social Media	3	0	0	3	S/ EM/E N		
7	CSE3113	Computational Complexity	3	0	0	3	S/ EM/E N		
8	CSE3114	Deep Learning for Computer Vision	3	0	0	3	S/ EM/EN		
9	CSE3115	Learning Analytics Tools	3	0	0	3	S/ EM/E N		
10	CSE3116	No Code AI	2	0	2	3	S/ EM/E N		
11	CSE3117	Industrial Digital Transformation	3	0	0	3	S/ EM/E N		
12	CSE3118	Blockchain for Decision Makers	3	0	0	3	S/ EM/E N		
13	CSE3119	Coding Skills in Python	3	0	0	3	S/ EM/E N		
14	CSE3121	Parallel Computer Architecture	3	0	0	3	S/ EM/E N		
15	CSE3124	Games and Information	3	0	0	3	S/ EM/E N		
16	CSE3140	Introduction To Industry 4.0 And Industrial Internet Of Things	3	0	0	3	S/ EM/E N		
17	CSE3142	Affective Computing	3	0	0	3	S/ EM/E N		

18	CSE3112	Privacy and Security in Online Social Media	3	0	0	3	S/ EM/E N			
19	CSE3196	Foundations of Cyber Physical Systems	3	0	0	3	S/ EM/E N			
20	CSE3197	Getting Started with Competitive Programming	3	0	0	3	S/ EM/E N			
21	CSE3198	GPU Architectures And Programming	3	0	0	3	S/ EM/E N			
22	CSE3199	Artificial Intelligence: Knowledge Representation And Reasoning	3	0	0	3	S/ EM/E N			
23	CSE3200	Programming in Modern C++	3	0	0	3	S/ EM/E N			
24	CSE3201	Circuit Complexity Theory	3	0	0	3	S/ EM/E N			
25	CSE3202	Basics of Computational Complexity	3	0	0	3	S/ EM/E N			
26	CSE3212	Introduction to Computer and Network Performance Analysis Using Queuing Systems	1	0	0	1	S/ EM/E N			
27	CSE3213	C Programming And Assembly Language	1	0	0	1	S/ EM/E N			
28	CSE3214	Python For Data Science	1	0	0	1	S/ EM/E N			
29	CSE3215	Software Conceptual Design	1	0	0	1	S/ EM/E N			
Des	ign Baske	t								
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	ß	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			
Eleo 1	ctrical and EEE1002	Electronics Basket IoT based Smart Building	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			
Ele	ctronics an	d Communication Basket								
1	ECE1003	Fundamentals of Electronics	3	0	0	3	F			
2	ECE3089	Artificial Neural Networks	З	0	0	3	S			
3	ECE3090	Digital System Design using VERILOG	З	0	0	3	F/EM			
4	ECE3091	Mathematical Physics	3	0	0	3	F			
5	ECE3092	Photonic Integrated Circuits	3	0	0	3	F			
6	ECE3093	Machine learning for Music Information Retrieval	3	0	0	3	F/EM			
7	ECE3094	Video Processing and Computer Vision	3	0	0	3	F/EM			

8	ECE3095	Blockchain and Cryptocurrency Technologies	3	0	0	3	S / EM / EN		
9	ECE3096	Natural Language Processing	3	0	0	3	F/ EM / EN		
10	ECE3097	Smart Electronics in Agriculture	3	0	0	3	F/EM		
11	ECE3098	Environment Monitoring Systems	3	0	0	3	F/EM		
12	ECE3099	Modern Wireless Communication with 5G	3	0	0	3	F/ EM / EN		
13	ECE3100	Underwater Communication	3	0	0	3	F/ EM / EN		

14	ECE3101	Printed Circuit Board Design	3	0	0	3	S/F/EM				
15	ECE3102	Consumer Electronics	3	0	0	3	F/EM				
16	ECE3103	Product Design of Electronic Equipment	3	0	0	3	S/F/ EM / EN				
17	ECE3104	Vehicle to Vehicle Communication	3	0	0	3	F/ EM / EN				
18	ECE3105	Wavelets and Filter Banks	3	0	0	3	F/EM				
19	ECE3106	Introduction to Data Analytics	3	0	0	3	F/EM				
20	ECE3107	Machine Vision for Robotics	3	0	0	3	F/EM				
Eng	lish 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 Commuication 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				
Kan	nada Baske	t					[]		r	1	
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				
0		Vichara Manthana	с 2	0	0	3 2	<u> </u>				
2	KAN2000	Katha Sahithya	2	0	0	3 2	3 6				
0	KAN2007	Sampada	2	U	U	3	3				
9	KAN2008	Ranga Pradarshana Kala	3	0	0	3	S				
Fore	eign Langua	ge 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										
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1	LAW1001	Introduction to Sociology	2	0	0	0	2	F	НР		
2	LAW2001	Indian Heritage and Culture	2	0	0	0	2	F	HP/G S		
3	LAW2002	Introdcution to Law of Succession	2	0	0	0	2	F	HP/G S		
4	LAW2003	Introduction to Company Law	2	0	0	0	2	F	НР		
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/G S			
11	LAW2010	Introduction to Patent Law	2	0	0	2	F	НР			
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	НР			
14	LAW2013	Introduction to Trademark Law	2	0	0	2	F	НР			
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/G S			
18	LAW2017	Media Laws and Ethics	2	0	0	2	F	HP/G S			
Math	ematics Bas	ket							-		
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				
Mech	anical Baske	et								<u> </u>	
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			
Petro	leum Baske	t								
1	PET1005	Geology for Engineers	2	0	0	2	S	ES / HP	NIL	
2	PET1006	Overview of Energy Industry	2	0	0	2	S	ES / HP	NIL	
3	PET1007	Introduction to Energy Trading and Future Options	2	0	0	2	S	ES / HP	NIL	
4	PET1008	Sustainable Energy Management	2	0	0	2	S	ES / HP	NIL	
5	PET2026	Introduction to Computational Fluids Dynamics	3	0	0	3	S	HP	NIL	
6	PET2028	Polymer Science and Technology	3	0	0	3	E	ES / HP	NIL	
7	PET2031	Overview of Material Science	3	0	0	3	E	ES / HP	NIL	
8	PET2032	Petroleum Economics	3	0	0	3	E	HP	NIL	
9	PHY1003	Mechanics and Physics of Materials	3	0	0	3	F/S			
10	PHY1004	Astronomy	3	0	0	3	F			
11	PHY1005	Game Physics	2	0	2	3	F/S			
12	PHY1006	Statistical Mechanics	2	0	0	2	F			
13	PHY1007	Physics of Nanomaterials	3	0	0	3	F			
14	PHY1008	Adventures in nanoworld	2	0	0	2	F			

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15	PHY200	1 Medical Physics		2	0	0	2	F	ES	 _	
16	PHY200	2 Sensor Physics		1	0	2	2	F/S	_	 	
17	PHY200	3 Computational Physics		1	0	2	2	F		 	
18	PHY200	4 Laser Physics		3	0	0	3	F	ES	 	
19	PHY200	5 Science and Technology of Energy		3	0	0	3	F	ES		
20	PHY200	9 Essentials of Physics		2	0	0	2				
Mana	gement E	asket									
1	MGT100	1 Introduction to Psychology		3	0	0	3	F	HP		
2	MGT100	2 Business Intelligence		3	0	0	3	EN			
3	MGT100	3 NGO Management		3	0	0	3	S			
4	MGT100	4 Essentials of Leadershi	ip	3	0	0	3	EM/ EN	N GS/ HP		
5	MGT100	5 Cross Cultural Communication		3	0	0	3	S/E M/ EN	НР		
6	MGT200	1 Business Analytics		3	0	0	3	S/ EM/E N			
7	MGT200	2 Organizational Behaviour		3	0	0	3	F	НР		
8	MGT200	3 Competitive Intelligen	ce	3	0	0	3	S			
9	MGT200	4 Development of Enterprises		3	0	0	3	S/EM /E N			
10	MGT200	5 Economics and Cost Estimation		3	0	0	3	S/EM			
11	MGT200	6 Decision Making Under Uncertainty	•	3	0	0	3	S			
12	MGT20 07	Digital Entrepreneurship	3	0	0	3		S/EM /E N			
13	MGT20 08	Econometrics for Managers	3	0	0	3		S			
14	MGT20 09	Management Consulting	3	0	0	3	S	/EM/E N			
15	MGT20 10	Managing People and Performance	3	0	0	3	9	S/EM /E N	HP/G S		
16	MGT20 11	Personal Finance	3	0	0	3		F			
17	MGT20 12	E Business for Management	3	0	0	3		S/EM			
18	MGT20 13	Project Management	3	0	0	3	E	N / EM	GS/HP /E S		
19	MGT20 14	Project Finance	3	0	0	3	E	N / EM	HP		
20	MGT20 15	Engineering Economics	3	0	0	3		S			
21	MGT20	Business of	3	0	0	3	E	M/ EN			
	16	Entertainment				1					

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22	MGT20 17	Principles of Management	3	0	0	3	S/E M/ EN			
23	MGT20 18	Professional and Business Ethics	3	0	0	3	S/E M/ EN	HP		
24	MGT20 19	Sales Techniques	3	0	0	3	S/EM/ EN	HP		
25	MGT20 20	Marketing for Engineers (Digital Marketing)	3	0	0	3	S/E M/ EN	НР		
26	MGT20 21	Finance for Engineers	3	0	0	3	S/EM/ EN	HP		
27	MGT20 22	Customer Relationship Management	3	0	0	3	S/EM/ EN	НР		
28	MGT20 23	People Management	3	0	0	3	S/E M/ EN	HP		
Media	Studies	Basket								
1	BAJ305 0	Corporate Filmmaking and Film Business	0	0	4	2	EM	HP		
2	BAJ305 1	Digital Photography	2	0	2	3	EM	HP		
3	BAJ305 5	Introduction to News Anchoring and News Management	0	0	2	1				
Resea	arch URE	Basket								
1	URE20 01	University Research Experience	-	-	-	3		S/ EM / EN		
2	URE20 02	University Research Experience	-	-	-	0		S/ EM / EN		

21 List of MOOC (NPTEL) Courses

21.1 NPTEL - Discipline Elective Courses for B. Tech. (Computer Science and Engineering (Data Science))

SI. No	Course Code	Course Name	Total 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	CSE502	Technical Skills in JAVA	3	0-0-6-3
7	CSE503	Technical Skills in Python	3	0-0-6-3
8	CSE504	Comprehensive Technical Skills	5	0-0-10-5
9	CSE505	The Joy Of Computing Using Python	3	3-0-0-3
10	CSE3119	Coding Skills in Python	3	3-0-0-3
11	CSE3121	Parallel Computer Architecture	3	3-0-0-3
12	CSE3124	Games and Information	3	3-0-0-3
13	CSE3140	Introduction To Industry 4.0 And Industrial Internet Of Things	3	3-0-0-3
14	CSE3142	Affective Computing	3	3-0-0-3
15	CSE3112	Privacy and Security in Online Social Media	3	3-0-0-3
16	CSE3196	Foundations of Cyber Physical Systems	3	3-0-0-3
17	CSE3197	Getting Started with Competitive Programming	3	3-0-0-3
18	CSE3198	GPU Architectures And Programming	3	3-0-0-3
19	CSE3199	Artificial Intelligence: Knowledge Representation And Reasoning	3	3-0-0-3
20	CSE3200	Programming in Modern C++	3	3-0-0-3
21	CSE3201	Circuit Complexity Theory	3	3-0-0-3
22	CSE3202	Basics of Computational Complexity	3	3-0-0-3
23	CSE3212	ion to Computer and Network Performance Analysis Using Queuing	1	1-0-0-1
24	CSE3213	C Programming And Assembly Language	1	1-0-0-1
25	CSE3214	Python For Data Science	1	1-0-0-1
26	CSE3215	Software Conceptual Design	1	1-0-0-1
27	CSE3117	Industrial Digital Transformation	3	3-0-0-3
28	CSE3118	Blockchain for Decision Makers	3	3-0-0-3
29	CSE3349	Technology for Lawyers	3	3-0-0-3
30	CSEXXXX	Deep Learning for Natural Language Processing	3	3-0-0-3
31	CSEXXXX	Machine Learning for Engineering and science applications	3	3-0-0-3
32	CSEXXXX	Algorithms in Computational Biology and Sequence Analysis	3	3-0-0-3
33	CSEXXXX	Introduction to Large Language Models (LLMs)	3	3-0-0-3
34	CSEXXXX	Quantum Algorithms and Cryptography	3	3-0-0-3

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

Sl.N O	Course Code	Course Name			Р	Credits	Cont act hour s	Bask et
Semester 1 - Physics Cycle						17	28	BSC
1	MAT1001	Calculus and Linear Algebra	3	0	2	4	5	SC
2	PHY1002	Optoelectronics and Device Physics	2	0	2	3	4	SC
3	ECE1001 Elements of Electronics Engineering				2	4	5	SC
4	ENG1002	1	0	2	2	3	SC	

5	PPS1001	Introduction to soft skills	0	0	2	1	2	SC
6	CSE1004	Problem Solving Using C	1	0	4	3	5	SC
7	CHE1018	Environmental Science	1	0	2	0	3	SC
8	PPS1011	Introduction to Verbal Ability	0	1	0	0	1	SC
Semes	ter 2 - Engine	ering Science Cycle				16	21	
1	MAT1003	Applied Statistics	1	0	2	2	3	SC
2	ECE2007	Digital Design	2	0	2	3	4	SC
3	CIV1008	Basic Engineering Sciences	2	0	0	2	2	SC
4	MEC1006	Engineering Graphics	2	0	0	2	2	SC
5	CSE1006	Problem Solving using JAVA	1	0	4	3	5	SC
6	ENG2001	Advanced English	1	0	2	2	3	SC
7	PPS1002	Soft Skills for Engineers	0	0	2	1	2	SC
8	ECE2010	Innovative Projects Using Arduino	-	-	-	1	0	SC
Sl.N o	Course Code	Course Name	L	Т	Р	Cre dits		
Semes	ter 3					28	33	
1	MAT1002	Transform Techniques, Partial Differential Equations and Their Applications	3	0	0	3	3	SC
2	CSE2001	Data Structures and Algorithms		0	2	4	5	SC
3	CSE3155	Data Communications and Computer Networks	3	0	2	4	5	PC
4	CSE2009	Computer Organization and Architecture	3	0	0	3	3	PC
5	MAT2004	Discrete Mathematical Structures	3	0	0	3	3	SC
6	CSE3190	Fundamentals of Data Analytics	2	0	2	3	4	PC
7	CSE2014	Software Engineering	3	0	0	3	3	PC
8	ECE2011	Innovative Projects Using Rasperry Pi	-	-	-	1	0	SC
9	CSE1005	Programming in Python	1	0	4	3	5	SC
10	PPS4002	Introduction to Aptitude	0	0	2	1	2	SC
Semes	ter 4					24	25	
1	MAT2003	Numerical Methods for Engineers	3	0	0	3	3	SC
2	CSE2007	Design and Analysis of Algorithms		0	0	3	3	PC
3	CSE3156	Database Management System		0	2	4	5	PC
4	CSE3351	Operating Systems		0	0	3	3	PC
5	CSE3078	Cryptography and Network Security	3	0	0	3	3	PC
6	CSEXXX X	Discipline Elective - I	3	0	0	3	3	DE

7	XXXXXX X	Open Elective – I (Management Basket)	3	0	0	3	3	OE
8	PPS4004	Aptitutde Training Intermediate	0	0	2	1	2	SC
9	CSE3216	Mastering Object-Oriented Concepts in Python	0	0	2	1	2	SC
Semes	ter 5					25		
1	CSE1700	Essentials of AI using Python	3	0	0	3	3	PC
2	CSD1712	Statistical Foundations of Data Science	3	0	0	3	3	PC
3	CSD1703	ntroduction to Data Science		0	0	3	3	PC
4	CSEXXX X	Discipline Elective - II		0	0	3	3	DE
5	CSE3412	Data Mining	3	0	0	3	3	PC
6	CSEXXX X	Discipline Elective - III	3	0	0	3	3	DE
8	CSE1701	Essentials of AI Lab	0	0	4	2	4	PC
9	CSD1713	Statistical Foundations of Data Science Lab	0	0	2	1	2	PC
9	AID1701	Machine Learning for Intelligent data Science	2	0	0	2	2	PC
10	CSE7000	Internship	0	0	0	2	0	SC
Semester 6						24		
1	CSD1714	Predictive Analytics	2	0	0	2	2	PC
2	CSD1704	Software Engineering for Data Science	3	0	0	3	3	PC
3	CSD1701	Social Media Analytics	3	0	0	3	3	PC
4	CSD1705	Cloud Computing for Data Science	2	0	0	2	2	PC
5	CSD1709	Edge AI and IoT Analytics	3	0	0	3	3	PC
6	CSD1715	Predictive Analytics Lab	0	0	2	1	2	PC
8	CSD1702	Social Media Analytics Lab	0	0	2	1	2	PC
9	CSEXXX X	Discipline Elective IV	3	0	0	3	3	DE
10	CSE1706	Cloud Computing for Data Science Lab	0	0	2	1	2	PC
11	XXXXXX X	Open Elective – II	3	0	0	3	3	OE
12	PPSXXXX	Industry PreparednessProgram	2	0	0	0	2	SC
13	CSE2510	Competitive Programming and Problem Solving	0	0	4	2	4	SC
Semes	ter 7					16		
1	XXXXXXX X	Open Elective – III (Management Basket)	3	0	0	3	3	OE
2	CSEXXX X	XX Discipline Elective -V		0	0	3	3	DE
3	CSEXXX X Discipline Elective –VI		3	0	0	3	3	DE

4	CSEXXX X	Discipline Elective –VII	3	0	0	3	3	DE
5	CSE7100	Mini Project				4		SC
Semes	ter 8					10		
1	CSE7300	Capstone Project	-	-	-	10		SC

Course Catalogue

	Course Title: Calculus and									
Course Code:	Linear Algebra	I -T- P-								
MAT1001		C	2	1	2	4				
	Type of Course: School Core									
	Lab Integrated									
Version No.	3.0									
Course Pre-	Basic Concepts of Limits, Different	iation, In	tegrati	on						
requisites										
Anti-requisites	NIL									
Course	The course focuses on the concept	s of calc	ulus a	nd lin	ear alg	gebra				
Description	with reference to specific enginee	ring prob	lems.	The c	ourse	is of				
	both conceptual and analytical ty	pe in na	ture.	The la	b ses	sions				
	associated with the course are con	cerned v	vith ac	quirin	ig an a	bility				
	to use the MATLAB software.									
Course	The objective of the course is Skill D	evelopn	nent o	fstude	ent by	using				
Objective	Problem Solving Techniques.									
Course Out	On successful completion of the co	urse the	stude	nts sh	all be a	able				
Comes	to:									
	1) Comprehend the knowledge of a	oplicatio	ns of n	natrix	princip	oles.				
	2) Understand the concept of applications.	partial	deriva	itives	and	their				
	3) Apply the principles of integral ca	lculus to	evalu	ate int	egrals	•				
	4) Adopt the various analytical equations.	methods	s to s	solve	differe	ential				
	5) Demonstrate the use of MATLAB mathematical problems.	software	to dea	l with	a varie	ety of				
Course Content:										

Module 1	Linear Algebra			10 Classes					
Review: Types of Solution of syste AX = O and AX = E	matrices, elen ms of linear eq 3 using rank me	nentary transformat juations: (Homogen ethod.	ions, rank of a matrix, no ous and non-homogenc	ormal form, ous system)					
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: Different Partial Derivativ	ial calculus wi es:	th single variable.							
Homogeneous fu Jacobians, Partia two variables, Ma undetermined m	unctions and E Il differentiatio axima and mini ultipliers.	Euler's theorem, Tot n of implicit functio ma of functions of t	tal derivative, Change o ons, Taylor's series for fr wo variables, Lagrange's	f variables, unctions of method of					
Engineering Applications of partial derivatives.									
Module 3	Advanced Integral calculus			12 Classes					
Review: Integral of	calculus for sir	ngle integrals.	1	<u> </u>					
Advanced Integr	al 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	Assignment	Programming	12 Classes
	Equations			

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-onlinetutorials/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 Descriptio n	The purpose of this course is to enable the stu fundamentals, working and applications of opto- develop the basic abilities to appreciate the a microscopy and quantum computers. The cou thinking, experimental and analytical skills. The provides an opportunity to validate the concept the ability to use the concepts for technolo laboratory tasks aim to develop following skills: confidence and ability to tackle new proble events and results, observe and measure select suitable equipment, instrument and ma systems.	dents to unde electronic dev pplications of rse develops to te associated ts taught and ogical applica An attitude o ms, ability to physical ph aterials, locat	erstand the ices and to advanced the critical laboratory enhances tions. The of enquiry, o interpret enomena, te faults in
Course Out Comes	On successful completion of the course the studen CO1: Describe the concepts of semiconductors, superconductors.	ts shall be able magnetic ma	to: terials and
	CO2: Apply the concept of materials in the work magnetic devices.	ing of optoeled	ctronic and
	CO3: Discuss the quantum concepts used in a quantum computers.	dvanced micro	oscopy and
	CO4: Explain the applications of lasers and technological fields.	optical fibers	in various
	CO5: Interpret the results of various experiments to in optoelectronics and advanced devices. [Lab orie	o verify the cor nted].	ncepts used

Cours Objec	e tive	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			
Cours Conte	e nt:				
Modul	e 1	Fundament als of Materials.	Assignm ent	Plotting of magnetization (M) v/s Magnetic field (H) for diamagnetic, paramagnetic and ferromagnetic materials using excel/ origin software.	No. of Classes: 07
	Topic of Fe	s: Concept of rmi level, Hall e	energy ban ffect, Magne	ds, charge carriers, carrier con etic materials, Superconducto	ncentration, concept rs:
Modul	e 2	Advanced Devices and application s	Assignm ent	Data collection on efficiency of solar cells.	No. of Classes: 8
	Topic devic	cs: p-n junctic ces:, Solar cells,	ons, Zener I-V characte	diode, transistor characteris ristics, and LEDs	tics, Optoelectronic
Modul	e 3	Quantum concepts and Application s	Term paper	Seminar on quantum computers.	No. of classes: 8
	Topic hypo elect equa	s: Planck's qu thesis, matter v ron. Heisenberg tion. Particle in	uantum the waves, prop g's uncertair a box	ory, applications of Quantun perties. de-Broglie wavelength nty principle. Schrodinger time	n theory: de-Broglie a associated with an e independent wave
Modul	e 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.					
	Princ Atter appli	iple of optical finuation, Applica cation of optica	ibers, Nume ations: Poin I fibers in er	erical aperture and acceptance at to point communication windoscopy.	e angle (Qualitative), with block diagram,

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 N	No. 8: To study the I-V characteristics and I-R characteristics of a
solar cell as a	a function of the irradiance.
Level 1: To st	udy the I-V characteristics
Level 2: I-R c	haracteristics of a solar cell as a function of the irradiance.
Experiment N	o. 9: Calculate the numerical aperture and study the losses
that occur in	optical fiber cable
Level 1: Calo	culate the numerical aperture.
Level 2: stud	ly the losses that occur in optical fiber cable.
Experiment N	o. 10: To determine the magnetic susceptibility of a given
diamagnetic	and paramagnetic substances using Quincke's method.
Level 1: To de	etermine the magnetic susceptibility of a given diamagnetic
substance.	
Level 2: To de	etermine the magnetic susceptibility of a given paramagnetic
substance.	
Experiment N	o. 11: Plotting I-V characteristics in forward and reverse bias for
LEDs	
and Determir	nation of knee voltage.
Level 1: Plot	ting I-V characteristics in forward and reverse bias for LEDs
Level 2: Dete	rmination of knee voltage.
Experiment N	lo. 12: Determination of Stefan's constant and verification of
Stefan-Boltzr	nann Law.
Level 1: Dete	ermination of Stefan's constant
Level 2: Verif	fication of Stefan-Boltzmann Law.
Targeted App	lication & Tools that can be used:
1. Areas	of application are optoelectronics industry, Solar panel
techno	ologies, quantum computing software, electronic devices using
transis	stors and diodes, memory devices, endoscopy, SQUIDS in MRI,
Advan	ced 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	
Assessment	Туре
•	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

	1. Prepare a comprehensive report on non-conventional energy						
		resources in Karnataka and their pro	os and cons	•			
		2. Write a report on importance of qu	uantum ent	angle	ment	in	
		supercomputers.					
	Text B	ook					
	1.	Engineering Physics by Avadhan Publications,2018.	ialu, Revise	ed e	dition	, S. C	hand
	Refer	ences: 1. Elementary Solid state Ph	nysics: Princ	iples	and A	pplicati	ions
		by M.A. Omar, 1 st Edition, Pears	son Publicat	tions,	2002.		
		2. Principles of Quantum Mech	nanics by R S	Shank	ar, 2 nd	editior	١,
	springer Publications, 2011.						
	3. Optoelectronics: An Introduction by John Wilson and John						
		Hawkes, 3 rd edition, Pearson Pl	ublications,	, 2017	′. 	_ :	
		4. Engineering Physics by Gaur	and Gupta,	Dnar	ipat R	ai	
		5 Introduction to Quantum Me	echanics D	avid I	Griff	iths	
		Cambridge University Press, 20	019		<u>Unn</u>	<u>ittio</u> ,	
	E-Res	ourses:					
	1.	https://search.ebscohost.com/login	n.aspx?dired	ct=tru	e&db	=nlebk&	&AN=
		553045&site=ehost-live	·				
	2.	https://search.ebscohost.com/login 833068&site=ehost-live	n.aspx?direc	ct=tru	e&db	=nlebk&	<u>&AN=</u>
	3.	https://search.ebscohost.com/login 323988&site=ehost-live	n.aspx?direc	ct=tru	e&db	=nlebk&	<u>&AN=</u>
	4.	https://search.ebscohost.com/login 1530910&site=ehost-live	n.aspx?direc	ct=tru	e&db	=nlebk&	<u>&AN=</u>
	5.	https://search.ebscohost.com/login 486032&site=ehost-live	n.aspx?direc	ct=tru	e&db	=nlebk&	<u>&AN=</u>
	Торіс	s relevant to "SKILL DEVELOPMENT	": Fundam	enta	ls of n	nateria	ls,
	Laser	s and optical fibers.					
	for Sk	Il Development through Participative	e Learning Te	chnic	ques.	This is	
	attained through the Assignment/ Presentation as mentioned in the						
	asses	sment component in course handout	t.				
	Cou	rse Title: Elements of Electronics					
Course	Eng	neering					
Code: ECE1001	Type Inte	e of Course: School Core Theory & L-1 grated Laboratory	T-P-C	3	0	2	4

Version No.	1.0					
Course Pre- requisites	NIL					
Anti- requisites	Nil					
Course Description	The purpose of this course is to enable the students to learn the fundamental concepts of electronic devices and circuits. The course aims at nurturing the students with the undamental principles of electronics engineering, prevailing in various engineering applications. The nature of the course is conceptual and analytical which imparts converse of electronic components and their behavior under various operating conditions. The course develops thinking skills of the students, encouraging their quest for converse about electronic devices and their usage in higher semester courses. The associated laboratory provides an opportunity to validate the concepts taught in theory classes and enable the students to work with basic electronic circuits using electronics components.					
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Elements of Electronics Engineering and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING .					
Course Outcomes	On successful completion of this course the students shall be able to: Identify various electrical and electronic components and basic electrical laws. Explainapplications of Diodes and BJTs. Summarize the concepts of Digital Electronics and Communication Systems. Discuss the basic concepts of microprocessorand computer organization. Perform experiments to familiarizevarious Electrical & Electronic components and equipment. Verify Basic Electrical Circuit configurations and Laws.					
Course Content:						
Module 1	Basic Electrical and Electronic Components	Assignment / Quiz	Identification of Practical electronic and electrical components / Memory Recall based Quizzes	10 Sessions		
Topics:	1	1	1	<u></u>		
		C Circuite: Classificat	tion of Electrical Elements, Ohm's law	(Sorios		

ELECTRICAL CIRCUITS AND LAWS:DC Circuits: Classification of Electrical Elements, Ohm's law, Series and Parallel Circuits, Kirchhoff's Voltage and Current laws, Power and Energy, Transformers and their types.

ELECTRONIC MATERIALS AND COMPONENTS: Conductors, Insulators, Semi-Conductor Material, P-N Junction diode, Characteristics and Parameters, Ideal Diode approximations, DC load line.

Module 2	Applications of Diodes and Introduction to BJT	Assignment / Quiz		Simulation Task/ Memory Recall based Quizzes	12 Sessions
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Topics:

RECTIFIERS: Half-wave rectifier, Two-diode Full-wave rectifier, Bridge rectifier, Capacitor filter circuit (only qualitative approach).

ZENER DIODE: Zener diode, Zener Characteristics, Zener diode as a voltage regulator.

BIPOLAR JUNCTION TRANSISTORS: BJT Construction and Operation, BJT Voltages and Currents, Common Base, Common Emitter Configuration and Characteristics, Current amplification Factor alpha and beta, DC Load line w.r.t. fixed bias circuit (Q-Point), AC Analysis.

Module 3	Digital Electronics and Communication System	Assignment / Quiz		Simulation Task / Memory Recall based Quizzes	13 Sessions
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Topics:

NUMBER SYSTEMS: Decimal Number System, Binary Number System, Hexadecimal Number System, Conversions: Binary to and from Hexadecimal; Hexadecimal to and from Decimal;1's and 2's Complement of Binary Numbers, Binary Addition.

BOOLEAN ALGEBRA: Boolean Laws and Theorems, De Morgan's theorem. Digital Circuits: Logic gates, NOT Gate, AND Gate, OR Gate, XOR Gate, X-NOR Gate, NAND Gate, NOR Gate.

COMMUNICATION SYSTEM: Block diagram of communication system, Modulation: Definition of Modulation, Need of Modulation, Types of Modulation: Amplitude Modulation and Frequency Modulation (Waveforms only).

	Microprocessors and			10
Module 4	Computer	Assignment / Quiz	Memory recall based Quizzes	Sessions
	Organization			

Topics:

INTEL 8085 MICROPROCESSOR: Basic Architecture and features of 8085 Microprocessor.

COMPUTER ORGANISATION:Basic structure of Computer Organisation describing the various Computer types, Functional Units, Basic Operational concepts, Bus Structures, Memory System: RAM and ROM.

List of Laboratory Tasks:

Experiment No. 1:Study of Resistors, Measuring instruments and DC Power Supply.

Level 1:Identification of resistor values from color bands and verification with Multimeter.

Level 2:Connecting a resistive circuit to a DC Power Supply and observing the input and output values using Voltmeters, Ammeters and hence calculate resistance values.

Experiment No. 2:Study of Reactive components, Multimeter, CRO and Function Generator.

Level 1:Identification of various types of capacitive and inductive components and verification with Multimeter.

Level 2:Connecting a reactive circuit to a function generator and observing the input and output waveform on CRO and calculation of Reactance and Impedance.

Experiment No. 3: Study of Ohm's Law.

Level 1:Rig up the circuit and verify Ohm's Law.

Level 2: Connect a 100 Ω Resistor to a Voltage source of 0-5V. Plot a V- I graph by tabulating the Voltage Vs Current Values accordingly. Repeat the experiment for 1K Ω resistor and compare the results.

Experiment No. 4:Study of Series and Parallel Resistor Connections.

Level 1:Carry out the equivalent resistance of given four resistors 100Ω each connected in series and parallel combination using breadboard.

Level 2:Rig up a Current Divider Circuit and a Voltage Divider Circuit and verify the results.

Experiment No. 5:Study of Kirchhoff's Voltage Law and Kirchhoff's Current Law.

Level 1:Verify KVLand KCL with circuit(a) and circuit(b) with #values.





Experiment No. 6: Study of PN-Junction Diode Characteristics in Forward and Reverse Bias Conditions.

Level 1:Carry out the experiment to find cut-in voltage on forward characteristics for Silicon P-N Junction diode.

Level 2: Carry out experiment to plot VI Characteristics of Silicon P-N Junction Diode in both forward and reverse biased conditions for Si P-N Junction diode.

Experiment No. 7: Study of Bipolar Junction Transistor in different regions of operation.

Level 1:Carry out the experiment to understand the importance of active, cut off and saturation regions.

Level 2: Carry out the experiment to design and analyze the operation of transistor as switch.

Experiment No. 8: Study of basic Digital Logic Gates using Integrated Chips IC's: NOT, AND, OR, XOR, NAND and NOR Gates

Level 1:Carry out the experiment to study and verify the truth table of logic gates using Digital ICs.

Level 2:Implementation of operation of a basic Boolean expression using basic gates.

Experiment No. 9: Study of Computer Organization: Identification of Components on Motherboard: CPU: Processor Chips (Processor Socket), PCI, Parallel Ports, Universal Serial Bus: USB, I/O Connectors, RAM Slots.

Level 1:Carry out the experiment to familiarize a computer system layout and mark the positions of SMPS, Motherboard, FDD, HDD, CD / DVD drive and add on cards.

Level 2:Study of a Desktop PC and its assembling.

Targeted Application & Tools that can be used:

Student will be able to find career opportunities in various domains such asAnalog Electronics, Digital Electronics, Microprocessors, VLSI Design, Telecommunication, Computers andWireless Communication. The students will be able to join a profession which involves basics to high level of electronic circuit design.

Professionally Used Software: MultiSim/ PSpice

Besides these software tools hardware equipment such as Multimeters, Function Generators, Power Supplies, Oscilloscopes etc., can be used to perform component/circuit testing and analysis.

Textbook(s):

T1. John Hiley, Keith Brown and Ian McKenzie Smith, *"Hughes Electrical and Electronic Technology",* Pearson,12th Edition

T2.William Stallings,"Computer Organization and Architecture Designing for Performance", Pearson Education, 10th Edition.

Reference(s):

Reference Book(s):

R1. Smarajit Ghosh, *"Fundamentals of Electrical and Electronics Engineering"*, PHI, 2nd Edition

R2. D.P. Kothari, I. J. Nagrath, *"Basic Electronics"*, McGraw Hill Education, 1st Edition

R3. Rajendra Prasad, *"Fundamentals of Electronics Engineering"*, Cengane Learning, 3rd Edition

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

Video lectures on "BASIC ELECTRONICS" by Prof. Dr. Chitralekha Mahanta, Department of Electronics and communication Engineering, IIT Guwahati": <u>https://nptel.ac.in/courses/117/103/117103063/</u>

Lecture Series on "Useful Laws in Basic Electronics" by Prof. T.S.Natarajan, Department of physics, IIT Madras: <u>https://www.youtube.com/watch?v=vfVVF58FtCc</u>

Lecture Series on "Introduction to Bipolar Junction Transistors BJT " by All About Electronics Youtube Channel: <u>https://www.youtube.com/watch?v=-</u> <u>VwPSDQmdjM&list=PLwjK_iyK4LLDoFG8FeiKAr3IStRkPSxqq</u>

Lecture Series on "PN Junction Diode " by All About Electronics Youtube Channel: <u>https://www.youtube.com/watch?v=USrY0JspDEg</u>

Lecture Series on "Introduction to Digital Electronics" by All About Electronics Youtube Channel:

https://www.youtube.com/watch?v=DBTna2ydmC0&list=PLwjK_iyK4LLBC_so3odA64E2MLg IRKafl

Lecture Series on "Introduction to Microprocessors" by Bharat Acharya Education :https://www.youtube.com/watch?v=0M74z5jEAyA

Lecture Notes on : "Electronic Devices", Bipolar Junction Transistors, 2nd Chapter, by Shree Krishna Khadka (PDF) Bipolar Junction Transistor (researchgate.net)https://www.researchgate.net/publication/323384291_Bipolar_Junction_ Transistor

E-content:

V. Milovanovic, R. van der Toorn, P. Humphries, D. P. Vidal and A. Vafanejad, "Compact model of Zener tunneling current in bipolar transistors featuring a smooth transition to zero forward bias current," *2009 IEEE Bipolar/BiCMOS Circuits and Technology Meeting*, 2009, pp.

99-102, doi: 10.1109/BIPOL.2009.5314134. https://ieeexplore.ieee.org/document/5314134

M. Oueslati, H. Garrab, A. Jedidi and K. Besbes, "The advantage of silicon carbide material in designing of power bipolar junction transistors," 2015 IEEE 12th International Multi-Conference on Systems, Signals & Devices (SSD15), 2015, pp. 1-6. https://ieeexplore.ieee.org/document/7348149

H. Luo, F. Iannuzzo, F. Blaabjerg, X. Wang, W. Li and X. He, "Elimination of bus voltage impact on temperature sensitive electrical parameter during turn-on transition for junction temperature estimation of high-power IGBT modules," *2017 IEEE Energy Conversion Congress and Exposition (ECCE)*, 2017, pp. 5892-5898 <u>https://ieeexplore.ieee.org/document/8096974</u>

F. Bauer, I. Nistor, A. Mihaila, M. Antoniou and F. Udrea, "Super junction IGBT Filling the Gap Between SJ MOSFET and Ultrafast IGBT," in *IEEE Electron Device Letters*, vol. 33, no. 9, pp. 1288-1290, Sept. 2012 <u>https://ieeexplore.ieee.org/document/6246672</u>

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

Topics relevant to "SKILL DEVELOPMENT": Electrical & Electronic component and laws, Fundamentals of Digital Electronics, Communication Systems, Microprocessors and Computer Organization for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: ENG1002	Course Title:Technical EnglishType of Course:1]School Core2]Laboratory integrated	L-T-P-C	1-0-2-2
Version No.	1.0 V. 3		
Course Pre- requisites	Intermediate Level English		
Course Anti-requisites	NIL		
Course Description	Technical English course is designed to equip students for effective communication in technical and scientif the specialized vocabulary, writing styles, and commu technical fields, including engineering and information	s with the language ic contexts. The con nication techniques n technology.	skills necessary urse focuses on used in various
Course Objectives	The objective of this course is to develop the learners using EXPERIENTIAL LEARNING and I TECHNIQUES.	[?] EMPLOYABILI ⁷ PARTICIPATIVE	TY SKILLS by LEARNING

Course On successful completion of the course, the students shall be able to:								
Outcomes	1. Develop proficiency in u	using technical voc	abulary and terminolog	y.				
	2. Apply language skills fo	r better speaking sl	cills in technical fields.					
	3. Write technical descrip	otions						
	4. Demonstrate writing s	kills in writing	echnical documents	such as				
	reports, manuals, and articles.							
Course Content:								
Module 1	Fundamentals of Technical CommunicationWorksheets& QuizVocabulary building9 Classes							
Introduction to Tee	chnical English							
Differences between	en Technical English and General E	English						
Technical Writing	Basics							
Technical Vocabul	ary							
Module 2	Technical Presentation	Presentations	Speaking Skills	12 Classes				
Introduction Planning the Prese	entation							
Creating the Prese	ntation							
Giving the Present	ation							
Module 3	Technical Description	Assignment	Group Presentation	12 Classes				
Product Description	pn							
Process Description	Process Description							
User Manuals	User Manuals							
Transcoding: Diag	Transcoding: Diagrams, charts and images							
Module 4	Technical Writing	Assignment	Writing Skills	1 2 C la ss es				

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

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

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:

Chauhan, Gajendra Singh, and Kashmiramka, Smita, *Technical Communication*. Cengage Publication. 2018.

Sunder Jain. Technical Report Writing. Centrum Press, 2013.

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.

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=J STOR1 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:	Course Title: Introduction to		
PPS 1001	Soft Skills		
		L- T-P- C	0-0-2-1
	Type of Course: Practical Only		
	Course		
Version No.	1.0		
Course Pre-	Students are expected to understa	and Basic Eng	glish.
requisites	Students should have desire and e and learn.	enthusiasm t	o involve, participate

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 PARTICIPATIVE LEARNING techniques.				
Course Out Comes	On successful completion able to:	of thi	s course the students shall	be	
	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 punctuality	Expectations, Ice Breaker, Si	gnifica	nce of soft skills, Formal gro	ooming,	
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 FORMATIONWorksheets & 4 Assignment4 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	Course Title: Problem Solv	ing Using C			1	0	4	3	
Code:				I - T-P-C					
CSE1004	Type of Course:								
	School Core Lab								
	Integrated.								
Version No.	1.0								
Course Pre-	NIL								
requisites									
Anti-requisites	NIL								
Course	The course is designed	o provide co	mplete know	wledge o	f C	laı	ngua	age.	
Description	Students will be able to	develop logi	cs which wi	ll help th	em	to	cre	eate	
	programs and application	s in C. AC Also	o by learning	the basic	pro	ogra	amn	ning	
	constructs they can easily switch over								
	to any other language in fu	iture.							
Course Object	The objective of the course	e is to familiar	ize the learne	ers with th	ne c	ond	cept	s of	
	Problem Solving Using C a	nd attain Emp	oloyability thr	ough Prol	oler	n S	olvir	ng	
	Methodologies.								
Course Outcomes	On successful completior	of this course	e the student	s shall be	ab	le to):		
	1. Write algorithms a	nd to draw flo	wcharts for s	olving pro	ble	ems			
	2. Demonstrate knov	ledge and de	velop simple	applicati	ons	in (С		
	programming constructs								
	Develop and imple	ment applica ⁻	tions using a	rrays and	stri	ngs	;		
	4. Decompose a prot	lem into func	tions and dev	velop mo	dula	ar			
	reusable code			1					
	5. Solve applications	in C using stri	uctures and l	Jnion			~		
	Processing.	s using Seque	intiat anu hai		,693	5 FI			
Course Content:									
Module 1	Introduction to C Languag	e Quiz	Problem	9 Hrs.					
		_	Solving						

Topics:							
Introduction to Pr	ogramn	ning – Algorithms – P	seudo C	ode - Fl	ow Chart – C	ompila	tion – Execution
– Preprocessor Di	rectives	s (#define, #include,	#undef)	- Overv	iew of C – Co	nstant	s, Variables and
Data types – Ope	rators	and Expressions – M	1anaging	g Input a	and Output	Operat	ions – Decision
Making and Branc	hing - E	Decision Making and	Looping	•			
Module 2	Introd	luction to Arrays and	l Quiz	F	Problem	9 Hr	s.
	String	(S		S	Solving		
Topics:							
Arrays: Introduct	ion – C	One Dimensional Ar	ray – In	itializat	ion of One	Dimen	sional Arrays -
Example Program	ns – So	rting (Bubble Sort, S	Selectior	n Sort) -	 Searching 	(Linea	r Search) - Two
Dimensional Arra	ıys – Ir	nitialization of Two	Dimensi	onal Ar	rays. Examp	ole Pro	grams – Matrix
operations. String	s: Intro	duction – Declaring	and Initia	alizing S	String		
Variables – Readii	ng Strin	gs from Terminal – W	/riting St	ring to S	Screen – Strir	ig Hand	aling Functions.
Module 3	Funct	tions and Pointers	Quiz	E E	Solving	9 Hr	s.
Topics:							
Functions: Introdu	uction -	- Need for User-defin	ed funct	ions – E	Elements of l	Jser-D	efined
Functions: declar	ation, d	lefinition and functio	n call–C	ategori	es of Functio	ons – Re	ecursion.
Pointers: Introduc	ction – D	Declaring Pointer Var	iables –	Initializ	ation of Varia	ables –	Pointer
Operators – Point	er Arith	metic – Arrays and P	ointers –	Param	eter Passing	: Pass I	by Value, Pass
by Reference.							
Module 4	S	tructures and Union	C	Quiz	Problem Solving		9 Hrs.
Topics:					·		
Structures: Introd	uction	– Defining a Structur	e – Decla	aring St	ructure Varia	ble – A	ccessing
Structure Membe	rs – Arra	ay of Structures – Arr	ays with	in Struc	tures – Unio	n: Intro	oduction -
Defining and Decl	aring U	nion – Difference Be	tween U	nion an	d Structure.		
Module 5	Fil	le handling	Case St	udy	Problem Sc	lving	9 Hrs.
Topics:	I	-					1
Files: Defining and Access Files	d Openi	ing a File – Closing a	File – Inp	out / Ou	tput Operati	ons on	File – Random
List of Practical							
Tasks Lab							
Sheet 1							
(Module I)							
CHE1018							
Lab Sheet 2 (Mod	ule II)						
Programs using A	rrays ar	nd Strings					
Lab Sheet 3 (Mod	ule III)						
Programs using F	unction	s and Pointers					
Lab Sheet 4 (Mod	ule IV)						
Programs using S ⁻	tructure	es and Unions					
Lab Sheet 5 (Mod	ule V)						
Programs using Fi	les						
Text Book(s):							
1. E. Balagur	uswam	y, "Programming in <i>I</i>	ANSI C",	8th Edi	tion, 2019, N	1cGrav	v Hill
Education, ISBN:	978-93	-5316- 513-0.					
Reference							
Book(s):							
1. Ya	shwant	Kanetkar, Let us C,	17th Edi	tion, BP	BPublicatio	ns, 202	20.
2. Re 20	emaTh 16.	areja, "Programming	g in C", C	oxtord U	Iniversity Pre	ss, Seo	cond Edition,

	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
	5.	Edition, 2014. Stephen G. Kochan, "Programming in C", Addison-Wesley Professional, 4th Edition, 2014.
Web Li	nks and	Video Lectures:
1.	https://	/nptel.ac.in/courses/106/105/106105171/
2.	https://	/archive.nptel.ac.in/courses/106/104/106104128/

Course	Course Title: Environmental Science			10		
Code:			L T-P- C	1	2	0
CHE1018	Type of Course: School Core-Theory and Lab		L- 1-F- C		2	Ū
Version No.	2.0			<u> </u>		<u> </u>
Course	NIL					
Pre-						
requisites						
Anti-	NIL					
requisites						
Course	This course emphasizes the need to conserve b	iodiversity and ad	opt a more	sust	aina	ble
Description	lifestyle by utilizing resources in a responsible way	y. Topics covered in	nclude basic	princ	iples	of
	ecosystem functions; biodiversity and its conserv	vation; human po	pulation gro	wth;	; wa	ter
	resources, pollution; climate change; energy	resources, and su	ustainability;	Sus	tain	ing
	human societies, policies, and education.					
	This course is designed to cater to Environment a	and Sustainability				
Course	The objective of the course is to familiarize the	e learners with th	ne concepts	of		
Objective	"Environmental Science" and attain SKILL DE	/ELOPMENT thro	ugh EXPERI	ΕΝΤΙ	AL	
	LEARNING techniques.					
Course	On successful completion of this course the stude	nts shall be able to	:			
Outcomes						
	Appreciate the historical context of human intera	actions with the er	ivironment a	nd t	he	
	need for eco-balance.					
	Describe basic knowledge about global climate cl	hange with particu	ilar referenc	e to	the	
	Indian context.					
	Develop an understanding on types of pollution	and ways to proto	ct the enviro	nmo	nt	
	Learn about various strategies on Global enviro	nmental managem	ent systems	mile	iii	
		intental managem	cht systems			
Course						
Content:			_			
Module 1	Humans and the Environment	Assignment	Data Collection	0	1 cla	ISS
Topics: The	man-environment interaction: Mastery of fire; O	rigin of agriculture	e; Emergenc	e of	city	
states; Great	t ancient civilizations and the environment.					
Self-learning	topics: Humans as hunter-gatherers; Industr	ial revolution and	d its impact	on	the	
environment	; Environmental Ethics and emergence of environr	mentalism.				
Module 2	Natural Resources and Sustainable Development	Assignment		03	Clas	ses

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
То	pics:			

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
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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									
managemer	nt; Was	te Management- Concept of 3R (Red	uce, Recycle and Reu	use) and sustaina	ability.				
Self-learning topics: Environmental audit and impact assessment; Eco labeling /Eco mark scheme									
Madula	0	Environmental Treaties and	Caso study Data analysis 01						
Would	0	Legislation							
Topics:									
Major Intern	ational	Environmental Agreements: Convention	on on Biological Diver	sity (CBD), Major	Indian				
Environment	tal Leg	islations: Environmental Protection A	ct, Forest Conservat	ion Act, Public a	wareness.				
Self-learnin	g topic:	s: Paris Agreement, Conference of the	e Parties (COP), India'	s status as a part	y to major				
conventions	: Air (P	revention and Control of Pollution) Ac	ct, Water (Prevention	and control of P	ollution) Act,				
Wildlife Prot	ection	Act.							
List of labor	atory t	asks : Any eight experiments will be c	conducted						
ermination o	f total :	alkalinity of a water sample (knowledg	ge)						
Estimation	of wat	er hardness by EDTA method and	its removal (by zec	olite/ ion exchar	ıge				
method) (C	omprel	nensive)							
nation of co	pper fr	om industrial effluents by colorimetric	c method (Compreher	ısive)					
mation of irc	on from	industrial effluents by titrimetric met	thod/potentiometric	method (Compre	hensive)				
mation of nic	ckel fro	m industrial effluents by titrimetric me	ethod (Comprehensiv	e)					
mation of ch	loride i	n drinking water by titrimetric method	d (Comprehensive)						
nation of flu	oride i	n ground water by colorimetric metho	d (Comprehensive)						
ermination o	f calciu	m in aqueous solution (Comprehensiv	e)						
ermination o	f Tota	Dissolved Salts, conductivity and pH of	of a water samples (K	nowledge)					
Determ	ninatior	n of Chemical oxygen demand in the ir	ndustrial effluent. (Co	omprehensive)					
Biologie	cal oxyg	gen demand of waste water sample (C	Comprehensive)						
Determ	nination	of dissolved oxygen of an industrial e	effluent (Comprehens	ive)					
Quality	monit	oring analysis of a soil sample (knowle	edge)						
Flame	photom	netric estimation of Sodium and potas	sium (Application)						
Gas Ch	romato	graphic analysis of volatile organic co	mpounds (Application	1)					
Targeted Ap	plication	on & Tools that can be used:							
Application a	areas a	re Energy, Environment and sustainab	ility						
Tools: Statis	stical a	nalysis of environmental pollutants us	ing excel, origin etc.						
Project worl	<td>nment:</td> <td></td> <td></td> <th></th>	nment:							
Assessmer	nt Type								
term exam									
Assignment	(revie	w of digital/ e-resource from PU link	given in references	section - manda	atory to				
submit scre	enshot	accessing the digital resource.)							
evaluation/	evaluation/Assignment								
Term Exam									
learning		_	_						
Assignment	1: Writ	te a Statement of Environment repor	t of your town/city/s	tate/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

yler Miller and Scott Spoolman (2020), Living in the Environment, 20th Edition, Cengage Learning, USA namurthy, K.V. (2003) Text book of Biodiversity, Science Publishers, Plymouth, UK.

Jackson, A.R. & Jackson, J.M. (2000), Environmental Science: The natural environment and human impact, Pearson Education.

Reference Books

Fisher, Michael H. (2018) An Environmental History of India- From Earliest Times to the Twenty-First Century, Cambridge University Press.

William P. Cunningham and Mary Ann Cunningham (2017), Principles of Environmental Science: Inquiry & Applications, 8th Edition, McGraw-Hill Education, USA.

a N., (2020) Wild and Wilful. Harper Collins, India.

www.ipcc.org; https://www.ipcc.ch/report/sixth-assessment-report-cycle/

Theodore, M. K. and Theodore, Louis (2021) Introduction to Environmental Management, 2nd Edition. CRC Press.

Richard A. Marcantonio, Marc Lame (2022). Environmental Management: Concepts and Practical Skills. Cambridge University Press.

E-resources:

https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DO AB 1 06082022 18126

https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DO AB 1 06082022 8761

https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DO AJ 1 02082022 3333

https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DO AB_1_06082022_3063

https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DO AB 1 06082022 20719

https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DO AB_1_06082022_16824

https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DO AB_1_06082022_3954

https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=DO AB_1_06082022_491

https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=CU STOM_PACKAGE_16012023_WORLD_BUSINESS_COUNCIL_SUSTAINABLE_488

https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=CU STOM_PACKAGE_16012023_WORLD_BUSINESS_COUNCIL_SUSTAINABLE_583

https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=SP RINGER INDEST 1 171

https://presiuniv.knimbus.com/user#/searchresult?searchId=3R%20principle&_t=1687427221129

<u>https://presiuniv.knimbus.com/user#/searchresult?searchId=eco%20labelling&_t=1687427279979</u> <u>https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=TE</u> <u>XTBOOK_LIBRARY01_06082022_395&xIndex=4</u>

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:	Course Title: Introduction to Verbal						
PPS 1011	Ability Type of Course: Theory Only	L- T- P- C	0	1	0	0	
	Course						
Version No.	1.0		I				
Course Pre-	Students are expected to understand Bas	sic English.					
requisites	Students should have desire and enthusi learn.	asm to invo	olve,	partic	ipate a	nd	
Anti-requisites	NIL						
Course Description	This course is designed to enable students understand the importance of Verbal Ability and improve confidence, communication and professional skills to give them a competitive advantage and increase chances of success in the professional world. The course will benefit learners in presenting themselves effectively through various worksheets and learning methodologies.						
Course Objective	The objective of the course is to familiar of "Verbal Ability" and attain SKILL DEV PARTICIPATIVE LEARNING techniques.	ize the lear ELOPMEN	rners T thre	with ough	the cor	ncepts	
Course Out Comes	On successful completion of this course CO1: Recognize significance of verbal	the studer	nts sł	nall be	able to	D:	
	ability CO2: Utilize the rules of						
	communication						
	CO3: Apply techniques of vocabu effective communication	lary build	ding	to s	howca	se	
Course Content:							

Module 1	INTRODUCTION TO VERBAL ABILITY	Individual Assessment	01 Hour					
Topics: Setting E	xpectations, Ice Breaker, Sign	ificance of verbal ability, pre-a	issessment					
Module 2	EFFECTIVE VERBAL COMMUNICATION	Practice Worksheets	06 Hours					
Topics: Different rules of grammar and application, Subject-Verb Agreement, Tenses								
Module 3	VOCABULARY BUILDING	Practice Worksheets	04 Hours					
Topics: Root	Topics: Root words, Synonyms and antonyms, analogies, para-jumbles							
Module 4	READING COMPREHENSION	Individual Assessment	02 Hours					
A session where	students will be introduced to	speed reading and comprehen	nsion, post-					
assessment								
largete	d Application & Tools that car	be used: LMS						
Project	work/Assignment: Mention th	e Type of Project /Assignmen	t proposed for					
this cou	rse							
Indi	vidual Assessment							
LMS	S MCQ							
The topics relate	ed to Skill Development: Com	munication, grammar rules, v	ocabulary					
building, effectiv	building, effective presentation for skill development through participative learning							
techniques. This is attained through learning and practicing the rules of effective								
communication through worksheets as mentioned in the assessment component.								

Course Code:	Course Title: Applied							
MAT1003	Statistics	LTP C	1	0	2	2		
	Type of Course: School Core							
Version No.	3.0							
Course Pre-	None	None						
requisites								
Anti-requisites	None							
Course Description	The goal of this course is to p probability and statistics by me descriptive statistics, probabilit keeping in mind the future course and probabilistic components. Th	rovide a ans of a y and p es having ne cours	firm thor probal stati e cov	under ough t bility c stical, ers top	rstandi reatme distribu quanti bics su	ng of ent of utions tative ch as		

	descriptive statis	tics, probability	y, rules for	probability, random		
	variables and probability distributions, standard discrete and					
	continuous probability distributions.					
Course	The objective of the course is to familiarize the learners with the					
Objective	concepts of "	Applied Stat	istics" a	nd attain <u>Skill</u>		
	<u>Development</u> Through <u>Problem Solving</u> techniques.					
Expected	At the end of this o	course, students	s will be in a	position to apply the		
Outcome:	techniques of des	criptive statistic	s effectively	interpret the ideas		
	of probability and	conditional prol	bability			
			<i>.</i>			
	demonstrate	demonstrate the knowledge of probability distributions				
	Compute stat	Compute statistical parameters, correlation and regression,				
	probability and sampling distributions using R software.					
	Descriptive		Coding	10 classes		
Module 1	Statistics	Assignment	needed	10 0103303		
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		14 classes
	Variables and	Coding	
	Probability	needed	
	Distributions		

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	Coding	15 classes
	Theory	needed	

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:Course Title: Digital DesignL- T-P- C2023	ourse Code:	Code: Course Title: Digital Design	L- T-P- C	2	0	2	3	
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ECE2007	Type of Course: Theory & Integ	rated						
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Version No.	2.0							
Course Pre- requisites	[1] Elements of Electronics/Electrical Engineering, 2] Basic concepts of number representation, Boolean Algebra							
Anti-	NIL							
requisites								
Course Description	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: Describe the concepts of number systems, Boolean algebra and logic gates. Apply minimization techniques to simplify Boolean expressions. Demonstrate the Combinational circuits for a given logic Demonstrate the Sequential and programmable logic circuits 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 Analy task	ysis	cla	06 sses		
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 Analy task	ysis	Cla	08 asses		
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 Analvsis task	08 Classes
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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- <u>NPTEL :: Electrical Engineering NOC:Digital Electronic Circuits</u>
- 5. Digital Logic Design PPT <u>Slide 1 (iare.ac.in)</u>
- 6. Lab Tutorial: <u>Multisim Tutorial for Digital Circuits Bing video</u>

CircuitVerse - Digital Circuit Simulator online

Learn Logisim - Beginners Tutorial | Easy Explanation! - Bing video

<u>Digital Design 5: LOGISIM Tutorial & Demo</u> 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:	Course Title: Basic					
CIV1008	Engineering Sciences	L-T-	2	•	0	2
	Type of Course: Theory	P-C	2	0	0	
	Only					
Version No.	1.0					
Course Pre- requisites	NIL					
Anti-requisites	NIL					
Course	This basic course on engineer	ing scie	nce is	designed	to intro	duce
Description	students to the fields of engineering. Student will be engineering and different man machinery for power product students will be getting an ove industries. This course acquain and Construction 4.0. The of appreciate the multidisciplinat operations in the current era transforming every aspect of e	civil, n expose ufactur ion and erview o nts stud ourse a ary natur with me	nechar ed to v ing tec I consu f variou ents to aims to re of eu echaniz ing.	nical and various fi- hniques in umption. us sectors basics of basics of basics of c enable ngineering zation and	petro elds in addit Additio of oil Indust studer g desig d digitiz	ileum civil ion to nally, & gas ry 4.0 nts to n and zation

Course	The objective	The objective of the course is skill development of student by using				
Objective	Participative Learning techniques.					
Course	On successf	ul completion	of this course the stude	ents shall be able		
Outcomes	to:					
		· · . · .	· · · ·	· · · · · · · · · ·		
	1] Recogn Engineeri	ize the signif ng	icance of various dis	ciplines in Civil		
	2] Discuss t	he recent evol	utions in Civil Engineeri	ing		
	3] Explain v energy co	arious energie nsumption ma	es, energy generating r achineries	nachineries and		
	4] Describe with the P	the fundamen Petroleum Indu	tal concept and termine Istry	ology associated		
	5] Distinguis technique	sh between co es.	onventional and moder	n manufacturing		
Course	<u> </u>					
Content:						
	Introducti					
	on to					
	various		Case studies on			
Module 1	fields in	Assignment	different Civil	6 Sessions		
	Civil		Engineering Projects			
	Engineerin					
	g					
Topics: Introductio	on to Civil Engi	neering: Defin	ition, scope and branch	nes of Civil		
Engineering, Role	of Civil Engine	er, Overview o	f Infrastructure.			
	Current Trends					
	and					
Module 2	Evolution	Assignment	Article Review	6 Sessions		
	in Civil					
	Engineerin					
	g					
Topics: Mechaniza	tion in Constr	uction, Applic	ation of Digital Technol	ogies in		
Planning, Design, e of Smart Cities.	execution, mo	nitoring and m	naintenance of Constru	ction. Overview		
	Power					
Module 3	Productio n and	Assignment & Quiz	Data Collection	6 Sessions		
	Sougaript		1			

	ion Machinery								
Topics: Energy and	lits types. Eng	vines and their	applications, Pumps-(Compressors					
and their applicati	ons.								
Module 4	Overview of Petroleum Engineerin g	Assignment & Quiz	Article Review	6 Sessions					
Overview of the Pe Petroleum produc Offshore and Onsh petroleum enginee	Overview of the Petroleum Industry, Importance of Petroleum Engineering, lifecycle of Petroleum products, Classifications of E&P activities: Key difference between Offshore and Onshore, Onshore facilities, offshore platforms, Digitization of petroleum engineering								
Module 5	Industry 4.0	Assignment & Quiz	Data Collection	6 Sessions					
Topics: Conventional manufacturing process: Metal forming, metal removal and metal joining process. Modern Manufacturing process: 3D Printing / Additive Manufacturing. Targeted Application & Tools that can be used: Application Areas include design and implementation of Smart City projects, Infrastructure maintenance, Power production, IC engines, Electric vehicles, onshore and offshore exploration and production activities									
Project work/Ass	ignment:								
Assignment 1: Collect data and prepare report on various Mega Projects in Civil Engineering Assignment 2: Review Articles on current evolutions in Civil Engineering. Assignment 3: Collect data related to renewable energy generation (Wind, Solar) Assignment 4: Prepare an energy consumption chart for a compressor or pumps. Assignment 5: Prepare a report on role of 3D printing across various industries. Assignment 6: Prepare an assignment on geopolitical influence on oil and gas industries.									
Text Book:									
 T1. Elements of Civil and Mechanical Engineering, L.S. Jayagopal & R Rudramoorthy, Vikas Publishers T2. Elements of Mechanical Engineering, by VK Manglik T3. Fundamentals of Oil & Gas Industry for Beginners by Samir Dalvi, Notion Press; 1st edition 									

References

- 1. K.P. Roy, S.K. Hajra Choudhury, Nirjhar Roy, "Elements of Mechanical Engineering", Media Promoters and Publishers Pvt Ltd, Mumbai.
- 2. Nontechnical Guide to Petroleum Geology, Exploration, Drilling & Production by Norman J. Hyne, PennWell Books; 3rd Revised edition

Web-resources:

1. Basic Civil Engineering

https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=2706932&site =ehost-live

2. Post-parametric Automation in Design and Construction

https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1155197&site =ehost-live

3. Smart Cities : Introducing Digital Innovation to Cities

https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1993146&site =ehost-live

4. Innovation Energy: Trends and Perspectives or Challenges of Energy Innovation

https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=2323766&site =ehost-live

- 5. Mechanical Engineering <u>https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOG</u> <u>UE_BASED&unique_id=EBSCO106_REDO_1705</u>
- 6. Additive Manufacturing: Opportunities, Challenges, Implications https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1134464& site=ehost-live
- 7. Society of Petroleum Engineers (SPE) https://www.spe.org/en/
- 8. PetroWiki: A comprehensive online resource created by the Society of Petroleum Engineers that provides information on various aspects of petroleum engineering. <u>https://petrowiki.spe.org/PetroWiki</u>
- 9. Rigzone: A resource for news and information about the oil and gas industry, including job postings and industry trends. https://www.rigzone.com/

Topics relevant to the development of SKILLS:

Engines-Turbines and their applications.

Mechanization in Construction.

Digitization in Petroleum Industries

Course	Course Title: Eng	ineering Graphics					
Code:	Type of Course:	School Core & The	eory	L- I-P- C	2-	-0-0-2	
MEC1006	Only						
Version No.	1.2						
Course Pre- reguisites	NIL						
Anti-requisites	NIL						
Course Descriptior	The course is de engineering gra students with the course emphasize isometric project	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 concepts of " En through Problem	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 Outcome s	 On successful completion of this course the students shall be able to: (1) Demonstrate competency of Engineering Graphics as per BIS conventions and standards. (2) Comprehend the theory of projection for drawing projections of Points, Lines and Planes 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	Standar drawing	rd technic g	al	02 Sessions	
Topics:DescriptionIntroduction, 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 2Orthographic projections ofAssignmentProjection methods10							
	Points, Straight Linesand Plane Surfaces		Analysi	S		Sessions	

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 guadrants.

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	Orthographi c Projections of Solids	Assignment	Multi-view drawing Analysis	10 Sessions
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Topics:

Introduction, Projection of right regular prisms, pyramids, cone, hexahedron and tetrahedron in different 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:	Course Title: Problem	m Solving us	sing JAVA	L- T-P-	1	0	4	3	
CSE1006	Type of Course: Lab	Integrated		C	1	0	1	5	
Version No.	2.0	.0							
Course Pre- requisites	CSE1004 – Problem	-Solving Us	sing C						
Anti-requisites	Nil								
Course Description	This course intro programming. This emphasizes unders object-oriented prog real-time secure app effective problem-se need for object-ories	his course introduces the core concepts of object-oriented rogramming. This course has theory and lab component which mphasizes understanding the implementation and application of bject-oriented programming paradigm. It helps the student to build eal-time secure applications by applying these concepts and also for ffective problem-solving. The students interpret and understand the eed for object-oriented programming to build applications.							
Course Objective	The objective of the c Problem-Solving usir EXPERIENTIAL LE	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 compl C.O. 1: Describe the C.O. 2: Apply the co problems. [Applica C.O. 3: Apply the co C.O. 4: Implement i applications. [Appli C.O. 5: Apply the co mechanism. [Applica	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 in 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 A Java	ssignment (Data Collection/I	Interpre	tatio	on	12 5	Sessions	
Topics: Introdu program struc Data types, Ic	action to Principles o ture, Download Ecli entifiers, Variables,	of Programi ipse IDE to , Constants	ming: Proc run Java in java, C	ess of F prograr Operato	Prok ns, rs,	olen Sar Ass	n Solvi nple p signme	ng, Java rogram, nts 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
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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
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Topics: Arrays: Defining an Array, Initializing & Accessing Array, Multi–Dimensional Array, Array of objects. String: Creation & Operation. String builder class, methods in String Buffer<mark>.</mark>

Module 4	Inheritance and	Ouiz	Case studies /	14 Sessions
	Polymorphism	Quiz	Case let	

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
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Input/output Operation in Java(java.io Package), Streams and the new I/O Capabilities, Understanding Streams, working with File Objects, 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: <u>http://rmi.yaht.net/bookz/core.java/9780134177373-Vol-</u> <u>1.pdf</u>

E book link R2: Java(tm) Design Patterns: A Tutorial([PDF] [7qmsenj197t0] (vdoc.pub)

Web resources

ps://youtube.com/playlist?list=PLu0W_9lII9agS67Uits0UnJyrYiXhDS6q

ps://puniversity.informaticsglobal.com:2229/login.aspx

Topics relevant to the 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 the assessment component mentioned in the course handout.

ENG2001	Advanced English	L- T- P-			0	0
		С	1	0	2	2
Version No.	1.3					
Course Pre-	ENG1002 Technical English					
requisites						
Anti-	NIL					
requisites						
Course	The course emphasizes on technical co	mmunicat	tion a	t ac	lvar	nced
Description	level by exploring critical reading, technic	al presen [.]	tation	an	d re	view
	writing. The purpose of the course is to	enable le	earner	s to	o re	view
	literature in any form or any technical ar	ticle and	delive	er te	echi	nical
	presentations. Extensive activities in pr	actical se	essior	is e	qui	p to
	express themselves in various forms of te	echnical c	comm	uni	cati	ons.
	Technical presentations and the module	on career	settii	ng f	ocu	s on
	learners' area of interests and enhance the	eir English	langi	Jago	e wr	iting
	skills to communicate effectively.					
Course Out	On successful completion of the course t	he studen	ts sha	all b	e al	ole
Come	to:					
	1. Develop a critical and informe	d respor	nse	refl	ecti	vely,
	analytically, discursively, and creativel	y to their I	readir	ıg.		
	2. Communicate effectively, creat	ively, a	ccura	tely	/	and
	appropriately in their writing.			-		
	3. Deliver technical presentations					
	4. Design resume and create professiona	l portfolio	to fin	da	suit	able
	career					
Course Conten	t: Theory					

	Critical			4
Module 1	Reasoning	Writing Essays	Critical Read	ling Classes
	and Writing			
Topics:			I	
 A Catalog 	g of Reading Stra	tegies		
 The Myth 	of Multitasking			
• A Guide t	o Writing Essays	Speculating about Ca	uses or Effects	3
 Is Google 	Making Us Stup	id (Self Study)		
	Technical			3
Module 2	Presentation	Presentation	Oral Skills	Classes
Topics:				·
Planning	the presentation	1		
Creating	the presentation	l		
Giving the	e presentation			
	Writing			4
Module 3	Reviews	Prezi	Review Writi	ng Classes
Topics:				
Review W	/riting			
Short film	reviews			
Advance	d English Gramm	var (Self Study)		
	Storting your			4
Module 4	Career	Online Writing Lab	Writing Skills	s Classes
Topics:	L			
Topics: • Preparing	a Resume			
Topics: Preparing Writing Et	a Resume ffective Applicat	ion Letter		
Topics: Preparing Writing Et Creating	g a Resume ffective Applicat a Professional Po	ion Letter ortfolio		
Topics: • Preparing • Writing Eff • Creating Course Content	g a Resume ifective Applicat a Professional Po t: Practical Sess	ion Letter ortfolio sions		
Topics: Preparing Writing Eff Creating Course Content Module 1	g a Resume ffective Applicat a Professional Po t: Practical Sess Critical Reaso	ion Letter ortfolio sions ning and Writing		8 Classes
Topics: • Preparing • Writing Et • Creating Course Content Module 1 1. Reading a	g a Resume Ifective Applicat a Professional Po t: Practical Sess Critical Reaso and Analyzing	ion Letter ortfolio sions ning and Writing		8 Classes
Topics: Preparing Writing Eff Creating of Course Content Module 1 1. Reading of Level 1 – 2	g a Resume ffective Applicat a Professional Po t: Practical Sess Critical Reaso and Analyzing Annotation	ion Letter ortfolio sions ning and Writing		8 Classes
Topics: Preparing Writing Eff Creating Course Content Module 1 1. Reading a Level 1 – J Level 2 – J	g a Resume Ifective Applicat a Professional Po t: Practical Sess Critical Reaso and Analyzing Annotation Assumptions	ion Letter ortfolio sions ning and Writing		8 Classes
Topics: Preparing Writing Eff Creating a Course Content Module 1 1. Reading a Level 1 – A Level 2 – A 2. Writing N	g a Resume ffective Applicat a Professional Po t: Practical Sess Critical Reaso and Analyzing Annotation Assumptions arrative Essays	ion Letter ortfolio sions ning and Writing		8 Classes
Topics: Preparing Writing Eff Creating 2 Course Content Module 1 1. Reading a Level 1 – 2 2. Writing N Level 1 –	g a Resume Ifective Applicat a Professional Po t: Practical Sess Critical Reaso and Analyzing Annotation Assumptions arrative Essays Draft 1	ion Letter ortfolio sions ning and Writing		8 Classes
Topics: Preparing Writing Et Creating 2 Course Content Module 1 1. Reading a Level 1 – 2 2. Writing N Level 1 – Level 2 –	g a Resume ifective Applicat a Professional Po t: Practical Sess Critical Reaso and Analyzing Annotation Assumptions arrative Essays Draft 1 Draft 2	ion Letter ortfolio sions ning and Writing		8 Classes
Topics: Preparing Writing Eff Course Content Module 1 1. Reading a Level 1 – J Level 2 – J 2. Writing N Level 1 – Level 2 – Module 2	g a Resume ffective Applicat a Professional Po t: Practical Sess Critical Reaso and Analyzing Annotation Assumptions arrative Essays Draft 1 Draft 2 Technical Pres	ion Letter ortfolio sions ning and Writing		8 Classes
Topics: Preparing Writing Eff Creating a Course Content Module 1 1. Reading a Level 1 – A Level 2 – A 2. Writing N Level 2 – Level 2 – Module 2 3. Fishbowl	g a Resume ifective Applicat a Professional Po t: Practical Sess Critical Reaso and Analyzing Annotation Assumptions arrative Essays Draft 1 Draft 2 Technical Pres	ion Letter ortfolio sions ning and Writing		8 Classes
Topics: Preparing Writing Eff Course Content Module 1 1. Reading a Level 1 – 2 Level 2 – 4 2. Writing N Level 1 – Level 2 – Module 2 3. Fishbowl In Fishbo	g a Resume ffective Applicat a Professional Po t: Practical Sess Critical Reaso and Analyzing Annotation Assumptions arrative Essays Draft 1 Draft 2 Technical Pres wl, students forr	ion Letter ortfolio sions ning and Writing sentation	ith a small grou	8 Classes 10 Classes

(discussic	on, while students in the outer circle listen and critiqu	le conte	ent, logic,
;	and group	o interaction.		
	Level 1 – v	within group		
	Level 2 – J	Among 2 group		
4.	Technica	l Group Presentation		
Module	e 3	Writing Reviews	4	Classes
5.	Practice \	Worksheets		
	Level 1 –	Eliminating the Passive Voice		
	Level 2 –	Simple, compound and complex sentences		
6. \	Writing S	hort Film Reviews		
Module	e 4	Starting your Career	6	Classes
7. (Collabora	ative Project		
-	Job searc	h and writing report		
, v	Writing R	esume		
Module	e 1-4	Academic Journal	2 Clas	Ses
8.	Academi	c Journal Writing		
	l evel 1- N	Aid Term		
	l evel 2 –	End Term		
	201012			
Targete	ed Applic	ation & Tools that can be used: Writing reports, Rev	iew wri	ting,
Group I	Discussio	on, Dyadic interviews, Grammarly.com		
Project	t work/As	ssignment:		
	Academi	c Journal – Assignment		
	In Acadei	mic Journal (CIJ), students compile task and activities	s comp	leted in
(each moo	dule and submit to the instructor at the middle and e	nd of th	е
:	semester			
Refere	nces			
	1. Herin	g, Heik. How to Write Technical Reports: Understa	anding	Structure,
	Good	Design, Convincing Presentation. Springer.		
:	2. Johns	on, Richard. (2010) Technical Communication Today.	Pearso	on, 2015
;	3. Rice I <i>Critica</i> Learn	B. Adelrod, Charles R. Cooper and Ellen C. Carillo <i>ally Writing Well: A Reader and Guide</i> . Beford/St. Ma ing, New York.	. (2020 artin's N) <i>Reading</i> Macmillan
	4. The F Prince	Princeton Review. (2010) <i>MCAT Verbal Reasoning</i> eton Review, Inc.	; & Wr	iting. The
	5. <u>https:</u>	//www.hitbullseye.com/Strong-and-Weak-Argument	s.php	Accessed

<u>on 10 Dec 2021</u>

6. https://www.inc.com/guides/how-to-improve-your-presentationskills.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

Course Code: PPS1002	Course Title: Soft skills for Engineers Type of Course: Practical Only Course	L-P- C	0	2	1	
Version No.	1.0					
Course Pre- requisites	Students are expected to understa Students should have desire and e and learn.	and Basic E enthusiasn	English. n to invo	olve, par	ticipate	
Anti-requisites	NIL					
Course Description	This course is designed to develop effective communication skills and boost confidence levels. The activity-based modules cover the art of Questioning, how to ask questions, goal setting with emphasis on time and stress management, creating the first impression and introducing one self and finally culminating with the etiquettes of email writing. The pedagogy used will be group discussions, flipped classrooms, continuous feedback, role-play and mentoring.					
Course Objective	The objective of the course is to the course is to the concepts of "Soft Skills for Development through Experie	o familiar or Engineo ntial Lea	ize the ers" and rning te	learner d attain chniqu	s with Skill es.	

Course Out Comes	On successful completion of this course the students shall be able to:						
	CO1 Employ effective communication skills						
	CO2 Practice questioning te	chniques for better decision ma	aking				
	CO3 Differentiate individual and stress management	strengths and weaknesses for	self-awareness				
	CO4 Recognise the need to set SMART GOALS						
Course							
Content:		Role plays					
Module 1	Art of Questioning	Kole plays	4 classes				
Topics: Note Tal Probing questior	Topics: Note Taking, Framing Open-ended and Close-ended questions, Funnel technique, Probing questions, Leading questions, Rhetorical questions, 5W1H Technique						
	Vocab Building		Every Class				
Dedicate 5-10mi	nutes towards vocabulary buil	ding in every session	1				
Module 2	Goal Setting & Time Management	Journal + Outbound training	8 Classes				
Goal Setting (SM outbound group Monitoring/chart	ART Goals), Time Managemen activity, Making a schedule, Da ing daily activity	t Matrix, Steps to managing tim aily Plan and calendars (To Do L	e through ist),				
Module 3	Self-introduction and Creating an Impression	Grooming checks + Evaluation	8 classes				
Topics: Body Lar	nguage, Grooming guidelines fo	or boys/girls, Common mistake	s in Grooming				
at workplace and awareness analy	d social gathering, Etiquettes a vsis, Self-introduction template	t work place & social gathering e, evaluation of self-introductio	, SWOT – Self- n in class				
Module 4	E-mail Etiquette	Industry expert / Trainer	4 Classes				
Topics: Dos and	Don'ts of professional email e	tiquette, practice writing emails	s (activity)				
REVISION	Recap & Summary		2 Classes				
Revision of all th	e modules, overall feedback fro	om the students with regards to	o the syllabus.				
Targeted	Application & Tools that can	be used: LMS					
Topics relevant Management, Se	to development of "SKILL": A	rt of Questioning, Goal Setting n Impression, E-mail Etiquette	& Time for Skill				

Development through Participative Learning Techniques. This is attained through assessment component mentioned in course handout.

Catalogue prepared by	L&D Department Faculty members
Recommended	BOS NO 3 Dated 10 Feb 23
by the Board of	
Studies on	
Date of	20 ACM dated 15 Feb 23
Approval by the	
Academic	
Council	
1	

Course Code: ECE2010	Course Title: Innovative Projects using Arduino	L- T-P- C			-	1		
Version No.	1.0							
Course Pre-	NIL							
requisites								
Anti-	NIL							
requisites								
Course	This course is designed to provide an in-dep	th understar	ndin	g of				
Description	Arduino microcontrollers and their applicati	on in variou	s rea	al time	ò			
	projects involving sensors. Throughout the course, students will learn							
	the fundamentals of Arduino programming and gain hands-on							
	experience with a wide range of sensors. Stu	dents will ex	cploi	re how	v to			
	connect and interface sensors with Arduino	boards, read	sen	sor da	ta,			
	and use it to control various output devices	This course i	s su	itable	for			

	beginners who ar	e interested in expl	oring the world of electron	nics and	
	developing practical applications using Arduino and sensors.				
Course	The objective of	the course is Empl	ovability Skille of studar	at by using	
Objective	PARTICIPATIVE	LEARNING technic	ques.	it by using	
Course	On successful co	mpletion of the cou	arse the students shall be	able to	
Outcomes	1) Explain the	main features of th	e Arduino prototype boar	:d	
	2) Demonstra	te the hardware	interfacing of the perij	pherals to	
	Arduino sys	tem.			
	3) Understand	l the types of sensor	rs and its functions		
	4) Demonstra	te the functioning	of live projects carried	out using	
	Arduino sys	tem.			
Course Content:					
Module 1	Basic concepts of Arduino	Hands-on	Interfacing Task and Analysis	4 Sessions	
Introduction to Concept of digit. Introduction to Arduino i/o Fur	Arduino, Pin config al and analog ports Embedded C and actions, Arduino Co	guration and archite s, Familiarizing with Arduino platform, ommunications, Arc	ecture, Device and platforn h Arduino Interfacing Boa , Arduino Datatypes and duino IDE, Various Cloud	n features, ırd, API's , variables, Platforms.	
Module 2	Sensory Devices	Hands-on	Interfacing Task and Analysis	4 Sessions	
Arduino Sensors: Humidity Sensor, Temperature Sensor, Water Detector / Sensor, PIR Sensor, Ultrasonic Sensor, Connecting Switches and actuators, sensor interface with Arduino. Introduction to 3D Printer: 3D Printer technology and its working Principles, Applications. Introduction to online Simulators: Working with Tinkercad Simulator.					
Topics: Types of	Arauino boards,	sensors, 3D Printer	[
Application Are	cation & 1001s that	t can be used:			

Home Automation, Environmental Monitoring, Agriculture and Farming, Industrial Automation, Internet of Things (IoT), Robotics, Wearable Devices, Security Systems, Education and Learning. These are just a few examples of the many application areas where Arduino and sensors can be applied. The flexibility and affordability of Arduino, combined with the wide range of sensors available, allow for endless possibilities in creating innovative projects.

Professionally Used Software: students can use open SOURCE Softwares Arduino IDE and Tincker CAD

Project work/Assignment:

1. Projects: At the end of the course students will be completing the project work on solving many real time issues.

2. 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. <u>Presidency University Library Link</u>.

3. Presentation: There will be a presentation from interdisciplinary students group, where the students will be given a project on they have to demonstrate the working and discuss the applications for the same

Textbook(s):

Monk Simon "Programming Arduino: Getting Started with Sketches", Mc Graw Hill Publications Second Edition

References Reference Book(s)

1. Neerparaj Rai "Arduino Projects for Engineers" BPB publishers, first edition, 2016.

2. Ryan Turner "Arduino Programming " Nelly B.L. International Consulting Ltd. first

edition,2019.

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

- 1. Arduino trending Projects < <u>https://www.https://projecthub.arduino.cc/</u>>
- 2. Introduction to Arduino https://onlinecourses.swayam2.ac.in/aic20_sp04/preview>
- 3. Case studies on Wearable technology< <u>https://www.hticiitm.org/wearables></u>

<

E-content:

1. Cattle Health Monitoring System Using Arduino and IOT (April 2021 | IJIRT | Volume 7 Issue 11 | ISSN: 2349-6002)

2. M H Hemanth Kumar, Ravi Pratap Singh, Nishu Sharma, Pragya Singh" IOT BASED SMART SECURITY SYSTEM USING ARDUINO" 2021 JETIR August 2021, Volume 8, Issue 8.

- R. Maheswar, P. Jayarajan, S. Vimalraj, G. Sivagnanam, V. Sivasankaran and I. S. Amiri, "Energy Efficient Real Time Environmental Monitoring System Using Buffer Management Protocol," 2018, pp. 1-5, doi: 10.1109/ICCCNT.2018.8494144. https://ieeexplore.ieee.org/document/8494144.
- Yaser S Shaheen, Hussam., " Arduino Mega Based Smart Traffic Control System ," December 2021 Asian Journal of Advanced Research and Reports 15(12): 43-52, 2021(15(12): 43-52, 2021):15(12): 43-52, 2021.

Topics relevant to development of "SKILL": System design for achieving Sustainable Development Goals.

	Course Title: Tra	nsform Techniques,	Partial					
Course Code:	Differential Equa	ations and Their App	lications	L-T-	2	•	•	3
MAT1002	P-C 3 0 0 5							
	Type of Course:	School Core						
Version No.	2.0				•	•		
Course Pre-	MAT1001 - Linea	r Algebra and Calcul	us					
requisites		0						
Anti-	NIL							
requisites								
Course	This course aims	to introduce various	transform	techniq	ues	suc	h as La	aplace
Description	transform, Fourie	r transform and Z trans	sform in add	lition to	exp	ress	sing fun	ctions
	in terms of Fourie	er series. The course c	overs applie	cations	of L	apla	ice tran	sform
	to LCR circuits and	l solution of difference	equations	using z-t	rans	for	n. The c	course
	also deals with th	e analvtical methods	for solving i	oartial o	liffe	rent	ial equ	ations
	and the classical a	opplications of partial of	differential e	equatio	ns.			
				equatio				
Course	The objective of	f the course is <u>Skill</u>	Developn	nent o	f st	ude	nt by	using
Objective	Problem Solving	Techniques.						
Course	On successful c	ompletion of this c	ourse the a	studen	te e	hal	l he ah	
Outcomes	to			studen	10 0	mat		10
	ιο.							
	CO-1: Express fu	unctions in terms of	f uniformly	, conve	rge	nt F	ourier	
	series.							
	CO-2: Apply Laplac	e transform technique	e to solve dif	ferentia	leq	uatio	ons.	
	CO-3: Employ z-	-transform techniqu	ue to solve	differe	ence	e ec	quatior	າຣ.
					- I:	11		
	CO-4: Solve a va	nety of partial differen	nuarequari	ons ana	atyti	cau	у.	
Course								
Content:								
								40
Module 1	Fourier Series						0.4	10
							CLA	'22F2
Fourier series:	Fourier series -	Euler's formulae -	Dirichlet's	s cond	itio	1s -	Chan	ge of
Interval - half	range series –	RMS value - Pars	eval's ide	entity -	- C	om	putatio	on of
harmonics.	0						•	
Engineering Ap	plications of Fou	rier series.						
	Integral							15
Module 2	Transforms						Cla	asses
	1101131011115							
Laplace Tran	sform: Definitior	n and Laplace trar	nsforms o	f elem	ient	tary	funct	ions.
Properties of	Laplace transform	n. Laplace transfo	rm of peri	iodic f	unc	tior	n, unit	-step
function and ir	npulse function a	function and impulse function and the related problems. Inverse Laplace transform of						rm of

standard functions and problems, initial and final value theorems. Convolution theorem, solution of linear ordinary differential equations, LCR circuit problems. **Fourier Transform:** Integral transforms, infinite Fourier transforms, Fourier sine and

cosine transforms, inverse Fourier transforms.

Engineering Applications of Fourier transform.

Module 3	Z Transform		
	and		8
	Difference		Classes
	Equations		

Definition of Z-transform, Z transforms of standard functions and the related problems, standard inverse Z transforms and problems, computation of inverse Z-transform by partial fraction and convolution methods, solution of difference equations using Z-transforms.

Business and Engineering Applications of Z transform.

	Partial		12
Module 4	Differential		Classes
	Equations		

Partial Differential Equations: Formation of PDEs, solution of non-homogeneous PDEs by direct integration, solution of homogeneous PDEs involving derivatives with respect to only one independent variable, method of separation of variables, solution of the Lagrange's PDE of the type Pp + Qq = R.

Applications of PDEs: Various possible solutions of the one dimensional wave and heat equations by the method of separation of variables, D'Alembert's solution of the wave equation, solution of related boundary value problems.

Targeted Applications & Tools that can be used:

Applications to electrical engineering, vibrational analysis, acoustics, optics, signal processing, image processing, quantum mechanics, econometrics and shell theory by means of Fourier Series and integral transforms.

Opens up new approaches in terms of Z-transform to solving one of the central problems of modern science involving difference equations.

Finding the solutions of boundary value problems involving PDEs with reference to wave, heat, and Laplace equations.

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

Two Assignments based on the applications of the concepts leading to a minimum of 5 engineering problems from a common pool of problems.

Text Book

Erwin Kreyszig, 2017: "Advanced Engineering Mathematics", 10th Edition, John Wiley.

References:

- 6. B. S. Grewal, 2017: "Higher Engineering Mathematics" 45th Edition, Khanna Publishers.
- 7. Peter V O'Neil, 2015: "Advanced Engineering Mathematics", 7th Edition, Cengage Learning.
- 8. Glyn James, 2016: "Advanced Modern Engineering Mathematics", 4th Edition, Pearson Education.
- 9. Michael D. Greenberg, 2018: "Advanced Engineering Mathematics", 2nd Edition, Pearson Education.

Topics relevant to the development of Foundation Skills: All the solution methods. Topics relevant to development of Employability skills: Use of relevant scientific application packages.

Course Code: CSE2007	Course Title: Design and Analysis of Algorithms Type of Course: Program Core & Theory only		3	0	0	3			
Version No.	2.1								
Course Pre- requisites	CSE2001, Data Structure and Algorithm	CSE2001, Data Structure and Algorithms							
Anti- requisites	NIL								
Course Description	This intermediate course enables stude efficient algorithms to solve problem typical design methods such as divid programming and greedy method t students shall develop strong analytic course.	This intermediate course enables students to design and analyze efficient algorithms to solve problems. This course covers typical design methods such as divide-and-conquer, dynamic programming and greedy method to solve problems. The students shall develop strong analytical skills as part of this course.							
Course Objectives	This course is designed to improve th SKILLS by using PROBLEM SOLVING	This course is designed to improve the learners' EMPLOYABILITY SKILLS by using PROBLEM SOLVING Methodologies.							
Course Outcomes	On successful completion of the cour able to: 1] Identify the efficiency of a given alg	rse the gorithr	e stuc n. [Co	lents ompre	shall b ehensi	on]			

			2] Employ divide and conquer approach to solve a problem. [Application]							
			3] Illus prot	Illustrate dynamic programming approach to solve a given problem. [Application]						
			4] Solv] Solve a problem using the greedy method. [Application]						
			5] Disc its c	5] Discuss the techniques to solve a real-world problem based on its complexity classes. [Comprehension]						
Cour Cont	se ent:									
Modu	ule 1	Introd to Alge	Iuction Iorithms Assignment Problem Solving S							
	Topics:									
	Algorithr and merg	n Desig ge sort,	n and eff Asympto	iciency, measuring of otic Growth and Notati	runni ions. l	ng time of algorithms. In RecurrencesMasters m	sertion sort ethod.			
	Assignm	nent: Co Reviev	omparati	vely evaluate bubble s 	sort, ir	nsertion sort and merges	ort.			
Modu	ıle 2	Searc	hing	Assignment		Programming/	12			
		and So techni	orting iques			Problem Solving	Sessions			
	Topics:									
	Divide a	nd Con	quer: Ex	amples. Strassen's Ma	atrix n	nultiplication.				
	Sorting:	Quick	sort, He	apsort, Lower boun	d of	comparison-based sol	rting, non-			
	compari	son-bas	sed sorti	ng: Radix sort.						
	Search:	Review	of Linea	r Search and Binary Se	earch,	, Hashing and hash table	s.			
	Assignm a given s	tent: De cenario	esign and	d develop an algorithm	usin	g Divide and Conquer tec	chnique for			
Modu	ule 3	Greed	У	Assignment		Programming/	09			
		Algori	thms			Problem Solving	Sessions			
	Topics: Introduc	tion, Fra	actional	Knapsack Problem, M	inima	l Spanning Tree: Prim's A	lgorithm			
	and Krus	kal's Al	gorithm,	Single-source Shortes	st Pat	h: Dijkstra's Algorithm. H	uffman			
	Codes.									
	Assignment: Design and Develop a solution to a given scenario using greedy method.									

Modı	ıle 4	Dynamic Programming	Assignment		Programming/ Problem Solving	09 Sessions				
	 Topics: Introduction with examples, Principles of Memoization, 0-1 Knapsack Problem, Bellman-Ford algorithm, Floyd-Warshall's Algorithms. Optimal Binary Search Trees, Chain Matrix Multiplication. Assignment: For a given scenario, attempt the three design paradigms learned so far and argue the best approach to solve the problem 									
Modu	ıle 5	Complexity Classes and Heuristics	Assignment		Programming/ Problem Solving	09 Hours				
	Topics: plexity classes: P, NP, and NP-Complete Problems. Backtracking: n-Queens. Branch and bound: Travelling Salesman Problem. Assignment: Apply backtracking algorithmic designing technique for solving queen's problems for 4, 8 and 16 inputs.									
	Targeted Application & Tools that can be used:Application Area is to Design and Analyzing the efficiency of Algorithms. This fundamental course is used by all application developers.Professionally Used Software: GCC compiler.									
	Project v	work/Assignme	nt:							
1	2. F	Problem Solving	s: Design of Algorithm	is and	l implementation of pro	grams.				
	3. F	Programming: Ir	nplementation of give	en sco	enario using Java.					
	Text Boo	ık:								
	T1. Th <i>'Ir</i>	nomas H.Corme ntroduction to Al	en, Charles E.Leiserso gorithms', MIT Press, 2	on, Ro 2022.	onald L. Rivest and Clif	ford Stein,				
	T2. J.	Kleinberg and E	. Tardos, 'Algorithm De	sign',	Addison-Wesley, 2005.					
	Referen	ces								
	R1. Ai Ec	nany Levitin, <i>'In</i> ducation, 2003.	troduction to the Desi	ign an	d Analysis of Algorithms	s', Pearson				
	R2. So	Tim Roughgar oundlikeyourself	rden, <i>'Algorithms I</i> Publishing, 2017,18,1	llumir 9 resj	nated' (books 1 th pectively.	rough 3),				
	R3. A\ W	/ Aho, J Hopcrof ′esley, 1974.	t, JD Ullman, 'The Desi	ign an	d Analysis of Algorithms	', Addison-				

Course Code: CSE3155	Course Title: Data Communications and Computer Networks	L-T-P- C	3	0	2	4		
	Type of Course: Program Core Theory– Laboratory integrated	3-0-2-4						
Version No.	1.0			1	<u> </u>			
Course Pre- requisites	Digital Design							
Anti-requisites	NIL							
Course Description	The objective of this course is to provide knowledge in data communicat and computer networks, its organization and its implementation, and g practical experience in the installation, monitoring, and troubleshooting 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 lear Data Communications and Computer Networks through Problem Solving Methodologies.	and atta	h tl ain	ne d Em	onc Iploy	epts of /ability		
Course Out	On successful completion of the course, the stude	nts shall	be a	able	e to:			
Comes	1] I							
	llustrate the Basic Concepts Of Data Comm Networks.	unication	18	nd	Co	mputer		
	2] Analyze the functionalities of the Data Link La	yer.						
	3] Apply the Knowledge of IP Addressing and Computer Networks.	Routing	g N	1ec	hani	sms in		
	4] Demonstrate the working principles of the Trans Layer.	sport laye	er a	nd 4	Appl	ication		
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 Mode and Data Link Layer – CO2	ls Assignment	Problem Solving	7 Classes					
Data Link Layer Control and Erro CSMA/CD,CSM	- Error Detection ar r Control, Stop and A/CA, IEEE 802.3,	d Correction – Par Wait, ARQ, Slidin IEEE 802.11 Ethe	ity, LRC, CRC, Ha g Window, Multip rnet.	amming Code, Flow le Access Protocols,					
Module 3	Network Layer CO 3	- Assignment	Problem Solving	10 Classes					
Network Layer S methods- IPv4 IP Routing –OSPF- VXLAN, VPLS,	Services - Networl V6 – Subnetting. R -Multi cast Routin ELAN.	c Layer Services, outing, - Distance g-MOSPF- DVM	Switching Technic Vector Routing – F RP – Broad Cas	ues, IP Addressing IP-BGP-Link State t Routing. EVPN-					
Module 4	Transport and Application Lay -CO3	er Assignment	Problem Solving	10 Classes					
Transport Layers congestion control	- Connection mar ol, – Congestion av	nagement – Flow o oidance (DECbit, l	control – Retransr RED)	nission, UDP, TCP,					
The Application Electronic Mail Networking.	Layer: Domain N (SMTP, POP3, IM)	ame System (DNS AP, MIME) – HT	S), Domain Name FP – – SNMP, We	Space, SSH, FTP, eb Services, Virtual					
List of Laborator	y Tasks:								
Lab sheet -1, M-1, 3 [2 Hours]									
Experiment No 1	:								
Level 1: Study of	basic network com	mands and networ	k configuration co	mmands.					

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.<u>https://archive.nptel.ac.in/courses/106/105/106105183/</u>

2. <u>http://www.nptelvideos.com/course.php?id=393</u>

3.<u>https://www.youtube.com/watch?v=3DZLItfbqtQ</u>

4.<u>https://www.youtube.com/watch?v=_fIdQ4yfsfM</u>

5. <u>https://www.digimat.in/keyword/106.html</u>

https://puniversity.informaticsglobal.com/login

Course Code:	Course Title: Operating Systems		3	0	0	3		
CSE3351	Type of Course: Program Core and Theory Only	L-T- P- C						
Version No.	1.0		•	•				
Course Pre- requisites	CSE2009- Computer Organization, Problem solving using C							

	Students should have basic knowledge on computers, computer software &									
	hardware, and C	omputer Organizatio	n. Prior programming experier	nce in C is						
	recommended.									
Anti-requisites	NIL									
Course	This course intro	duces the concepts	of operating system operation	s, operating						
Description	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 Operating Syste Methodologies.	the course is to fam ems and attain Er	iliarize the learners with the o nployability through Proble	concepts of em Solving						
Course Out	On successful c	ompletion of the cou	rse the students shall be able	to:						
Comes	1] Describe the f [Knowledge]	undamental concept	s of operating Systems and ca	ase studies.						
	2] Demonstrate	various CPU schedul	ing algorithms[Application]						
	3] Apply various	tools to handle synchi	conization problems.[Application	on]						
	4] Demonstrate d	eadlock detection and	recovery methods [Application]						
	5] Illustrate vario	ous memory manage	ment techniques.[Applicatio	n]						
Course Content:										
Module 1	Introduction to Operating System	Assignment	Programming	9 Hours						
Topics:	1	1	1	1						
Introduction to (and its types, Op Overview of OS o	DS , Operating-Sy perating System S design and impler	ystem Operations, Op Structure, System Pro mentation, Open-sou	perating System Services, , S ogram and its types, Linkers a rce operating system	ystem Calls						

Module 2	Process Management	Assignment/Case Study	Programming/Simulation	11 Hours
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 Rigorithms: FCFS, SJF, SRTF, RR and Priority.

	Process			
Module 3	Synchronization	Assignment	Programming	11 Hours
	and Deadlocks			

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.

Module 4 Memory Management	Assignment	Programming/Simulation	10 Hours
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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.

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 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 215 / CSE 3078	Cryptography and Network Security	L-T- P- C	3	0	0	3				
Version No.	2.0									
Course Pre- requisites	Basic Knowledge in Number Theory, Binary Operations									
Anti-requisites	NIL									
Course Description	The Course deals with the principles and practice of crypt focusing in particular on the security aspects of the web	he Course deals with the principles and practice of cryptography and network security, ocusing in particular on the security aspects of the web and Internet.								
Course Objective	The objective of the course is to familiarize the learners andNetwork Security above and attain Skill Developmer methodologies.	The objective of the course is to familiarize the learners with the concepts of Cryptography andNetwork Security above and attain Skill Development through Problem Solving methodologies.								

	On successful completion of this course the students shall be able to:							
	1. Describe the basic concept of Cryptography							
Course Outcomes	2. Classify different types of Cryptographic Algorithms							
	3. Solve Mathematical problems required for Cryptography							
	4. mustrate Network Sec	unty concepts						
Course Content:								
	Introduction		Recognize	07				
Module 1	to	Assignment	the	Sessions				
	Cryptography		techniques					
Topics:		c :: oci						
Introduction to Cr	yptography, Model of Network	Security, OSI	Security architecture, Security Atta	acks: active				
ALLACKS, PASSIVE A	ubstitution Cinhors - Play fair an	on, Access C	Vigenere cipher Introduction to P	i integrity, lock Ciphor				
and Stream Cinher		iu niii cipiter,	vigenere cipiter, introduction to b					
Feistel Structure. E	, CB modes of block cipher							
	Symmetric			09				
iviodule 2	Encryption	Assignment	Analysis of results	Sessions				
	Algorithms							
Topics:								
Symmetric Encrypt	ion Algorithms : Data Encryptior	n Standard, Int	roduction to Galois Field, Advanced	Encryption				
Standard, Modular	Arithmetic, Prime numbers, Fer	rmat's little th	eorem, Applications of Fermat's litt	le theorem				
in modular athem	natic, brief about primality tes	ting and fact	orization, Euclidean and Extended	Euclidean				
Algorithm, Euler To	ptient Function, Chinese remaine	der theorem.		-				
Module 3	Public Key Cryptography	Assignment	Analysis of solutions	09 Sessions				
Topics:	•							
Overview of Public	: Key Cryptography, RSA, Diffie-I	Helman Key e	xchange, Man in the middle attack,					
Cryptographic Has	h functions, Secure Hash Algorit	hm, Message	Authentication Codes – HMAC, Dig	ital				
Signature, Ei-gama	I							
Encryption, Elliptic overview	curve cryptography							
Module 4	Network Security	Assignment	Analysis of solutions	05 Sessions				
Topics:		·						
Network Security	fundamentals, Network Security	y applications	: Authentication: Kerberos, PKI, Ne	twork				
Security application	ns: e-mail security: PGP, MIME,	Network Sec	urity applications: IP Security: IPSec	:				
architecture, Netw	vork							
Security application	ns: DNS Security.							
Targeted Applicati	on & loois that can be used:	ala a i au ca a falla		atio a				
and docruptions & t	the techniques for authenticatio	n and confide	ntiality of mossages	ption				
Textbooks:			Infiancy of messages.					
T1 William Stalling	s "Cryptography and Network	Security - Prir	ciples and Practices" 7th Edition					
Pearson publicatio	n ISBN: 978-93-325-8522-5 201							
	,	- /						

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":

- 1. Play-fair and Hill Cipher
- 2. Euclidean and Extended Euclidean Algorithm
- 3. Secure Hash Algorithm
- 4. Diffie-Helman Key exchange
- 5. Totient Function.
- 6. Fermat's little theorem

Course Code:	Course Title: Aptitude Training-								
PPS4004	Intermediate	L-T P- C	0	0	2	1			
	Type of Course: Practical Only		Ŭ	Ŭ	~				
	Course								
Version No.	1.0								
Course Pre-	Students should have the basic concepts of Quantitative aptitude								
requisites	along with its applications in real life problems.								
Anti-	Nil								
requisites									
Course	This is a skill-based training program for the students (Undergraduate). This								
Description	course is designed to enable the students to enhance their skills in								
	Quantitative Aptitude.								
Course	The objective of the course is to familiarize the learners with the concepts								
Objective	of Aptitude and attain Skill Development through Problem Solving								
	techniques.								
Course	On successful completion of the course the students shall be able to:								
Outcomes	CO11 Understand all the sensents								
	COTJ Understand all the concepts.								
	CO2] Apply the concepts in problem solving (Bloom's taxonomy Level 3)								
Course									
Content:									
Module 1	Quantitative Ability	Assignment		24 Hours					
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Topics:									
Number System,	Percentage, R	atio and Proportion, Ave	erage, Mixture and Allegatior	n, Time and					
Work, Profit and	Loss, Time Spe	ed and Distance, Boats	and Streams, Simple Intere	st and					
Compound Inter	est, Probability	, Permutation and Com	bination.						
Targeted Areas									
Application area	: Placement ac	tivities and Competitive	e examinations.						
Tools: LMS									
Text Book									
Fast Track Objec	tive by Rajesh \	/erma							
R S Aggarwal									
Rakesh Yadav									
References									
www.indiabix.co	<u>m</u>								
www.testbook.co	<u>om</u>								
www.youtube.co	m/c/TheAptitu	deGuy/videos							
Topics relevant	to Skill develo	pment: Quantitative	aptitude for Skill Developm	nent					
through Problem solving Techniques. This is attained through assessment component									
mentioned in course handout.									
Evaluation – Co	ntinuous Evalı	uation (Topic wise eva	luation Mid-Term & End te	erm)					

Course Code: CSE3216	Course Title: Mastering Object- Oriented Concepts in Python Type of Course: Lab	L- T- P- C	0-0-2-1	
Version No.	1			
Course Pre- requisites	CSE1005 – Programming in Python			
Anti- requisites	NIL			
Course Description	This course covers mastering object-oriented concepts in Python, including classes, inheritance, polymorphism, and encapsulation. Students will learn to design and implement robust, reusable code using real-world examples.			

	Ideal for those with basic Python knowledge, it enhances problem-solving skills and software development proficiency.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Mastering Object Oriented Concepts in Python and attain Skill Development through Experiential Learning.				
Course Out Comes	 CO1: Explain features of Oops along with creation of Python classes and objects to represent real world Objects. [Understand] CO2: Demonstrate inheritance, polymorphism, and abstraction in Python to build maintainable and extendable software systems.[Apply] CO3: Demonstrate exception handling in Python to build robust errorhandling mechanisms and debugging tool and Assess various file handling techniques in Python. [Apply] 				
Course Content:					
Module 1	Introduction to OOPS, Classes and Objects	MCQ	Assignment	10 Sessions	
Tonics					

Iopics:

Introduction to OOPs: Problems in Procedure Oriented Approach, Specialty of Python Language, Features of OOPS - Classes and Objects, Encapsulation, Abstraction, Inheritance and Polymorphism.

Classes and Objects: Creating a Class, The Self Variable, Constructor, Destructors, Types of Variables, Namespaces, Types of Methods - Instance Methods, Class Methods, Static Methods, Passing Members of One Class to Another Class, Inner Classes.

Module 2	Inheritance and Polymorphism	MCQ	Assignment	10 Sessions	
Constructors in	Inheritance, Overriding S	Super Class C	onstructors and Methods, Th	e Super()	
Method, Types o	of Inheritance – Single Inf	heritance, Mu	ltiple Inheritance, Method Re	solution	
Order(MRO), Polymorphism, Duck Typing Philosophy of Python, Operator Overloading,					
Method Overloading, Method Overriding.					

Abstract Classes and Interfaces: Abstract Method and Abstract Class, Interfaces in Python, Abstract Classes vs. Interfaces.

Module 3 Exceptions and Files in Python	MCQ	Assignment	10 Sessions
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Exceptions: Errors in a Python Program – Compile-Time Errors, Runtime Errors, Logical Errors. Exceptions, Exception Handling, Types of Exceptions, The Except Block, The assert Statement, User-Defined Exceptions, Logging the Exceptions.

Files in Python: Files, Types of Files in Python, Opening a File, Closing a File, Working with Text Files Containing Strings, Knowing whether a File Exists or Not, Working with Binary Files, The with Statement, Pickle in Python, The seek() and tell() Methods.

Targeted Application & Tools that can be used:

Python, PyCharm

Project work/Assignment:

Assignment:

Module 1 Assignment: Design and implement a Python application that simulates a banking system using classes and methods for customers and accounts.

Module 2 Assignment: Develop a Python application that simulates Library management system that demonstrates inheritance, polymorphism and abstraction concepts.

Module 3 Assignment: Develop a Python program that handles different types of exceptions while processing user input for a movie ticket booking system showcasing exception handling and File handling concepts.

Text Book

Dr. R Nageshwara Rao, "Core Python Programming", Dreamtech Press, 3rd Edition, 2021.

References

Alex Martelli, Anna Ravenscroft & Steve Holden, "Python in a Nutshell The Definitive Reference", O'Reilly Media, 3rd edition, 2017.

Luciano Ramalho, "Fluent Python Clear, Concise, and Effective Programming", O'Reilly Media, 2nd edition, 2022.

Mark Lutz, "Learning Python: Powerful Object-Oriented Programming", O'Reilly Media, 5th edition, 2013.

David Beazley, Brian K. Jones, "Python Cookbook: Recipes for Mastering Python 3", O'Reilly Media, 3rd edition, 2013.

Weblinks:

www.learnpython.org

https://realpython.com/python3-object-oriented

https://www.tutorialspoint.com/python/python_oops_concepts.htm

Topics relevant to "SKILL DEVELOPMENT":

Building Real-World Applications Using OOPS Concepts, Error Handling and Debugging Techniques, Concurrency in Python, Advanced File Handling Techniques, Creating and Managing Python Packages and Modules, Designing and Implementing Python Interfaces

This is attained through assessment component mentioned in course handout.

Course Code:	Course Title: Essentials of A	J				_			
CSE1700	Type of Course: Theory	L- T-P- C		3	0	0	3		
Version No.	2.0	2.0							
Course Pre- requisiData tes	Basic knowledge of programme handling	ming, mather	natics, ur	ndersta	andir	ng of	f data		
Anti-requisites	NIL								
Course Description	This course is a comprehensive introductory course designed to equip learners with the fundamental Python programming skills necessary to work with artificial intelligence (AI) technologies. This course is aimed at individuals who are new to AI but have a basic understanding of programming concepts. It combines Python programming fundamentals with hands-on experience in implementing AI techniques such as machine learning, neural networks, and natural language processing.								
Course Objective	The objective of the course is Fundamentals, Manipulate a Machine Learning Algorithms Applications.	to Understa nd Process D and Build ar	nd Pythor Data with F nd Train N	n Progr Pythor eural I	ramn 1, Imp Netw	ning olem orks	nent s for Al		
Course Outcomes	On successful completion of the course the students shall be able to: CO 1: Apply Python Programming to AI Projects CO 2: Build and Train Machine Learning Models CO 3: Develop Deep Learning Models with Neural Networks CO 4: Deploy AI Solutions and Understand Ethical Implications								
Course Content:									
Module 1	Introduction to Python Programming for Al	Assignment	Impleme	ntatio	n		10 Sessi	ons	
Topics:	1	I	I				1		

Python Basics: Variables, Data Types, Operators, and Control Flow Functions, Loops, and Conditionals statements, Data Structures: Lists, Tuples, Dictionaries, Sets ,Introduction to Libraries: NumPy and Pandas for data manipulation, Basic Input/Output and File Handling Introduction to Python for AI: Libraries and Frameworks Overview Data Processing, 10 Sessions Assignment Implementation Module 2 Visualization Topics: cleaning and preprocessing with Pandas, Handling missing data, outliers, and duplicates, Data transformation (Normalization, Encoding), Introduction to Matplotlib and Seaborn for Data Visualization, Exploratory Data Analysis (EDA), Visualizing datasets to understand patterns and relationships. Introduction to Machine Mini -Implementation 10 Sessions Module 3 Learning Project Topics: What is Machine Learning? Types of ML algorithms Supervised Learning: Regression, Classification, Unsupervised Learning: Clustering, Key ML Algorithms: Linear Regression, Decision Trees, K-Means , Introduction to Scikit-learn library Model evaluation (Accuracy, Precision, Recall, Confusion Matrix) Module 4 Neural Networks Quiz Implementation 10 Sessions and Deep Learning Topics: Introduction to Neural Networks and Deep Learning, Perceptron Model and Backpropagation Deep Neural Networks and Activation Functions, Introduction to TensorFlow and Keras, Building and Training Neural Networks for Image and Text Classification, Overview of Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs) Targeted Application & Tools that can be used: Applications: Data Preprocessing: Clean and manipulate data from various sources such as CSV, Excel, SQL databases, and APIs.

- **Exploratory Data Analysis (EDA)**: Gain insights into datasets by identifying trends, patterns, and outliers.
- **Predictive Modeling:** Build models for classification (e.g., spam detection) and regression (e.g., house price prediction).
- **Clustering**: Group data into clusters for unsupervised learning tasks (e.g., customer segmentation).
- **Model Evaluation**: Assess model performance using appropriate metrics such as accuracy, precision, recall, and F1-score.

Tools:

- **Pandas**: For data manipulation and cleaning (e.g., handling missing values, merging datasets).
- **NumPy**: For numerical operations and working with arrays and matrices.
- Matplotlib: For creating static, animated, and interactive visualizations.
- Seaborn: For advanced data visualizations (e.g., heatmaps, pair plots).
- **Plotly**: For creating interactive visualizations, especially useful for large datasets.
- **Scikit-learn**: The go-to library for implementing machine learning algorithms (e.g., linear regression, decision trees, k-means clustering).
- **XGBoost**: For advanced gradient boosting models, particularly for large-scale machine learning tasks.
- **TensorFlow** (for deep learning in Module 4): A powerful open-source library for building machine learning and deep learning models.
- **Keras**: High-level neural network API, built on top of TensorFlow, to easily create deep learning models.

NLTK: The Natural Language Toolkit for various text processing tasks like tokenization, stemming, and part-of-speech tagging.

spaCy: A fast NLP library for advanced NLP tasks such as named entity recognition and dependency parsing.

Transformers (by Hugging Face): A powerful library for using pre-trained Transformer-based models like BERT, GPT, and others for advanced NLP tasks.

Text Book(s):

T1: **Essentials of Python for Artificial Intelligence and Machine Learning** by Pramod Gupta and Anupam Bagchi

Reference(s):

- 1. "Artificial Intelligence with Python" Prateek Joshi
- 2. "Python Machine Learning" Sebastian Raschka & Vahid Mirjalili
- 3. "Hands-On Artificial Intelligence with Python" Teet Straus
- 4. "Deep Learning for Coders with Fastai and PyTorch" Jeremy Howard & Sylvain Gugger

Catalogue prepared by	
Recommended by the Board of Studies on	
Date of Approval by the Academic Council	

Course Code: CSE3412	Course Title: Data Mining 0<
Version No.	2.0
Course Pre- requisites	Students are expected to be familiar with the basics of Linear Algebra, Probability and Statistics and should have a knowledge on DBMS.
Anti-requisites	NIL
Course Description	Introduction, Applications, issues in data mining, data pre-processing techniques, data mining tasks, association rules, advanced association rules, classification, different approaches for classification, clustering, outlier detection. Recent trends in data mining.
Course Objective	The objective of the course is to familiarize the learners with the concepts of Data Mining and attain Employability through Problem Solving Methodologies
Course Out Comes	On successful completion of the course the students shall be able to: • Apply the various pre-processing techniques needed for a data mining task. • Understand the functionality of the various data mining algorithms.
	 Appreciate the strengths and limitations of various data mining models. Understand the advances in data mining for real life applications.

Course Conte	ent:					
Module	1	Introduction to Data Mining		Assignment	Data Collection	5 Sessions
	Topics Introdu Merits	iction to Da and Demei	ata mining – Data Mi ʻits.	ning Goals– Stages	of the Data Mining Process	–Data Mining Techniques–
Module	2	Data prep	rocessing	Quiz	Problem Solving	9 Sessions
	Topics Types o measu	f data – Pr res.	e Processing steps -	- Data Preprocessin	g Techniques – Similarity a	nd Dissimilarity
Module	3	Data Mini Patterns	ng – Frequent	Assignment	Problem Solving	7 Sessions
	Topics Market FPGrov	: Basket Ar vth.	alysis, item sets –	Generating frequen	It item sets and rules effic	iently – Apriori Algorithm–
Module	4	Classifica clustering	ntion and វ	Assignment	Problem Solving	11 Sessions
	Classif Propag Cluste	ication an ation - Laz ring Analys	d Clustering Decis y learners – Modern is – portioning meth	ion tree Induction evaluation and sele od – Hierarchical m	 Bayesian classification <l< td=""><td>–Classification by Back ve classification accuracy. ethod</td></l<>	–Classification by Back ve classification accuracy. ethod
Module	5	Outlier de mining tre	etection & Data ends	Assignment	Problem Solving	5 Sessions
	Anoma Demor	ly detecti stration of	on preliminaries - Weka tool.	Different Outlier	detection techniques-W	eb mining- Text mining-
				Project work/A	ssignment:	
	 Assignments From the dataset given, find the Entropy, Gain value of the attributes and also draw the decision treusing entropy for the given dataset. Transactional Data Base, D given below which contains set of items find the frequent item set usir the Apriori Algorithm and generate the Association Rules. Minimum Support count is 2%. Minimum confidence is 60%. 					
		T _{id}	Items			
		10	1, 3, 4			

	2	20	2, 3, 5						
	3	80	1, 2, 3, 5						
	۷	10	2,5						
	T D								
	Т1 Т1.	ок Tan P. N.	, Steinbach M & Kum	ar V. "Introduction to Data N	1ining" ,Pearson	Educ	atior	n, 2016	
	Referer	nces							
	R1 <i>H</i>	an J & Kai	mber M, "Data Mining	g: Concepts and Techniques	s", Elsevier, Seco	ond E	dition	, 2006	
	R2 G	K Gupta,	"Introduction to Data	a Mining with Case Studies"	, PHI, Third Editi	on, 20)14.		
	R3 Ale	ex Berson	and Stephen J. Smith	h, "Data Warehousing, Data	Mining and OLA	Α <i>Ρ", Τ</i>	ata M	lcGraw	– Hill
	Additio	nal web-	based resources						
	W1. <u>htt</u> Techniq	ps://onlin ues, Jiaw	necourses.swayam2. ei Han, Micheline Ka	ac.in/cec20_cs12/preview_1 mber and Jian Pei, Morgan	Fext book of Data Kaufmann Pub	a Mini olishe	ng: C rs, 20	oncep ¹)12.	ts and
	W2.http fd3049a &db=nle	os://puniv a98f0393@ ebk	ersity.informaticsglo e963521dbd%40redi	bal.com:2284/ehost/detail/ s&bdata=JnNpdGU9ZWhvc	detail?vid=7&sid 3QtbGl2ZQ%3d	d=e2c %3d#	17362 AN=:	2a- 377411	
		3.	https://nptel.ac.in/o	courses/105105157					
	Topics Employ compor	relevant ability S	to "EMPLOYABILI kills through Partici tioned in the course h	TY SKILLS": Data Minin pative Learning technique nandout.	g Techniques, s. This is attair	FP (ied th	Growt	th for h the a	developing assessment
Course Co	de:	Course	Title: Essentials	of AI Lab	LTDC	0	0	4	2
CSE1701		Type of	f Course: Lab		L- I-P- C	0	0	4	2
Version No Course Prerequisit	o. Jes	2.0 Basic Ja Basic D Underst	ava Programming l Pata Structures and canding of Basic M	Knowledge, Mathematic Algorithms, Familiarity Jachine Learning Concep	s: Linear Alge with Libraries ots.	bra a s and	nd F Too	robab ls,	ility,
Anti-requis	sites	NIL							
Course Description	This course introduces students to the essential concepts and techniques of Artifices Intelligence (AI) with a focus on practical implementation using Python. Students we explore core AI topics such as search algorithms, knowledge representation, mach learning, and neural networks, while gaining proficiency in using popular Python libral like NumPy, pandas, scikit-learn, and TensorFlow. Through a series of lab exercises a projects, students will apply AI principles to solve real-world problems, develop intellige applications, and understand how AI systems function at a foundational level.					Artificial dents will , machine n libraries rcises and intelligent			
Course Ob	jective	The primary objectives of the course are to Gain Proficiency in AI Concepts and Python Implementation, Develop and Implement Machine Learning Models, Understand and Build Neural Networks, Apply AI to Real-World Problems							

Course	On successful completion of the	On successful completion of the course the students shall be able to:				
Outcomes	1. Proficiency in Implement	ing AI Algor	rithms Using Python			
	2. Ability to Build and Evalu	uate Machine	e Learning Models			
	3. Hands-on Experience with	h Neural Net	tworks and Deep Learn	ning		
	4. Practical Application of <i>A</i>	AI to Solve R	Leal-World Problems			
~ ~ ~ ~ ~						
Course Content:						
Module 1	hIntroduction to AI and ssignme	nt n	nplementation	10 Sessions		
· · ·	ython for Al		-p			
Lab Assignment	1: Setting Up the Python Environ	nment				
Objective	: Get familiar with setting up a Pyth	hon environi	ment for AI projects.			
• Tasks:		NT (11-				
1. Ins	tall Python, Anaconda, and Jupyter	r Notebook.				
2. Set	t up a virtual environment for AI de	evelopment.	(1-1-41) and called (1		
3. Ins	tall essential Python libraries: num	py, pandas, i	matplotlib, and scikit-i	learn.		
4. vv i	The and execute simple Python code	e to verify in	istaliation (e.g., print a	Hello Al		
Illessay	30). 2. Desie Dythen Drogromming fr	A T				
Lab Assignment	2: Dasic Fyllion Frogramming to)[AI Duthon sunt	toy and data structures	used in AI		
• Unjective	: Understand and practice the basic	; Python sym	tax and data subclures	useu III AI.		
• LASKS. $1 W_1$	rite Python code to work with basic	, data types (integer float string h	voolean)		
2 Im	plement and manipulate Python lis	te tunles set	te and dictionaries	001can).		
3. Cr	eate basic control flow structures. i	f-else for lo	one while loops			
4. Us	e functions and lambda functions to	o solve small	1 AI-related problems.	such as calculating		
factori	al or Fibonacci numbers.	U BOIVE BIIM	TH related problems,	such as curculating		
Lab Assignment	3: Data Exploration and Preproc	cessing				
Objective	: Learn how to work with data for	AI models.				
• Tasks:						
1. Lo	ad a dataset (e.g., Titanic or Iris da	taset) using	pandas.			
2. Cle	ean the dataset by handling missing	z values, rem	oving duplicates, and	converting data types		
if need	led.	, .				
3. Ex	plore the dataset by visualizing it u	sing matplot	tlib and seaborn.			
4. Per	rform basic data preprocessing task	as such as fea	ature scaling, encoding	g categorical variables,		
and sp	litting data into training and testing	g sets.		· _		
Module 2	Data Processing, Visualization	Assignmen	t Implementation	10 Sessions		
Lab Assignment	1: Data Preprocessing with Pand	las	<u> </u>			
Objective:	_					
Learn the fundam	entals of data preprocessing, includ	ling cleaning	g, handling missing va!	lues, and performing		
basic transformati	ons using Pandas.					
Tasks:						
1. Load and	Inspect the Dataset:					
o Lo	ad a dataset (e.g., Iris, Titanic, Wi	ine Quality (dataset) using pandas.1	read_csv() or		

pandas.read_excel().
Inspect the first few rows of the dataset using .head() and check basic information using .info().

2. Handle Missing Values:

- Identify missing values in the dataset using .isnull() or .isna().
- Handle missing data by imputing with mean, median, or mode using SimpleImputer from sklearn, or remove rows with missing data using .dropna().

3. Data Transformation:

- Convert categorical variables to numerical values using one-hot encoding or label encoding.
- Normalize/standardize numerical columns using StandardScaler or MinMaxScaler from sklearn.

4. Subset and Filter Data:

• Create subsets based on certain conditions (e.g., select rows where a specific feature value is greater than a threshold).

• Filter outliers from numerical data using interquartile range (IQR).

Lab Assignment 2: Data Aggregation and Grouping with Pandas Objective:

Master aggregation and grouping techniques using **Pandas** for summarizing data. **Tasks:**

- 1. Group Data by Category:
 - Group data by one or more categorical features (e.g., "class" in the Iris dataset or "embarked" in Titanic dataset).
 - Use .groupby() to calculate aggregate statistics such as mean, median, sum, and count.

2. Pivot Tables:

• Create a pivot table to summarize data (e.g., aggregate the average age of passengers in the Titanic dataset by class and gender).

• Use .pivot_table() to perform multi-dimensional aggregation.

3. Data Aggregation and Custom Functions:

• Apply custom aggregation functions to the grouped data (e.g., calculate custom metrics or perform complex transformations within each group).

4. Sorting and Ranking Data:

- Sort the dataset by multiple columns (e.g., sorting by "age" or "fare").
- $\circ~$ Rank data based on specific metrics (e.g., assign ranks to passengers by fare in the Titanic dataset).

Lab Assignment 3: Data Visualization with Matplotlib and Seaborn Objective:

Learn to visualize datasets using **Matplotlib** and **Seaborn** for better understanding and insights. **Tasks:**

1. Basic Plotting with Matplotlib:

- Create simple plots like line plots, bar plots, and histograms using Matplotlib.
- Customize the plots by setting titles, labels, and legends.
- Create scatter plots to visualize relationships between two variables.

2. Advanced Plotting with Seaborn:

• Use **Seaborn** to create advanced visualizations like pair plots, heatmaps, box plots, and violin plots.

- Customize visualizations with color palettes, styling, and themes.
- Create a correlation heatmap to visualize correlations between features in the dataset.

3. Distribution Visualizations:

• Plot distributions of continuous variables using **Seaborn's** distplot() or kdeplot().

• Create bar plots for categorical variables to understand their frequency distribution.

4. Multi-Plot Grid Layouts:

• Use **Matplotlib's** subplots() function to create multiple plots in a grid layout for comparison (e.g., scatter plot and histogram in the same figure).

Lab Assignment 4: Visualizing Relationships and Feature Importance

Objective:

Understand how to visualize relationships between features and evaluate feature importance for predictive models.

Tasks:

1. Scatter Plot Matrix:

• Use **Seaborn's** pairplot() to create a scatter plot matrix to visualize the relationships between multiple features.

• Analyze the pairwise relationships between features and identify any patterns or correlations.

2. Heatmap of Correlation Matrix:

• Use **Pandas** to calculate the correlation matrix of numeric features.

 \circ Visualize the correlation matrix using Seaborn's heatmap() to understand feature correlations and multicollinearity.

3. Feature Importance from Models:

• Train a decision tree or random forest model using **scikit-learn** on a dataset (e.g., **Iris** or **Titanic**).

 \circ $\,$ Visualize feature importance using a bar chart to understand which features have the most impact on the model.

4. Visualizing Predictions vs. Actual Values:

• For regression tasks, visualize the predicted values against the actual values using a scatter plot.

• For classification tasks, visualize the classification results with a confusion matrix.

Lab Assignment 5: Time Series Data Visualization and Processing

Objective:

Learn how to process and visualize time series data, which is common in AI applications like forecasting and trend analysis.

Tasks:

1. Load and Preprocess Time Series Data:

- Load a time series dataset (e.g., stock market data, weather data).
- Parse dates properly and set the date column as the index using pd.to_datetime() and .set_index().

2. Plot Time Series Data:

- Plot a time series line chart using **Matplotlib** to visualize trends over time.
- Create rolling averages (e.g., 7-day, 30-day) to smooth out short-term fluctuations in the time series data.

3. Seasonal Decomposition of Time Series:

- Use **statsmodels** to decompose a time series into seasonal, trend, and residual components.
- Visualize the decomposed components to understand seasonal variations.

4. Forecasting with Simple Models:

- Use simple forecasting models (e.g., moving average, ARIMA) to predict future values.
- Visualize the forecasted data along with actual historical data.

Module 3	3	Introduction to Mach	nine	Assignments	Implementatior	10 Sessions	
Lab Assi	gnment (3: Implementing Line	ar Regressi	on			
• T	asks:	8					
	1. Loa	ad a real-world dataset	(e.g., Bosto	n Housing Pr	ice dataset).		
	2. Tra	in a Linear Regression	n model usi	ng LinearRegi	ression() from scik	it-learn.	
	3. Eva	aluate the model using I	Mean Squa	red Error (M	ISE) and R-square	ed Score.	
	4. Vis	ualize the regression lin	ne using Ma	tplotlib.			
Lab Assi	gnment 4	4: Logistic Regression	for Classif	ication			
• 1	asks:	d the Iris or Broost C	ancor datase	at			
	1. Lui 2. Pre	process the dataset (ha	ndle missino	values enco	de categorical varia	ables scale data)	
	3 Tra	in a Logistic Regressi	n n model us	ing LogisticR	egression().	iolos, soulo data).	
	4. Eva	aluate performance usir	ng Accuracy	, Precision, I	Recall. F1-score.		
	5. Plo	t the Confusion Matri	x and ROC	Curve.	,		
Lab Assi	gnment :	5: Implementing K-N	earest Neigl	hbors (KNN)			
• T	asks:						
	1. Loa	ad the Iris dataset and	split it into t	raining and te	esting sets.		
	2. Tra	in a KNN classifier us	ing KNeigh	borsClassifier	r().		
	3. Exp	periment with different	values of K	and evaluate	performance.		
	4. V1S	ualize decision bounda	ries using a	scatter plot.			
Lah Assi	anment (6. Decision Trees and	Random F	orests			
• T	asks:	becision frees and	Kanuom P	01 0505			
	1. Tra	in a Decision Tree cla	ssifier on th	e Titanic data	set.		
	2. Vis	ualize the tree structure	e using plot	tree().			
	3. Tra	in a Random Forest c	lassifier and	compare per	formance with the	decision tree.	
	4. Det	termine the feature im	p ortance us	ing feature_in	nportances		
Module 4	1	Neural Networks	Quiz	Im	plementation	10 Sessions	
		and Deep Learning			-		
La	ab Assig	nment 7: Introduction	n to Percept	ron and Acti	vation Functions		
Tasks:							
1. In	nplement	a single-layer percept	t ron using N	JumPy.			
2. Tı	ain the p	erceptron to classify A	ND, OR, X	OR gates.			
3. Ez	xperimen	t with different activat	ion function	ns (Sigmoid, l	ReLU, Tanh).		
4. V	isualize d	lecision boundaries.					
La	ab Assig	nment 8: Building a S	imple Neur	al Network v	vith Keras		
Tasks:							
1. Load the MNIST dataset from keras.datasets.							
2. Pr	2. Preprocess the data (normalize pixel values, reshape input).						
3. Create a fully connected neural network using Sequential API.							
4. 11	ain and e	evaluate the model usin	g categoric	ai cross-entro	opy loss and accur	acy.	
Lab Assi	gnment ?	9: Implementing CNN	Irom Scra	tch			

Tasks:

- 1. Load the **CIFAR-10 dataset**.
- 2. Build a CNN with **Conv2D**, **MaxPooling2D**, **Flatten**, **Dense**, **Dropout** layers.
- 3. Use Adam optimizer and categorical cross-entropy loss.
- 4. Train and visualize loss/accuracy curves.

Lab Assignment 10: Image Augmentation & Regularization Tasks:

- Tasks:
 - 1. Apply data augmentation (rotation, zoom, flipping) using ImageDataGenerator.
 - 2. Add dropout and batch normalization to prevent overfitting.
 - 3. Compare model performance with and without augmentation.

Lab Assignment 11: Transfer Learning with Pre-trained Models Tasks:

- 1. Use VGG16 or ResNet50 pre-trained on ImageNet.
- 2. Replace the output layer to classify **new images**.
- 3. Freeze earlier layers and fine-tune deeper layers.
- 4. Evaluate the model on a custom **dataset** (e.g., Cats vs. Dogs).

Lab Assignment 12: Implementing RNN for Text Classification

Tasks:

- 1. Load IMDB movie reviews dataset from keras.datasets.
- 2. Preprocess text (tokenization, padding sequences).
- 3. Build an **RNN** with **Embedding**, **SimpleRNN**, **Dense** layers.
- 4. Train and evaluate the model.

Lab Assignment 13: Building an LSTM for Time Series Prediction

Tasks:

- 1. Load a **time series dataset** (e.g., stock prices, temperature data).
- 2. Preprocess the data (normalize, reshape).
- 3. Build an LSTM-based model.
- 4. Predict future values and visualize trends.

Targeted Application & Tools that can be used: Applications:

• **Data Preprocessing**: Clean and manipulate data from various sources such as CSV, Excel, SQL databases, and APIs.

• **Exploratory Data Analysis (EDA)**: Gain insights into datasets by identifying trends, patterns, and outliers.

- **Predictive Modeling**: Build models for classification (e.g., spam detection) and regression (e.g., house price prediction).
- **Clustering**: Group data into clusters for unsupervised learning tasks (e.g., customer segmentation).
- **Model Evaluation**: Assess model performance using appropriate metrics such as accuracy, precision, recall, and F1-score.

Tools:

- **Pandas**: For data manipulation and cleaning (e.g., handling missing values, merging datasets).
 - **NumPy**: For numerical operations and working with arrays and matrices.
 - **Matplotlib**: For creating static, animated, and interactive visualizations.
 - **Seaborn**: For advanced data visualizations (e.g., heatmaps, pair plots).
 - **Plotly**: For creating interactive visualizations, especially useful for large datasets.
- **Scikit-learn**: The go-to library for implementing machine learning algorithms (e.g., linear regression, decision trees, k-means clustering).
- **XGBoost**: For advanced gradient boosting models, particularly for large-scale machine learning tasks.

• **TensorFlow** (for deep learning in Module 4): A powerful open-source library for building machine learning and deep learning models.

• **Keras**: High-level neural network API, built on top of TensorFlow, to easily create deep learning models.

NLTK: The Natural Language Toolkit for various text processing tasks like tokenization, stemming, and part-of-speech tagging.

spaCy: A fast NLP library for advanced NLP tasks such as named entity recognition and dependency parsing.

Transformers (by Hugging Face): A powerful library for using pre-trained Transformer-based models like BERT, GPT, and others for advanced NLP tasks.

Text Book(s):

T1: Essentials of Python for Artificial Intelligence and Machine Learning by Pramod Gupta and Anupam Bagchi

Reference(s):

- 1. "Artificial Intelligence with Python" Prateek Joshi
- 2. "Python Machine Learning" Sebastian Raschka & Vahid Mirjalili
- 3. "Hands-On Artificial Intelligence with Python" Teet Straus
- 4. "Deep Learning for Coders with Fastai and PyTorch" Jeremy Howard & Sylvain Gugger

Catalogue prepared by					
Recommended by the Board of Studies on					
Date of Approval by the Academic Council					
Course Code: CSD1712	Course Title: Statistical Foundations for Data Science Type of Course: Theory	L-T-P-C	3		3
Version No.	1.0			0 0	
Course Pre- requisites	NIL				

Anti-requisites	NIL						
- Course Description	This course provides an in-depth i	ntroduction to statis	stics and machine learn	ning theory,			
	methods, and algorithms for data	science. Topics in	clude multiple regress	sion, kernel			
	learning, sparse regression, gener	alized linear mode	ls, supervised and un	nsupervised			
	learning, deep learning, covariance	learning, factor mod	lels, principal compone	ent analysis,			
	mathematical statistics and real-wor	ne application and rld data sets	IIIIIItations of mese me	thous using			
Course Obiective	The objective of the course is to fam	iliarize the learners v	with the concepts of St	atistical			
oburbe objective	Foundations for Data Science and attain Employability through Participative Learning						
	techniques.						
Course Out Comes	On successful completion of the course the students shall be able to:						
	1. Understand the rise and sign	ificance of Big Data	in various fields such a	as Biological			
	Sciences, Health Sciences, Compute	er and Information S	ciences, Economics an	d Finance,			
	Business and Program Evaluation, I	Earth Sciences, and A	Astronomy.	NA 1			
	2. Develop a strong foundation	in multiple linear re	gression and the Gauss	s-Markov			
	3 Apply linear regression with	random design and	partial linear regression	n			
	4 Apply the power method and	1 learn about factor r	nodels and structured c	rovariance			
	learning.	r louin about ractor i	noucle and structures c	0 variance			
Course Content:							
Modulo 1	Introduction	Assignment	Drogramming	No. of			
		Assignment	Programming	Classes:10			
theory - Aim of High-	-dimensional Statistical Learning.	Assignment	Programming	No. of			
Mouule 2	Multiple Linear Regression	Assignment	Programming	Classes:12			
<u>Topics:</u>							
Multiple Linear Regre Transformation, Mod Covariates, Ridge Re Regression Solution F models, Maximum li Deviance, Regularizat	ession, The Gauss-Markov Theorem , lel Building and Basis Expansions, Po- gression - Bias-Variance Tradeoff - P Path - Kernel Ridge Regression , Expo kelihood , Computing MLE: Iterativel tion parameters, Refitted Cross-valida	Statistical Tests - W olynomial Regressio enalized Least Squar mential family 231 5 ly reweighed least sq ition, Extensions to N	eighted Least-Squares n - Spline Regression, res - Bayesian Interpret 1.2 Elements of genera juares, Deviance and A Nonparametric Modelin	, Box-Cox Multiple tation - Ridge alized linear Analysis of ng.			
Module 3	Inference in linear regression	Assignment	Programming	No. of Classes:14			
<u>Topics:</u>							
Inference in linear reg level, Inference in g hypotheses, Numeric Linear regression with least squares, Sample swap, Gradient appro-	ression - Debias of regularized regress generalized linear models, Desparsif cal comparison - Asymptotic efficien h random design, Partial linear regres size in regression and graphical mode	sion estimators, Cho fied Lasso, Decorre cy 345 7.3.1 Statist ssion, Gaussian graj els, General solution	bices of weights , Infere elated score estimator ical efficiency and Fis phical models - Inferen s , Local semi-LD deco	ence for the noise - Test of linear her information, nee via penalized omposition, Data			

Module 4	Principal Component Analysis	Assignment	Programming	No. of Classes:9

Topics:

Principal Component Analysis -Introduction to PCA, Power Method, Factor Models and Structured Covariance Learning, Factor model and high-dimensional PCA-Cluster Analysis - K-means clustering, Hierarchical clustering, Model-based clustering, Spectral clustering, Data-driven choices of the number of clusters, Variable Selection in Clustering, Sparse K-means clustering, Sparse model-based clustering, Sparse Mixture of Experts Model, Correlation Screening, Generalized and Rank Correlation Screening, Nonparametric Screening, Sure Screening and False Selection.

Targeted Application & Tools that can be used: Tools: Torch, Google Colaboratory, Spider, Jupiter Notebook

Project work/Assignment:

Text Book

TextBook(s):

T1 Fan, J., Li, R., Zhang, C.-H., and Zou, H. (2020). Statistical Foundations of Data Science. CRC Press.

T2 Wainwright, M. J. (2019). High-dimensional statistics: A non-asymptotic viewpoint. Cambridge University Press.

References

R1. James, G., Witten, D., Hastie, T.J., Tibshirani, R. and Friedman, J. (2013). *An Introduction to Statistical Learning with Applications in R*. Springer, New York.

R2. Hastie, T.J., Tibshirani, R. and Friedman, J. (2009). *The elements of Statistical Learning: Data Mining, Inference, and Prediction* (2nd ed). Springer, New York.

R3. Buehlmann, P. and van de Geer, S. (2011). *Statistics for High-Dimensional Data: Methods, Theory and Applications*. Springer, New York.

Book link

R1: Fan, J., Li, R., Zhang, C.-H., and Zou, Statistical Foundations of Data Science. CRC Press.

E book link

R2: W. N. Venables, D. M. Smith and the R Core Team, <u>https://cran.r-roject.org/doc/manuals/R-intro.pdf</u>, October, 2022

eb resources:

W1. <u>https://www.youtube.com/playlist?list=PLOU2XLYxmsIK9qQfztXeybpHvru-TrqAP</u> https://presiuniv.knimbus.com/user#/

Topics relevant to "EMPLOYABILITY SKILLS": - Asymptotic efficiency 345 7.3.1 Statistical efficiency and Fisher information, Linear regression with random design, Partial linear regression **for developing Employability Skills through Participative Learning techniques. This is attained through assessment component mentioned in course handout..**

Catalogue prepare	ed						
by	Ms.Radhika Sreedharai	1					
Recommended by	ion						
on	ies						
Date of Approval	hv						
the Academic	, by						
Council							
Course	Course Title: Introduc	tion to Data	L-P-C	3 0	0	3	
Code:CSD1703	Science						
	Type of Course: Progr	am Core					
Version No.	1.0		1 1	I			
Anti-requisites	NIL						
Course	This course offers a co	morehensive intro	duction to th	e interd	iscinli	nary field of Data	
Description	Science Students will e	xplore the data scie	nce lifecycle	heginn	ing wi	ith data acquisition	
Description	and progressing through	cleaning explorate	rv analysis	, oogiini visualiza	tion a	and basic predictive	
	modeling. Emphasis is i	placed on using Pvt	hon-based to	ols (Pan	das. N	SumPy, Matplotlib	
	Seaborn, Scikit-learn) to	perform real-world	data tasks. T	he cours	e foste	ers critical thinking.	
	statistical reasoning, and	d data-driven decisi	ion-making e	essential	for m	odern data science	
	roles.						
Course	To introduce students to the fundamentals and workflow of Data Science						
Objectives	To impart practical experience with Python tools used in data analysis						
, and the second	To develop understand	ing of data explorat	ion, transform	nation, a	nd vis	sualization	
	techniques	0 1	,	,			
	To build foundational k	knowledge of statist	ical methods	and basi	c prec	dictive modeling	
Course Out	CO1: Describe the stag	es of the data scien	ce lifecycle a	nd tools	used		
Comes	CO2: Perform data wra	ingling, cleaning, ar	nd explorator	y analysi	s with	n Python	
	CO3: Create and interp	ret data visualizatio	ons for effecti	ve comm	nunica	ation	
	CO4: Apply basic statis	stical concepts and	develop pred	ictive mo	odels		
Course							
Content:		Т			-		
Module 1	Introduction to Data	Quiz	Knowledg	e based		10 Hours	
Introduction to D	science ata Sajanaa: Dafinitiana a	nd Applications De	to Science L	ifoquala	Dutho	on for Data Sajanca:	
Syntax Variables	and Science. Definitions a	w Setting up Envir	na Scicille Li	vter Note	r yulu book	Anaconda Google	
Colab Working y	vith Python I ibrarias. Nu	ImPy and Pandas R	asics Real-	vorld ann	licatio	ons of Data Science	
(case studies from	healthcare finance and	l social media)	usics, iteai-w	ond app	mean		
(ease studies non	in neurineare, manee, and	i soeiai meaia)					
	Data Wrangling and	Assignment	Impleme	ntation		12 Hours	
Module 2	Exploration		impieme				
DataFrames and S	Series in Pandas , Data C	leaning: Missing Va	alues, Duplic	ates, Dat	a Typ	e Conversion, Data	
Transformation:	Sorting, Filtering, Mer	ging, Grouping, Fea	ture Engine	ering Ba	asics,	Exploratory Data	
Analysis (EDA):	Descriptive Statistics,	Distributions, Outli	er Detection	, Hands	-on: A	Analyzing a public	
dataset (e.g., Tita	nic, Iris)					-	

Module 3	Data Visualization and Communication	Term paper/Assignme	ent Impler	nentati	on	11 He	ours	
Introduction to Data Visualization: Importance & Principles, Visualization with Matplotlib and Seaborn Line Charts, Bar Charts, Histograms, Boxplots, Pairplots, Heatmaps, KDE plots, and advance visualizations, Creating Dashboards using Plotly or Streamlit (Intro), Data Storytelling: How to Present Da Insights Effectively, Project: Create an interactive EDA dashboard								
Module 4	Introduction to Statistics & Predictive Modeling	Term paper/Assignme	Impler ent	nentati	on	12 Ho	ours	
 Descriptive Statistics: Mean, Median, Mode, Variance, Standard Deviation, Probability Basics and Distributions, Hypothesis Testing: t-Test, p-value, Confidence Intervals, Correlation and Causation, ntroduction to Regression: Simple and Multiple Linear Regression Classification Overview: Logistic Regression Introduction to Model Evaluation: Accuracy, Confusion Matrix, Precision, Recall, Case Study: Predictive modeling on a real dataset 								
Fextbook(s): Fitle: Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Jupyter, Author: Wes McKinney, Publisher: O'Reilly Media, Edition: 3rd Edition, 2023								
 Title: Practical Statistics for Data Scientists: 50+ Essential Concepts, Authors: Peter Bruce, Andrew Bruce, Peter Gedeck, Publisher: O'Reilly Media, 2nd Edition (2021) Title: Doing Data Science, Authors: Cathy O'Neil, Rachel Schutt, Publisher: O'Reilly Media Title: An Introduction to Statistical Learning with Applications in R, Authors: Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Publisher: Springer, 2nd Edition (2021) 								
Catalogue prepared by	Dr.Saira Banu							
Recommended by the Board of Studies on								
Date of Approval by the Academic Council	Academic Council Meet	ing No.						
Course Code: CSE1701	Course Title: Essential Type of Course: Lab	s of Al Lab	L- T-P- C	0 0	4	2		
Version No.	2.0				1		1	
Course Prerequisites	Basic Java Programming Probability, Basic Data S Tools, Understanding of	g Knowledge, Math Structures and Alg Basic Machine Le	nematics: L orithms, Fa earning Con	inear Al imiliarit cepts.	gebra a y with L	ind .ibraries and		
Anti-requisites	NIL							

Course)	This course introduc	ces students to	the essential concep	ots and techniques of	
Descri	Artificial Intelligence (AI) with a focus on practical implementation using Python. Students will explore core AI topics such as search algorithms, knowledge representation, machine learning, and neural networks, while gaining proficiency in using popular Python libraries like NumPy, pandas, scikit- learn, and TensorFlow. Through a series of lab exercises and projects, students will apply AI principles to solve real-world problems, develop intelligent					
		applications, and u	nderstand how a	Al systems function a	at a foundational level.	
Course	ourse Objective The primary objectives of the course are to Gain Proficiency in Al Concepts and Python Implementation, Develop and Implement Machine Learning Models, Understand and Build Neural Networks, Apply AI to Real-World Problems					
Course On successful completion of the course the students shall be able to: Outcomes 1. Proficiency in Implementing AI Algorithms Using Python 2. Ability to Build and Evaluate Machine Learning Models 3. Hands-on Experience with Neural Networks and Deep Learning 4. Practical Application of AI to Solve Real-World Problems					nall be able to: Python Iodels Deep Learning roblems	
Course	Content:					
Modulo	e 1	InIntroduction to AI and Python for AI	Assignment	Implementation	10 Sessions	
Lab As	signment 1	Setting Up the Pytl	hon Environme	nt		
•	Objective:	Get familiar with set	ting up a Pythor	n environment for Al p	projects.	
•	Iasks:	on Anooondo and I	uputor Notoboo			
ו. כ		tual anvironment for		•K. +		
2.				L.	ikit looro	
3. 4.	Install essential Python libraries: numpy, pandas, matplotlib, and scikit-learn. Write and execute simple Python code to verify installation (e.g., print a "Hello AI"					
l ah An	signmont 2	Basic Duthon Brog	ramming for Al			
	Objective:	Understand and practice	ctice the basic l	Python syntax and da	ta structures used in	
	Al.			,		
•	Tasks:					

- 1. Write Python code to work with basic data types (integer, float, string, boolean).
- 2. Implement and manipulate Python lists, tuples, sets, and dictionaries.
- 3. Create basic control flow structures: if-else, for loops, while loops.
- 4. Use functions and lambda functions to solve small AI-related problems, such as calculating factorial or Fibonacci numbers.

Lab Assignment 3: Data Exploration and Preprocessing

- **Objective:** Learn how to work with data for AI models.
- Tasks:
- 1. Load a dataset (e.g., Titanic or Iris dataset) using pandas.
- 2. Clean the dataset by handling missing values, removing duplicates, and converting data types if needed.
- 3. Explore the dataset by visualizing it using matplotlib and seaborn.
- 4. Perform basic data preprocessing tasks such as feature scaling, encoding categorical variables, and splitting data into training and testing sets.

Modulo 2	Data Processing,	Assignment	Implementation	10 Sessions
Module 2	Visualization			

Lab Assignment 1: Data Preprocessing with Pandas

Objective:

Learn the fundamentals of data preprocessing, including cleaning, handling missing values, and performing basic transformations using **Pandas**.

Tasks:

1. Load and Inspect the Dataset:

- Load a dataset (e.g., Iris, Titanic, Wine Quality dataset) using pandas.read_csv() or pandas.read_excel().
- Inspect the first few rows of the dataset using .head() and check basic information using .info().

2. Handle Missing Values:

- \circ $\;$ Identify missing values in the dataset using .isnull() or .isna().
- Handle missing data by imputing with mean, median, or mode using SimpleImputer from sklearn, or remove rows with missing data using .dropna().

3. Data Transformation:

- Convert categorical variables to numerical values using one-hot encoding or label encoding.
- Normalize/standardize numerical columns using StandardScaler or MinMaxScaler from sklearn.

4. Subset and Filter Data:

- Create subsets based on certain conditions (e.g., select rows where a specific feature value is greater than a threshold).
- Filter outliers from numerical data using interquartile range (IQR).

Lab Assignment 2: Data Aggregation and Grouping with Pandas

Objective:

Master aggregation and grouping techniques using **Pandas** for summarizing data.

Tasks:

1. Group Data by Category:

- Group data by one or more categorical features (e.g., "class" in the Iris dataset or "embarked" in Titanic dataset).
- Use .groupby() to calculate aggregate statistics such as mean, median, sum, and count.

2. Pivot Tables:

- Create a pivot table to summarize data (e.g., aggregate the average age of passengers in the Titanic dataset by class and gender).
- Use .pivot_table() to perform multi-dimensional aggregation.

3. Data Aggregation and Custom Functions:

• Apply custom aggregation functions to the grouped data (e.g., calculate custom metrics or perform complex transformations within each group).

4. Sorting and Ranking Data:

- Sort the dataset by multiple columns (e.g., sorting by "age" or "fare").
- Rank data based on specific metrics (e.g., assign ranks to passengers by fare in the Titanic dataset).

Lab Assignment 3: Data Visualization with Matplotlib and Seaborn

Objective:

Learn to visualize datasets using **Matplotlib** and **Seaborn** for better understanding and insights.

Tasks:

1. Basic Plotting with Matplotlib:

- Create simple plots like line plots, bar plots, and histograms using **Matplotlib**.
- Customize the plots by setting titles, labels, and legends.
- Create scatter plots to visualize relationships between two variables.

2. Advanced Plotting with Seaborn:

- Use **Seaborn** to create advanced visualizations like pair plots, heatmaps, box plots, and violin plots.
- Customize visualizations with color palettes, styling, and themes.
- Create a correlation heatmap to visualize correlations between features in the dataset.

3. Distribution Visualizations:

- Plot distributions of continuous variables using **Seaborn's** distplot() or kdeplot().
- \circ $\,$ Create bar plots for categorical variables to understand their frequency distribution.
- 4. Multi-Plot Grid Layouts:
- Use **Matplotlib's** subplots() function to create multiple plots in a grid layout for comparison (e.g., scatter plot and histogram in the same figure).

Lab Assignment 4: Visualizing Relationships and Feature Importance

Objective:

Understand how to visualize relationships between features and evaluate feature importance for predictive models.

Tasks:

1. Scatter Plot Matrix:

- Use **Seaborn's** pairplot() to create a scatter plot matrix to visualize the relationships between multiple features.
- Analyze the pairwise relationships between features and identify any patterns or correlations.

2. Heatmap of Correlation Matrix:

- \circ ~ Use \mbox{Pandas} to calculate the correlation matrix of numeric features.
- Visualize the correlation matrix using **Seaborn's** heatmap() to understand feature correlations and multicollinearity.
- 3. Feature Importance from Models:

- Train a decision tree or random forest model using **scikit-learn** on a dataset (e.g., **Iris** or **Titanic**).
- Visualize feature importance using a bar chart to understand which features have the most impact on the model.
- 4. Visualizing Predictions vs. Actual Values:
- For regression tasks, visualize the predicted values against the actual values using a scatter plot.
- \circ For classification tasks, visualize the classification results with a confusion matrix.

Lab Assignment 5: Time Series Data Visualization and Processing

Objective:

Learn how to process and visualize time series data, which is common in AI applications like forecasting and trend analysis.

Tasks:

- 1. Load and Preprocess Time Series Data:
- Load a time series dataset (e.g., stock market data, weather data).
- Parse dates properly and set the date column as the index using pd.to_datetime() and .set_index().

2. Plot Time Series Data:

- Plot a time series line chart using **Matplotlib** to visualize trends over time.
- Create rolling averages (e.g., 7-day, 30-day) to smooth out short-term fluctuations in the time series data.
- 3. Seasonal Decomposition of Time Series:
- Use **statsmodels** to decompose a time series into seasonal, trend, and residual components.
- \circ $\;$ Visualize the decomposed components to understand seasonal variations.
- 4. Forecasting with Simple Models:
- Use simple forecasting models (e.g., moving average, ARIMA) to predict future values.
- \circ $\,$ Visualize the forecasted data along with actual historical data.

	Introduction to Machine	Assignments	Implementation	10 Sessions
Module 3	Learning			

Lab Assignment 3: Implementing Linear Regression

- Tasks:
- 1. Load a real-world dataset (e.g., Boston Housing Price dataset).
- 2. Train a Linear Regression model using LinearRegression() from scikit-learn.
- 3. Evaluate the model using Mean Squared Error (MSE) and R-squared Score.
- 4. Visualize the regression line using Matplotlib.

Lab Assignment 4: Logistic Regression for Classification

- Tasks:
- 1. Load the Iris or Breast Cancer dataset.
- 2. Preprocess the dataset (handle missing values, encode categorical variables, scale data).
- 3. Train a Logistic Regression model using LogisticRegression().
- 4. Evaluate performance using Accuracy, Precision, Recall, F1-score.
- 5. Plot the Confusion Matrix and ROC Curve.

Lab Assignment 5: Implementing K-Nearest Neighbors (KNN)

- Tasks:
- 1. Load the **Iris dataset** and split it into training and testing sets.
- 2. Train a KNN classifier using KNeighborsClassifier().
- 3. Experiment with different values of K and evaluate performance.
- 4. Visualize decision boundaries using a scatter plot.

Lab Assignment 6: Decision Trees and Random Forests

- Tasks:
- 1. Train a **Decision Tree classifier** on the Titanic dataset.
- 2. Visualize the tree structure using plot_tree().
- 3. Train a Random Forest classifier and compare performance with the decision tree.
- 4. Determine the feature importance using feature_importances_.

Modul	e 4	Neural Networks and Deep Learning	Quiz	Implementation	10 Sessions				
Lab As	signment 7: li	ntroduction to P	erceptron and A	ctivation Functions					
Tasks:				_					
1.	1. Implement a single-layer perceptron using NumPy.								
2.	2. Train the perceptron to classify AND, OR, XOR gates.								
3.	3. Experiment with different activation functions (Sigmoid, ReLU, Tanh).								
4.	Visualize dec	ision boundaries	5.						
Lab As	signment 8: B	Building a Simple	e Neural Networ	k with Keras					
Tasks:									
1.	Load the MNI	I ST dataset from	keras.datasets.						
2.	2. Preprocess the data (normalize pixel values, reshape input).								
3.	3. Create a fully connected neural network using Sequential API.								
4. Train and evaluate the model using categorical cross-entropy loss and accuracy.									
Lab As	signment 9: lı	mplementing Cl	NN from Scratch	I					
Tasks:									
1.	Load the CIF	AR-10 dataset.							
2.	Build a CNN \	with Conv2D, M a	axPooling2D, Fla	tten, Dense, Dropou	t layers.				
3.	Use Adam op	otimizer and cat	egorical cross-e	ntropy loss.					
4.	Train and visu	ualize loss/accura	acy curves.						
Lab As	signment 10:	Image Augment	tation & Regulari	zation					
Tasks:									
1.	Apply data a	u gmentation (ro	tation, zoom, flip	ping) using ImageData	aGenerator.				
2.	Add dropout	and batch norm	alization to prev	ent overfitting.					
3.	Compare mo	del performance	with and without	t augmentation.					
Lab As	signment 11:	Transfer Learni	ng with Pre-train	ed Models					

Tasks:

- 1. Use VGG16 or ResNet50 pre-trained on ImageNet.
- 2. Replace the output layer to classify **new images**.
- 3. Freeze earlier layers and fine-tune deeper layers.
- 4. Evaluate the model on a custom **dataset (e.g., Cats vs. Dogs)**.

Lab Assignment 12: Implementing RNN for Text Classification

Tasks:

- 1. Load IMDB movie reviews dataset from keras.datasets.
- 2. Preprocess text (tokenization, padding sequences).
- 3. Build an RNN with Embedding, SimpleRNN, Dense layers.
- 4. Train and evaluate the model.

Lab Assignment 13: Building an LSTM for Time Series Prediction

Tasks:

- 1. Load a time series dataset (e.g., stock prices, temperature data).
- 2. Preprocess the data (normalize, reshape).
- 3. Build an LSTM-based model.
- 4. Predict future values and visualize trends.

Targeted Application & Tools that can be used:

Applications:

- **Data Preprocessing**: Clean and manipulate data from various sources such as CSV, Excel, SQL databases, and APIs.
- **Exploratory Data Analysis (EDA)**: Gain insights into datasets by identifying trends, patterns, and outliers.
- **Predictive Modeling**: Build models for classification (e.g., spam detection) and regression (e.g., house price prediction).

- **Clustering**: Group data into clusters for unsupervised learning tasks (e.g., customer segmentation).
- **Model Evaluation**: Assess model performance using appropriate metrics such as accuracy, precision, recall, and F1-score.

Tools:

- **Pandas**: For data manipulation and cleaning (e.g., handling missing values, merging datasets).
- **NumPy**: For numerical operations and working with arrays and matrices.
- **Matplotlib**: For creating static, animated, and interactive visualizations.
- Seaborn: For advanced data visualizations (e.g., heatmaps, pair plots).
- **Plotly**: For creating interactive visualizations, especially useful for large datasets.
- **Scikit-learn**: The go-to library for implementing machine learning algorithms (e.g., linear regression, decision trees, k-means clustering).
- **XGBoost**: For advanced gradient boosting models, particularly for large-scale machine learning tasks.
- **TensorFlow** (for deep learning in Module 4): A powerful open-source library for building machine learning and deep learning models.
- **Keras**: High-level neural network API, built on top of TensorFlow, to easily create deep learning models.

NLTK: The Natural Language Toolkit for various text processing tasks like tokenization, stemming, and part-of-speech tagging.

spaCy: A fast NLP library for advanced NLP tasks such as named entity recognition and dependency parsing.

Transformers (by Hugging Face): A powerful library for using pre-trained Transformer-based models like BERT, GPT, and others for advanced NLP tasks.

Text Book(s):

T1: **Essentials of Python for Artificial Intelligence and Machine Learning** by Pramod Gupta and Anupam Bagchi

Reference(s):

- 1. "Artificial Intelligence with Python" Prateek Joshi
- 2. "Python Machine Learning" Sebastian Raschka & Vahid Mirjalili

4. "Deep Learning for Catalogue prepared by Recommended by the Board of Studies on Date of Approval by the Academic Course Course Code: Course Pre- requisites Anti-requisites M Course Description Ie Course Objectives	Course Title: Statistical Foundations for Data Science ype of Course: Discipline elective Lab tegrated	/ Howard	& Sylv.	ain G	Bugge	er
Catalogue orepared by Recommended by Recommended by Che Board of Studies on Date of Approval by the Academic Course Code: Code: Course Pre- requisites Anti-requisites M Course Description Ie Im Course Objectives	Course Title: Statistical Foundations for Data Science ype of Course: Discipline elective Lab tegrated	L-T-P-C	0	0		
Recommended by the Board of Studies on Date of Approval by the Academic Council Course Code: CSD1713 Version No. Course Pre- requisites Anti-requisites N Course Description	Course Title: Statistical Foundations for Data Science ype of Course: Discipline elective Lab tegrated	L-T-P-C	0	0		
Date of Approval by the Academic Council Course Code: CSD1713 Course S Code: CSD1713 Version No. Im Course Pre- requisites N Anti-requisites N Course Description Ie Ie In Course Objectives I	Course Title: Statistical Foundations for Data Science ype of Course: Discipline elective Lab tegrated	L-T-P-C	0	0		
Course S Code: CSD1713 Version No. In Course Pre- requisites N Anti-requisites N Course Description Ie le Ie Course Objectives I	Course Title: Statistical Foundations for Data Science ype of Course: Discipline elective Lab tegrated	L-T-P-C	0	0		
Version No. Course Pre- requisites Anti-requisites N Course Description Course Objectives Course Objectives					2	1
Course Pre- requisites N Anti-requisites N Course Description II Ie Ie Ie Ie Course Description II Course Objectives II Course Objectives II						
Anti-requisites N Course Description Course Objectives						
Course Description						
Course Objectives	his course provides an in-depth introduction t ethods, and algorithms for data science. To arning, sparse regression, generalized linear arning, deep learning, covariance learning, fac ad more. The course emphasizes the applicabili- athematical statistics and real-world data sets.	to statistic opics inclu- ur models ctor model lity and lin	es and ude mu , super ls, prine mitation	mach ultipl rviseo cipal ns of	tine le e reg d and comp these	earning theory, ression, kernel d unsupervised conent analysis, methods using
	The objective of the course is to familiarize the Soundations for Data Science and attain Learning techniques.	e learners n <mark>Employ</mark>	with th <mark>yabilit</mark> y	ne con y thr	ncepts ough	s of Statistical Participative
Course Out Comes	On successful completion of this course, studer outcomes: CO1: Understand the rise and significance of B Biological Sciences, Health Sciences, Compute Economics and Finance, Business and Program Astronomy. [Understand] CO2: Develop a strong foundation in multiple I Markov theorem. [Apply] CO3: Apply linear regression with random desi Apply] CO4: Apply the power method and learn about arning. [Apply]	nts can ex Big Data in er and Info n Evaluati linear reg sign and pa t factor m	pect to n vario ormatic on, Ear ression artial li odels a	achion scorth Sc	eve the state of the G	ne following uch as rs, es, and dauss- red covariance
Course Content:		No	of Ses	sions	s: 15 /	(30 hours)
List of Programs	annig. [Appiy]	1 11/4		,		<hr/>
Experiment 1: Use big dat	առուց. [Ճրրդյ	110				

Experiment 2: Predict stock market trends using big data.Experiment 3: Segment customers based on purchasing behavior.Experiment 4: Apply statistical learning techniques to high-dimensional data.

Experiment 5: The Gauss-Markov Theorem Experiment 6: Statistical Tests - Weighted Least-Squares

Experiment 7: Box-Cox Transformation

Experiment 8: Ridge Regression - Bias-Variance Tradeoff

Experiment 9: Ridge Regression Solution Path - Kernel Ridge Regression

Experiment 10: Debias of Regularized Regression Estimators

Experiment 11: Inference in Generalized Linear Models (GLMs)

Experiment 12: Partial Linear regression

Experiment 13: Power Method: To implement the Power Method for finding the largest eigenvalue and

corresponding eigenvector.

Experiment 14: Factor model and high-dimensional PCA

Experiment 15: Hierarchical clustering

Targeted Application & Tools that can be used:

Torch, Google Colaboratory, Spider, Jupiter Notebook

Project work/Assignment: Mention the Type of Project /Assignment proposed for this course Sentiment analysis of Facebook and Twitter data

Dataset resource link:

https://www.kaggle.com/datasets

REFERENCE MATERIALS:

Textbook(s):

T1 Fan, J., Li, R., Zhang, C.-H., and Zou, H. (2020). Statistical Foundations of Data Science. CRC Press.

T2 Wainwright, M. J. (2019). *High-dimensional statistics: A non-asymptotic viewpoint*. Cambridge University Press.

Reference Book(s):

R1. James, G., Witten, D., Hastie, T.J., Tibshirani, R. and Friedman, J. (2013). *An Introduction to Statistical Learning with Applications in R*. Springer, New York.

R2. Hastie, T.J., Tibshirani, R. and Friedman, J. (2009). *The elements of Statistical Learning: Data Mining, Inference, and Prediction* (2nd ed). Springer, New York.

R3. Buehlmann, P. and van de Geer, S. (2011). *Statistics for High-Dimensional Data: Methods, Theory and Applications*. Springer, New York.

R1: Fan, J., Li, R., Zhang, C.-H., and Zou, Statistical Foundations of Data Science. CRC Press.

<u>E book link</u>

R2: W. N. Venables, D. M. Smith and the R Core Team, <u>https://cran.r-roject.org/doc/manuals/R-intro.pdf</u>, October, 2022

eb resources:

W1. <u>https://www.youtube.com/playlist?list=PLOU2XLYxmsIK9qQfztXeybpHvru-TrqAP</u> https://presiuniv.knimbus.com/user#/

Catalogue prepared	by							-
Recommended by Board of Studies on	y the	BOS NO: 17 th. BOS held on 22/12/22						
Date of Approval by the Academic Council	l	Academic Council Meeting No.x , Dated xx/xx/2	23					
Course Code:	Cou	rrse Title: Machine Learning for Intelligent						
AID1701	Dat		L-T- P- C	2	0	0	2	
	Тур	e of Course: Theory						
Version No.	1.0			•	1		1	
Course Pre-	Bas	ic programming (Python/Java/R), Linear Algebra	a, Probabil	ity & Sta	atistic	s, Intro	to Data	3
requisites	Scie	Science						
Anti-requisites	NIL	NIL						
Course Description	Inrough the study of incident response and contingency planning, including incident response plans, disaster recovery plans, and business continuity plans, this course aims to help students comprehend the principles of risk management. This course explores the intersection of machine learning and intelligent data science, focusing on how learning algorithms empower smart, data-driven systems. Students will gain a solid foundation in supervised and unsupervised learning, delve into deep learning, and learn how to apply these techniques to build intelligent applications across domains such as healthcare, finance, and IoT. With a blend of theory and hands-on practice, the course emphasizes model interpretability, ethical AI, and real-world problem-solving using intelligent automation. Students will work with modern tools and frameworks (such as Python, Scikit-learn, TensorFlow, and PyTorch) to build robust, scalable models that drive intelligent decision-making. By the end of the course, learners will be equipped to design, implement, and evaluate machine learning pipelines within intelligent data science systems, making them well-prepared for roles in data science, applied AI, and analytics.							
Course Objective	The Lea Lea	objective of the course is to familiarize the lear rning for Intelligent Data Sciencey and attain rning techniques.	rners with t Employat	he cono Sility the	cepts rough	of Ma Partic	chine ipative	
	Ons	successful completion of the course the stu	dents sha	ll be ab	le to:			
Course Out Comes		 Understand and apply the fundamental co intelligent data science systems. 	ncepts of r	nachine	elearn	ing wit	thin	
	2. Design and implement supervised learning models to solve real-world intelligent system problems.							

F

	 Apply intelligent data preprocessing and feature engineer model performance 	ring techniques to enhance
	4. Analyze and implement intelligent data science solutions applications.	s for domain-specific
Course Conte	ent:	
Module 1: For	undations of Machine Learning and Intelligent Systems	10 Sessions
Int	roduction to Machine Learning in the context of Intelligent Data Scienc	e- Types of Learning:
Su	pervised, Unsupervised, Semi-supervised, Reinforcement- Model eval	uation metrics (Accuracy,
Pre	ecision, Recall, F1-Score, ROC-AUC)- Bias-Variance Tradeoff and Over	fitting/Underfitting- Cross-
val	idation and Model Selection. Data preprocessing: handling missing da	ta, encoding, feature
sca	aling.	
Module 2: Su	pervised Learning for Smart Systems	10 Sessions
	ener and Lagistic Degression - Desision Trees Dandom Ferente Credia	nt Departing (VODepart
	iear and Logistic Regression - Decision nees, Random Forests, Grade	III DOUSTING (AGDOUST,
	d Backpropagation-Hyperparameter tuning (Grid Search, Bandom Sea	rch Bayesian Ontimization)
an	a backpropagation-hyperparameter tuning (ond Search, Nahdom Sea	ren, bayesian Optimizationj
Module 3 Inte	elligent Data Processing and Feature Engineering	12 Sessions
Sm	nart Data Preprocessing (Outlier Detection, Noise Handling, Missing Da	ata Imputation) - Feature
En	gineering using AI: Automated Feature Selection, Transformation, and	Extraction-Dimensionality
Re	duction (PCA, LDA, t-SNE, Autoencoders)-Introduction to Feature Stor	es and MLOps Pipelines-
Da	ta Annotation and Labeling Tools (for supervised tasks)	
	с., , , , , , , , , , , , , , , , , , ,	
Module 4 Ap	plications and Case Studies of Intelligent Data Science	8 Sessions
	5	
Int	elligent Data Science in: Smart Healthcare (e.g., disease prediction, pa	atient monitoring) - Finance
(e.,	g., fraud detection, credit scoring) - Marketing (e.g., personalized targe	ting, churn prediction)-
Sm	nart Cities & IoT (e.g., traffic forecasting, energy optimization)-End-to-E	nd Project: Design and
De	ploy an Intelligent Data Science System -Introduction to DataOps & Mo	odelOps
Tex	xt Book	
	1 "Intelligent Systems for Machine Learning: A Madaus Annualty to	Automated Al"
	Intelligent Systems for Machine Learning: A Modern Approach to	Automated Al
	Nature Edition: 1st Edition (2022) ICRN: 0702021225042	indeller. ohunger
	wature, Luition. 1st Luition (2023), 13DN: 9703031323043	

F	Referer	ices
	1.	Alice Zheng and Amanda Casari "Feature Engineering for Machine Learning: Principles and Techniques for Data Scientists" by -Edition: 1st Edition (2018)-Publisher: O'Reilly Media
	2.	Christopher M. Bishop "Pattern Recognition and Machine Learning" Edition: 1st Edition (2006).Publisher: Springer
	3.	Kevin P. Murphy "Machine Learning: A Probabilistic Perspective" Edition: 1st Edition (2012) <i>Publisher</i> : MIT Press
	4.	Yoshua Bengio, and Aaron Courville "Deep Learning" by Ian Goodfellow, Edition: 1st Edition (2016) Publisher: MIT Press
	5.	Foster Provost and Tom Fawcett "Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking" Edition: 1st Edition (2013) Publisher: O'Reilly Media.
v	Veb re:	sources:
	6.	NPTEL Course – Introduction to Machine Learning
h	<u>nttps://i</u>	nptel.ac.in/courses/106/106/106106202/
	7.	Google Machine Learning Crash Course
h	nttps://o	developers.google.com/machine-learning/crash-course
	8.	Coursera – Machine Learning by Andrew Ng (Supervised Models)
h	<u>nttps://v</u>	www.coursera.org/learn/machine-learning
T e d t	Topics i encodir levelo g hrough	relevant to "EMPLOYABILITY SKILLS": Data Preprocessing (Missing data handling, ng, scaling)- Dimensionality Reduction Techniques (PCA, t-SNE, Autoencoders) for ping Employability Skills through Participative Learning techniques. This is attained a assessment component mentioned in course handout.
Catalogue		Dr.S.Saravana Kumar
prepared by	У	
Recommended by the Board of Studies on		

Date of Approval	
by the Academic	
Council	

Course Code:	Course Title: Predictive Analytics			L- P-	2	0	2		
CSD1714	Type of Course: Program Core			С					
Version No.	1			L					
Course Pre- requisites	Fundamentals of Data Analytics								
Anti-requisites	NIL								
Course Description	Predictive Analytics subject is conceptual in nature. The students will be benefited in this course to know about modern data analytic concepts and develop the skills for analyzing and synthesizing data sets for decision making in the firms.								
Course Objective	The objective of the course is skill development of student by using Learning techniques								
Course Out Comes	 On successful completion of the course the students shall be able to: CO 1: Define the nature of analytics and its applications. (Remember) CO 2: Summarize the concepts of predictive analytics and data mining.(Understand) CO 3: Construct the analytical tools in business scenarios to achieve competitive advantage.(Apply) CO 4: Build the real-world insights in decision trees and time series analysis methods in dynamic business environment.(Apply) 								
Course Content:									
Module 1	Introduction to Predictive Analytics	Self-Learning	Applicat analytic	tions o s	f	7 Sess	sions		
Topics: Analytics- Def Experts perception or case studies	finition, importance, A n analytics; Popularity	nalytics in decisic in Analytics; Pred	on makin; ictive an	g, Appl alytics	icatior in bus	ns, Challe iness Sce	enges, enarios-		
Module 2	Principles and Techniques	Case analysis				8 Ses	sions		

Topics:								
Predictive modeling: F limitations - Statistica	Propensity models, clı I analysis: Univariate	uster models, colla Statistical analysis	aborative filtering, appli s, Multivariate Statistica	cations and al analysis				
Module 3	Model Selection	Participative Learning & Case Analysis		7 Sessions				
Preparing to model the methodology, cross-verse establishing baseline	e data: supervised ver alidation, overfitting, l performance.	rsus unsupervised bias-variance trade	methods, statistical an e-off, balancing the trai	d data mining ning dataset,				
Measuring Performan Regression Models - F	ce in Regression Mode Regression Trees and F	els - Linear Regres Rule-Based Models	sion and Its Cousins - N s	lon-Linear				
Measuring Performan Classification Models	ce in Classification M - Non-Linear Classifi	odels - Discrimina cation Models	nt Analysis and Other L	inear				
Module 4	Time Series Analysis	Discussion & Presentation		8 Sessions				
Time series Model: AF reasoning, temporal c	MA, ARIMA, ARFIMA - onstraint networks	- Temporal mining -	- Box Jenkinson methoc	I, temporal				
Text Book								
1.Jeffrey Strickland, Predictive analytics using R, Simulation educators, Colorado Springs, 2015								
2.Max Kuhn and Kjell J	Iohnson, Applied Prec	lictive Modeling, 1	st edition Springer, 2013	3.				
References								
R1 Dinesh Kumar, U	. (2021). Business Ana	alytics: The Scienc	e of data-Driven Decisi	on Making.				
R2 Business Analytics Winston, Cengage Pul	s - Data Analysis & De blication, 5th Edition,	cision Making", S. 2012	Christian Albright and \	Nayne L.				

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

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

3. **E book link R3:** Singh, R., Sharma, P., Foropon, C., & Belal, H. M. (2022). The role of big data and predictive analytics in the employee retention: a resource-based view. International Journal of Manpower. https://www-emerald-com-presiuniv.knimbus.com/insight/content/doi/10.1108/IJM-03-2021-0197/full/html

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

Web resources:

W1.https://www.sas.com/en_in/insights/analytics/predictive-analytics.html

W2. https://www.techtarget.com/searchbusinessanalytics/definition/predictive-analytics

W3. <u>https://www.cio.com/article/228901/what-is-predictive-analytics-transforming-data-</u> intofutureinsights.html

W4. https://www.simplilearn.com/what-is-predictive-analytics-article

W5. <u>https://www.northeastern.edu/graduate/blog/predictive-analytics/</u> W6.https://www.marketingevolution.com/knowledge-center/the-role-of-predictive-analyticsin-datadriven-marketing

Swayam & NPTEL Video Lecture Sessions on Predictive Analytics

1. https://onlinecourses.swayam2.ac.in/imb20_mg19/preview

2. https://onlinecourses.nptel.ac.in/noc19_mg42/preview

Case References

- 1. Predictive Analytics Industry Use cases.
- 2. https://www.rapidinsight.com/blog/11-examples-ofpredictive-analytics/
- 3. Srinivasan Maheswaran (2017). Predictive Analytics Employee Attrition Case center.

Topics relevant to development of "Skill Development": ": Application of Business Analytics to enhances customer satisfaction and firms' success
Topics relevant to development of "Environment and sustainability: Focus on Predictive analytics to minimize the errors in decision making

Course Code: CSD200 1	Course Title: Applied Type of Course: Pro	Data Science gram Core	e	L-T-P-C	3	0	0	3	
Version No.	1.0	1.0							
Course Pre- requisite s	NIL								
Anti- requisite s	NIL								
Course Descripti on	The aim of the course is to give complete overview of Python's data analytics tools and techniques. Learning python is a crucial skill for many data science roles, and this course helps to understand and develop feature engineering. With a blended learning approach, Python for data science along with concepts like data wrangling, mathematical computing, and more can be learnt.								
Course Objectiv es	The objective of the course is to familiarize the learners with the concepts of Applied 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: 1. Describe Numpy and Matrix Operations [Remember] 2. Summarize the need for data preprocessing and visualization techniques. [Understand] 3. Demonstrate the performance of different supervised learning algorithms [Apply] 4. Apply unsupervised learning algorithms for grouping the given data. [Apply] 								
Course Content:									
Module 1	Introduction to Data Science, Python Data Structures, Python Numpy Package	Quiz	Knowledge based qu	iz	No. Of ses	sions:11	l		

Data Science: Basics of Data Science, Sources of Data, Data Science Project Life Cycle: OSEMN Framework, Difference between data analysis and data analytics. Python- Variables, data types, control structures, Operators, Simple operations, Array and its operations, Numpy operations, Matrix and its operations.

Module 2	Data preparation and preprocessing using Pandas dataframe, Exploratory Data Analysis, Data Visualization	Assignme nt	Data Visualization	No. Of sessions:12
-------------	---	----------------	--------------------	--------------------

Data Quality Assessment, Feature Aggregation, Feature Encoding, Dealing with missing values, Normalization techniques, Statistical description about the data, Relationship between the data, Data Visualization using matplotlib.

Module 3Supervised Le Algorithms	Design an algorithm using Example	Random Forest	No. Of sessions:11
--	--	---------------	--------------------

Supervised learning techniques: Regression Models- Linear and Logistic Model, Classification Models – Decision Tree, Naïve Bayes, Model Selection and Evaluation criteria: Accuracy, F1 score – Sensitivity – Specificity – AUC.

Module 4	Unsupervised Learning Algorithms	Case Study	Conduct a case study on how data sets can be gathered and implemented in real time application.	No. Of sessions:11
-------------	-------------------------------------	------------	--	--------------------

The Clustering Models – K Means algorithm, K- Medoids Algorithm, types of clustering models, Hierarchical clustering techniques, drawbacks of K Means, case study for different algorithms.

Textbook(s):

- 1. Data Science Using Python and R- Chantal D.L & Daniel T.L John Wiley & Sons, Inc. -2019
- 2. Applied Data Science with Python and Jupyter-Alex Galea, Packt Publishing, October 2018 Data Visualization in Python with Pandas and Matplotlib Paperback – David Landup, June 16, 2021

References:

1.Data Science with Python and Dask- Jesse Daniel,1st Edition,July30,2019

Weblinks:

- https://presiuniv.knimbus.com/user#/home
- Udemy: https://www.udemy.com/course/applied-data-science-with-python-specialization-mhm/
- NPTEL online course : https://nptel.ac.in/courses/106106179

Topics relevant to "SKILLS Development": Data Science, Decision Tree Algorithm for developing **Skills development** through **Experiential Learning techniques.** This is attained through assessment component mentioned in course handout.

Course Code:	Course Title: Social Media Analytics						
UG COURSE: CSD 1701	Type of Course: Theory	L-T-P-C	3	0	0	3	
Version No.	1.0	1		1		I	
Course Pre- requisites							
Anti-	NIL						
requisites							
Course Description	This course provides a comprehensive overview of social media analytics, focusing on the techniques and tools used to analyze social media data. Students will learn how to collect, process, and analyze data from various social media platforms to extract valuable insights. The course covers topics such as big data collection, demographic analysis, web analytics, and the use of analytics tools to understand online customer behavior and make data-driven decisions.					tics, ta. ous social such as of a-driven	
Course Objective	The objective of the course is to familiarize the learners with the concepts Social Media Analytics and attain Skill Development through Experiential Learning techniques.				epts Social arning		
	On successful completion of the Social Media expect to achieve the following outcomes:	Analytics	6 CO	urse	e, stude	ents can	
	CO1: Understand the fundamental concepts a analytics in modern business contexts. [Reme	nd impor mber]	tan	ce o	f socia	l media	
	CO2: Effectively collect data from various social media platforms, ensuring they can gather relevant and accurate information. [Apply]						
Course Out	CO3: Develop the ability to process and analyz raw data into meaningful insights. [Apply]	e social r	ned	lia d	ata, tra	Insforming	
Comes	CO4: Acquire skills in visualizing data, enabling them to present findings in a clear and impactful manner. [Apply]						

Course					
Content:					
Module 1	Introduction to Social	Assignment	Practical	11	
	Media Analytics			Sessions	
				Remember	
The foundation for analytics, Social media data sources, Data sources and Factual Data Sources, Public and Private data, data gathering in social media analytics., Dealing with Unstructured Data, Challenges, Social media Mining Techniques, Social media data, Types of data, Text data formats, Text cleaning, tagging and storing. API: RESTful API, Stream API, OAuth Parsing API.					
Module 2	Text Mining in Social	Assignment	Practical	11 Sessions Apply	
Networks, Sam mining, tools fo	pling of online social net r text mining.	works, Compariso	n of different algorithm	ns used for	
Module 3	Network Measures and Behavior Analytics	d Assignment	Practical	12 Sessions Apply	
Centrality: Degree Centrality, Eigenvector Centrality, Katz Centrality, PageRank, Between ness Centrality, Closeness Centrality, Similarity: Structural Equivalence, Regular Equivalence, Individual Behavior: Individual Behavior Analysis, Individual Behavior Modeling, Individual Behavior Prediction Collective Behavior: Collective Behavior Analysis, Collective Behavior Modeling, Collective Behavior Prediction					
Module 4 Mining Faceboc	Analyzing the Social Media Data Ik: Overview, Exploring F	Assignment acebook's Social (Practical Graph API's, Analyzing S	11 Sessions Apply Social Graph	
Connections. M	lining Twitter: Overview,	Exploring Twitter's	API, Analyzing 140 Cha	aracters	

REFERENCE MATERIALS:

(i) Textbooks

T1. Mining the Social Web – Mathew A. Rusell, 3rd Edition, O'Reilly, 2019.

T2 : Python Social Media Analytics – Michal Krystyanczuk and Siddhartha Chatterjee, PacktPub, 2017.

(ii) Reference Book(s)

R1. Charu C. Aggarwal, Social Network Data Analytics, Springer, 2011

R2:Mastering Social Media Mining with Python – Macro Bonzanini, PacktPub, 2016.

R3; Reza Zafarani Mohammad Ali Abbasi Huan Liu, Social Media Mining, Cambridge University Press, 2014

W1. NPTEL: https://onlinecourses.nptel.ac.in/noc21_cs28

W2. Coursera: https://www.coursera.org/learn/social-media-data-analytics

W3.Udemy:https://www.udemy.com/course/introduction-to-social-analytHYPERLINK "https://www.udemy.com/course/introduction-to-social-analytics/"ics/

W4. Others : <u>https://research.facebook.com/publications/realtime-data-processing-at-</u><u>facebook/</u>

Topics relevant to Entrepreneurial Skills: Extract and Analyze Social media Data for Entrepreneurship Development through Problem Solving methodologies/Participative Learning Techniques/ Experiential Learning Techniques.

Catalogue prepared by	MsRadhika Sreedharan
<u> </u>	•
Recommended	
by the Board	
of	
Studies on	
Date of	
Approval by	
the Academic	
Council	

Course Code:	Course Title: CSD1705 Data Science	Cloud Computing for	L- P-	2 (0	2
CSD1705	Type of Course: Program	n Core	С			
Version No.	1					
Course Pre-						
requisites						
Anti-requisites	NIL					
Course Description	Cloud Computing for D cloud platforms with dat storage, data pipelines, i using AWS, Azure, and G industry tools and scala	ata Science introduces a science workflows. Th machine learning deploy CP. Students will gain ha ble cloud services.	learners t e course o ment, and ands-on e	to the ir covers o d real-ti experier	ntegra cloud ime ai nce wi	tion of nalytics th
Course Objective	The objective of the cour techniques	rse is skill development (ofstudent	t by usir	ng Lea	irning
Course Out Comes	On successful completion of the course the students shall be able to: CO1: Understand the core concepts of cloud computing. CO2: Learn to use cloud platforms for storing, processing, and analyzing data. CO3:Implement data science workflows on cloud environments. CO4: Master scalable machine learning and big data tools on the cloud.			τ ο: ng I.		
Course Content:						
Module 1	Fundamentals of Cloud Computing			7 Ses	sions	
Overview of Clo Public, Private, basics); Introduction to Cloud	bud Computing, Service Hybrid, Community,• V AWS, Azure, and Google	Models: IaaS, PaaS, Sa irtualization and Conta Cloud Platform , Secu	aS, Deplo iners (Do rity and C	oyment cker, K Complia	t Mod ubern ance i	els: netes n the

Module 2	Cloud Storage & Data		8 Sessions
	Engineering		
Cloud Storage	Services (S3, Google Clou	Id Storage, Azure Blob);I	Data Lake vs. Data
Warehouse; ET	L Pipelines in the Cloud (A	AWS Glue, Dataflow, Azı	ure Data Factory); Data
Migration & Inge	estion Tools;Distributed C	omputing with Hadoop	and Spark on Cloud;Cost
Optimization Te	chniques		
		1	1
	Machine Learning and		
Module 3	Analytics on the		8 Sessions
	Cloud		
Cloud ML Tools	(AWS SageMaker, Azure N	1L, Google Vertex AI); E	nd-to-End ML Pipelines on the
Cloud; Model D	eployment and Monitorin	g; AutoML and MLOps; I	ntegrating Notebooks (Jupyter,
Colab) with Clo	ud Environments; Real-Ti	me Analytics with BigQu	iery, Redshift
	Time Series Analysis	Discussion &	
Module 4		Presentation	7 Sessions
Introduction to	Serverless Computing (AV	NS Lambda, Azure Fund	tions) ; Cloud-Native Data
Science Tools ,	Generative AI and LLMs in	n Cloud , Edge Computir	ng and IoT Integration
Text Book			
1."Cloud Com	outing: Concepts and Tec	chnology" by Thomas E	rl, Zaigham Mahmood, and
RICARDA DUITTINI	– 2nd Edition (2023)		
A foundational	text covering updated clou	ud architectures, platfor	ms, and security.
A foundational	text covering updated clou	ud architectures, platfor	ms, and security.
A foundational	text covering updated clou	ud architectures, platfoi	ms, and security.
A foundational	text covering updated clou	ud architectures, platfor	ms, and security.
A foundational Reference Bool	text covering updated clou	ud architectures, platfoi	ms, and security.
A foundational Reference Bool	text covering updated clou	ud architectures, platfor	ms, and security.
A foundational Reference Bool 1. "Data S Data Pi	text covering updated clou c c c cience on the Google Cla pelines" by Valliappa Laks	ud architectures, platfor oud Platform: Impleme shmanan (2023)	ms, and security.
A foundational Reference Bool 1. "Data S Data Pi Hands-	text covering updated clou c science on the Google Cl pelines" by Valliappa Laks on guide to building scalar	ud architectures, platfor oud Platform: Impleme shmanan (2023) ble data science project	ms, and security. Enting End-to-End Real-Time
A foundational Reference Bool 1. "Data S Data Pi Hands- 2. "Machi	text covering updated clou c c c c c c c c c c c c c	ud architectures, platfor oud Platform: Impleme shmanan (2023) ble data science project with Python: Deploy a	ms, and security. enting End-to-End Real-Time is on Google Cloud. nd Scale ML Models on AWS.
A foundational Reference Bool 1. "Data S Data Pi Hands- 2. "Machi Azure. a	text covering updated clou c c c c c c c c c c c c c	ud architectures, platfor oud Platform: Implemo shmanan (2023) ble data science project with Python: Deploy an cMahon (2024)	ms, and security. enting End-to-End Real-Time is on Google Cloud. nd Scale ML Models on AWS,

Course Code:	Course Title: Edge AI and IoT Analytics	L-T- P- C	3		0	3		
CSD1709	Type of Course: Theory			0				
Version No.	1.0							
Course Pre- requisites	Basics of Machine Learning, IoT fundament	asics of Machine Learning, IoT fundamentals, and Python programming						
Anti-requisites	NIL							
Course Description	This course provides a comprehensive overview of the convergence between Edge Computing, Artificial Intelligence (AI), and the Internet of Things (IoT). Learners will explore how intelligent analytics can be performed on-device at the edge of the network, reducing latency and enabling real-time decision-making in resource- constrained environments. The course covers core concepts of edge architecture, IoT protocols, AI model optimization, and deployment on edge hardware such as Raspberry Pi, Jetson Nano, and Google Coral Real-world use cases from domains such as healthcare, smart cities, and Industry 4.0 are discussed along with emerging trends in DataOps, ModelOps, and Edge-to-Cloud integration. By the end of the course, students will be able to design, build, and deploy secure and efficient edge-Al- powered IoT systems.							
Course Objective	The objective of the course is to familiarize and IoT Analytics and attain Employability techniques.	the learne / through f	rs wit Partic	th the o ipativ	concep e Lear i	ots of Edge Al ning		
	On successful completion of the course the students shall be able to:							
	1. Understand and analyze the architecture of IoT systems and Edge AI platforms.							
Course Out	2. Select and apply appropriate hardware, tools, and optimization techniques for deploying AI models on edge devices.							
Comes	3. Perform real-time analytics on IoT data streams using lightweight ML models and appropriate platforms.							
	4. Design and develop secure, scalable, and intelligent Edge-IoT solutions for real-world applications.							
Course								

Introduction to IoT and Edge Computing- Edge vs Cloud vs Fog Computing-Architectures of IoT & Edge Devices-Key Communication Protocols: MQTT, CoAP, BLE, LoRaWAN.

Overvi	ew of Edge AI: Concepts and Industry Trends-Introduction	n to TinyML and Embedded Al.		
dule 2: E	dge Hardware, Platforms, and Al Model Deployment	12 Sessions		
Edge A Model Frame Workfl Edge D	I Hardware Platforms: Raspberry Pi, NVIDIA Jetson, Goog Optimization Techniques for Edge: Quantization, Pruning works for Edge: TensorFlow Lite, ONNX, PyTorch Mobile, E ows: From Training to On-Device Inference-Power, Memo Devices	gle Coral, Arduino Nano 33 BLE- g, Knowledge Distillation-AI Edge Impulse-Deployment ry, and Latency Constraints in		
dule 3 lo	T Data Analytics and Real-Time Processing	12 Sessions		
loT Dat Lightw and Pr Core-E	ta Acquisition, Streaming, and Preprocessing -Time-Serie reight ML Models for Edge: Decision Trees, k-NN, Naïve Ba edictive Maintenance -Tools and Platforms: Azure IoT Hub Data Visualization for Edge Analytics (Grafana, ThingsBoar	s Analysis for IoT Sensors - ayes, SVMs -Anomaly Detection o, AWS Greengrass, Google IoT rd)		
dule4 A	pplications, Security, and Project Implementation	10 Sessions		
Smart Survei Secure	Home, Smart Agriculture, Industrial IoT (IIoT), Smart Citie llance, Energy Monitoring, Healthcare-Security in Edge AI e Boot, Data Privacy)-Edge-to-Cloud Integration	s-Case Studies: Edge AI in and IoT (Device Authentication,		
Text B	ook			
1.	Xiaofei Wang, Yi Pan "Edge Al: Machine Learning for Em Springer- 1st Edition (2022)	bedded Applications" Publisher:		
2.	2. Yunchuan Sun et al " Learning Edge AI: Algorithms and Applications". Publisher: Springe Edition: 1st Edition (2022)			
3.	3. Arshdeep Bahga, Vijay Madisetti "Internet of Things: A Hands-On Approach" Publisher: Universities Press Edition: 2nd Edition (2023)			
4.	William Lawless et al. "Artificial Intelligence for the Inter Academic Press (Elsevier) Edition: 1st Edition (2022)	rnet of Everything" Publisher:		
Refere	ences			
1.	Colin Dow "Hands-On Edge Analytics with Azure IoT: St Devices to Cloud" Publisher: Packt Publishing Edition:	ream Data Processing from 1st Edition (2022).		
Web r	esources:			
1.	NPTEL – Introduction to Internet of Things			
https:	//nptel.ac.in/courses/106/105/106105166/			
2.	Google Developers – Edge Al Overview			
https:/	/developers.google.com/edge-tpu			

	3. Go	ogle Cloud IoT Core (Edge to Cloud Integration)
	https://clo	oud.google.com/iot-core
	Topics rele	evant to "EMPLOYABILITY SKILLS": Edge computing vs. cloud computing: trade-offs
	and applic	ations- Use of analytics platforms (Grafana, AWS IoT, Azure IoT) for developing
	Employabi	ility Skills through Participative Learning techniques. This is attained through
	assessme	nt component mentioned in course handout.
Catal	ogue	Dr.S.Saravana Kumar
prepa	red by	
D		
Recor	nmended	
by the	Board of	
Studie	es on	
Date o	of	
Appro	val by the	
Acade	emic	
Count	cil	
Sound		

Course Code:	Course Title: Predictive Analytics Lab L- P- 0 0 1			
CSD1715	Type of Course:			
Version No.	1			
Course Pre- requisites	NIL			
Anti-requisites	NIL			
Course Description	Predictive Analytics subject is conceptual in nature. The students will be benefited in this course to know about modern data analytic concepts and develop the skills for analyzing and synthesizing data sets for decision making in the firms.			
Course Objective	/e The objective of the course is skill development of student by using Learning techniques			
Course Out Comes	 On successful completion of the course the students shall be able to: CO 1: Define the nature of analytics and its applications. (Remember) CO 2: Summarize the concepts of predictive analytics and data mining.(Understand) 			

	CO 3: Construct the analytical tools in business scenarios to achieve competitive advantage.(Apply)
	• CO 4: Build the real-world insights in decision trees and time series analysis methods in dynamic business environment.(Apply)
Cours	Content:
List of	-aboratory Tasks:
1.Pred	cting buying behaviour
•	analytics to identify buying habits based on previous purchase history.
•	predict customer purchase patterns.
2.Frau	I detection
a.	To identify anomalies in the system and detect unusual behavior to determine threats.
b.	experts can feed historical data of cyberattacks and threats to the system. When the predictive analytics algorithm identifies something similar, it will send a notification to the respective personnel.
3.Hea	hcare diagnosis
•	understanding the disease by providing an accurate diagnosis based on past data.
•	predictive analytics help doctors reach the root cause of diseases.
4.Carc	abandonment
•	predict how likely a customer is to abandon the cart.
•	It will also provide companies with details about each customer about whether they will purchase or abandon the cart based on the previous visits to the store.
5.Con	ent recommendation
•	entertainment companies can predict what users want to watch based on their history.
•	use analytics for predicting the user's behavior.

6. Equipment maintenance

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

Targeted Application & Tools that can be used

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

Project work/Assignment:

Project:

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

Assignment:

1. Review the article on Organisational capabilities in PA using PU link https://wwwemeraldcom-presiuniv.knimbus.com/insight/content/doi/10.1108/MD-03-2018-0324/full/html

2. Develop a podcast of 5 mins of each group discussions on Darkside of data mining. Each group consist of 5 members in the team

Text Book

1.Jeffrey Strickland, Predictive analytics using R, Simulation educators, Colorado Springs, 2015

2.Max Kuhn and Kjell Johnson, Applied Predictive Modeling, 1st edition Springer, 2013.

References

R1 Dinesh Kumar, U. (2021). Business Analytics: The Science of data-Driven Decision Making.

R2 Business Analytics - Data Analysis & Decision Making", S. Christian Albright and Wayne L. Winston, Cengage Publication, 5th Edition, 2012

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

2. **E book link R2:** Jing, Z., Luo, Y., Li, X., & Xu, X. (2022). A multi-dimensional city data embedding model for improving predictive analytics and urban operations. Industrial Management & Data Systems, (ahead-of-print). https://www-emerald-compresiuniv.knimbus.com/insight/content/doi/10.1108/IMDS-01-2022- 0020/full/html

3. **E book link R3:** Singh, R., Sharma, P., Foropon, C., & Belal, H. M. (2022). The role of big data and predictive analytics in the employee retention: a resource-based view. International Journal of Manpower. https://www-emerald-compresiuniv.knimbus.com/insight/content/doi/10.1108/IJM-03-2021- 0197/full/html

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

Web resources:

W1.https://www.sas.com/en_in/insights/analytics/predictive-analytics.html

W2. https://www.techtarget.com/searchbusinessanalytics/definition/predictive-analytics

W3. <u>https://www.cio.com/article/228901/what-is-predictive-analytics-transforming-</u> <u>data-</u> intofuture-insights.html

W4. https://www.simplilearn.com/what-is-predictive-analytics-article

W5. https://www.northeastern.edu/graduate/blog/predictive-analytics/

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

Swayam & NPTEL Video Lecture Sessions on Predictive Analytics

1. https://onlinecourses.swayam2.ac.in/imb20_mg19/preview

2. https://onlinecourses.nptel.ac.in/noc19_mg42/preview

Case References

- 1. Predictive Analytics Industry Use cases.
- 2. https://www.rapidinsight.com/blog/11-examples-ofpredictive-analytics/
- 3. Srinivasan Maheswaran (2017). Predictive Analytics Employee Attrition Case center.

Topics relevant to development of "Skill Development": ": Application of Business Analytics to enhances customer satisfaction and firms' success

Topics relevant to development of "Environment and sustainability: Focus on Predictive analytics to minimize the errors in decision making

Course Code: CSD200 2	Course Title: Applied Data Science Lab Type of Course: Program Core	L-T-P-C	0	0	2	
Version No.	1.0					<u>.</u>

Course Pre- requisite s	NIL
Anti- requisite s	NIL
Course Descripti on	The aim of the course is to give complete overview of Python's data analytics tools and techniques. Learning python is a crucial skill for many data science roles, and this course helps to understand and develop feature engineering. With a blended learning approach, Python for data science along with concepts like data wrangling, mathematical computing, and more can be learnt.
Course Objectiv es	The objective of the course is to familiarize the learners with the concepts of Applied 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: 5. Describe Numpy and Matrix Operations [Remember] 6. Summarize the need for data preprocessing and visualization techniques. [Understand] 7. Demonstrate the performance of different supervised learning algorithms [Apply] 8. Apply unsupervised learning algorithms for grouping the given data. [Apply]
Course Content:	List of Laboratory Tasks:1. Basic operations using Python2. Reading and writing different types of datasets.3. Descriptive statistics in python4. Visualizations5. Simple linear Regression6. Simple logistic Regression7. Decision trees classifier8. Support vector machine classifier9. Naive Bayes classifier10. Clustering model

Targeted Application & Tools that can be used:

- Anaconda- Jupyter Notebook
- Google-Colab

Project work/Assignment:

- 1. Design forest fire and wildfire prediction system.
- 1. Driver Drowsiness Detection System with OpenCV & Keras
- 1. Credit Card Fraud Detection using Python.

Textbook(s):

- 2. Data Science Using Python and R- Chantal D.L & Daniel T.L John Wiley & Sons, Inc. -2019
- 3. Applied Data Science with Python and Jupyter-Alex Galea, Packt Publishing, October 2018 Data Visualization in Python with Pandas and Matplotlib Paperback –DavidLandup, June 16, 2021

References:

1.Data Science with Python and Dask- Jesse Daniel,1st Edition,July30,2019

Weblinks:

- https://presiuniv.knimbus.com/user#/home
- Udemy: https://www.udemy.com/course/applied-data-science-with-python-specialization-mhm/
- NPTEL online course : https://nptel.ac.in/courses/106106179

Topics relevant to "SKILLS Development": Data Science, Decision Tree Algorithm for developing **Skills development** through **Experiential Learning techniques.** This is attained through assessment component mentioned in course handout.

Course Code: CSD1702	Course Title: Social Media Analytics Type of Course: Discipline elective Lab Integrated	L-T-P-C	0	0	2	1
Version No.	1.0					

Course Pre-	
requisites	
Anti-requisites	NIL
Course Description	This course provides a comprehensive overview of social media analytics, focusing on the techniques and tools used to analyze social media data. Students will learn how to collect, process, and analyze data from various social media platforms to extract valuable insights. The course covers topics such as big data collection, demographic analysis, web analytics, and the use of analytics tools to understand online customer behavior and make data-driven decisions.
Course Objectives	The objective of the course is to familiarize the learners with the concepts Social Media Analytics and attain Skill Development through Experiential Learning techniques.
	On successful completion of the Social Media Analytics course, students can expect to achieve the following outcomes:
Course Out Comes	CO1: Understand the fundamental concepts and importance of social media analytics in modern business contexts. [Remember]
	CO2: Effectively collect data from various social media platforms, ensuring they can gather relevant and accurate information. [Apply]
	CO3: Develop the ability to process and analyze social media data, transforming raw data into meaningful insights. [Apply]
	CO4: Acquire skills in visualizing data, enabling them to present findings in a clear and impactful manner. [Apply]
Course Content:	No. of Sessions: 15 (30 hours)
List of Programs	
Experiment 1:	
LO1: Python Prog	rams Dealing with structured Data
LO2: Python Prog	rams Dealing with Unstructured Data
Experiment 2:	

LO1: Python Programs for Data Integration

LO2: Python Programs for Outlier detection

Experiment 3:

LO1: Python Programs for Data transformation

LO2: Python Programs for Text cleaning

Experiment 4:

LO1: Python Programs Obtaining tokens

LO2: Programs for OAuth Authentication

Experiment 5:

LO1: Text classification using different

Classification Algorithms

LO2: Performance analysis of different classification algorithms

Experiment 5:

LO1: Text clustering using different Algorithms

LO2: Performance analysis of different clustering algorithms

Experiment 8:

LO1: Python program of individual behavior classification

LO2: Python program of individual Analysis

.Experiment 9:

LO1: Python program of collective behavior classification

LO2: Python program of collective behavior Analysis

Experiment 10:

LO1: Extracting my Facebook profile

LO2: Extracting friends' information from Facebook.

Experiment 11:

LO1: Perform a time frequency analysis of the posts extracted from Facebook page

LO2: Visualize the posts of Facebook page using word cloud

Experiment 12:

LO1: Python Programs for Extract Tweets from Home Timeline.

LO2: Retrieve tweets from a specific user timeline

Targeted Application & Tools that can be used:

Python Programming Language

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

Sentiment analysis of Facebook and Twitter data

Dataset resource link:

https://www.kaggle.com/datasets

REFERENCE MATERIALS:

i. Textbooks

T1. Mining the Social Web – Mathew A. Rusell, 3rd Edition, O'Reilly, 2019.

T2 : Python Social Media Analytics – Michal Krystyanczuk and Siddhartha Chatterjee, PacktPub, 2017.

ii. Reference Book(s)

R1. Charu C. Aggarwal, Social Network Data Analytics, Springer, 2011

R2:Mastering Social Media Mining with Python – Macro Bonzanini, PacktPub, 2016.

R3; Reza Zafarani Mohammad Ali Abbasi Huan Liu, Social Media Mining, Cambridge University Press, 2014

W1. NPTEL: https://onlinecourses.nptel.ac.in/noc21_cs28

W2. Coursera: <u>https://www.coursera.org/learn/social-media-data-analytics</u>

W3.Udemy:<u>https://www.udemy.com/course/introduction-to-social-analytHYPERLINK</u> "https://www.udemy.com/course/introduction-to-social-analytics/"ics/

W4. Others : <u>https://research.facebook.com/publications/realtime-data-processing-at-</u><u>facebook/</u>

Catalogue prepared	
by	
Recommended by	BOS NO: 17 th. BOS held on 22/12/22
the Board of	

Studies on	
Date of Approval by the Academic	Academic Council Meeting No.x , Dated xx/xx/23
Council	

Course Code: CSE3016	Course Title:CSE Fuzzy Logic Type of Course: Basket	23016 Neural Network Discipline Elective in A	s and AI & ML	L-T- P- C	3	0	0	3
Version No.	1.0				l		1	
Course Pre- requisites	NIL							
Anti-requisites	NIL							
Course Description	This course aims to introduce the basic concepts of Neural Networks and Fuzzy Logic. Neural networks reflect the behavior of the human brain, allowing computer programs to recognize patterns and solve common problems in the fields of AI, machine learning, and deep learning. Fuzzy Logic is a method of reasoning that resembles human reasoning. The approach of Fuzzy Logic imitates the way of decision-making in humans that involves all intermediate possibilities between digital values YES and NO. This course introduces fundamental concents in Neural Networks and Fuzzy Logic Theory.							
Course Objective	The objective of the course is to familiarize the learners with the concepts of Neural Networks and Fuzzy Logic and attain Skill Development through Participative Learning techniques.							
Course Outcomes	 On successful completion of this course the students shall be able to: Define the concept of Neural Networks. [Knowledge] Define the ideas behind most common learning algorithms in Neural Network.[Knowledge] Discuss the concepts of Fuzzy Sets and Relations. [Comprehension] Demonstrate the Fuzzy logic concepts and its applications.[Application] 							
Course Content:								
Module 1	Introduction to Neural Network	Quiz	Single L	ayer Per	ceptr	on	9Cla	isses
Topics: Introduction to NN: History, Artificial and biological neural networks, Artificial intelligence and neural networks. Neurons and Neural Networks: Biological neurons, Models of single neurons, Different neural network models. Single Layer Perceptron: Least mean square algorithm, Learning curves, Learning rates, Perceptron.								
Module 2	Perceptron	Quiz	Multilay	ver Perce	ptror	L	10 C	lasses

Topics:

Multilayer Perceptron: The XOR problem, Back-propagation algorithm, Heuristic for improving the back-propagation algorithm, Some examples.

Radial-Basis Function Networks: Interpolation, Regularization, Learning strategies.

Kohonen Self-Organising Maps: Self-organizing map, The SOM algorithm, Learning vector quantization.

	Fuzzy Sets,			
Module 3	Operations and	Quiz	Fuzzy Operations	10Classes
	Relations			

Topics:

Fuzzy Sets: Crisp Sets - an Overview, Fuzzy Sets - Definition and Examples, α - Cuts and its Properties, Representations of Fuzzy Sets, Extension Principles of Fuzzy Sets.

Fuzzy Operations: Operations on Fuzzy Sets - Fuzzy Complements, Fuzzy Intersections, Fuzzy Unions, Combinations of Operations, Aggregation Operations.

Fuzzy Relations: Binary Fuzzy relations, Fuzzy Equivalence Relations, Fuzzy Compatibility Relations.

Controller	Module 4	Fuzzy Logic and Fuzzy LogicAssignment Controller	Developing Fuzzy Logic Controller
------------	----------	--	--------------------------------------

Fuzzy Logic: Classical Logic, Multivalued Logic, Fuzzy Propositions, Fuzzy Quantifiers, Linguistic Hedges, Inference from Conditional Fuzzy Propositions, Conditional and Qualified Propositions and Quantified Propositions.

Fuzzy Controllers: An Overview, Fuzzification Module, Fuzzy Rule Base, Fuzzy Inference Engine, Defuzzification Module, An Example.

Targeted Application & Tools that can be used:

1. Python Libraries and Software (Eg., Tensorflow, Scikit-Learn etc.)

2. Matlab (Neural Network Toolbox, Fuzzy Logic Toolbox)

Project work/Assignment:

Students will have to do group assignments for Modules 2 & 4. As a part of their assignments, they will have to implement the solution to particular problems.

Textbook(s):

1. Haykin, Simon. "*Neural networks and learning machines*", 3/E. Pearson Education India, 2011. https://www.pearson.com/en-us/subject-catalog/p/Haykin-Neural-Networks-and-Learning-Machines-3rd-Edition/P20000003278/9780133002553

2. George J. Klir and Bo Yuan, "*Fuzzy Sets and Fuzzy Logic- Theory and Applications*", Prentice Hall of India, 2015.

https://www.worldcat.org/title/fuzzy-sets-and-fuzzy-logic-theory-and-applications/oclc/505215200

References:

1. Shivanandam, Deepa S, "*Principles of Soft computing*", N Wiley India, 3rd Edition, 2018.https://www.wileyindia.com/principles-of-soft-computing-3ed.html

2. Timothy J. Ross, "*Fuzzy Logic with Engineering Applications*", Third Edition, Wiley, 2011. https://onlinelibrary.wiley.com/doi/book/10.1002/9781119994374

3. Kumar S., "*Neural Networks - A Classroom Approach*", Tata McGraw Hill, 2nd Edition 2017.https://www.worldcat.org/title/neural-networks-a-classroom-approach/oclc/56955342

4. Fakhreddine O. Karray, and Clarence W. De Silva. "*Soft computing and intelligent systems design: theory, tools, and applications*". Pearson Education, 2009.

Weblinks

https://www.pearson.com/en-gb/search.html?q=Karray%20Soft-Computing-and-Intelligent-Systems-Design-Theory-Tools-and-Applications

Topics relevant to "Skill Development ": Assignment implementations in software, batch wise presentations are used for Skill Development through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Catalogue prepared by	Dr. S. Thiruselvan
Recommended by the Board of Studies on	BOS NO: 12th BOS, held on 04/08/2021
Date of Approval by the Academic Council	Academic Council Meeting No. 16, Dated 23.10.2021

Course Code: CSE390	Course Title: Front-end Full Stack Development	L-T- P- C	0	0	4	2
Version No.	1.0					
Course Pre-requisites	Nil					
Anti-requisites	NIL					
Course Description	This intermediate course enables students to perform front-end full stack development, with emphasis on employability skills. The course covers key technologies and architectures that enables the student to design and implement front-end. On successful completion of this course, the student shall be able to pursue a career in full-stack development. The students shall develop strong problem-solving skills as part of this course.					
Course Objectives	The objective of the course is to famili end Full Stack Development and att Learning techniques.	arize the learne tain Employat	ers w oility	ith th thro	ie con ugh (cepts Fron <mark>t</mark> experiential

Course Outcomes	On successful completion of the course the students shall be able to: Describe the fundamentals of DevOps and Front-end full stack development. [Comprehension] Illustrate a basic web design using HTML, CSS, Javascript. [Application] Illustrate development of a responsive web. [Application] Apply concepts of Angular.js to develop a web front-end. [Application]
Course Content:	
	Fundamentals of

Module 1	Fundamentals of DevOps	Project	Programming	04 Sessions
Topics				

Topics:

Introduction to Agile Methodology; Scrum Fundamentals; Scrum Roles, Artifacts and Rituals; DevOps – Architecture, Lifecycle, Workflow & Principles; DevOps Tools Overview – Jenkins, Docker, Kubernetes.

Review of GIT source control.

Module 2	Web Design & Development	Project	Programming	03 Sessions
-				

Topics:

HTML5 – Syntax, Attributes, Events, Web Forms 2.0, Web Storage, Canvas, Web Sockets; CSS3 – Colors, Gradients, Text, Transform;

Assignment: Develop a website for managing HR policies of a department.

Module 3	Responsive web design	Project	Programming	08 Sessions

Topics:

BootStrap for Responsive Web Design; JavaScript – Core syntax, HTML DOM, objects, classes, Async; Ajax and jQuery Introduction

Assignment: Design and develop a website that can actively keep track of entry-exit information of a housing society..

Module 4	Fundamentals of Angular.js	Project	Programming	15 Sessions

Topics:

Setting up Development & Build Environment: Node.js and NPM; Introduction to TypeScript; Working with OOP concepts with TypeScript; Angular Fundamentals; Angular CLI; Introduction to TypeScript; Debugging Angular applications; Components & Databinding in Depth; Angular Directives; Using Services & Dependency Injection; Angular Routing; Observables; Handling Forms in Angular Apps; Output transformation using Pipes; Making Http Requests; Authentication & Route Protection; Dynamic Components; Angular Modules & Optimizing Angular Apps; Deploying an Angular App; Angular Animations; Adding Offline Capabilities with Service Workers; Unit Testing in Angular Apps (Jasmine, Karma). Overview of React.js

Assignment: Develop a software tool to do inventory management in a warehouse.

Targeted Application & Tools that can be used:

Application Area is to Design and Analyzing the efficiency of Algorithms. This fundamental course is used by all application developers.

Professionally Used Software: GCC compiler.

Text Book:

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

References:

R1. Flanagan D S, "Javascript : The Definitive Guide" 7th Edition. 7th ed. O'Reilly Media; 2020.

Alex Libby, Gaurav Gupta, and Asoj Talesra. "Responsive Web Design with HTML5 and CSS3 Essentials", Packt Publishing, 2016

. Duckett J Ruppert G Moore J. "Javascript & Jquery : Interactive Front-End Web Development."; Wiley; 2014.

Web Reference:

/www.youtube.com/watch?v=JGNTYXkVCVY&list=PLd3UqWTnYXOkTSBCBNyyhxo_jxlY_uT WA&index=2

Web Reference: https://www.freecodecamp.org/news/frontend-web-developer-bootcamp/

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

https://nptel.ac.in/courses/106102064

Topics relevant to development of "Employability": DevOps Tools Overview – Jenkins, Docker, Kubernetes for developing Employability Skills through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

Catalogue prepared	Dr. Jayakumar V, Dr. M Chandrashekhar, Dr. Murali Parameswaran
by	
Recommended by the	BOS NO: 16th BOS held on 25.07.2022
Board of Studies on	
Date of Approval by	Academic Council meeting no. 18 dated 03.08.2022
the Academic	
Council	

Course Code: CSD1705	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	[1] Data Communication and Computer Networks (CSE2011)						
Anti-requisites	NIL						
Course Description	This course provides a hands-on comprehensive st capabilities across the various Cloud service models Service (IaaS), Platform as a Service (PaaS), and Soft dives into all of the details that a student needs to developing applications on the cloud and what to look or services hosted on a cloud.	udy of C including tware as a know ir for wher	loud Inf Ser ord usi	l co rastr vice der ng a	ncept ructur e (Saa to pla pplic	ts and re as a nS). It an for ations	

Course Objective	The course aims to impart knowledge to students that can provide easy, scalable access to computing resources and IT services.				
	using EXPERIENTIAL LE	CARNING techniques.	EMPLOYAE	SILITY SKILLS	
Course Outcomes	 Upon successful completio 1. Comprehend the si 2. Describe appropria infrastructures 3. Apply Cloud mech 4. Interpret recent text 	n of the course, the stud gnificance of Cloud con te Virtualization technic anisms to optimize the o chnologies on Cloud	ents shall be a nputing techno ques to virtuali QoS parameter	ble to: blogies ze rs	
Course Content:		1	1		
Module 1	Introduction to Cloud Services	Assignment	Theory	No. of Hours:10 (Theory: 6, Lab:4)	
Topics: A Facility for From Multiple Core Server Computers, Architecture JaaS J	or Flexible Computing, The s to Multiple Machines, Fro The Economic Motivatior PaaS, SaaS, Types of Clouds	Start of Cloud: The Po m Clusters to Web Sites for a Centralized Da and Cloud Computing	ower Wall and and Load Bala ta Center, Cl Environment	Multiple Cores, ancing, Racks of oud Computing	
Module 2	Virtualization Techniques	Lab-based Assignments	Theory	No. of Hours:10 (Theory: 6, Lab:4)	
Topics: Basics of V Implementation Lev	irtualization - Types of Virtu els of Virtualization.	ializations, Taxonomy o	f Virtualizatio	n Techniques,	
Module 3	QoS and Management	Application Development	Theory	No. of Hours:10 (Theory: 6, Lab:4)	
Topics: Quality of Agreements (SLAs) development in the	Service (QoS) in the Clou , Specialized Cloud Mecha Cloud	id, Cloud Infrastructure nisms, Cloud Managen	e Mechanisms nent Mechanis	, Service Level sms, Application	
Module 4	Security and advancements	Case Study	Case Study	No. of Hours:10 (Theory: 6, Lab:4)	
Topics: The Zero T Technologies And Environment, Appli Dew Computing, Ca	Trust Security Model, Identi Their Effect on Security cation development in Clou ase Studies, and Recent Adv	ity Management, Privile , Protecting Remote A d, Latest trends in Cloud ancements	eged Access M Access, Priva d Computing,	Management, AI cy in a Cloud Fog Computing,	
Targeted Application	ns & Tools that can be used:				
Targeted Application Developing applicat Cloud Tools: • VMWare • Amazon EC • Google Con	ns: tions on Cloud Platforms via 22 npute Engine	Virtual machines			

• 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:

litle
Install Virtualbox/VMware Workstation with different flavors of Linux or Windows OS on top of windows 11
Install a C compiler in the virtual machine created using a virtual box and execute Simple Programs.
Install Google App Engine (GAE). Create a "hello world" application and other simple web applications using python/java
Use GAE launcher to launch the web applications.
Simulate a cloud scenario using CloudSim and run a scheduling algorithm
Find a procedure to transfer the files from one virtual machine to another virtual machine.
Find a procedure to launch a virtual machine using Openstack
Demonstrate Migration, Cloning, and Snapshots within and across VMs
Demonstrate on the Virtual Environment on hypervisor. a) Communication between the VM's.
b) The backup and restore mechanism.
Implement and Evaluate the performance of MapReduce program on word count for different
file size.

Text Book(s)

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

References

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

2. Thomas Erl, Zaigham Mahmood, and Ricardo Puttini, "Cloud Computing Concepts, Technology & Architecture", PHI publisher 2013 edition.

3. Anthony T Velte, Toby J Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", Tata McGraw-Hill, 2010 edition.

4. David E.Y. Sarna, "Implementing and Developing Cloud Applications", CRC Press, 2018 edition.

5. Man Technologie	vi, Sunilkumar, and G s". CRC Press, 2021.	Gopal K.	Shyam.	"Cloud	Computing:	Concepts	and
Web Resources and I	Research Articles links:						
6. IEEI https://ieeex	E Transactions on Cloud plore.ieee.org/xpl/Recent	Computin tIssue.jsp?	g- punumbe	er=62455	<u>19</u>		
7. Inte https://www. 8. Clou plus/latest/or 9. Jour https://www	rnational Journal of Clou inderscience.com/jhome idSim Resources- https:// rg/cloudbus/cloudsim/res nal of Network and Com journals.elsevier.com/jou	ud Compu e.php?jcodo /javadoc.ic sources/cla nputer Netw urnal-of-no	ting- e=ijcc o/doc/org ss-use/Ro working- etwork-ar	.cloudsin esource.h	nplus/cloudsi html uter-applicatio	m- ons	
Catalogue prepared by	Dr. Gopal K. Shyam						
Recommended by the Board of Studies on	BOS NO: SOCSE 2 nd BC	OS held o	n 10/07,	/23			
Date of Approval by the Academic Council	Academic Council Me	eting No	21, Date	ed 06/09	/2023		

Course Code: CSE3035	Course Title: R Pro	gramming for Data S	Science L-T- P	- C 1 0 4 3
	Type of Course: Pro	ogram Core		
	Lab Integrated Cou	irse		
Version No.	1.0			
Course Pre- requisites	Nil			
Anti-requisites	Nil			
Course Description	R Programming cleansing, transf discovering usefu The course begin transformation. I intuitive way to a to apply the know applications	for Data Science forming, and modul information, and s by covering Data t delivers the bas nalysis the data. The powledge on Data	e is designed leling data wit d supports in de extraction, pre- sic statistics and his course will h Analytics to a	for inspecting, h the goal of ecision-making. processing, and d taught in an elp the students wide range of
Course Objective	The objective of the objective of the objective of the objective of the of R Programming Problem Solving M	e course is to familia g for Data Science a lethodologies.	rize the learners w and attain Emplo	vith the concepts yability through
Course Out Comes	On successful com 1) Describe the R 2) Generalize the 3) Demonstrate th 4) Apply the proba data.[Application]	pletion of the course programming for I appropriate visuali he various statistica ability and complex	the students shall Data Analytics.[K zation methods.] I testing methods distribution fun	be able to: [nowledge] Comprehension] [Application] ctions for the analysis of
Course Content:				
Module 1	Introduction toC R Programming	Case studies	Programming	8 Sessions
R Studio: Base R calculator-Scripts Exporting Data-M elements-Renami Columns-Orderin	-R Studio IDE-Int and Comments-R fore ways to save- ng Columns-Subs g Columns - Orde	troduction to R Pro Variables. Data I/O Data I/O in Base R. setting Columns - ering Rows	jects and R Mar D: Working Direct Subsetting Data Subsetting Row	kdown. Basic R: R as a ctories-Importing Data- in R: Selecting specific /s – Adding/Removing
Module 2	Data Analysis Ca	ase studies	Programming	10 Sessions
Data Summariza Dimensional Dat Missing Data-Str Merging Datasets	tion: One Quan a Classes-Data F ings and Recodin . Data Visualization	titative and Cate rames and Matric ng Variables. Mani ons: Plotting with g	gorical Variable es-Lists. Data C pulating Data in gplot2- Plotting	e. Data Classes: One Cleaning: Dealing with n R: Reshaping Data- 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 4SimulationsCase studiesProgramming10 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:

- a. create a new variable called my.num that contains 6 numbers
- b. multiply my.num by 4
- c. create a second variable called my.char that contains 5 character strings
- d. combine the two variables my.num and my.char into a variable called both
- e. what is the length of both?
- f. what class is both?
- g. divide both by 3, what happens?

Level 2:

- a. create a vector with elements 1 2 3 4 5 6 and call it $\scriptstyle \times$
- b. create another vector with elements 10 20 30 40 50 and call it $_{\mathbb{Y}}$
- c. what happens if you try to add \times and γ together? why?
- d. append the value 60 onto the vector y (hint: you can use the c() function)
- e. add x and y together
- f. multiply \times and $_{\rm Y}$ together. pay attention to how R performs operations on vectors of the same length.

Exp 2.

Level 1:

a. Read in the Youth Tobacco study, Youth_Tobacco_Survey_YTS_Data.csv and name it youth.

b. 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:

a. 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.

b. Write out the mon R object as a CSV file using readr::write_csv and call the file "monuments.csv".

c. Write out the mon R object as an RDS file using readr::write_rds and call it "monuments.rds".

Exp 3:

Level 1:

a. Check to see if you have the mtcars dataset by entering the command mtcars.

b. What class is mtcars?

c. How many observations (rows) and variables (columns) are in the mtcars dataset?

d. Copy mtcars into an object called cars and rename mpg in cars to MPG. Use rename().

e. Convert the column names of cars to all upper case. Use rename_all, and the toupper command (or colnames).

f. 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().

g. 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:

a. Convert the column names of carsSub to all upper case. Use rename_all(), and toupper() (or colnames()).

b. Subset the rows of cars that get more than 20 miles per gallon (mpg) of fuel efficiency. How many are there? (Use filter().)

c. 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().)

d. 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?

e. Re-order the rows of carsSub by weight (wt) in increasing order. (Use arrange().)

f. Create a new variable in carsSub called wt2, which is equal to wt^2, using mutate() and piping %>%.

Exp 4:

Level 1:

a. How many bike lanes are currently in Baltimore? You can assume that each observation/row is a different bike lane.

b. How many (a) feet and (b) miles of total bike lanes are currently in Baltimore? (The length variable provides the length in feet.)

c. How many types (t_{ype}) bike lanes are there? Which type (a) occurs the most and (b) has the longest average bike lane length?

Level 2:

a. How many different projects (project) do the bike lanes fall into? Which project category has the longest average bike lane length?

b. 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.)

c. Numerically and graphically describe the distribution of bike lane lengths (length).

d. 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:

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

b. 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.

c. 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:

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

b. Reassign dateInstalled as a factor, using the default levels. Run head(bike\$dateInstalled).

c. Do not reassign dateInstalled, but simply run

head (as.numeric (bikedateInstalled)). We are looking to see what happens when we try to go from factor to numeric.

d. 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:

a. "2014/02-14"

b. "04/22/14 03:20" assume mdy

c. "4/5/2016 03:2:22" assume mdy

Exp 6:

Level 1:

a. 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.

b. 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.

c. 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().

d. 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 ==.

e. 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).

f. Read the Property Tax data into R and call it the variable tax.

g. How many addresses pay property taxes? (Assume each row is a different address.)

h. 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.

i. Using table() or group by and summarize(n()) or tally().

a. How many observations/properties are in each ward (Ward)?

b. What is the mean state tax per ward? Use group by and summarize.

c. What is the maximum amount still due (AmountDue) in each ward? Use group by and summarize with 'max'.

d. What is the 75th percentile of city and state tax paid by Ward? (quantile)

j. 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:

a. Subset the data to only retain those houses that are principal residences. Which command subsets rows? Filter or select?

a. How many such houses are there?

b. Describe the distribution of property taxes on these residences. Use

hist/qplot with certain breaks or plot (density (variable)).

b. 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.

c. Make a data set called trans which contains only agencies that contain "TRANS".

d. What is/are the profession(s) of people who have "abra" in their name for Baltimore's Salaries? Case should be ignored.

e. 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.

f. 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.

g. 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?

h. 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.

i. (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:

a. Read in the Bike_Lanes_Wide.csv dataset and call is wide.

b. 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.

c. Read in the roads and crashes .csv files and call them road and crash.

d. Replace (using str_replace) any hyphens (-) with a space in crash\$Road. Call this data crash2. Table the Road variable.

e. How many observations are in each dataset?

f. 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.

g. Which and how many years were data collected in the crash dataset?

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

Level 2:

a. Keep rows where the record is not missing type and not missing name and re-assign the output to bike.

b. 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 length to the length variable). Call this data set sub.

c. 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).

d. 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?

e. Join data using a full_join. Call the output full. How many observations are there?

f. Do a left join of the road and crash. ORDER matters here! How many observations are there?

g. Repeat above with a right_join with the same order of the arguments. How many observations are there?

Exp 8

Level 1:

a. Plot average ridership (avg data set) by date using a scatterplot.

- a. Color the points by route (orange, purple, green, banner)
 - b. Add black smoothed curves for each route
 - c. Color the points by day of the week

b. Replot 1a where the colors of the points are the name of the route (with banner -> blue)

pal = c("blue", "darkgreen","orange","purple")

c. Plot average ridership by date with one panel per route

Level 2:

a. Plot average ridership by date with separate panels by ${\tt day}$ of the week, colored by ${\tt route}$

b. 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.

c. 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:

a. 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".

b.

a. Compute the correlation between the Myanmar, China, and United States mortality data. Store this correlation matrix in an object called country_cor
b. Extract the Myanmar-US correlation from the correlation matrix.

c. 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:

a. 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.

b. 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).

c. 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:
 - a. takes two numbers x and y with default values of 2 and 3.
 - b. takes the difference
 - c. squares this difference
 - d. then returns the final value
 - e. 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. a normal distribution with mean 0 and variance 1. (see norm)
- b. a normal distribution with mean 1 and variance 1. (see rnorm)
- c. 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 σ/\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.

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

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

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

d. 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

1. 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.

 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"

Catalogue	Dr. R Vignesh and Dr. A Jayachandaran
prepared by	
Recommended	BOS NO: SOCSE 2 nd BOS held on 10/07/23
by the Board of	
Studies on	
Date of	Academic Council Meeting No 21, Dated 06/09/2023
Approval by the	

Academic								
Council								
Course Code:	Course Title: Appli	ed Machine Learnir	ıg					
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CSE3087	Type of Course: 1] 2]	Program Core Laboratory integrat	ed	L-T- P- C	2	02	2	3
Version No.	1.0				. <u> </u>			
Course Pre-	CSE3001 Artificial I	ntelligence and Ma	chine l	Learnin	g			
requisites		U U			0			
Anti-requisites	NIL							
Course	Machine Learning a	achine Learning algorithms are the key to develop intelligent systems						
Description	such as Apple's Siri	ch as Apple's Siri, Google's self-driving cars etc. This course introduces						
	the concepts of the	e concepts of the core machine learning techniques such as Regression						
	learning, Bayesian	learning, Ensembl	e learı	ning, I	Percept	ron	lea	rning,
	Unsupervised learr	ning, Competitive le	earning	g, learr	ing fr	om	Ga	ussian
	mixture models and	learning to detect or	utliers.	Course	lectur	es c	over	's both
	the theoretical four	ndations as well as	the e	ssential	algor	ithn	ns f	or the
	various learning me	thods. Lab sessions c	omplei	ment th	e lectu	res a	and	enable
	the students in deve	loping intelligent sy	stems f	or real	life pro	oble	ms.	4
Course	This course is design	ed to improve the le	arners	<u>'EMPL</u>	<u> </u>	LIT	YS	<u> (ILLS'</u>
Objectives	by using <u>EXPERIEN</u>	TIAL LEARNING t	echniq	ues. Th	e supe	rvis	ed l	hands-
	on laboratory exerci	ises, assessments an	d the g	group p	rojects	fac	ilita	te this
	learning process.		-					
Course Out	On successful comp	letion of the course t	the stuc	dents sh	all be a	able	e to:	
Comes	[] Apply advanced s	supervised machine	learnır	ng meth	ods foi	r pr	edic	tive
	modeling. [Applicat	10n]	1. 1		-1:	(-		
	2] Produce machine	learning models wit	th bette	er predi	ctive p	errc	orma	ince
	using meta learning	modele using Denoe						
	b] Create predictive	inodels using Percep	ptron le	earning				
	4] Employ advanced	lunsupervised learn	ing alo	orithm	s for cl	11cta	orina	T
	competitive learning	and outlier detection	n[Anr	lication		usu	-1112	51
	5] Implement machi	ne learning based in	telliger	nt mode	u als msir	ισ Ρ	wthe	m
	libraries [Application]	nl	item gei	in mou	210 u 011	·6 ·	yun	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
	inoraneo. [rippileade	,,						
Course Content:								
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Module 1	Joaming	Assignment	Fiogra Koroc /	'Sldoom	using	O	f Cl	asses
	Learning		Relas/	Skiedii	L	L	-7]	P - 12
Topics: An ove	rview of Machine I	earning(ML); ML v	workflo	w; typ	es of l	ML;	Ty	pes of
features, Feature	Engineering -Data I	mputation Methods;	Regre	ssion –	introd	ucti	on; s	simple
linear regression	, loss functions; Po	olynomial Regressio	on; Lo	gistic I	Regress	sion	; Sc	oftmax
Regression with	cross entropy as co	ost function; Bayes	sian Lo	earning	, – Ba	yes	The	eorem,
estimating condit	ional probabilities fo	r categorical and cor	ntinuou	ıs featu	res, N	aïve	e Bay	yes for

supervised learning; Bayesian Belief networks; Support Vector Machines – soft margin and kernel tricks.

Module 2	Ensemble Learning	Assignment	Programming using Keras/Sklearn	No. of Classes L-3 P-4
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Topics: **Ensemble Learning** – using subset of instances – Bagging, Pasting, using subset of features –random patches and random subspaces method; Voting Classifier, Random Forest; Boosting – AdaBoost, Gradient Boosting, Extremely Randomized Trees, Stacking.

Module 3	Perceptron Learning	Assignment /Quiz Kera	gramming using ns/Sklearn I-7 P-2
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Topics: **Perceptron Learning** – from biological to artificial neurons, Perceptrons, Linear Threshold Units, logical computations with Perceptrons, common activation functions – sigmoid, tanh, relu and softmax, common loss functions, multi-layer Perceptrons and the Backpropagation algorithm using Gradient Descent.

Module 4	Unsupervised Learning	Assignment	Programming using Keras/Sklearn	No. of Classes L-6 P -6
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Topics: Unsupervised Learning - simple k Means clustering- simple and minibatch; updating centroids incrementally; finding the optimal number of clusters using Elbow method ; Silhoutte coefficient, drawbacks of kMeans, kMeans++ ; Divisive hierarchical clustering _ bisecting k-means, clustering using Minimum Spanning Tree (MST) Competitive Learning - Clustering using Kohenen's Self Organising Maps (SOM), Density Based Spatial Clustering - DBSCAN; clustering using Gaussian Mixture Models (GMM) with EM algorithm ; Outlier Detection methods - Isolation Forest, Local Outlier Factor(LOF)

List of Laboratory Tasks:

Experiment N0 1: Methods for handling missing values

Level 1: Given a data set from UCI repository, implement the different ways of handling missing values in it using Scikit-learn library of Python **Level 2:** Implement one of these methods using a custom defined function in Python.

Experiment No. 2: Data Visualization

Level 1 Perform Exploratory Data Analysis for a given data set by creating Scatter Plot, Pair Plot, Count Plot using Matplotlib and Seaborn **Level 2** Create Heat Maps, WordCloud

Experiment No. 3: Regression learning

Level 1 Given a data set from UCI repository, implement the simple linear regression algorithm and estimate the models parameters and the performance metrics. Plot the learning curves.

Level 2 Implement the polynomial regression algorithm. Compare the learning curves of Polynomial and Linear Regression.

Experiment No.4: Logistic regression

Level 1 Write custom code for generating the logistic/sigmoid plot for a given input **Level 2** Given a data set from UCI repository, implement the Logistic regression algorithm. Estimate the class probabilities for a given test data set. Plot and analyze the decision boundaries.

Experiment No.5: Bayesian Learning

Level 1 Given a data set from UCI repository, implement a classification model using the Bayesian algorithm

Experiment No.6: Support Vector Machine(SVM)

Level 1 Given data sets from UCI repository, implement a linear SVM and a non-linear SVM based classification model.

Experiment No. 7: Ensemble Learning

Level 1 : Implement Ensemble Learning algorithms such as Bagging, Pasting and Out-of Bag Evaluation

Level 2 : Random Patches and Random Subspace Method

Experiment No. 8: Ensemble Learning

Level 1 : AdaBoost and Gradient Boosting, Stacking

Experiment No. 9: Perceptron Learning

Level 1 : Implement the Perceptron Classifier

Level 2 : - An Image Classifier Using the Sequential API of Keras

Experiment No. 10: Unsupervised Learning

Level 1 : K-means – simple and mini-batch. Finding the optimal number of clusters using Elbow method and Silhoutte Coefficient . Compare the inertia of both as k increases. Tuning the hyperparameter 'k' using GridSearchCV.

Level 2 : - Using clustering for Image segmentation and Preprocessing. Kmeans++

Experiment No. 11: Density Based Clustering

Level 1 Implement DBSCAN – clustering using the local density estimation. Perform hard and soft clustering for new instances.

Experiment No. 12: Outlier Detection

Level 1 Outlier Detection using Isolation Forest and Local Outlier Factor

Targeted Application & Tools that can be used :

1. Execution of the ML algorithms will be done using the Google's cloud service namely "Colab", available at <u>https://colab.research.google.com/</u> or Jupyter Notebook.

2. The data sets will be from the bench marking repositories such as UCI machine learning repository available at : <u>https://archive.ics.uci.edu/ml/index.php</u>

3. Laboratory tasks will be implemented using the libraries available in Python such as Scikit learn, matplotlib, seaborn, perceptron and the deep learning framework namely Keras.

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

Students can be assigned a mini project to develop a machine learning application for reallife problems in various domains such as health care, business intelligence, environmental modeling, etc.

Text Book

There are a number of useful textbooks for the course, but each cover only a part of the course syllabus. Following is an indicative list of textbooks.

1. Aurélien Géron, "Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow", Oreilly, Second Edition, 2019.

2. Andreas C Muller, Sarah Guido, "Introduction to Machine Learning with Python :A Guide for Data Scientists", Oreilly, First Edition, 2018

3. Giuseppe Bonaccorso, "Machine Learning Algorithms: A reference guide to popular algorithms from data science and machine learning", Packt Publishing, 2017.

References In references apart from the books and web links, mention a few standards &Hand books relevant to the Laboratory tasks used by the professionals.

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

2. https://towardsdatascience.com/machine-learning/home

3. MITopencourseware:<u>https://ocw.mit.edu/courses/6-0002-introduction-to-computational-thinking-and-data-science-fall-2016/resources/lecture-11-introduction-to-machine-learning/</u>

4. <u>https://onlinecourses.nptel.ac.in/noc21_cs85/preview</u>

Dr J Alamelu Mangai
BOS NO: SOCSE 2 nd BOS held on 10/07/23
Academic Council Meeting No 21, Dated 06/09/2023
]

Course Code: UG COURSE:	Course Title: Robotic Vis	ion					
CSE3107	Type of Course: Program embedded lab	L~T~ P~ C	2	0	23	3	
Version No.	1.0						
Course Pre- requisites	MAT1001~ Calculus and Techniques, Partial Diffe	d Linear Algebra, <i>N</i> erential Equations a	MAT1002 ~ nd their Ap	Trans plicati	sfor ons	m	
Anti-requisites	NIL						
Course Description	This Course is an introduction to Robotic vision and image analysis techniques and concepts. Robotic vision has found much wider applications not only in the space program, but also in the areas such as medicine, biology, industrial automation, astronomy, law enforcement, defense, intelligence. With the progress made AI Robotics these days, Robotic vision has become an indispensable part of our digital age. This course includes Fundamentals, Applications, Human Visual Perception, Image Formation, Sampling and Quantization, Binary Image, Three-Dimensional Imaging, Image file formats. Color and Color Imagery: Perception of Colors, Image Transformation: Fourier Transforms, Image Enhancement and Restoration, Image Reconstruction, Image Segmentation, Visual based Servoing, Object detection.						
Course Objective	The objective of the course is to familiarize the learners with the concepts of Robotic Vision Employability through Problem Solving Methodologies.						
Course Out Comes	 On successful completion of the course the students shall be able to: Explain the fundamentals of Robotic vision and its processing. [Understanding] Utilize image enhancement techniques in spatial and frequency domain. [Application] Apply the mathematical modeling of image degradation and restoration. [Application] Apply the concept of image 						
Course		[Дрри	cation				
Content:		1	1		1		
Module 1	Introduction to Robotic Vision	Assignment	Practical			No Clas	o. of sses:8
Overview of computer vision and its applications in robotics, Introduction to robotic perception and the role of vision sensors, Challenges and limitations of robotic vision systems Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Classification of images, Some Basic Relationships between Pixels Linear and Nonlinear Operations					ion ng and onships		
Module 2	Image Transformation:	Assignment	Practical			No Clas	o. of sses:8
Image enhanceme Smoothing and SI Image enhanceme domain filters. He	ent in spatial domain: Some harpening spatial filters. ent in frequency domain:	basic gray level trans 1D FFT, 2D FFT, Smo	formations,	Histogi Sharpe	ram ning	pro 3 fre	cessing, quency
Module 3	Image Restoration	Assignment	Practical			No Clas	o. of sses:8

A model of the properties of	ne image restoration noise, some importat	and degra nt probabi	dation process, lity density fund	Noise models – spat ctions: Gaussian nois	ial and frequency se, Rayleigh noise,
Gamma noise	, exponential, unifor	m, impuls	se noise, Periodi	c noise Restoration i	in the Presence of
Noise Only us	ing Spatial Filtering a	ind Freque	ency Domain Filt	ering.	No of
Module 4	Ethics	ation and	Assignment	Practical	Classes:6
Point, Line, ar Color image p Morphologica Basic Morpho Ethical and S concerns and	nd Edge Detection, The processing: Color Fund Il Image Processing: F logical Algorithms. Social Implications: data protection, Social	resholding damentals, reliminari Ethical con al impact a	g, Region-Based Color Models, I les, Erosion and siderations in ro nd implications	Segmentation, Pseudo color Image P Dilation, Opening an Obotic vision applicati of robotic vision tech	rocessing. Id Closing, Some ons, Privacy nologies
Lab Experi	ments are to be c	onducte	ed on the follo	owing topics:~	
1. Simulation Session)	n and Display of an I	nage, Nega	ative of an Imag	e (Binary & Gray Sca	le(One Lab
a) Rec	l Blue and Green and	Gray Com	ponents		(Level
b) D c) Si	isplay color Image, fir mulation of an Image	nd its com	plement and cor tic & Logic Oper	<pre>ivert to gray scale</pre>	(Level 1) (Level
2. Implement Session)	ation of Relationships	s between	Pixels		(One Lab
a.	find Neighbour of	a given Pix	tel (Leve)	(1)	
b.	4 Point Neighbour		、	(Level 1)	
<i>c</i> .	8 Point Neighbour			(Level 2)	
d	Diagonal Neighbou	ır		(Level 2)	
Lab Sheet	2: ation of Transformat	ions of an I	Image		(One Lab
a.	Scaling & Rotation				(Level
1) b. 2)	Gray level transfor	mations, p	ower law, logar	ithmic, negative	(Level
4. Contr	ast stretching of a lov	v contrast	image, Histogram	m, and Histogram Eq	ualization. (One Lab
5. Displa	n) (Level 2) av of bit planes of an 1	Image.			(One Lab Session)
(Level 2) 6. Implement (Level 2)	ation of Image Intens	sity slicing	technique for in	nage enhancement	(One Lab Session)
Lab Sheet	<u>3:</u>				
Session) (Level 8. Computati	111 (1~D & 2~D) of 8 [2) on of mean. Standard	In image. <u>-</u> Deviation	. Correlation co	efficient of the given	Image.
	,		,	- 0	0

		(One Lab
Session) (Level 2)	- Church Current and Different Martin and Min Mart	6:11
9. Implementation Image)	n of Image Smoothening Filters(Mean, Median and MinMax	filtering of an
		(One Lab
Session) (Level 2)	on of image champening filters and Edge Detection using Cra	diant Filtan
io. Implementati	on of image sharpening inters and lage Detection using Gra	(One Lab
Session) (Level 2)		
Lab Sheet 4:		
11. Canny edge d	etection Algorithm	(One Lab
Session) (Level 2)	ological operations opening closing erosion dilation	(Two Lab
Sessions) (Level 2)		
13. Image segmen	tation by region growing split and merge algorithm	_(Two Lab
Sessions) (Level 2)		
Tools/Software I	Required:	
1. OpenCV	4	
2. Python 3.	7	
3. MATLAB		
Text Books		
1. Rafael C.	Gonzalez and Richard E. Woods' "Digital Image Processing", J	Fourth Edition, Global
Ealtion 2018.		
1.	Perter Corke, "Robotics, Vision and Control: Fundar	nental Algorithms in
MATLAB"	, 2nd Edition, Springer, 2017	0
2.	Ravishankar Chityala, Sridevi Pudipeddi, "Image Proce	ssing and Acquisition
Using Pyth	10n", Taylor & Francis, 2020. Jason M. Kinser, "Image Operators: Image Processing i	n Puthon" CPC Pross
2018.	Jason W. Kinser, mage Operators, mage riccessing i	fright, exericss,
4.	TinkuAcharya and Ajoy K. Ray, "Image Process	sing Principles and
Applicatio	ns", John Wiley and Sons publishers.	-
Catalogue	1 Mr Vamananna	
prepared by	1. Mit. Tuilianappa	
Recommended	BOS NO: SOCSE 2 nd BOS held on 10/07/23	
by the Board of		
Studies on		
Approval by the	Academic Council Meeting No 21, Dated 06/09/2023	
Academic		
Council		

Course Code: CSE3155	Course Title: Dat Computer Netwo Type of Course: H Laboratory integ	a Communications rks Program Core The rated	s and ory–	L-T-P- C	3	0	2	4
Version No.	1.0			1				
Course Pre- requisites	Digital Design							
Anti-requisites	NIL							
Course Description	The objective of th and computer netw practical experience LAN systems The associated lab networks using Cis the fundamentals on network traffics.	ne objective of this course is to provide knowledge in data communications id computer networks, its organization and its implementation, and gain factical experience in the installation, monitoring, and troubleshooting of AN systems the associated laboratory is designed to implement and simulate various etworks using Cisco packet tracer, NS2. All the lab exercises will focus on the fundamentals of creating multiple networks, topologies and analyzing the etwork traffics.						
Course Objective	The objective of the Communications ar Problem Solving Me	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							
Course Content:								
Module 1	Introduction and Physical Layer- CO1	Assignment	Problem So	lving	0	07 C	Class	es
Introduction to Topologies, Tran Physical Layer Multiplexing and	Computer Networ smission Media – -Analog and Digit d Spread Spectrum.	ks and Data comm Reference Models -C al Signals – Digital	nunications, DSI Model – and Analog	Networ TCP/IP Signals	k (Su	Con ite. Frai	npon nsmi	ents – ssion -
Module 2	Reference Mod and Data Link Layer – CO2	els Assignment	Proble Solvir	em 1g	7	Cla	asses	5

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.

Tra Module 4 Appl	ansport and lication 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

1. Problem Solving: Choose and appropriate devices and implement various network concepts.

2. **Programming: Simulation of any network using NS2.**

Text Book 1. Behrouz A Tata McGraw 2. Andrew S Networks" Six References 1. "Compute Kurose, Keith W. 2. William S Education 2007	. Forouzan, "Data Communications and Networking 5E", 5 th Edition, -Hill, 2017. Tanenbaum, Nick Feamster & David J Wetherall, "Computer Ath Edition, Pearson Publication, 2022 r Networking: A Top-Down Approach", Eighth Edition, James F. Ross, Pearson publication, 2021. Stallings, Data and Computer Communication, 8th Edition, Pearson
3. Larry L. Approach, 4th Ed	Peterson and Bruce S. Davie: Computer Networks – A Systems lition, Elsevier, 2007.
1. <u>https://archive.i</u> 2. <u>http://www.npt</u> 3. <u>https://www.you</u> 4. <u>https://www.you</u> 5. <u>https://www.dig</u> https://puniversity.	nptel.ac.in/courses/106/105/106105183/ elvideos.com/course.php?id=393 itube.com/watch?v=3DZLItfbqtQ itube.com/watch?v= fIdQ4yfsfM gimat.in/keyword/106.html informaticsglobal.com/login
Catalogue prepared by	Prof. Dr.A.VIJAYAKUMAR
Recommended by the Board of Studies on	BOS NO: SOCSE 2 nd BOS held on 10/07/23
Date of Approval by the Academic Council	Academic Council Meeting No 21, Dated 06/09/2023

Course Code:	Course Title: Medical	Image Processi	ng				
CSE 5020	Type of Course: Discip Theory and Lab Integr	line Elective rated		L- T-P- C	2 0	2	3
Version No.	2.0						
Course Pre- requisites	 Python program OpenCV library Basics of digital	ning language image processir	ng				
Anti-requisites	NIL						
Course Description	The course introduces the basics to advance the implementation of biomedical images such as MRI, CT, X-ray, etc. Here we will be studying about complete basics of theical image processing and then moving forward we will be learning about the various filters and feature extraction techniques. This course also teaches the segmentation and restoration techniques in depth along with the practical implementation						
Course Objective	The objective of the cou PARTICIPATIVE LEAR	The objective of the course is SKILL DEVELOPMENT of student by using PARTICIPATIVE LEARNING techniques.					
Course	On successful completion	on of the course,	the students	shall be a	ble	to:	
Outcomes	 CO 1: understand digital image processing using OpenCV and Python programming language. CO 2: Demonstrate image enhancements for Filter and feature extraction of statistical measurement. CO 3: Implement deep learning techniques for image restoration and segmentation. CO 4: Experiment with soft computing techniques for content-based medical image retrieval 						
Course Content:							
Module 1	Digital image processing	Assignment	Image proces	sing	Se	10 essic	ons
Introduction: What is an image, Digital image, Image resolution, and aspect ratio, components of digital image processing, sampling, and quantization, applications areas, vision fundamentals, CAD systems, research areas of digital image processing. Biomedical image processing: various modalities of medical imaging: breast cancer imaging, mammographic imaging, ultrasound imaging, magnetic resonance imaging(MRI), and breast thermography imaging. Problems with medical images, image enhancement, and other modalities of medical imaging.							
Module 2	Filters and feature extraction	Use case study	Feature extra	ction	Se	10 essic	ons

Noise reduction filters for medical imaging: sources of noise and filters used for noise reduction, spatial domain filters, frequency domain filters, practical results. Feature extraction and statistical measurement: selection of features, shape-related features, Fourier descriptors, text analysis.

Madula 3	Image	restoration	and Λ	ssignmont	Segmentation	8 Sossions
widule 5	segmer	ntation	A	assignment	Segmentation	0 565510115

Medical Image restoration: Image resolution, degradation model, estimation of degradation function, blur model, medical image restoration, blur identification, super-resolution method. **Biomedical image segmentation:** Broad classification and applications, point detection, line detection, edge detection methods, histogram-based image segmentation, segmentation using split and merge method, region growing method, watershed method, k-means clustering method, self-similar fractal method, topological derivative-based segmentation, comparison of segmentation methods.

Module 4	Soft computing techniques and content-based image	use case study	Content retrieval	based	imge	10 Sessions
	retrieval					

Soft computing techniques: Fuzzy-based techniques, Neural network-based techniques ,genetic algorithm-based techniques. **Content-based image retrieval:** Content-based image retrieval (CBIR): Visual connect descriptors, shape similarity measure, relevance feedback, distance measureand s, challenges,**Content-based medical image retrieval (CBMIR):** Challenges in implementation of CBMIR, Practical approaches of CBMIR.

Targeted Application & Tools that can be used:

- Google Collab Pro
- Jupyter Notebook with GPU

Project work/Assignment:

Mini project on feature extraction using deep learning algorithm such as CNN.

Text Book

T1. G.R Sinha, Bhagwati Charan Patel," Medical Image Processing Concepts and Applications", Eastern Economy Edition.2020

References

R1. Geoff Dougherty California State University, Channel Islands" Digital Image Processing for Medical Applications", Cambridge University Press.2019

Weblinks

W1. <u>https://onlinecourses.nptel.ac.in/noc22_bt34/preview</u>

W2. https://www.slideshare.net/AboulEllaHassanien/medical-image-analysis-27297012

Topics relevant to development of "SKILL DEVELOPMENT":Design and development of feature extraction and segmentation algorithm using python programming language.

Topic relevant to HUMAN VALUES & PROFESSIONAL ETHICS": Naming and coding convention for Project Development.

Catalogue	Dr.Senthilkumar S
prepared by	

Recommended	BOS NO: SOCSE 2 nd BOS held on 10/07/23
by the Board of	
Studies on	
Date of	Academic Council Meeting No 21, Dated 06/09/2023
Approval by the	
Academic	
Council	

Course Code:	Course Title:Adva	anced DBMS			2	0	2	3
CSE3068	Type of Course: C	Core	-	гтр				
		Theory &Integrated	ł	L-1- r-				
	Laboratory							
Varsian No	1.0							
Course Due	1.0 [1] Dotobogo Man	a man and Suraham (C)	SE2074)					
Course Pre-	[1] Database Man	agement System (C	SE2074) Li4a duau	uhaalea D	a t a k a a			aah 2
requisites	Basics of DBIVIS, I Schome Architect	Sasics of DBMS, like, File System and its drawbacks, Database Approach, 3-						
	Schema Architect	ite concepte Booku	is, Relat	ional Algo	eura, 1 n lobor	NULL NOTO	nanz my N	Lation,
	databasa skills ar	loornt	p anu Ke	covery. I		ator	y 1 v 1	IYSQL
Anti requisites	NII							
Anti-requisites	The number of	this course is to	maka	ho studo	nta no		- DI	DDMS
Course Description	the purpose of	Then introduce f	make i	th Distril	nts re butod	Dor	l KI alla	DDN15
	NaSOL database	and the second sec	includ	ui Distri	outeu,	r ai bon	ane	I, allu vistios
	advantages and	disadvantages of	anch on	e une m	n Im	nar	tone	a and
	differences among	them are noted No	each on tr	ansit fron	111. 1111 1 RRM	pu S to	No	e anu SOL is
	discussed The st	triking features of	distribu	tod nara	l KDN llol an	d N	[08C	JQL 13 M ara
	considered and st	udied	uistiibu	icu, para	ner an	uiv		
	The associated la	unicu. Iboratory provides	a chanc	e to hav	e hand	اد-ما	1 00	ncents
	learned during th	is course.	a chanc		c mane	13 01	1 00	neepts
Course Obiective	This course is des	signed to improve t	he learn	ers' EMP	LOYABI	LITY	SKI	LLS by
·····	learning the worki	ng on Database usin	g MySQL					~,
Course Outcomes	On successful con	pletion of this cour	se the st	udents sha	all be a	ble	to:	
	1. Re	call the transactions	in RDMS	5				
	(2) Explain advan	nced features of distri	buted, pa	arallel, and	l NoSQ	L da	itaba	uses.
	(3) Illustrate the f	eatures in Distributed	d databas	e		h.		
	(4) Employ Parall	lel database concepts	in real li	fe applica	tions.			
Course Content:				• •				
			Compre	hension b	ased			
Module 1	Transactions in	Ouiz	Ouizzes	and		0	6Cla	isses
	RDBMS		assignm	ents.				
Topics:			0					
RDBMS - Transaction	n control state diagr	am, ACID properties	s of transa	action, Sch	nedules	in t	ransa	actions
- Serial, Non-Serial	and Serializable, Se	rializability-Conflict	and View	w, Conflic	t Seria	lizat	oility	check
by Precedency Graph	n, Concurrency Con	trol – Lock Based an	d Time S	stamp Base	ed.		2	
			Laborat	ory experi	ments			
	NoSQL	Programming and	and Mir	ni Projects	on		0.0	1
viodule 2	Databases	Mini Project	NoSQL	Topics us	ing		06C	lasses
		, č	Mongol	DB/ Casan	dra.			

Topics:

NoSQL Introduction – Scale Out, Commodity Hardware, Brief History, Features – Non-Relational, Schema Free, Simple API, and Distributed. NoSQL Architectures/Data Models - Document, Columnar, Key-Value, and Graph. Transaction in NoSQL- BASE for reliable database transactions, Achieving Horizontal Scalability with Database Sharding, CAP theorem.

Case Study: MongoDB/Casandra/ AWS/ HBase

Module 3	Distributed Databases	Assignment	Assignment on main topics of Distributed Databases	06Classes

Topics:

Loosely Coupled, Characteristics of Distributed Databases, Local and Global view of applications, Distributed Processing, Types – Homogeneous and Heterogeneous, Distributed Data Storage – Replication and Fragmentation, Fragmentation – Horizontal and Vertical Type, Difference between Centralized and Distributed Databases.

Module 4 Parallel Databases Assignment	Assignment on main <mark>06 Classes</mark> topics of Parallel Databases
--	---

Topics:

Tightly Coupled, Features of parallel databases, Shared Memory, Shared Disk, Shared Nothing Systems. Advantages of each of these schemes, Advantages and Disadvantages of Parallel Databases, Differences between Parallel and Distributed Databases.

Install MONGODB

https://www.javatpoint.com/mongodb-create-database

Create any one of the following databases.

Employee, Student, University, Banking, or Online Shopping

Drop database

Create Collection: In MongoDB db.createCollection(name,option) is used to create collection. Drop Collection

List of Laboratory Tasks:(7 X 2= 14 Sessions)

Level 1: Perform CRUD operations (Insert, Update, Delete and Query Documents) on 'Student' Database.

Level 2: Do MongoDB text search on 'Employee' Database.

Experiment No. 2: Try experiments on MongoDB Operators

Level 1: Perform queries involving MongoDB Query and Projection Operators using 'Student' Database.

Level 2: Do queries involving MongoDB update operator on 'Employee' Database.

Experiment No. 3:Explore different query modifiers. Level 1: Perform different query modifiers on 'Student' Database. Level 2: Try various query modifiers on 'Employee' Database.

Experiment No. 4:Explore Aggregation commands.

Level 1: Implement different aggregation commands on 'Student' Database. Level2: Perform various aggregation commands on 'Employee' Database.

Experiment No. 5:Explore Authentication commands. Level 1: Try authentication commands on 'Student' Database.

Level 2: NA

Experiment No. 6:Explore Replication Commands Level 1: Try all replication commands on 'Student' Database. Level2: Implement replication commands on 'Employee' Database.

Experiment No.7:Try Sharding Commands. Level1: Explore Sharding Commands on 'Student' Database. Level 2: Implement Sharding Commands on 'Employee' Database.

Targeted Application & Tools that can be used: MongoDB is to be installed and used.

Project work/Assignment:

Each batch of students (self-selected batch mates) will identify projects, such as, Library, Banking, and Reservation etc.,and do it. Concepts of NoSQL, like, CRUD operations, supporting ad hoc queries, indexing flexibility, assisting replication, creating capped collections, and Retrieving data from multiple documents.

Sample Mini Projects:

1. Content Management System

Clubbing the content assets like text and HTML into a single database helps provide a better user experience. MongoDB has an excellent toolset not only for storing and indexing but also for controlling the structure of a content management system. You can easily design a web-based CMS by using the model proposed by "Metadata and Asset Management" in MongoDB. Additionally, you can use "Storing Comments" to model user comments on blog posts. 2. Gaming Project

Data is an essential part of making video games work. Some typical examples of gaming data include player profiles, matchmaking, telemetry, and leaderboards.

The common thread between all games is that they all have a specific goal. And you have to achieve multiple objectives or pay your way out to reach the end goal. This may involve steps like watering your plants, growing vegetables, serving food in a restaurant, and so on.

Textbook(s):

1. Sadalage, P. & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, 1st Edition, 2019(Wiley Publications).

2. Stefano Ceri, Giuseppe Pelagatti, Distributed Databases: Principles and Systems,

2017(McGraw Hill Education).

References

1. Elmasri R and Navathe S B, "Fundamentals of Database System", 7th Edition, 2017(Pearson Publication).

2. Pivert. NoSQL Data Models: Trends and Challenges, 1st edition(Wiley).

Topics related to development of "FOUNDATION":Transaction, CRUD Operations, Replication, and Sharding

Topics related to development of "EMPLOYABILITY": Project implementations in software, batch wise presentations

Topics related to development of "HUMAN VALUES AND PROFESSIONAL ETHICS": Team Dynamics during Mini Project Development.

Catalogue prepared Dr. Naga Raju Mysore

Recommended by	BOS NO: SOCSE 2 nd BOS held on 10/07/23
the Board of Studies	
on	
Date of Approval by	Academic Council Meeting No 21, Dated 06/09/2023
the Academic	
Council	

Course Code: CSE3070	Course Title: Advanced C	omputer Networks	³ L-Т- Р- С	3 0 0 3		
Version No.	1.0			II		
Course Pre-	CSE-2011-Data communica	ation and Compute	r Networks- T	CP/IP Protocol		
requisites	Suite, IEEE 802.x, VLA	N. Ipv4 Addresses	s. IpV6 address	8		
Anti-requisites	NIL		-, - <u>-</u>			
· Course Description	This course emphasizes the	advanced concents	of computer po	tworks and their		
course Description	design aspects. This course network layers, switching network traffic and schedul with current internet techn	the advanced concepts of computer networks and then design aspects. This course will explore the design aspects of physical and network layers, switching basics, logical design and management aspects, network traffic and scheduling, performance of WIFI AND WIMAX network along with current internet technology like 5G and Software Defined Network				
Course Objective	This course goal is to provide an advanced background on relevant and recent computer networking topics and to have a comprehensive and deep knowledge in computer networks.					
Course Outcomes	Upon successful completion of the course the students shall be able to: 1. Understand the physical network technology and design of WAN.					
	2. Understand switching networks, routing in packet switching networks with different routing algorithms.					
	 4. Understand the pri alternative Infrastructure 	nciples of new gener is and SDN.	ration of comput	er networks,		
Course Content:						
Module 1	PHYSICAL NETWORK DESIGN	Assignment	Theory	No. of Classes:10		
Topics: Remote Acc and Enterprise Netw	cess Technologies and Devic orks – Core networks, distri	es – Modems and D bution networks and	SLs – SLIP and PI access network	P - WAN Design		
Module 2	SWITCHING BASICS	Assignment	Theory	No. of Classes:12		
Topics: Circuit switcl Cell switching – Labe resolution, Spanning blocking – Back pres	hing, Message switching and I switching – L2 switching Vs g tree algorithms – Cut thro sure – Switch design goals	d Packet switching – : L3 switching – VLAN ough and Store and	Datagrams and s – Switching and forward switche	Virtual circuits – d Bridging – Loop s – Head of line		
Module 3	LOGICAL DESIGN AND MANAGEMENT	Assignment	Theory	No. of Classes:10		
Topics: VLSM, OSF modeling, RTS/CTS n 802.16 protocol – sv	PF and BGP – VPN –RMON nodeling, Modeling 802.11e stem and user performance	and SNMP, Modeli , Performance, 802.1	ing 802.11 proto 1e HCCA Perform	ocol – Basic DCF nance. Modeling		

Module 4	NETWORK TRA SCHEDULING Alternative Infrastructures	AFFIC, and	Assignment	Case Study	No. of Classes:12
Topics: Modeling ne modeling, Pareto tra Infrastructures (Acti Mobile networks, 50	etwork traffic – Flow f ffic distribution, Desti ve networks, Softwa i cloudification.	traffic i nation re defi	models – Continuo traffic. Scheduling a ned network. Network.	us time modelin algorithms – Ana work Security a	ng, Discrete time alysis Alternative and wireless and
Targeted Applicatior 1. CISCO Packe 2. Whireshark	ι & Tools that can be ι t Tracer,	used:			
Project work/Assign	ment:				
 Design LAN V Configure th Design Wirel 	WAN and assign IP Ado e WAN topology using ess network in college	dress. routin camp	g protocols us.		
Suggested List of Ha 1. Perform a ca 2. Using CISCO addressing and I 3. DO a case st 4. Perform a ca	nds-on Activities: use study on VLSM Packet Tracer design outing protocols udy on an SDN for an use study on 5G Cloud	a LAN Enterp ificatio	with 50 PCV and co prise. pn.	nfigure it with s	uitable IP
Text Book 1. Larry L. Pete Kaufmann, 5/e, 2 2. Jochen Schill	rson & Bruce S. Davie, 2012. er, "Mobile Communi	"Comp	outer Network: A Sy ", Pearson Addison	vstem Approach' •Wesley, 2/e, 201	', Morgan 10.
References 1. Behrouz A. F 2. James F. Kurd 3. Charles M. K 4. Computer No 6th Edition,2012 5. A Practical G 3rd Edition,2012 6. Computer N	orouzan , "TCP/IP Pro ose, Keith W. Ross, "Co ozierok, "The TCP/IP C etworking: A Top-Dow uide to Advanced Net letworks , Andrew S. T	tocol Si ompute Guide", n Appr workin Ganenba	uite", McGraw- Hill, er Networking", Pea No starch press, 20 roach, James F. Kurc g , Jeffrey S. Beasler aum, David J. Wethe	4/e, 2015. rson, 2016. 18. Is and Keith W. R y and PiyasatNill erall,Prentice, 5t	Ross,Pearson, kaew,Pearson, h Edition,201

1. Journal of I https://www.j	Network and Computer Networking- ournals.elsevier.com/journal-of-network-and-computer-applications
Catalogue prepared	Dr. Ashish Kumar Srivastava
by	Dr. Shanmugarathinam Ms. B Prema Sindhuri, Ms. Bhavana A Ms. Kaipa Sandhya
Recommended by the Board of Studies on	BOS NO: SOCSE 2 nd BOS held on 10/07/23
Date of Approval by the Academic Council	Academic Council Meeting No 21, Dated 06/09/2023

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Course Code:	Course Title:							
CSF 3071	Computer Vision			I.T. P.	2	0	2	R
	Type of Course: Proe	ram Core		C C	2	Ŭ	2	5
	Theory and Lab Inter	grated Course						
Version No.	1.0	.0						
Course Pre-	Linear algebra, vecto	r calculus, and probal	bility, Data sti	ructures				
requisites	0 /	, ,	,,					
Anti-requisites	NIL							
Course	This course introdu	uces computer visio	on, including	g fundai	menta	als	of	image
Description	formation, camera i	maging geometry, fe	eature detect	ion and	mat	chin	g,	stereo,
	motion estimation a	ind tracking, image o	classification,	scene ı	inder	star	dir	ig, and
	deep learning with ne	eural networks. We wi	ill develop ba	sic meth	ods fo	or ap	pli	cations
	that include finding l	known models in imag	ges, depth re	covery fi	rom s 	tere	0, (camera
	detection and record	nition We will develo	n the intuitio	neni, li Dos and i	ackin matha	ig, ama	b0 tice	unuary
	methods in class, and	then learn about the	o difference b	etween [.]	theor	v ar	nd r	practice
	in HomeWorks.			etheen		y ai		naetiee
Course Objective	The objective of t	he course is SKILL	DEVELOPM	ENT of	stude	ent	by	using
	PARTICIPATIVE LEARN	NING TECHNIQUES <mark>.</mark>						_
Course	On successful com	pletion of the course	e the student	s shall b	e abl	e to):	
Outcomes								
	CO1: Apply mathema	atical modeling metho	ods for low-, i	ntermed	liate-	and	hi	gh-
	level image processir	ng tasks.						
	CO2. Dorform coffue	ro ovnorimente on co	moutorvicio	o problo		م م		nara
	their performance w	ith the state of the ar	mputer visioi +	n proble	ms an		JIII	pare
	CO3· Describe the ge	ometric relationshins	hetween 2D	images	and tl	he 3	D١	world
			betheen 20					· or idi
Course Content:		. .						
Module 1	Digital Image	Programming	Data Coll	ection	and	12	ses	sions
T D (Processing	Assignment	Analysis					a
Image Formation	n, Image Filtering,	Edge Detection, Pr	incipal Con	ponent	Anal	lysi	s, (Corner
Detection SIF1,	Applications: Large	Scale Image Search	l.					
Modulo 2	Geometric Techniques ir	Programming	Data Coll	ection	and	12	0.00	sions
Widdule 2	Computer Vision	Assignment	Analysis			14	ses	SIOIIS
Image Transform	pations Camera Pr	iections Camera (alibration	Denth t	from	Ste	rec	Two
View Structure fi	rom Motion Object	Tracking	Janoration,	Depui	10111	510	100	, 100
	Machine Learning for	Programming						
Module 3	Computer Vision	Assignment	Data analys	is		14	ses	sions
Introduction to Ma	achine Learning, Imag	e Classification. Obie	ct Detection.	Semant	ic Seg	mer	nta	tion.
List of Laborate	prv Tasks:	,			0			
1. Simulation and	d Display of an Ima	ge, Negative of an li	mage (Binar	y & Gra	y Sc	ale)	[Te	xt
Wrapping Break]2.	Implementation of F	Relationships betwee	en Pixels[Te	kt Wrappi	ng Bre	eak]	3.	
mplementation of Transformations of an Image[Text Wrapping Break]4. Contrast stretching of a								

low contrast image, Histogram, and Histogram Equalization[Text Wrapping Break]5. Display of bit planes of an Image[Text Wrapping Break]6. Display of FFT (1-D & 2-D) of an image[Text Wrapping Break]7. Computation of Mean, Standard Deviation, Correlation coefficient of the given Image[Text Wrapping Break]8. Implementation of Image Smoothening Filters (Mean and Median filtering of an Image)[Text Wrapping Break]9. Implementation of image sharpening filters and Edge Detection using Gradient Filters[Text Wrapping Break]10. Image Compression by DCT, DPCM, HUFFMAN coding[Text Wrapping Break]11. Implementation of image restoring techniques[Text Wrapping Break]12. Implementation of Image Intensity slicing technique for image enhancement

Targeted Application & Tools that can be used: Matlab

Project work/Assignment:

Text Book

T1 Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011.

T2 Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, 2ndEdition, Cambridge University Press, March 2004.

References

R1. R. Bishop; Pattern Recognition and Machine Learning, Springer,2006

R2. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Addison- Wesley, 1992.

R3. K. Fukunaga; Introduction to Statistical Pattern Recognition, Second Edition, Academic Press, Morgan Kaufmann, 1990.

Web references:

https://onlinecourses.swayam2.ac.in/cec20 cs08/preview

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

Topics relevant to development of "Employability": Topics relevant to "HUMAN VALUES &PROFESSIONAL ETHICS"":

Catalogue prepared by	Dr.PravinthRaja.
Recommended by the Board of Studies on	BOS NO: SOCSE 2 nd BOS held on 10/07/23
Date of Approval by the Academic Council	Academic Council Meeting No 21, Dated 06/09/2023

Course Code:	Course Title: Applied	Artificial Intelligence							
CSD3423	Type of Course: Prog Only	ram Core & Theory	L-T- P- C	3	0	0	3		
Version No.	1.0								
Course Pre-	NIL	NIL							
requisites									
Anti-requisites	Nil								
Course Description	Applied Artificial Intel foundational knowle engineering. This cou understanding of AI t the future of AI-driver examples, and case st their application in so	ligence is an advanced-l dge of artificial intell urse aims to provide el echniques, algorithms, n engineering systems. udies, students will expl lving complex engineeri	evel course desig ligence (AI) and ngineering stude and emerging tr Through theoreti ore cutting-edge ing problems.	gned to d its a ents wit ends th cal con Al met	buil appl th a lat a cept hod	d up icati n in are s ts, p olog	on the ons in -depth haping ractical ies and		
Course Objectives	This course is design PROBLEM SOLVING M	ed to improve the lear Iethodologies.	rners' EMPLOYAE	BILITY S	KILL	S by	/ using		
Course Out Comes	On successful comple 1. Explain AI tec 2. Solve problen [Apply] 3. Apply logic m 4. Describe solu	tion of the course the st hniques and algorithms ms in AI using search ethods for problem-solv tions for problems invol	tudents shall be a in engineering de methods and c ving using Resolu lving uncertainty	able to: omains onstraii tion. [A in AI. [/	. [Ui nt s .pply	nder atisf /]	stand] action.		
Course Content:									
Module 1	Search	Quiz Tests	Programming Ass	signmer	nt	L:	12		
Introduction: Sol Uninformed Sea Applications in pa Heuristic Search Uniform cost sea	lving Problems by Sear arch Algorithms: Bre athfinding in games. Algorithms: Heuristi arch and A* search.	rching. Problem-solving adth-first search. Dept cs. Greedy best-first se	agents. Formulat th-first search. earch. A* search	ting pro Uniforn 1. Differ	bler n co enc	ns. ost : e be	search. etween		
Adversarial Sear	ch Algorithms: Game	tree. Minimax algorith	m. Alpha-beta p	runing.	Ide	al o	rdering		
and worst order games (Expectim	ing. Extensions of Mir ax)	imax algorithm for mu	ltiplayer games (MaxN)	anc	l sto	chastic		
Module 2	Knowledge-Based Logic Representation	Quiz Tests				L:	12		
Representation, Reasoning, and Logic. Prepositional Logic. First-Order Logic. Syntax and Semantics. Inference Rules. Propositional and First-Order Resolution. Applications for solving story problems using Resolution.									
Module 3	Constraint Satisfaction Problems	Quiz Tests	Programming Ass	signmer	nt	L	.:7		
Constraints. Def Problem structur Timetable sched	inition of a CSP. Exar re and problem decor uling as a real-world ex	nples of Constraint Sa nposition. Backtracking. xample.	tisfaction Proble . Backtracking he	ems. A euristics	rc c 5. Lc	onsi Ical	stency. search.		

Module 4	Uncertainty in Al	Quiz Tests	Programming Assignments	L: 7
Uncertainty in A	I. Revision of Probab	ility Basics and Ba	yes Theorem. Bayesian Netw	orks. Hidden
, Markov Models.	Sub-problems in HI	, MM and their solu	, utions – Forward probability	and Viterbi
Algorithm. Case s	study of sequence lab	eling using HMM fo	or part-of-speech tagging and	named entity
recognition.				
Targeted Applica	tion & Tools that can	be used :		
Applications:				
Game playing, k	nowledge representat	tion, solving story	problems, timetable scheduli	ng, sequence
labeling in NLP.				
Tools:				
1. Google C	olab			
2. IDEs (in c	ase they are solving t	nem using C/C++ or	Java) like Visual Studio, Netbe	ans, Eclipse,
etc.				
Project work/Ass	ignment: Mention th	e Type of Project //	Assignment proposed for this	course
1. Students	will be given program	iming assignments	to implement AI algorithms	
2. Students	may work with real c	or simulated datase	ts and be asked to explore an	d analyze the
data, extract	meaningful insights, a	ind visualize the res	ults using appropriate tools.	
3. Students	are also recommend	ed to watch NPTE	videos, register for correspo	onding NPIEL
courses, etc.				
Text Book		·		
1. Stuart J.	Russell and Peter Norv	/ig, "Artificial intellig	gence: A Modern Approach", ²	th edition,
2022. Pearso	n Education.		Versionalization of the California 2021	\ A /:
2. Lavika Go	bei, Artificial Intellige	nce: Concepts and A	Applications , 1 st Edition. 2021.	wiley.
References	(homoni "A First Cou	rea in Artificial Into	lizance" First Edition Sixth De	$rac{1}{2}$
I. Deepak r	Lill	rse in Artificial inte	lingence, First Edition Sixth Re	eprint (2018).
	nd other video links)			
1 Mausam	(IIT Delbi) "A	• n Introduction	to Artificial Intelligence	′Link:
https://pptel	ac in/courses/106102	220 Useful for the	full course	. – LINK.
2 Deenak k	(hemani (IIT Madras)	"Artificial Intelligen	rui course.	m-Solving" -
Link: https://	nntel ac in/courses/10	06106226 Useful fo	or Module 1	in solving .
3. Deepak	Khemani (IIT Madra	us). "Artificial Inte	lligence: Knowledge Represe	entation and
Reasoning"	- Link: https://nptel.ac	in/courses/10610	5140. Useful for Module 2.	
4. Deepak	Khemani (IIT	Madras). "Al:	Constraint Satisfaction"	– Link:
https://nptel	.ac.in/courses/106106	5158. Useful for Mo	dule 3.	
5. IJCAI 20	20 Talk by Eugene	Freuder. Link: http	os://ijcai20.org/excellence-res	earch-award-
session/. This	s will serve as a motiva	ation for the Modul	e 3.	
Catalogue	Dr. Jai Singh W			
prepared by	Dr. Sandeep Albert M	athias		
Recommended	BOS NO: SOCSE 2nd	BOS held on 10/0	07/23	
by the Board of		1	,	
Studies on				
Date of	Academic Council N	Meeting No 21, Da	nted 06/09/2023	
Approval by the		, ,	· ·	
Academic				
Council				

Course	Course Title: Opt	timization Techniq	ues for					
Code:	Machine Learnin	Ig		I.T.D.	3	0	0	3
CSE3009				C				
	Type of Course:	Program Core& Th	eory					
Marata a Na	Only							
Version No.	1.1			P I.				. 1. 111
Course Pre-requisites	is required. Fami	soning and analysi liarity with Python	s using i is prefe	linear alg errable.	ebra a	na p	oroba	adility
Anti-requisites	NIL	NIL						
Course Description	The course aims to equip students with advanced techniques and methods in optimization that are tailored to large-scale statistics and machine learning problems. A number of prominent developments in first-order optimization methods in the convex, nonconvex, stochastic, and distributed settings are explored in this course. Upon completing the course, students are expected to be able to better formulate an optimization problem by exploiting desired structural properties (for example, convexity, smoothness, and sparsity), and to select an efficient optimization method under problem constraints (for example, online, distributed, and memory cost). The course aims to equip students with advanced techniques and methods in optimization that are tailored to large-scale statistics and machine learning problems. A number of prominent developments in first-order optimization methods in the convex, nonconvex, stochastic, and distributed settings are explored in this course. Upon completing the course, students are explored in this course. Upon completing the course, students are explored to be able to better formulate an optimization problem by exploiting desired structural properties (for example, convexity, smoothness, and sparsity), and to select an efficient optimization method under problem constraints (for example, online, distributed and memory cost)				s and cs and ents in hastic, ng the te an es (for ficient online, s and ents in hastic, ng the te an es (for ficient online, s and cs and ents in hastic, ng the te an es (for ficient online, s and ents in hastic, ng the te an es (for ficient online, s and ents in hastic, ng the ents (for ficient online, s and ents (for ficient online, s (for ficient online, s and ents (for ficient online, s (for ficient online, ents (for ficient online, ents (for ficient online, ents (for ficient online, ents (for ficient online, ents (for ficient online, ents (for ficient online,			
Course Objective	This course is dea by using PROBLE	signed to improve M SOLVING Metho	the lear odologie	rners' EM es.	Ploya	BILI	TY SI	KILLS
Course Out Comes	On successful co	mpletion of the \overline{co}	urse the	e student	s shall	be a	able	to:
Course Content:	 Understand standard supervised and unsupervised machine learning tasks as optimization problems [Understand] Understand key definitions relating to convex functions, convex sets, and convex optimization [Understand] Implement first-order and stochastic first-order solvers for convex optimization problems. [Application] Apply machine learning techniques to real world problems. [Application] 							
Course Content:								
Module 1	Fundamentals of Convex Analysis	Assignment	Progra	imming Ta	ask		8 Se	ssions

Topics:

Review of basic linear algebra and probability, convex sets and functions – Strong and weak duality, constraint qualifications, Optimality conditions for machine learning problems (regressions, SVM, etc.)

Assignment: Quiz on optimality conditions for machine learning problems.

Module 2	First order and	Assignment	Data Collection/Excel	14
	Higher Order			Sessions
	Methods			

Topics:

First Order Methods : Gradient descent convergence analysis – Convergence analysis for momentumbased acceleration methods: Heavy-ball, multistep, Nesterov, FISTA, etc. – Convergence speedup with conjugacy – Convergence analysis for sub-gradient methods – Stochastic (sub) gradient descent (convergences in probability and distribution, almost sure convergence, parallelism, applications in deep learning, etc.)

Higher-Order Methods – Newton's method: convergence analysis (exact/inexact step-sizes, selfconcordance), applications in regressions – Quasi-Newton Theory (Secant methods), convergence proofs for BFGS/DFP, L-BFGS in machine learning

Assignment: Different first order methods and their types with examples.

0		/ 1		
Module 3	Regularized	Assignment	Programming/Data	10
	Optimization &		analysis	Sessions
	Proximal and		Task	
	Operator			
	Splitting			

Topics:

¹ -regularized sparse optimization for machine/statistical learning: compressed sensing, LASSO, logistic regression, etc. – Structured sparsity optimization for machine/statistical learning: low-rank matrix completion, nuclear norm regularization, inverse covariance inference, atomic norm regularization, etc.

Dual decomposition and decentralization – Method of multipliers and ADMM methods: convergence analysis and proofs – Proximal operators and proximal methods – Design and analysis of distributed algorithms

Assignment: Design of distributed algorithms with examples.

Module 4	Nonconvex Optimization in Machine Learning	Assignment	Programming/Data analysis Task	8 Sessions
	Machine Learning		Таѕк	

Topics:

Coordinate descent methods and convergence analysis – Special structured nonconvex optimization – Optimization landscape – Saddle point escape

Assignment: Design of nonconvex optimization algorithms and their usage.

Targeted Application & Tools that can be used: Google Colab

Project work/Assignment:

Creating a classification system using Machine Learning methods (Stochastic Gradient Descent, Naïve bayes Classifier, etc.) using standard datasets like Iris Recognition Dataset etc.

Text Book

T1. A. Beck, First-Order Methods in Optimization, MOS-SIAM Series on Optimization, 2017. T2. S. Bubeck, Convex Optimization: Algorithms and Complexity, Foundations and Trends in Optimization, 2015.

T3. F. Bach, "Learning with Submodular Functions: A Convex Optimization Perspective", Foundations and Trends in Machine Learning, Now Publishers Inc., 2013.

References

R1. S. Boyd, N. Parikh, and E. Chu," Distributed optimization and statistical learning via the alternating direction method of multipliers", Foundations and Trends in Machine Learning, Now Publishers Inc.
R2. Y. Nesterov, "Introductory Lectures on Convex Optimization: A Basic Course," Springer, 2004.
R3. M. Bazarra, H.D. Sherali, and C.M. Shetty, "Nonlinear Programming: Theory and Algorithms," John Wiley & Sons, 2006.

http://192.168.1.10/cgi-bin/koha/opacdetail.pl?biblionumber=11708&query_desc=ti%2Cwrdl%3A%20MACHINE%20LEARNING

Topics relevant to development of "SKILL":

Gradient descent convergence analysis, Quasi-Newton Theory (Secant methods), LASSO, Logistic Regression,

Coordinate descent methods and convergence analysis

Topics relevant to development of "ENVIRONMENT AND SUSTAINABILITY SKILLS": NIL

Catalogue prepared by	Ms. Tulika Dutta
Recommended by the Board of Studies on	BOS NO: SOCSE 2 nd BOS held on 10/07/23
Date of Approval by the Academic Council	Academic Council Meeting No 21, Dated 06/09/2023

Course Code:	Course Title: Reinfor	cement Learning						
CSE3011	Type of Course: 1] P 2] L	rogram Core .aboratory integrated		- T - P-	2	0	2	3
Version No.	1.0							
Course Pre- requisites	CSE3001: Artificial Ir	ntelligence and Machine	Learning	5				
Anti-requisites	NIL							
Course Description	For both engineers and researchers in the field of Computer science, it is common to develop models of real-life situations and develop solutions based on those models. It is of utmost importance to come up with innovative solutions for scenarios that are highly stochastic. The objective of this course, is to introduce different reinforcement learning techniques which is a promising paradigm for stochastic decision making in the forthcoming era. Starting from the basics of stochastic processes, this course introduces several RL techniques that are as per the industry standard. With a good knowledge in RL, the students will be able to develop efficient solutions							
Course Objectives	This course is design using EXPERIENTIAL	ned to improve the LEARNING techniques.	learners	<u>'EMP</u>	LOYABI	LITY	SKI	<u>LLS</u> ' by
Course Out Comes	Course Out Comes On successful completion of the course the students shall be able to: 1. Apply dynamic programming concepts to find an optimal policy in a gaming environment [Applying] 2. Implement on-policy and off-policy Monte Carlo methods for finding an optimal policy in a reinforcement learning environment. [Applying] 3. Utilize Temporal Difference learning techniques in the Frozen Lake RL environment [Applying] 4. Solve the Multi-Armed Bandit (MAB) problem using various exploration-						ıg ptimal	
Course Content:								
Module 1	Introduction to Reinforcement Learning	Assignment	Program OpenAl (environr	ming us Gym nent	ing the	2	N of C L — 5	lo. lasses P – 6
Topics : Elements of RL, Agent, environment Interface, Goals and rewards, RL platforms, Applications of RL, Markov decision process (MDP), RL environment as a MDP, Maths essentials of RL, Policy and its types, episodic and continuous tasks, return and discount factor, fundamental functions of RL – value and Q functions, model-based and model-free learning, types of RL environments, Solving MDP using Bellman Equation, Algorithms for optimal policy using Dynamic Programming -Value iteration and policy iteration, Example : Frozen Lake problem, Limitations and Scope								

			Programming using the	No.	
Module 2	Monte-Carlo(MC)	Assignment	OpenAl Gym	of Classes	
	methods	_	environment	L-5 P-6	
Topics: Monte C	Carlo methods, predic	tion and control tasks,	Monte Carlo prediction : a	lgorithm,	
types of MC prea	diction, examples , ind	cremental mean update	es, Monte Carlo Control : a	gorithm, on-	
policy MC contro	ol, MC with epsilon-gr	eedy policy, off-policy	MC control. Limitations of I	МС	
method.					
	Temporal		Programming using the	No.	
Module 3	Difference(TD)	Assignment /Quiz	OpenAl Gym	of Classes	
	Learning		environment	L-7 P -6	
Topics: Tempor	al difference learning	g: TD Prediction, TD (Control : On-policy TD cor	ıtrol – SARSA,	
computing the c	optimal policy using	SARSA, Off-policy TD o	control – Q learning, comp	outing optimal	
policy using Q le	arning, Examples, Dif	ference between SARS	A and Q-learning, Compari	son of DP, MC	
and TD methods					
			Programming using the	No.	
Module 4	Nulti-Armed Bandit	Assignment	OpenAl Gym	of Classes	
	(IVIAB) problem		environment	L-6 P -4	
 Software Setu Basic sim Working with 2.1 Creat probabil 2.2 Creat game Finding the of 3.1 Com method 3.2 Com method Implementing 4.1 Every 4.2 First- Implementing 	p: installalling Anaconulations of some gar Gym environments to the the Frozen Lake GY ity, reward functions ate an agent for the C ptimal policy for the pute the optimal poli pute the optimal poli g Monte Carlo prediction y-visit MC prediction to policy MC control	onda, OpenAl Gym and ning environments in G to create agents with r 'M environment and e and generating episodo Cart-Pole environment agent using Dynamic F cy for the Frozen Lake cy for the Frozen Lake tion method using bla	d Universe. Gym andom policy xplore the states, action, tr es. using a random policy and p Programming Environment using value ite Environment using policy it ckjack game	ansition record the eration eration	
o. Implementing	on-policy wit contro	n method using the ep	shon-greedy policy for the	ыаскјаск	
game Cumplementing		unadiation for the Fre	an leke environment for		
b. Implementing	iemporal Difference	e prediction for the Fro	izen lake environment for a	a random	
policy	a antineal realized as a tr		CADCA		
7. Computing the optimal policy using on-policy TD control – SARSA					
8. Computing the optimal policy using off-policy TD control – Q-learning					
9. IVIUITI-Armed	Bandit problem				
9.1 Creat	πng a MAB in Gym				
9.2 Com	pute the best arm usi	ng various exploration	strategies such as epsilon-	greedy and	
softmax	exploration method.				

10. Application of MAB – Finding the best advertisement banner for a web site using MAB
Targeted Application & Tools that can be used :
1. Execution of the RL algorithms will be done using the environments provided by OpenAl's
Gym and Gymnasium of Farama Foundation in "Colab", available
at https://colab.research.google.com/ or Jupyter Notebook.
2. Laboratory tasks will be implemented using the necessary libraries available in Python
Project work/Assignment: Mention the Type of Project /Assignment proposed for this course
Students can be given group assignments to develop different gaming environments and impleme the RL algorithms
Text Book
1. Richard S. Sutton and Andrew G. Barto, "Reinforcement Learning: An Introduction", MIT pres
Second Edition, 2018.
2. Sudharshan Ravichandiran, "Deep Reinforcement Learning with Python", Packt Publishers,
Second Edition, 2020
References
1. Laurra Graesser and Wan Loon Keng, "Foundations of Deep Reinforcement Learning
Pearson, 2022
2. <u>https://www.udemy.com/course/artificial-intelligence-reinforcement-learning-in-python/</u>
Catalogue Dr J Alamelu Mangai, Dr Jai Singh and Dr Swati Sharma
prepared by
Recommended BOS NO: SOCSE 2 nd BOS held on 10/07/23
by the Board of
Studies on
Date of Academic Council Meeting No 21, Dated 06/09/2023
Approval by the
Academic
Council

Course Code:	Course Title: Time S	Series Analysis		L-T- P-	2	0	2	3
CSE 3012	Type of Course: Lab	oratory Integrated		С				
Version No.	1							
Course Pre-	CSE 3001 Artificial Intelligence and Machine Learning							
requisites								
Anti-requisites								
Course Description	The course will provide a basic introduction to modern time series analysis. This course teaches time-series analysis and the methods used to predict, process, and recognize sequential data. The objective of the course is to give students a better understanding of the concepts and the tools in time series analysis. The course develops a comprehensive set of tools and techniques for analyzing various forms of time series and for understanding the current literature in applied time series econometrics. This course covers time series regression and exploratory data analysis, ARMA/ARIMA models, model identification/estimation/linear operators, Fourier analysis spectral estimation and state space models							
Course Objective	This course is desig EXPERIENTIAL LEARI the Peer Learning ar	ned to improve tl NING techniques. L nd group projects c	ne learners ecturers on on real time	"EMPLO the Tim applicat	DYIBILI e Serie tions.	TY SH es Ana	KILLS alysi:	" by using a facilitates
Course Out Comes	On successful comp Understand Understand Understand Onderstand Onderstand Onderstand Onderstand Understand <l< td=""><td>letion of the cours basic concepts the use of time se nderstand] le series regression with multivariate</td><td>e the stude in time ries models models. [A times s</td><td>ents shal series a for fore opplications series a</td><td>li be ak analysi: casting on] and c</td><td>ole to s and g and other</td><td>the</td><td>orecasting. limitations oplications.</td></l<>	letion of the cours basic concepts the use of time se nderstand] le series regression with multivariate	e the stude in time ries models models. [A times s	ents shal series a for fore opplications series a	l i be ak analysi: casting on] and c	ole to s and g and other	the	orecasting. limitations oplications.
Course Content:								
Module 1	INTRODUCTION OF TIMESERIES ANALYSIS	Assignment	Data Collection/	/Interpre	tation	-	+P[2]	L[6] Sessions
Topics: Introduction to T Models for time Nature and uses Graphical Displa	Time Series and Fore series analysis-Auto of forecasting-Forec ys -Time Series Plots	casting -Different to correlation and Pa asting Process-Dat - Plotting Smoothe	ypes of data rtial autocc a for foreca ed Data - Nu	a-Interna prrelation sting – R umerical	al struc n. Exan Resourc Descri	tures nples ces fo	s of t s of 1 or for n of 1	ime series- ime series ecasting. ime Series

Graphical Displays -Time Series Plots - Plotting Smoothed Data - Numerical Description of Time Series Data - Use of Data Transformations and Adjustments- General Approach to Time Series Modeling and Forecasting- Evaluating and Monitoring Forecasting Model Performance.

Module 2	TIME SERIES REGRESSION MODEL	Assignment/Quiz	Case studies	L[6] +P[3] Sessions
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Topics:

Introduction - Least Squares Estimation in Linear Regression Models - Statistical Inference in Linear Regression- Prediction of New Observations - Model Adequacy Checking -Variable Selection Methods in Regression - Generalized and Weighted Least Squares- Regression Models for General Time Series Data- Exponential Smoothing-First order and Second order.

Topics:

Autoregressive Moving Average (ARMA) Models - Stationarity and Invertibility of ARMA Models -Checking for Stationarity using Variogram- Detecting Nonstationarity - Autoregressive Integrated Moving Average (ARIMA) Models - Forecasting using ARIMA - Seasonal Data - Seasonal ARIMA Models-Forecasting using Seasonal ARIMA Models Introduction - Finding the "BEST" Model - Example: Internet Users Data- Model Selection Criteria - Impulse Response Function to Study the Differences in Models - Comparing Impulse Response Functions for Competing Models .

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Module 4	MULTIVARIATE TIME SERIES	Assignment	Case studies	L[8] +P[1] Sessions
	FORECASTING	_		

Topics:

Multivariate Time Series Models and Forecasting - Multivariate Stationary Process- Vector ARIMA Models - Vector AR (VAR) Models - Neural Networks and Forecasting -Spectral Analysis - Bayesian Methods in Forecasting.

List of Laboratory Tasks:

- 1. Loading, Preprocessing and Handling Time series data.
- 2. Fitting and plotting by Modified Exponential Curve.
- 3. Estimating and eliminating trend using Aggregation, Smoothing and Polynomial Fitting.
- 4. Eliminating Trend and Seasonality via Differencing and Decomposition.
- 5. Fitting of Trend using Moving Average Method.
- 6. Forecasting by Exponential Smoothing, ARIMA.
- 7. Forecasting by Seasonal autoregressive integrated moving average model (SARIMA).
- 8. Develop Time series model using Multivariate Analysis models via Canonical Correlation
- 9. Develop Time series model using Multivariate Analysis models via Structural Equation Modeling.

10. Develop Time series model using Inter Dependence Techniques via Factor Analysis.

11. Develop Time series model using Inter Dependence Techniques via Cluster Analysis.

Targeted Application & Tools that can be used

Target Applications:

- HealthCare Industries.
- Manufacturing Industries.
- Cyber Security.
- Smart Intelligent systems.

Tools:

- Python
- R
- MATLAB

- XLSTAT
- Tableau
- Qlik Sense

Project work/Assignment:

Assignment:

- Predicting changes in the thickness of Ozone layer based on its time-series data from 1926 2016.
- Examine the South African GDP on a period from 1960 to 2016. Our data contains 226 observations and has been obtained from OECD Statistics.
- Developing an ARIMA model to forecast the monthly Australian gas production level for the next 12 months.

Text Book

T1 Douglas C. Montgomery, Cheryl L. Jen , Introduction To Time Series Analysis And Forecasting,

4th Edition, Wiley Series In Probability And Statistics, 2019. https://b-ok.cc/book/2542456/2fa941

T2 Dr. Avishek Pal , Dr. Pks Prakash , Master Time Series Data Processing, Visualization, And

Modeling Using Python, 2019. https://b-ok.cc/book/3413340/2eb247

T3 John Wiley & Sons , Time Series Analysis And Forecasting By Example ,Technical University Of

Denmark, 2021.

https://b-ok.cc/book/1183901/9be7ed

References

R1 Peter J. Brockwell Richard A. Davis Introduction To Time Series And Forecasting Third Edition.(2016).

R2 Multivariate Time Series Analysis and Applications William W.S. Wei Department of Statistical

Science Temple University, Philadelphia, PA, SA This edition first published 2019 John Wiley & Sons

Ltd.

R3 Time Series Analysis by James D Hamilton Copyright © 2020 by prince town university press.

E book link R1: https://b-ok.cc/book/2802612/149485

E book link R2: https://b-ok.cc/book/3704316/872fbf

E book link R3: https://b-ok.cc/book/3685042/275c71

Web resources:

1.	https://www.coursera.org/learn/practical-time-series-analysis	S
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2. <u>https://ocw.mit.edu/courses/economics/14-384-time-series-analysis-fall-2013/download-</u>

<u>course-materials/</u>

3. <u>https://swayam.gov.in/nd1_noc19_mg46/preview</u>

Topics relevant to development of "Skill Development":

- 1. Systematic variation in time series data
- 2. Autoregressive Models
- 3. Exponential smoothing models or esms
- 4. Generating forecasts on time series

Topics relevant to development of "Employability Skills"

- 1. Time series analysis to Monitor and access water resources.
- 2. Remote Sensing time series analysis for Crop Monitoring.
- 3. Satellite Image Time series Analysis.

4. Waste M	1onitoring and Analysis.
Catalogue	Mrs. Poornima S
prepared by	
Recommended	BOS NO: SOCSE 2 nd BOS held on 10/07/23
by the Board of	
Studies on	
Date of	Academic Council Meeting No 21, Dated 06/09/2023
Approval by the	
Academic	
Council	

Course Code: CSE3017	Course Title: Autonomous Navigation and Vehicles Type of Course : TheoryL-T- P- C3003		
Version No.	1.1		
Course Pre- requisites	 Real-time embedded programming Optimal estimation and control Linear algebra 		
Anti-requisites	NIL		
Course Description	 NIL Overview of technologies vehicles including sensors, sensing algorithms, machine learning, localization, mapping, object detection, tracking, communication and security. Hands-on implementation of robotic sensing and navigation algorithms on both simulated and physical mobile platforms. This course covers the mathematical foundations and state-of-the-art implementations of algorithms for vision-based navigation of autonomous vehicles (e.g., mobile robots, self-driving cars, drones). It culminates in a critical review of recent advances in the field and a team project aimed at advancing the state-of-the-art. Topics include: Autonomous driving technologies overview, Object Recognition and Tracking, Localization with GNSS, Visual Odometry, Perceptions In Autonomous driving, Deep learning in Autonomous Driving Perception, Prediction and Routing, Decision planning and control 		
Course Objective	This course is designed to improve the learners' EMPLOYABILITY SKILLS by using PROBLEM SOLVING Methodologies.		
Course Out Comes	 On successful completion of the course the students shall 1. Understand the Autonomous system's and its requiral algorithm, sensing, object recognition and tracking of a system. [Understand] 2. Do the error analysis of Localization systems and u techniques, [Analyze] 3. Explain, plan and control the traffic behavior, and sh lane level routing and create simple algorithms. [Application 4. Explain Plan and control motion, choose proper cliautomotive vehicles and understand the cloud platform.[Application] 	be able to: ements. Explain an Autonomous se the tools and all be able to do n] ient systems for blication]	
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Course Content:			
Module 1		12 Sessions	
autonomous driv Autonomous driv Production, Deep error analysis, sar precise point po Odometry, Visua	ving algorithms: Sensing, Perception. Object Recognition ving client system, driving cloud platform, Robot Operating S o learning Model Training, Localization with GNSS: GNSS of tellite based augmentation systems, real time kinematic and o sitioning, Visual Odometry: Stereo Visual Odometry, Mo I Inertial Odometry, Dead Reckoning and Wheel Odometry.	and Tracking: ystem, HD Map overview, GNSS lifferential GPS, onocular Visual	
Module 2		8 Sessions	
Perceptions In Sterio, Optical fl Convolutional Ne	Autonomous driving: Introduction, Datasets, Detection, ow and Scene flow. Deep learning in Autonomous Drivi eural Networks, Detection, Semantic segmentation, Stereo ar	, Segmentation, ing Perception: ad optical flow.	
Module 3		10 Sessions	
Prediction and prediction as clas weighted directed	Routing: Planning and control overview, Traffic predicts sification, Vehicle trajectory generation, Lane level routing d graph for routing, typical routing algorithms, routing graph	tion: Behaviour : Constructing a cost.	
Module 4		08 Sessions	
Decision planning Reinforcement La Operating system Introduction, infr	ng and control: Behavioral decisions, Motion planning, F earning Based Planning and Control, Client systems for Autor ns and computing platform Cloud platform for Auton astructure, simulation.	eedback control nomous Driving: omous driving:	
Targeted Applic Applications: OI Tools: MIDGUA	ation & Tools that can be used: ostacle Avoidance, Path Planning, Autonomous Vehicles. ARD A Simulation platform for Autonomous Vehicle navigat	ion.	
Project Work/A 1. Develop a syst 2. To develop a considered, draw	em that avoids obstacles in the path. cloud based autonomous navigation, what are the param a framework for the navigation system.	eters should be	
Text Book T1: Shaoshan Lin Systems Morgan	u, Liyun Li, Jie Tang, Shuang Wu, Jean-Luc, Creating Auton & Claypool Publishers 2 nd Edition, 2019	omous Vehicle	

T2: Ronald K. Jurgen Autonomous Vehicles for Safer Driving SAE International Edition, 2019

References

R1. Hod Lipson, Melba Kurman Driverless: Intelligent Cars and the Road ahead MIT Press. 1st Edition, 2016

R2. Markus Maurer, J. Christian Gerdes, Barbara Lenz Autonomous Driving: Technical, Legal and Social Aspects 1st Edition, 2016

R3. Hannah YeeFen Lim, Autonomous Vehicles and the Law: Technology, Algorithms and Ethics ,Edward Elgar Publishing. 1st Edition, 2018

Web Resources: <u>http://pu.informatics.global</u>

Topics relevant to development of "Employability":

Deep Learning Models, Convolutional Neural Networks, Vehicle trajectory generation, Decision planning, Reinforcement learning.

Catalogue prepared by	Dr. RAGAVENTHIRAN
Recommended	BOS NO: SOCSE 2 nd BOS held on 10/07/23
by the Board of	
Studies on	
Date of	Academic Council Meeting No 21, Dated 06/09/2023
Approval by	
the Academic	
Council	

Course Code:	Course Title: Digita	al Health and Imaging		L-T- P-	3	0	0	3
CSE3018	Type of Course: Pro	gram Core& Theory C	Dnly	C				
Version No.	1.0							
Course Pre-	CSE3008: Machine	Learning Techniques						
requisites								
Anti-requisites	-							
Course	This course will give	an overview of digita	l health and	its impa	ct on h	ealt	hcar	e,
Description	Image enhancement informatics, Health (t techniques, filtering, data analytics and pre	, and restora dictive mod	ition. Me eling.	edical II	mag	ing,	health
Course	This course is desig	ned to improve the	learners' El	VPLOYA	SILITY S	SKILI	LS b	y using
Objectives	PROBLEM SOLVING	Methodologies.						, 0
Course Out	On successful comp	letion of the course th	ne students s	shall be a	able to	:		
Comes	1.Understand the ro	le of digital health's ir	mpact in eth	ical and	legal co	onsi	dera	tions.
	[Understand]							
	2. Apply Machine l	earning techniques fo	r medical ir	nage ana	alysis. [Арр	licat	ion]
	3. Apply Computer-a	3. Apply Computer-aided detection and diagnosis in medical imaging.						
	[Application]	Application]						
	4. Apply Health data	analytics and predict	tive modelin	g. [Appl i	cation			
Course Conten	t:							
	Introduction to							
Modula 1	Digital Health and	Assignment	Theory					. Q
Would'E I	Digital Image	Assignment	ineory				-	. 0
Introduction to) Digital Health							
Overview of di	gital health and its imp	bact on healthcare, Int	roduction to	o teleme	dicine,	wea	arabl	es, and
health monitor	ing devices, Ethical and	d legal considerations	in digital he	alth.				
Digital image P	rocessing Fundament	als:	waa waa a waa a da	ah ai au a		£	:I - :	
Digital image i	epresentation and pro	fosture extraction	incement te	crinique	S, IIIId	ge n	iteri	ng anu
			Casa stu	dias can	ha			
				ules can	be			
	Medical Imaging		assigned		ents,			
Module 2	Modalities	Assignment	where the	ney anar	yze rea	1-	L:	10
			world sc		ano a			
			propose	Al-Dase	u			
			solution	S				
Medical Imagir	ng Modalities: Principl	es and applications of	various me	dical ima	aging m	noda	litie	s. X-rav
imaging, comp	uted tomography (CT),	, and magnetic resona	ince imaging	(MRI),	Ultrasc	ound	l ima	, aging
and nuclear me	edicine imaging, Imagir	ng modalities for spec	ific healthca	ire doma	ains (e.	g., ra	adiol	logy,
cardiology)								0,1
	Image Analysis in		Researc	ning and				
Module 3	Healthcare	Assignment /Quiz	reviewir	ig acade	mic		L	:12
			papers of	or indust	rv			

	publications on specific AI	
	applications	

Image registration and fusion techniques, Quantitative image analysis for disease diagnosis and treatment planning, Computer-aided detection and diagnosis in medical imaging, Machine learning in medical image analysis.

Health Informatics and Electronic Health Records, Introduction to health informatics and electronic health records (EHR), EHR systems and interoperability, Data privacy, security, and regulatory considerations in health informatics.

Module 4	Digital Health Applications and Innovations	Assignment	Students may work with real or simulated datasets and be asked to explore and analyze the data, extract meaningful insights, and visualize the results using appropriate tools.	L: 10
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Mobile health (mHealth) applications and remote patient monitoring, Health data analytics and predictive modeling. Artificial intelligence and machine learning in digital health. Emerging technologies and trends in digital health.

Targeted Application & Tools that can be used:

Applications: Quantitative image analysis for disease diagnosis, Mobile health (mHealth Tools: TensorFlow, PyTorch, Computer-aided detection

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

Assignments can involve researching and reviewing academic papers or industry publications on specific AI applications in engineering / Students may be given programming assignments to implement AI algorithms / Case studies can be assigned to students, where they analyze real-world scenarios and propose AI-based solutions / Students may work with real or simulated datasets and be asked to explore and analyze the data, extract meaningful insights, and visualize the results using appropriate tools.

Text Book

- 1. "Digital Health: Scaling Healthcare to the World" by Paul Sonnier-2020
- 2. Digital Image Processing" by Rafael C. Gonzalez and Richard E. Woods
- 3. "Biomedical Signal and Image Processing" by Kayvan Najarian and Robert Splinter

References

- 1. Lavika Goel, Artificial Intelligence: Concepts and Applications, Wiley, 2021..
- 2. "Introduction to Health Informatics" by Mark S. Braunstein
- 3. <u>https://talentsprint.com/course/ai-digital-health</u>
- 4. https://www.udemy.com/topic/medical-imaging/

Catalogue	Mr. Yamanaapa
prepared by	
Recommended	BOS NO: SOCSE 2 nd BOS held on 10/07/23
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Studies on	
Date of	Academic Council Meeting No 21, Dated 06/09/2023
Approval by the	

Academic	
Council	

Course Code:	Course Title: Stocha	astic Decision Making						
CSE3019	Type of Course: Pro	gram Core& Theory Onl	y	L-T- P- C	3	0	0	3
Version No.	1.0		I		1	<u> </u>	<u> </u>	
Course Pre-	MAT1003: Applied S	Statistics						
requisites								
Anti-requisites	-							
Course Description	Stochastic Decision foundational know engineering. This co understanding of St shaping the future concepts, live exar building intelligent complex partially ol	Making is an advanced-l ledge of artificial inte ourse aims to provide e ochastic techniques, alg of Agent-driven engir nples, and case studie agents methodologie bservable environment.	evel cours Iligence engineerir gorithms, s neering s es, studer es and t	se desig (AI) and ng stude and emo ystems. nts will their an	ned to d its a ents wi erging f Throu explor pplicati	buil appl th a tren igh e ci on	d up ication in in ds theo uttin in	on the ons in -depth hat are pretical g-edge solving
Course Objectives	This course is desig PROBLEM SOLVING	This course is designed to improve the learners' EMPLOYABILITY SKILLS by using PROBLEM SOLVING Methodologies.						
Course Out Comes	On successful compl 1. Understand the r solving [Understand 2. Apply dynamic System environment. [Appli 3. Implementation c decision in the real t 4. Apply various P [Application]	letion of the course the s ole of knowledge-based ling] stem concepts to find an ication] of various detection tech time environment [Appli roject Scheduling strate	students s agents ar optimal hniques a i cation] egies to	hall be and Apply policy in nd hypc solve th	able to: / logic ii) partial othesis f he dec	n pro Ily o for t isioi	oble bser akin n pr	m- vable g the oblem.
Course								
Content: Module 1	Intelligent Agents and Searching Techniques	Assignment	Theory				L:	10
Introduction - S agents - Utility- observable vs. p continuous, Sing Searching Tech Problems - Real- Uniform cost sea	tructure of Intelligent based agents - Agent partially observable - gle agent vs. multiage niques : Solving Prok -world problems - Sea arch - Depth-first sea	t Agents - Agent prograr ts and Environments - P - Deterministic vs. stock nt olems by Searching - F arching for Solutions - So rch - Depth-limited searc	ns - Simp Properties hastic. Sta Problem-S earch Stra ch -	ole reflex of task atic vs, Solving ategies -	x agent enviro dynam Agents · Bread	s - nme ic, [- F th-fi	Goal ents Discr Corm rst s	-based - fully ete vs. ulating earch -
Module 2	Dynamic Systems	Assignment	Case stud assigned where th	dies can to stud	be ents, vze rea	I-	L:	10

	world scenarios and	
	propose AI-based	
	solutions	

Dynamic Programming - Decision Trees - Deterministic Decision Trees , Stochastic Decision Trees scenario tree , Stochastic Dynamic Programming, Markowitz' model Comparing the Deterministic and Stochastic Objective values.

Recourse Problems - Outline of Structure - Knowledge Engineering - The Electronic Circuits Domain -General Ontology - The Grocery Shopping World.

Problem Reduction: Finding a Frame, Removing Unnecessary Columns, Removing Unnecessary Rows, Reducing the Complexity of Feasibility Tests

Detection and Module 3 decisions	Assignment /Quiz	Researching and reviewing academic papers or industry publications on specific Al applications	L:10
--	------------------	--	------

Detection and decisions: Decision criteria and the maximum a posteriori probability criterion, Binary MAP detection, Binary detection with a minimum-cost criterion, The error curve and the Neyman–Pearson rule, The min–max detection rule

Hypothesis testing : Sufficient statistics with $M \ge 2$ hypotheses, More general minimum-cost tests, Binary hypotheses with IID observations,

Feasibility in Networks: The un-capacitated case, Generating Relatively Complete Recourse, An Investment Example

Module 4	Project Estimation and Scheduling	Assignment	Students may work with real or simulated datasets and be asked to explore and analyze the data, extract meaningful insights, and visualize the results using appropriate tools.	L: 10
----------	--------------------------------------	------------	--	-------

Project Estimation : Introduction - The squared-cost function, Other cost functions. MMSE estimation for Gaussian random vectors- Scalar iterative estimation, The vector space of random variables; orthogonality MAP estimation and sufficient statistics

Project Scheduling : PERT as a Decision Problem , Introduction of Randomness, Bounds on the Expected Project Duration, Series reductions, Parallel reductions, Disregarding path dependences, Arc duplications ,Using Jensen's inequality,

Targeted Application & Tools that can be used:

Applications: Object detection, image classification, Sentiment analysis, language translation, Speech recognition, speaker identification, emotion recognition, Personalized product recommendations etc.

Tools: OpenCV, TensorFlow, PyTorch, NLTK (Natural Language Toolkit), OpenAI Gym

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

Assignments can involve researching and reviewing academic papers or industry publications on specific AI applications in engineering / Students may be given programming assignments to implement AI algorithms / Case studies can be assigned to students, where they analyze real-world scenarios and propose AI-based solutions / Students may work with real or simulated datasets and be asked to explore and analyze the data, extract meaningful insights, and visualize the results using appropriate tools.

Text Book

1. Peter Kall, Stein W. Wallace, "Stochastic Programming," Springer 2020

2. Robert G. Gallager, "Stochastic Processes Theory for Applications", Cambridge University Press 2019

References

- 1. Lavika Goel, Artificial Intelligence: Concepts and Applications, Wiley, 2021.
- 2. Laurra Graesser and Wan Loon Keng, "Foundations of Deep Reinforcement Learning", Pearson, 2022

3. <u>https://www.udemy.com/course/artificial-intelligence-reinforcement-learning-in-python/</u>

Catalogue	Dr Jai Singh W
prepared by	
Recommended	BOS NO: SOCSE 2 nd BOS held on 10/07/23
by the Board of	
Studies on	
Date of	Academic Council Meeting No 21, Dated 06/09/2023
Approval by the	
Academic	
Council	

Course Code: CSD3406	Course Title: Business Intelligence and Analytics Type of Course:1] Theory	L-T- P- C	3	0	0	3
Version No.	1.0					
Course Pre- requisites	NIL					
Anti-requisites	NIL				_	
Course Description	The purpose of the course is to instill a strong process orientation that is the cornerstone Intelligence (BI) is a set of architectures, theo technologies that transform structured, semi-str data into meaningful and useful information enterprise data requirements to develop queries, cubes that use business analytics to answer comp	foundation of effectories, met uctured an Student reports an lex busing	on o tive. hodc nd u s w nd b ess q	f s plo nst ill uil ue	sci Bu gie tru a d sti	entific usiness es and actured nalyze OLAP ons.
Course Objective	This course is designed to improve the learners' EMP using PROBLEM SOLVING Methodologies.	LOYABIL	JTY	SF	ζΠ	LLS by

Course Out	On successful completion	n of this course	the students shall b	e able to:
Comes	1. Discuss the impact of	of Business Intelli	igence (BI) theories, a	architectures,
	and methodologies o	n the orga	nizational decision	n making
	process.[Comprehension]			
	2. Analyse the differe	ences between the	e structured, semi-str	ructured and
	unstructured data types to le	verage the best tec	chnologies.[Applicatio	on]
	3. Develop Ad hoc que	eries, reports, spre	ead sheets, dashboards	s and mobile
	BI applications [Application	n]		
	A Using business and	lution to onewor	complex husiness au	ations using
	4. Using business and data from a variety of source	s such as data files	s and relational/NoSO	I databasas [
	Knowledgel	s, such as data mes		L uarabases.[
	Kilowiedgej			
Course Content:				
	An Overview of Business			
Module 1	Intelligence Analytics	Assignment		10 Hours
	(Comprehension)	rissignment		
Topica	(comprehension)			
Topics.	Dusinges Intelligence (DI)	Intelligence Cru	ation Use and DI	Commence
A Framework for	Business Intelligence (BI).	Interingence Cre	ation Use and BI	Governance.
Transaction Process	sing versus Analytic Proce	essing. Successit	и вт пприетиентации	n. Analytics
Overview. Brief intr	oduction to Big Data Analytic			
	Business Reporting, Visual			10 Hours
Module 2	Analytics and Business	Assignment		
	Performance (Knowledge)			
Topics:				
Management Busine	ess Reporting Definitions and	nd Concepts. Dat	a and Information V	isualization.
Different Types of (Charts and Graphs. The Eme	rgence of Data V	isualization and Visu	al Analytics.
Performance Dashbo	bards. Business Performance	Management. Per	formance Measureme	nt. Balanced
Scorecards. Six Sign	na as a Performance Measure	ment System.	[]	
Module 3	Big Data and Analytics (Application)	Assignment		10 Hours
Topics				
Definition of Big D	ata Fundamentals of Big Dat	a Analytics Big l	Data Technologies D	ata Scientist
Big Data and Data V	Varehousing Big Data Vende	ors Rig Data and	Stream Analytics An	ulti Selentist.
Stream Analytics	varenousing. Dig Data Vend	515. Dig Data and	Stream 7 marytres. 7 tp	pheations of
Stream 7 maryties.				
	Emerging Trends and			
Module 4	Future Impacts	Assignment		10 110015
	(Application)	_		
				
Topics:				
Location-Based An	alytics for Organizations. Ai	nalytics for Consi	umers. Recommendat	ion Engines.
The Web 2.0 Revo	lution and Online Social N	etworking. Cloud	Computing and BI.	Impacts of
Analytics in Organi	zations: An Overview. Issue	es of Legality, Pr	ivacy, and Ethics. T	he Analytics
Ecosystem.				
Targeted Applica	tion & Tools that can be ı	ised: Anaconda/	Google Colab, Goog	gle Data
Studio, Deep Note				
Project work/Ass				
r toject work/Assi	ignment: Mention the Ty	pe of Project /A	ssignment proposed	d for this

1. Gain an immersive understanding of the practices and processes used by a junior or associate data analyst in their day-to-day job

2. Learn key analytical skills (data cleaning, analysis, & visualization) and tools (spread sheets, SQL, R programming, Tableau)

Text Book

1. C. Albright and W. L. Winston "Business Analytics: Data Analysis & Decision Making", Cengage Learning India Pvt. Ltd; Sixth Edition, September 2019

2. S. Christian, and L.Wayne, "Business Analytics: Data Analysis and Decision Making with MindTap". Second Edition, September 2022

References

R1. Ramesh Sharda, Dursun Delen, Efraim Turban "Analytics, Data Science, & Artificial Intelligence (10th ed.). Upper Saddle River, NJ: Pearson. ISBN- 9781292341552, Second Edition 6 March 2020

R2. Jose, J. and Lal, S.P. :Introduction to Computing & problem solving with Python, Khanna Book Publishing First edition 2019

R3. B. Mt Wan "Data Analytics using Python ", 9th Edition, published by Pearson Education 2020.

R4. Ramesh Sharda "Business Intelligence Analytics And Data Science A Managerial Perspective" 4Th Edition , Pearson India, April 2019.

Web links

R1. <u>http://owl.english.purdue.edu/owl/resource/560/01/</u>

R2. <u>http://myregisapp.regis.edu/Citrix/StoreWeb/</u>

R3. <u>https://in.coursera.org/courses?query=business%20intelligence</u>

R4. https://www.coursera.org/learn/business-intelligence-data-analytics

R5. https://www.udemy.com/course/business-intelligence-and-data-analytics/

Topics relevant to d	evelopment of "Employability": Business Intelligence, Big Data
Analytics, Data Scie	ntist.
Catalogue	Dr. Harish Kumar K S
prepared by	
Recommended by	BOS NO: SOCSE 2 nd BOS held on 10/07/23
the Board of	
Studies on	
Date of Approval	Academic Council Meeting No 21, Dated 06/09/2023
by the Academic	
Council	

				1		
Course Code:	Course Title: Cognitive Science &	L-T- P- C	3	0	0	3
Version No.	1 1					
Course Pre-	CSE3008: Machine Learning Techniques					
requisites						
Anti-requisites	NIL					
	Overview of biological structure and artificia	al networ	k, sen	sing	alg	orithms,
Course Description	machine learning, localization. Hands-on implem algorithms on both simulated and physical pl mathematical foundations and state-of-the-art ir cognitive analysis. It culminates in a critical revie and a team project aimed at advancing the Rease	nentation (latforms. ⁻ mplement ew of rece oning.	of cogr This co ations nt adva	nitive ourse of al ance	e rec e co gori s in	ognition vers the thms for the field
Course Objective	This course is designed to improve the learners PROBLEM SOLVING Methodologies.	' EMPLOY	ABILITY	/ SKI	LLS	by using
Course Out Comes	 On successful completion of the course the 1. Understand the different neural network 2. Understand cognition systems and its red 3. Apply dynamic System concepts Neuroeconomics. [Application] 4. Apply Cognitive Science in Learning and 	students c models. quirement in Cog d Reasonin	shall [U s. [U gnitive g. [Ap	be a Inde Inde Sc plica	ble rsta rsta cienc tion	to: nd] nd] ce and
Course Content:						
Module 1			٤	3 Ses	ssio	ns
Introduction to Biological Neuron: Structure of Neuron, Action Potential, Process of Action Potential, Process of Synaptic Transmission, Stimulate the synaptic vesicle, <i>Depolarization of the neuron</i> , Memory (Biological Basis): Theories of Memory Formation, System Consolidation Theory, Multiple- Trace Theory, Reconsolidation Theory, Artificial Neural Network: Models of single neurons, Different neural network models. Single Layer Perceptron: Least mean square algorithm, Learning curves, Learning rates, Perceptron. Bayesian Network, Degree of Belief, Conditional Probability, Bayes's Rule						
Module 2			1	L2 Se	essi	ons
Cognitive Archited Applied Cognitive Psychology, Notion Processes, Working Study of the Nerve Neuropsychology, C Module 3 MO D E L S AN D TO Symbol System, No Systems, Applying Neuroeconomics	ture: Fundamental Concepts, Cognitive View, Science, Interdisciplinary Nature of Cognitive of Cognitive Architecture, Global View of the g Memory, and Attention. Neuroscience: Brain a bus System, Organization of the Central Nervous Computational Neuroscience, DO LS : The Physical Symbol System Hypothesis :I eural based Models of Information Processing. G Dynamical Systems. Neuroeconomics: Perce	Computer e Science Cognitive nd Cogniti s System, Intelligent Cognitive eption as	s in Co , Natu Archite ion, Int Neural Action Scienc a Ba	ognit ire o ectur trodu Rep LO So and e an yesia	tive of C re, C uctic orese essi the d D an I	Science, Cognitive Cognitive on to the entation, Ons Physical ynamical Problem,
Strategies for Brair	Mapping, Studying Cognitive Functioning: Techn	iques fron	n Neur	oscie	ence	!

	
Module 4	08 Sessions
Application: Mod	els of Language Learning- Language Learning in Neural Networks, Bayesian
Models of Children	Language Acquisition, Natural Language Processing, Semantics. Neural Network
Combining Deep Le	arning and Intuitive Knowledge
Targeted Applicat	ion & Tools that can be used:
Applications: Beha	avior-Based Robotics
Tools: SHAKEY's Sof	ftware, Logic Programming in STRIPS and PLANEX
Project Work/Assi	ignment:
1. Develop a Mode	el for Cognition and Knowledge Representation
2.Develop a Mode	el for Biorobotics- Insects and Morphological Computation
Text Book	
T2: José Luis Bern	núdez, COGNITIVE SCIENCE Publishers 3 rd Edition, Cambridge University
Press,2020	
T2: Shaoshan Liu	, Liyun Li, Jie Tang, Shuang Wu, Jean-Luc, COGNITIVE SCIENCE Publishers
3 rd Edition, Cambri	idge University Press,2020
References	
R1. Hod Lipson, N	Aelba Kurman Driverless: Intelligent Cars and the Road ahead MIT Press.
$2^{n\alpha}$ Edition, 2019	en la Christian Canden Berkenn Leon Alternation - Dei inn Tachaire Leon
RZ. Markus Maure	er, J. Christian Gerdes, Barbara Lenz Autonomous Driving: Technical, Legal
and Social Aspects	s IZN Ealtion, 2020
R3. Hannan Yeer	en Lim, Autonomous venicles and the Law: Technology, Algorithms and
Ethics ,Edward Eig	ar Publishing. 2nd Edition, 2019
Web Resources: H	https://www.cambridge.org/highereducation/books/cognitive-science/
Topics relevant to	development of "Employability":
Deep Learning N	Nodels, Convolutional Neural Networks, Vehicle trajectory generation,
Decision planning,	, Reinforcement learning.
Catalogue	
prepared by	Dr. Jayakumar
Recommended	BOS NO: SOCSE 2 nd BOS held on 10/07/23
by the Board of	
Studies on	
Date of Approval	Academic Council Meeting No 21, Dated 06/09/2023
by the Academic	-

Council

Course Code: CSE3108	Course Title: Exp Type of Course: F Only	ert Systems Program Core& The	eory	L-T- P- C	3	0	0	3
Version No.	1.1							
Course Pre-requisites	CSE3008: Machi	ne Learning Technic	ques					
Anti-requisites	NIL							
Course Description	This course is an introduction to expert systems, which is an integral part of the computer science curriculum. In this course, we learn how theory and applications complement each other. Both theory and application are presented. Students are provided with the various tools language which they can use to develop systems of their own. By integrating theory with a fully functional means of applying that theory to real-world situations, students will gain an appreciation for the role played by expert systems in today's world.							
Course Objective	Course ObjectiveThis course is designed to improve the learners' EMPLOYABILITY SKILLS by using PROBLEM SOLVING Methodologies.				LS by			
Course Out Comes	On successful cor [1] Understand th [2] Apply the exp [3]Design and De tools.	npletion of the cou ne various AI progra ert system techniqu evelop expert system	rse the s amming ues for s ms using	students sl knowledge pecific tas g appropria	nall be es. k com ate kn	e able pletic owlec	to: m. Ige-b	ased
Course Content:								
Module 1	Introduction to A programming knowledges	I Case study	Progra	amming Ta	sk	1	.2 Ses	sions
Introduction to AI programming languages, Blind search strategies, Breadth-first – Depth-first – Heuristic search techniques Hill Climbing – Best first – A Algorithms AO* algorithm – game tress, Min-max algorithms, game playing – Alpha-beta pruning. Knowledge representation issues predicate logic – logic programming Semantic nets- frames and inheritance, constraint propagation; Representing Knowledge using rules, Rules-based deduction systems.								
ινιοαμίε 2	Expert System tools	Assignment	10015				14	+ Sessions

Introduction to Expert Systems, Architecture of expert system, Representation and organization of knowledge, Basics characteristics, and types of problems handled by expert systems.

Expert System Tools: Techniques of knowledge representations in expert systems, knowledge engineering, system-building aids, support facilities, stages in the development of expert systems.

Module 3	Building an expert	Assignment	Programming	16 Sessions
	systems			
Building an Expert System	m: Expert system of	development, Select	ion of the tool, Acquiring Kı	nowledge,
Building process.	ome. Difficulties so	aman ni tf alla in nIa.	ning decling with domain	overste
difficultion during dovelops	ems: Difficulties, cor mont	mmon pittalis in plar	ning, dealing with domain	experts,
anneuties auring develop	nent.			
Targeted Application & Too	ols that can be used:			
Al related tools and knowle	edge based tools for	expert system.		
	C	. ,		
Project work/Assignment:				
Assignment 1:Task on Fuzzy	/CLIPS.			
Assignment 2: Back-propag	ation algorithm for t	raining Neural Netw	orks (NN)	
Tout Datab				
T1 Elain Pich and Kovin I	(night "Artificial Inte	ulligonco" Tata McCr	aw Hill Now Dolbi	
T1.Eldin Rich and Revin r	right, Artificial file	D 2rd odition Addi	aw-Hill, New Delfil.	
T2. Πατουμετιοπ το Expe	uide to Expert System	ns" Addison Wesley	longman	50-0
References			Longman	
R1. Stuart Russel and ot	her Peter Norvig. "Ar	rtificial Intelligence –	A Modern Approach". Prent	ice-Hall.
R2.Patrick Henry Winsto	n, "Artificial Intellige	ence", Addison Wesle	Υ,	
R3.Patterson, Artificial Ir	itelligence & Expert	System, Prentice Hal	l India,1999.	
R4.Hayes-Roth, Lenat, a	nd Waterman: Buildi	ing Expert Systems, A	ddison Wesley,	
R5.Weiss S.M. and Kulike	owski C.A., "A Practio	cal Guide to Designir	ng Expert Systems", Rowmar	n &Allanheld, New
Jersey				
Weblinks:		200004		
https://onlinelibrary.wi	ley.com/journal/146	080394		
nttps://www.youtube.c	com/watch?v=11nzri	NKN9D8		
https://puniversity.info	rmaticsglobal.com:2	229/login.aspx?dire	ct=true&db=nlebk&AN=122	<mark>3875&site=ehost-</mark>
live&ebv=EB&ppid=pp	xiii			
https://puniversity.info	rmaticsglobal.com:2	229/login.aspx?dire	ct=true&db=nlebk&AN=270	6929&site=ehost-
live				

Catalogue prepared by	Ms.Akshatha Y
Recommended by the Board of Studies on	BOS NO: SOCSE 2 nd BOS held on 10/07/23
Date of Approval by the Academic Council	Academic Council Meeting No 21, Dated 06/09/2023

Course Code: CSE3072	Course Title: Wireless S	Sensor Networks	L-T- P- C	3	0	0	3
Version No.	1.0		•				
Course Pre-	CSE-236 Principles of D	ata Communicatio	ons and Compu	iter Ne	twor	ks	
requisites							
Anti-requisites	NIL						
	This course examines v	wireless cellular,	ad hoc and sei	nsor ne	etwo	rks, c	overing
Course Description	topics such as wireless network and transport mobility and its impact service guarantees, and software architectures	communication t protocols, uni c on routing protoc l security. Energy may also be prese	fundamentals, cast and multic ols, application efficiency and t ented for senso	mediur cast ror perfor the role or netwo	m ac uting man of h orks.	cess g algo ce, qu ardw	control, prithms, uality of vare and
Course Objective	The objective of the	course is SKILL	DEVELOPMEN	T of s	tude	nt b	y using
	PARTICIPATIVE LEARN	IING TECHNIQUE	ES	hall be	ablo	to	
	Evolution Evolution	the basics of the	Wireless syste	me	able	ιυ.	
	 Explain the basics of the wireless systems. Describe different protocols being used by wireless networks. 						
	including ABR and MANETS.						
Course Out Comes	 Comes Illustrate the Fundamental Concepts and applications of ad hor 						
	and wireless sensor networks.						
Interpret the WSN routing issues by considering related QoS							
	measurements.						
Course Content:							
	Overview of Wireless						
Module 1	Sensor and Adhoc	Assignment	Data Interpreta	ation		08 S	essions
Topics:	Networks						
Introduction, Sensor Network Technology background, Elements of basic Sensor Network							
Architecture, Survey of Sensor Networks, Network Characteristics and Challenges, Applications of							
Wireless Sensor Net	Wireless Sensor Networks, Range of Applications, Category 2 WSN Applications – Home Control,						
Industrial Automation, Medical Applications, Category 1 WSN Applications – Sensor and Robots,							
Reconfigurable Sensor Networks, Highway Monitoring, Military Applications, Civil and Environmental							
Engineering Applications, Wildfire Instrumentation, Habitat Monitoring, Nanoscopic Sensor							
Applications, Introduction to Cellular and Adhoc Networks, Issues in Adhoc Networks – Routing,							
Multicasting, QoS, Security, Scalability.							
	Wireless Transmission		Basics a	nd			• • • • •
wodule 2	Protocols for Adhoc	Assignment	Interpreta	tion	13	Sess	lons
Topics:		I	1				
Introduction, Radio	Technology Primer	 Propagation 	and Modulat	tion, F	Propa	agatio	on and
Modulation impairr	ments, Available Wire	less Technologie	s, Campus A	pplicati	ons,	MA	N/WAN
Applications, Mediur	n Access Control Proto	cols – Fundamen	tals, Performar	nce Red	quire	men	ts, MAC
Protocols for WSNs -S	Schedule based Protocol	ls and Random Ac	cess based Pro	tocols,	Sens	or M	AC case

study, Issues in Designing MAC Protocol for Adhoc Networks - Bandwidth efficiency, QoS support, Synchronization, error-prone broadcast channel, Mobility of nodes.

	Module 3	Routing Protocols for Adhoc and WSN	Quiz	Questions Set	9Sessions
--	----------	--	------	---------------	-----------

Topics:

Background, Data Dissemination and gathering, Routing challenges, Network Scale and Time-Varying Characteristics, Routing Strategies, characteristics of an ideal Routing Protocol for Adhoc Networks, WSN Routing Techniques, Classifications of Routing Protocols, Table-driven and on-demand Routing Protocols, Routing Protocols with efficient flooding mechanism.

	Demonstration of			
Module 4	WSN Adhoc Network	Quiz	Questions Set	8 Sessions
	using Simulators			

Topics:

GloMoSim Simulator, TOSSIM, OMNeT++ and other recent available simulation tools (MATLAB wireless module, NS2, etc).

Targeted Application & Tools that can be used:

This course helps the students to understand the concepts related to Wireless Sensor and Adhoc and networks.by using simulation tools in several educational associations and research hubs. For this reason, the study of existing experimental tools for analyzing the behavior of WSNs has become essential, with wireless sensor networks that include NS-2, OMNeT++, Prowler, OPNET, and TOSSIM.

Project work/Assignment:

Project Assignment:

1. Resource Allocation Robust to Traffic and Channel Variations in Multihop Wireless Networks.

2. Evaluation Models for the Nearest Closer Routing Protocol in Wireless Sensor Networks Assignment:

1]Define Wireless Sensor Networks? Explain in brief about the Applications of Wireless SensorNetworks

2] Discuss the advantages and applications of sensor networks?

3] Discuss the design considerations of physical layer and transceiver?

Text Book

T1: Kazem Soharby, Daniel Minoli and Taieb Znati, Wireless Sensor Networks: Technology, Protocols and Applications, Wiley Publication, 2016, ISBN : 978-81-265-2730-4

T2: C. Siva Ram Murthy and B. S. Manoj, Adhoc Wireless Networks – Architecture and Protocols, Pearson Publication, 2013. ISBN: 978-81-317-0688-6

References

1: Jagannathan Sarangapani, Wireless Adhoc and Sensor Networks – Protocols, Performance and Control, CRC Press 2017, e-book ISBN: 9781315221441

2: Chai K. Toh, Ad Hoc Mobile Wireless Networks: Protocols and Systems, Prentice Hall Publisher 2007, ISBN : 0-13-007617-4

3: https://networksimulationtools.com/glomosim-simulator-projects/

R4 : http://vlabs.iitkgp.ac.in/ant/8/

Case study

link:https://www.academia.edu/33109763/A_Case_Study_on_Mobile_Adhoc_Network_Security_fo r_Hostile_Environment

E book link : http://www.tfb.edu.mk/amarkoski/WSN/Kniga-w03.pdf

E book link : https://referenceglobe.com/CollegeLibrary/library_books/20180301073312adhoc2ilovepdf-compressed.pdf

Web resources: http:	s://archive.nptel.ac.in/courses/106/105/106105160/- IIT KGP, Prof. SUDIP
MISHRA	
Web resources: https	://www.digimat.in/nptel/courses/video/106105160/L22.html - IIT KGP, Prof.
SUDIP MISHRA	
Topics relevant to de	evelopment of "Skill Development":Sustainable development tools, Integrity
Availability Concepts	Policies, procedures, Guidelines, infrastructure-less wireless network that is
deployed in a large nu	umber of wireless sensors.
Catalogue prepared	Dr.Ashsih
by	
Recommended by	BOS NO: SOCSE 2 nd BOS held on 10/07/23
the Board of Studies	
on	
Date of Approval by	Academic Council Meeting No 21, Dated 06/09/2023
the Academic	
Council	

Course Code: CSE3073	Course Title: Gam Development	e design and		L-T- P- C	2	0	2	3	
	Type of Course: Pro	ogram Core							
Version No.	1.0								
Course Pre-	Nil								
requisites									
Anti-requisites	NIL								
Course Description	The Game Design a focuses on teaching Students will learn mechanics, and g programming. Thro refine their game instructor and their engines, and the cr culminate in a fina completed game pr	The Game Design and development course is a hands-on learning experience that focuses on teaching students how to design, develop, and test game prototypes. Students will learn game design concepts such as player engagement, game mechanics, and game balance, and the basics of game art, sound, and programming. Throughout the course, students will work in teams to develop and refine their game prototypes, receiving feedback and guidance from the instructor and their peers. Topics covered include prototyping tools, sample game engines, and the creation of simple 2D and 3D game prototypes. The course will culminate in a final project where students will present and demonstrate their							
CourseObjective	This course is de USING EXPERIE	This course is designed to develop ENTREPRENEURIAL SKILLS by USING EXPERIENTIAL LEARNING Techniques.							
Course OutComes	At the end of the of CO1 Recall the ele CO2Distinguish be CO3 Employ the co	At the end of the course the student should be able to: CO1 Recall the elements of Game Mechanics. CO2Distinguish between several types of prototypes. CO3 Employ the concepts to create prototypes of games.							
CourseContent:	Game mechanics, structures.Uses a stages of prototyp	Game mechanics, emergence and progression, resource mechanics, feedback structures. Uses and importance of prototyping, distinct types of prototypes, stages of prototyping, identifying key features, create functioning prototypes.							
Version No.	1.0								
Module 1	Game Mechanics	Assignment	Evoluti prototy	on of /ping			Class	No.of es:12	
Topics: Introduction to Gan emergence and pro in levels, feedback	ne Mechanics, disting ogression, Resource structures and sen	nct types of gam e mechanics and niotics.	e mechan l economi	ics and es, leve	applica l desig	ations gn an	s, cor d pro	cepts of	
Module 2	Designing	Case Study	Import prototy	ance of /ping			C	No.of asses:13	
Topics: Introduction to prot as paper, physical, p core game and com	otyping, uses and in layable, art and sou plete game prototyp	nportance of prot nd prototypes, in pes.	otyping. D terface, lo	Distinct t w fidelit	ypes o ty and	f prot high-l	otype fidelit	es such y code,	

	Creating and		Prepare physical		
Module 3	Testing Prototypes	Assignment	prototype of a popular	r No. ofClasses:2	
	game		game		
Topics:					
Documentation, ide	entifying key features	s, stages of prototy	ping, testing and feedba	ack, application of	
different prototypin	ig techniques such as	paper, physical, pla	yable, art and sound pro	totypes, interface,	
code, low fidelity ar	nd high-fidelity proto	typing techniques t	to create functioning pro	totypes.	
Targeted Applicatio	on & Tools that can b	e used:			
Algodoo					
Project work/Assig	nment:				
1. 2D Platform	ner Design				
2. Game Deve	elopment				
3. UI/UX Desi	gn				
Textbook(s):					
Edition, Ac References 1. Ennio De N Design Throu 2. Ernest Ada Weblinks: https://lear https://lear	ddison-Wesley Profes Nucci, Adam Kraman Igh Applicable Skills ams, "Fundamentals m.unity.com/	rzewski, "Practica and Cutting-edge s of Game Design	l Game Design : Learn e Insights", Packt Publi ", Pearson Education, 2	the Art of Game ishing, 2018. 2012.	
<u>nttps://star</u>	loopstudios.com/rap	id-game-prototypii	<u>ng-wny-is-it-important-ir</u>	<u>1-game-</u>	
developme	nt/[lext wrapping Brea	зк]			
Catalogue prepared	Dr. Pradeep Bhaska	•			
by					
Recommended by	BOS NO: SOCSE 2	2nd BOS held on 10)/07/23		
the Board of			, ,		
Studies on					
Date of Approval	Academic Council	Meeting No 21,	Dated 06/09/2023		
by the Academic		0 /			
Council					

Course Code: CSE3083	Course Title: Advance	ed Computer Archite	ecture	L-T- P- C	3 0	0	3		
	Type of Course: Disci	pline Elective							
Version No.	1.0								
Course Pre-	CSE 2009 Computer (Drganization and Arcl	nitecture						
requisites									
Anti-requisites	NIL								
Course Description	Inis course introduces the principles and classes of parallelism in computation and architectures of different levels of parallel processing from intermediate to advanced level. This theory-based course emphasizes understanding advanced memory optimization techniques. It equips the students with the intuition behind Instruction level parallelism with pipelining and reducing the cost & hazards using dynamic scheduling. It helps the students to appreciate multiprocessing & thread level parallelism using shared, distributed and directory-based memory models for synchronization and consistency. The course also explores SIMD processors like								
Course	On successful comple	tion of the course th	e students shal	l he ahle tr	י.				
Outcomes	 Discuss the concept of parallelism, virtualization, and memory optimization. Interpret the practices to explore Instruction level parallelism with pipe lining and reducing the cost & hazards using dynamic scheduling. Explain the intuition behind multiprocessing & thread level parallelism using shared, distributed and directory-based memory models for synchronization and consistency. 								
Course Content:									
Module 1	Flynn's classification and Memory Hierarchy	Assignment	Data Analysis ta	ask	10) Cl	asses		
Topics: Defining Computer Architecture, Flynn's Classification of Computers, Metrics for Performance Measurement, Amdahl's Law, Advanced Optimizations of Cache Performance, Memory Technology and Optimizations, Virtual Memory and Virtual Machines, The Design of Memory Hierarchy. Case Study: Memory Hierarchies in Intel Core i7 and ARM Cortex-A8.									
Module 2	Instruction Level Parallelism	Assignment	Analysis, Data (Collection	9	Cla	isses		
Topics: Concepts and Chall Order Execution ar Dynamic Schedulin Case Study: Dynam	enges, Superscalar arc nd Register Renaming, g, Advanced Technique ic Scheduling in Intel C	hitecture, Hazard Re , Reducing Branch C es for Instruction Deli Core i7 and ARM Cort	solution and Tin osts with Adva very and Specul cex-A8.	ming Cons nced Bran ation, Limi	trair ch P itatio	nts, Prec	Out of liction, of ILP.		
Module 3	Thread Level Parallelism	Case Study	Data analysis ta	ask	9	Cla	isses		

Topics:

Introduction, Shared-Memory Multicore Systems, Performance Metrics for Shared-Memory Multicore Systems, Prefetching, Cache Coherence Protocols, Synchronization, Memory Consistency. Case Study: Intel Skylake and IBM Power8.

Module 4	Data Parallelism	LevelAssi	nment Analysis,	Data Collection	9 Classes
----------	---------------------	-----------	-----------------	-----------------	-----------

Topics:

Introduction, Vector Architecture, SIMD Instruction Set Extensions for Multimedia, Graphics Processing Units, GPU Memory Hierarchy, Detecting and Enhancing Loop- Level Parallelism Case Study: Nvidia Maxwell.

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

Project work/Assignment:

Case Study:

- Memory Hierarchies in Intel Core i7 and ARM Cortex-A8
- Dynamic Scheduling in Intel Core i7 and ARM Cortex-A8

Term Assignments:

• Comparative analysis of instruction set architecture (ISA) of CISC and RISC processors

Carry out a thorough analysis of the internal organization and Instruction set Architecture of state-of the art CISC processors like VAX, PDP-11, Motorola 68k, Intel's x86 and the best in the market RISC architectures including DEC Alpha, ARC, AMD 29k, Atmel AVR, Intel i860, Blackfin, i960, Motorola 88000, MIPS, PA-RISC, Power, SPARC, SuperH, and ARM too.

• A short survey of the recent trends in advanced Cache memory optimization

Study and analyze few important present day cache memory optimization techniques the levels used, the mapping technique employed, read and write policies, coherency and consistency scenarios etc.

Text Book

1. J.L. Hennessy and D.A. Patterson, "Computer Architecture: A Quantitative Approach", 6th Edition, Morgan Kauffmann Publishers, November 2021.

References

1. J.P. Shen and M.H. Lipasti, "Modern Processor Design: Fundamentals of Superscalar Processors", 2nd Edition paperback imprint, McGraw-Hill Higher Education, 2013.

2. D.B. Kirk and W.W. Hwu, "Programming Massively Parallel Processors", 3rd Edition, Morgan Kauffmann Publishers, November 2016.

Topics relevant to development of "FOUNDATION SKILLS": Pipelining, CISC and RISC processors, Static and Dynamic scheduling

Topics relevant to "HUMAN VALUES & PROFESSIONAL ETHICS": Collaboration and Data collection for Term assignments and Case Studies.

Catalogue	Prof. Archana Sasi
prepared by	Dr. Tapas Guha
	Prof. Preethi
Recommended by	BOS NO:
the Board of	
Studies on	
Date of Approval	Academic Council Meeting No.
by the Academic	
Council	

Course Code: CSE3085	Course Title: Real Time Operating Systems Type of Course:Theory	L-T- P- C	3	0	0	3			
Version No.	1								
Course Pre-	NIL								
requisites									
Anti-requisites	NIL								
Course Description	The Real-time Operating Systems program is an e document included in the master's educational progra of skills and competencies related to the study of the systems, as well as real-time systems. Real-time Op formation of competencies aimed at obtaining embedded operating systems, and the acquisi competencies in installing, configuring and debuggi	ducation am, prov features erating S theoreti tion of ng opera	al and rides for of embe Systems cal kn praction ting systems	met the edde is a owl cal	hod acc ad o aime edg ski ns.	ological quisition perating ed at the e about lls and			
Course Objective	This course is designed to develop ENTREPRE EXPERIENTIAL LEARNING Techniques.	This course is designed to develop ENTREPRENEURIAL SKILLS by using EXPERIENTIAL LEARNING Techniques.							
	*								
Course Out Comes	 On successful completion of the course the studen Explain the fundamentals of R classifications. Understand the concepts of Syst computer hardware requirements for real-time Describe the operating system concepts for real time systems. 	ts shall l eal tim tem con the applic cepts and	be able e syste trol an ations. l techni	to: ems id t que	an he s ap	d their suitable plicable			

Apply deadlock detection and prevention a given problem	lgorithms to solve the
Course Content:	
Module 1	8 Sessions
Introduction Real Time Operating System Introduction to Operating System: Computer Hardware Organization, BIOS an threading concepts, Processes, Threads, Scheduling	d Boot Process, Multi-
Module 2	8 Sessions
BASICS OF REAL-TIME CONCEPTS Terminology: RTOS concepts and definitions, real-time design issues, examples Considerations: logic states, CPU, memory, I/O, Architectures, RTOS building Kernel	s, Hardware blocks, Real-Time
Module 3	8 Sessions
Concepts, scheduling, IPC, RPC, CPU Scheduling, scheduling criteria, schedulin Multi-threading models, threading issues, thread libraries, synchronization Mu prioritizing mutex, mutex internals	ng algorithms Threads: tex: creating, deleting,
Module 4	8 Sessions
INTER-PROCESS COMMUNICATION: Messages, Buffers, mailboxes, deadlock, priority inversion, PIPES MEMORY MANAGEMENT: - Process stack management, run-time overlays, block/page management, replacement algorithms, real-time garbage c	queues, semaphores, buffer size, swapping, ollection
Text Book	2002
2. Jane W S Liu "Real-time systems" Prentice Hall 2000	28, 2002.
 W. Richard Stevens, "Advanced Programming in the UNIX Edition, Pearson Education India, 2011. Philips A. Laplante, "Real-Time System Design and Analys Wley& Sons, 2004 Doug Abbott, "Linux for Embedded and Real-Time Applic Edition, 2011. 	® Environment", 2nd is", 3rd Edition, John rations", Newnes, 2nd
Web resources: <u>http://pu.informatics.global</u>	
Topics relevant to development of "Skill Development": Threads: Multi-thread	ding models, threading
issues, thread libraries, synchronization	
prepared by Dr Madhushudhan	
Recommended BOS NO: SOCSE 2 nd BOS held on 10/07/23	
huthe Reard of	
by the Board of	

Date of Approval	Academic Council Meeting No 21, Dated 06/09/2023
by the Academic	
Council	

Course Code: CSE3089	Course Title: Software	Architecture		L-T-P- C	3	0	0	З			
	Type of Course: Theory	y Only				-	_				
Version No.	2.0										
Course Pre- requisites	Software Engineering	Software Engineering and Object-oriented Analysis and design									
Anti-requisites	NIL	NIL									
Course	This course deals with l	This course deals with basic concepts and principles regarding software architecture									
Description	and software design. It issues, followed by co architectural structures and analysing software between quality attril experience with examp architecture.	and software design. It starts with discussion on importance of Architectures, design ssues, followed by coverage on design patterns. It then gives an overview of architectural structures and styles. Practical approaches and methods for creating and analysing software architecture is presented. The emphasis is on the interaction between quality attributes and software architecture. Students will also gain experience with examples in design pattern application and case studies in software architecture.									
Course	This course is designed	l to improve the lea	rners' EM	PLOYABI	LITY S	KILLS	by				
Objective	using PARTICIPATIVE LI	EARNING techniques	5								
Course Out	COURSE OUTCOMES	: On successful com	pletion o	f the cou	rse th	ne					
	CO1. Describe the importance of software architecture in large-scale software systems. CO2.Understand the major software architectural-styles, design-patterns, and frameworks. CO3.Distinguish the quality attributes of a System Architecture.										
Course Content:	CO4.identity the appro		Jattern(s)			enario					
Modulo 1	Introduction	Quiz	Introduct	ion on S	/\\/\	00 0	ossio	n c			
Topics: The A	rehitecture Rusiness Cu	Quiz	ccoc and	the arek				115			
cycle; What m both busines architectures;	nakes a "good" architect s and technical, Arch Architectural structures	itectural patterns, and views.	ftware ard referenc	chitectur e mode	e on o ls an	organi d ref	zatior	יג ו- e			
Module 2	Architectural Styles and Case Studies	Quiz	Design			07	Sessi	ons			
Topics: Architectural styles; Four Architectural Designs for the KWIC System; Pipes and filters; Data abstraction and object-oriented organization; Event-based, implicit invocation; Layered systems; Service oriented architecture, Hypertext style, Repositories; Interpreters; Heterogeneous architectures. Case Studies: Keyword in Context. Mobile Robot system.											
Module 3	Quality: Functionality and architecture	Quiz	Quality A	ttributes		09	Sessi	ons			
Topics: Architect practice; Busines	ure and quality attribut s qualities; Introducing	tes; System quality a tactics; Availability t	attributes actics; Mo	; Quality odifiabilit	attril y tact	oute s tics; Po	cenar erforn	ios in nance			
tactics, Security tactics. Quality Model, Application of The Customized Quality Model to a Case Study								Study			
Module 4	Architectural patterns and styles	Seminar	Architect	ural style	S	17 :	Sessio	ons			
Topics: Archite	ectural Patterns: Introdu	iction; From Mud to	Structure	e: Layers,	Pipe	s and	Filters	5,			
Blackboard, D	istributed Systems: Brol	ker. Design Patterns:	Structura	al decom	positi	on: W	/hole	-			
Part; Organization of work: Master – Slave;											

Model View Co Types of Service-	ontroller and Reflection patterns. Introduction to Service Oriented Architecture,Three Oriented Architecture
Targeted Applica	tion & Tools that can be used:
Multiple integrati	ons with other major architecture software (ArchX, Archisoft, Build software, Astena,
Bouwsoft, Teamle	eader, Total Synergy, etc.) and export opportunities with google drive, dropbox, and
CSV formats allow	v this tool to be widely and comfortably used in the industry.
Professionally us	ed software–Slack, Google calendar, outlook email, and others.
Quiz and Semina	r
Quiz on topics fro	om the module 1,2 and 3. Seminar topics will be given to students to present in the
class	
Text Book	
1. T1.Software	Architecture in Practice–LenBass,PaulClements,RickKazman,2ndEdition,Pearson
Education, 201	9.
T2.Pattern-Orie	entedSoftwareArchitecture,ASystemofPatterns-Volume1–FrankBuschmann,
Regine Meunie	r, Hans Rohnert, Peter Sommerlad, Michael Stal, John Wiley and Sons, 2019.
13.MaryShawa	ndDavidGarlan:SoftwareArchitecture-PerspectivesonanEmergingDiscipline,
Prentice-Hall o	f India, 2007.
References	
R1.DesignPatte	rns-ElementsofReusableObject-OrientedSoftware–E.Gamma,R.Helm,R.Johnson,J.
Vlissides:, Addi	son- Wesley, 1995.
E-Resources	"Detterne biter //
VV1. VVebsitero	reatterns: <u>http://www.ninside.net/patterns/</u>
Cosoctuduon Archit	o the development of SKILLS:
ModelViewPresent	er(MVP) Architecture
	Dr Preethi
prepared by	
Recommended	BOS NO: 11 th BOS, held on 7/8/2020
by the Board of	
Studies on	
Date of	Academic Council Meeting No. 15 ^{th,} Dated 23/10/2020
Approval by the	
Academic	
Council	

Course	Course Title: Statis	stica	l Foundat	ion of	L-T- P-	2	0	2 3			
Code: CSE	Data Science Type	of C	ourse: In	tegrated	С						
2028											
Version No.	1										
Course Pre-	Basic knowledge about mathematical operations and statistics, Machine										
requisites	learning.										
Anti-requisites											
Course Description	This course is intend field of data science statistics with the h simple explanation. machine learning th multiple regression generalized linear m learning and factor topics.	This course is intended for those developers who are interested in entering the field of data science and are looking for concise information on the topic of statistics with the help of insightful content based exercises, examples and simple explanation. This course gives in depth introduction to statistics and machine learning theory, methods, and algorithms for data science. It covers multiple regression, kernel learning, sparse regression, sure screening, generalized linear models and quasi-likelihood, covariance learning and factor models, principal component analysis and other related topics.									
Course	This course is design	ned t	to improve	the learne	r's <u>EMPL</u>	OYAB	BILIT	Y			
Objective	<u>SKILLS</u> by using reasons and the second s	eal-v	vorld <u>PRC</u>	BLEM-S	<u>OLVING</u> n	nethod	lologi	es.			
Course Out Comes	 Identify the statistical concepts in the field of data science. (Knowledge) Apply logical thinking, solve the problem in context of High Dimensional Inference. (Application) Classify the relevant topics in statistics and supervised learning & unsupervised learning (Comprehension) Demonstrate different types of data classification real -world problems of data science applications. (Application) 										
Course Content:											
Module 1	Multiple and Nonparametric Regression	Ass	signment	Data Collection	n/Interpreta	ition	1	0Sessions			
Topics: Introduction, Multiple Linear Regression - The Gauss-Markov Theorem, Statistical Tests Weighted Least-Squares, Box-Cox Transformation, Model Building and Basis Expansions - Polynomial Regression, Spline Regression, Multiple Covariates, Ridge Regression - Bias-Variance Tradeoff, Penalized Least Squares, Bayesian Interpretation, Ridge Regression Solution Path, Kernel Ridge Regression,											
widule 2	Inference Case studies Case studies / Case let 10 Sessions										
Topics: Inference	in linear regression -	Deb	bias of reg	ularized re	gression es	stimate	ors, In	ference in			
generalized linear	models, Test of linear l	hypo	theses, Nu	merical co	mparison -	Asym	ptotic	efficiency,			
Statistical efficiency and Fisher information, Linear regression with random design, Partial linear											
regression, Gauss	ian graphical models	- In	ference v	ia penalize	ed least sq	uares,	Sam	ple size in			
regression and gra	phical models, Genera	al sol	utions.								
			0.		0 1	•		10			
iviodule 3	lviainematics of machi	ne	Quiz		Case stud	les		10 Session			
J	ieurinng							56351011			

Topics: Bayesian modelling and Gaussian processes, randomized methods, Bayesian neural networks: approximate inference, variational autoencoders, generative models, applications. Recurrent neural networks, backpropagation through time, Long short term memory networks, neural Turing machines, machine translation, Restricted Boltzmann Machin

		-		
Module	Advanced Neural	Quiz	Case studies	10
4	Networks			Sessions
Convolutional 1	neural network, Predicti	ion of data	using Convolutional Neura	al Networks,
Generative adv	ersarial networks-Deep J	learning in S	equential Data, RNN(Recu	rrent Neural
Networks) & L	STM(Long Short Term	Memory), C	GRU(Gated Recurrent Unit	:), Sentiment
Analysis, Recon	nmender systems.			
List of Laborator	y Tasks:			
Experiment No 1 :	Working with Numpy	arrays		
Level 1:	Basic Statistics, Copying	g, & Subsettin	ng, Indexing, Flattening,	
Level 2: D	Dealing with Missing Valu	ues, and fillir	ng with missing values	
Experiment No. 2	: Working with Pandas d	lata frames		
Level 1: 1	Descriptive Statistics, Bas	sic statistical	functions	
Level 2: S	Statistical functions, Agg	regations		
Experiment No. 3	: Develop python progra	am for Basic	plots using Matplotlib	
Level 1: 1	Plot, Line, Scatter Plot, P	ie Charts, Ba	rs, Histogram, Box Plots	
Level 2: T	ime Series, Categorical I	Data, and Tex	t Data	
Experiment No. 4	: Develop python progra	am for Freque	ency distributions	
Level 1: s	tudent dataset, pollution	dataset		
Level 2: s	tack market dataset			
Experiment No. 5	: Develop python progra	am for Variab	oility	
Level 1: S	tatistical values			
Level 2: P	robability Distributions a	and Pipes		
Experiment No.	6: Develop python progra	am for Norma	ll Curves	
Experiment No.	7: Develop python progr	ram for Corre	elation and scatter plots	
Experiment No.	8: Develop python progra	am for Correl	ation coefficient	
Experiment No.	9 : Develop python prog	gram for Sim	ole Linear Regression	
Experiment No.	10 : Apply and explore	e various plot	ting functions on UCI data	sets, Normal
curves, Density a	nd contour plots, Correlat	ion and scatte	er plots	

Targeted Applications & Tools that can be used:

- Data Analysis
- Data classification
- Data Exploration
- Data Clustering

Tools:

Python with statistical packages

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 students to be developed as a series of Program/ Application.
- On completion of Module 2 and Module 4, students will be asked to develop a Mini Project using python.

Text Book

T1 Fan, Jianqing, Runze Li, Cun-Hui Zhang, and Hui Zou. *Statistical foundations of data science*. CRC press, 2020.

T2 Alan Agresti, Maria Kateri "Foundations of Statistics for Data Scientists With R and Python" 2021

References

Books

R1. James, G., Witten, D., Hastie, T.J., Tibshirani, R. and Friedman, J. (2013). *An Introduction to Statistical Learning with Applications in R*. Springer, New York.

R2. Hastie, T.J., Tibshirani, R. and Friedman, J. (2009). *The elements of Statistical Learning: Data Mining, Inference, and Prediction* (2nd ed). Springer, New York.

R3. Buehlmann, P. and van de Geer, S. (2011). *Statistics for High-Dimensional Data: Methods, Theory and Applications*. Springer, New York.

E book link

1.W. N. Venables, D. M. Smith and the R Core Team, <u>https://www.ebooksdirectory.com/details.php?ebook=1791</u>

Web link:

- 1. <u>https://www.udemy.com/course/statistics-for-data-science-and-business-analysis(Udemy)</u>
- 2. https://www.coursera.org/learn/foundations-of-data-science(Coursera)

Topics relevant to the development of "Foundation Skills":

• Data Exploration using Python and R Programming.

Topics relevant to the development of "Employability Skills":

Statistical Data Analysis and exploration using Python and R Programming.				
Catalogue prepared	Dr. HarishKumar K S			
by				
Recommended by the	BOS NO: SOCSE 2^{nd} BOS held on $10/07/23$			
Board of				
Studies on				
Date of Approval by	Academic Council Meeting No 21, Dated 06/09/2023			
the Academic				
Council				

Course Code: UG COURSE: CSE3013	Course Title: Machine Vision Type of Course: Discipline elective Theory with embedded lab	L-T- P- C	2	0	2	3
Version No.	1.0					L
Course Pre-	MAT1003 Applied Statistics					
requisites	CSE2048 Robotic Vision					
Anti~	NIL					
Course Description	Machine Vision is a field of study that focuses on the design, development, and implementation of computer vision systems and technologies for visual perception and analysis. This course provides an in-depth understanding of the fundamental principles, algorithms, and applications of machine vision. The Machine Vision course covers a wide range of topics related to computer vision, image processing, and pattern recognition. It combines theoretical concepts with hands-on practical exercises to provide students with a comprehensive understanding of machine vision techniques. Introduction to Machine Vision, Image Acquisition and Preprocessing, Image Segmentation and Feature Extraction. Object Detection and Recognition. Machine Vision					
Course Object	The objective of the course is to familiarize the learners wit Vision and attain Employability through Problem Solving N	h the c viethod	oncep ologie	ots c es.	of M	achine
Course Out Comes	 1. Gain a solid understanding of the fundamental underlying machine vision systems, including imagivision algorithms, and pattern recognition techniques. [Knowledge of various machine vision techniques used for tasks such as image acquisitic segmentation, feature extraction, object detection, tracking. n] 3. Ability to Implement Machine Vision Systems design, implement, and evaluate machine vision sprogramming languages and libraries commonly as MATLAB, OpenCV, Python, TensorFlow, or PyTorch. [Application] 4. Gain hands-on experience through lab exercise assignments that involve implementing and experience systems. [Application] 5. Develop teamwork and communication skills be projects and effectively presenting findings and residues. [Application] tasks.] 	princip ge proc ge] algori on, pre Develc systems used in ses, pro rimenti plicatic oy worl sults re	thms proce op the s usin a the ojects ing w on] cing c lated	nd (g, (and essii [A] e sk g fiel c, an ith on g to 1 [A]	con com d ng, ppli ills d, s nd ma grou mac ppli	cepts iputer

Course Content:		_		
Module 1	Introduction to Machine Vision	Assignment	Practical	No. of Classes:8
Overview of n Challenges an	nachine vision and its application d limitations in machine vision	ons, Basic componer	nts of a machine vision	system,
Module 2	Image Acquisition and Preprocessing	Assignment	Practical	No. of Classes:14
Image format	ion and acquisition methods,	Image enhancemen	t techniques, Noise re	duction and
Image denoisi Image Segmer • Edge c • Region • Featur	ng. Itation and Feature Extraction: detection algorithms n-based segmentation re extraction methods	Thresholding techni	ques	
Module 3	Object Detection and Recognition	Assignment	Practical	No. of Classes:8
Object detect	tion algorithms (e.g., templa	ate matching, Haa	ar cascades),Feature-b	pased object
Module 4	Machine Vision Systems and Application	Assignment	Practical	No. of Classes:8
 Indust Roboti Medic Survei Augm 	ics and autonomous systems cal imaging and healthcare app illance and security systems ented reality and virtual reality	lications applications		
Lab Experi	ments are to be conducte	ed on the follow	ing topics:~	
Lab Sheet	1:			
1. Image Lo	oading and Display:			
0 0 Se	Load an image from a file u Display the loaded image u ssion)	using the imread finite states in the second states in the second states of the second states of the second states and st	unction. (Or	ne Lab
2. Image Ar	ithmetic Operations:			
0	Perform addition, subtraction	on, and multiplicat	ion of images using b	asic
ar	arithmetic operations. Display the results of each operation using the inchest function (Operation)			(One
Lab Session)				
3. Implementa	ation of Transformations of an I	mage	(One Lab
a.	Scaling & Rotation			
b.	Gray level transformations, p	ower law, logarithn	nic, negative.	

4. Contrast stretching of a low contrast image, Histogram, and Histogram Equalization. (One Lab Session)

Lab Sheet 2:

5. Edge Detection:

a. Apply edge detection algorithms (e.g., Sobel, Canny) to detect edges in the image.

b. Display the edge-detected images using imshow and compare them with the original. (One Lab Session)

6. Image Restoration:

a. Introduce noise (e.g., Gaussian, salt and pepper) to the image using functions like imnoise.

b. Apply suitable restoration techniques (e.g., median filtering, Wiener filtering) to remove the noise. **(One Lab Session)**

7. Image Segmentation:

a. Convert the image to grayscale using the rgb2gray function.

- b. Perform thresholding using a suitable threshold value to segment the image.
- c. Display the segmented image using imshow and compare it with the original. (One Lab Session) (Level 2)

Lab Sheet 3:

8. Feature Extraction:

a. Texture feature extraction using methods like Gray-Level Co-occurrence Matrix (GLCM) or Local Binary Patterns (LBP).

b. Shape feature extraction (e.g., area, perimeter, eccentricity) using region properties.

c. Color feature extraction using color histograms or color moments. (Two Lab Session) (Level 2)

Lab Sheet 4: (Group Project)

9. Object Detection and Recognition:

• Haar cascade object detection (e.g., face detection or object detection using pre-trained classifiers).

Feature-based object detection using techniques like Speeded-Up Robust
 Features (SURF) or Scale-Invariant Feature Transform (SIFT).

• Deep learning-based object detection using Convolutional Neural Networks (CNNs) or You Only Look Once (YOLO) algorithm.

10. 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).

11. 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. "Machine Vision: Theory, Algorithms, Practicalities" by E.R. Davies 4th edition 2005

References

- 2. "Computer Vision: Algorithms and Applications" by Richard Szeliski 2nd edition 2022.
- 3. Ravishankar Chityala, Sridevi Pudipeddi, "Image Processing and Acquisition Using Python", Taylor & Francis, 2020.

Catalogue prepared by	1. Mr. Yamanappa
Recommende d by the Board of Studies on	BOS NO: SOCSE 2 nd BOS held on 10/07/23
Date of Approval by the Academic Council	Academic Council Meeting No 21, Dated 06/09/2023

Course Code: CSE 3038	Course Title: Applied Data Science Type of Course: Program Core Theory and Laboratory Integrated	L-T- P- C	2	0	2	3
Version No.	1.0					
Course Pre- requisites	knowledge of statistics and Machine learning					
Anti- requisites	-					
Course Descriptio n	This course introduces the core concepts of Data Science followed by programming using R. This course has the theory and lab component which emphasizes on understanding and programming right from Basics to Visualization, and analysis in R. It helps the student to explore data by applying these concepts and also for effective problem solving, visualizing and analyzing.					
Course Objectives	This course is designed to improve the learner's EMPLOYAB real-world PROBLEM-SOLVING methodologies.	ILITY SK	(ILLS k	oy u	sin	g

Course	On successful completion of the	e course, the students shall be	e able to:			
Out	1. Discuss the process involved in Data Science (Knowledge)					
Comes	2. Apply suitable models using machine learning techniques and analyze their nerformance					
	(Application)					
	(ripplication)					
	3. Analyze the performance of the model and the quality of the results (Application)					
	4. Demonstrate the different r	nethodologies and evaluation	on strategies	to real-world		
	problems (Application)					
Course Content:						
Module 1	Introduction to Data Science	Assignment	Case Studies	10 Sessions		
Data Scien Science Pro Data Pre Dimensiona Concept L VC Dimen	 Data Science: Basics – Digital Universe – Sources of Data – Information Commons – Data Science Project Life Cycle: OSEMN Framework Data Preprocessing - Data Quality Assessment, Feature Aggregation, Feature Sampling, Dimensionality Reduction, Feature Encoding. Concept Learning: Formulation of Hypothesis – Probabilistic Approximately Correct Learning - VC Dimension – Hypothesis elimination – Candidate Elimination Algorithm 					
Module 2	PREPARING MODEL USING R	Assignment	Programmi ng	10 Sessions		
Topics: Regression SVM and R	Models- Linear and Logistic Mo andom Forest, Clustering Mode	odel, Classification Models - ls – K Means and Hierarchic	- Decision Tr al clustering	ee, Naïve Bayes,		
Module 3	Performance Evaluation	Assignment	Programmi ng	8 Sessions		
Model Evaluation Techniques: Hold out, cross-validation - Prediction Errors: Type I, Type II - Loss Function and Error: Mean Squared Error, Root Mean Squared Error – Model Selection and Evaluation criteria: Accuracy, F1 score – Sensitivity – Specificity – AUC						
Module 4	Applications of Data Science	Case Study	Programmi ng	8 Sessions		
Predictive I	Modeling: House price prediction	on, Fraud Detection Cluster	ing: Custom	er Segmentation		
Time series	forecasting: Weather Forecastin	ng Recommendation engines	: Product rec	ommendation.		
List of Lab	oratory Tasks:					
Experimen	t No 1: Create an array and p	perform the following oper	ations on it			
Lev	rel 1: Basic Statistics, Copyin	ng, Slicing & Subsetting, I	ndexing, Fla	attening,		
Rea	shaping, Resizing,					
Level 2: Sorting, Swapping, and Dealing with Missing Values						
Experimen	t No. 2: Create an K Data frai	ne and perform the follow	ing operation	ons on it		
	aling with Missing Data	iucanig & reindexing, Re	naming, ner	anon, sorung,		
DC	uning with whooling Data					

Level 2: Statistical functions, Window functions, Aggregations				
Experiment No. 3: Create an R Data frame and perform the following operations on it				
Level 1: Group by Operations Merging/Joining Concatenation				
Level 2: Time Series, Categorical Data, and Text Data				
Experiment No. 4: Using B graphics perform the following				
Level 1. Dist Line Sector Dist Die Charts Dars Histogram Day Dists				
Level 1: Plot, Line, Scatter Plot, Ple Charts, Bars, Histogram, Box Plots,				
Level 2: 5D Pie Charls, 5D Scaller Piol, GG Piol				
Experiment No. 5: Using R Statistics perform the following				
Level I: Max & Min, Mean Median Mode, Subgroup Analyses,				
Level 2: Probability Distributions and Pipes				
Experiment No. 6: House rent prediction using linear regression				
Experiment No. 7: Analysis of tweet and retweet data to identify the spread of fake news				
Experiment No. 8: Perform analysis of power consumption data to suggest minimizing the				
usage				
Experiment No. 9 : Agricultural data analysis for yield prediction and crop selection on Indian				
terrain data set				
Experiment No. 10 : Behavioural analysis of customers for any online purchase model				
Targeted Applications & Tools that can be used:				
Data Exploration				
Data classification				
Data Analysis				
Tools:				
R Studio				
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 students to be developed as a series of Program/ Application.				
• On completion of Module 2 and Module 4, students will be asked to develop a Mini Project				
using R.				
Text Book				
1. The Essentials of Data Science, Knowledge Discovery Using R, Graham J Williams, CRC				
Press, 2017				
2. HadleyWickhmen, Garrette Grolemund, R for Data Science: Import, Tidy, Transform,				
Visualize and Model Data, OReilly, 2017				
3. Build A Career in Data Science, March 2020, by Emily Robinson, Jacqueline Nolis				
References				
Books				
1. R for Data Science by Hadley Wickham & Garrett Grolemund, Reference, 2017				
2. Practical Data Science CookBook, APRESS Publications, 2018				
Web Links:				
1. <u>nups://www.coursera.org/learn/introducton-r-programming-data-science</u> (Coursera)				
2. <u>https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE</u>				
BASED&unique_1d=DOAJ_1_02082022_17/3 (E-Library Resource)				
5. <u>nups://onlinecourses.nptel.ac.in/noc22_cs52/preview (NPTEL)</u>				
Topics relevant to the development of "Foundation Skills":				
• Data Exploration K Programming.				
topics relevant to the development of "Employability Skills":				

• Dat	Data Analysis and Visualization using R Programming.			
Catalogue				
prepared by	Dr.A.Jayachandran,			
Dy Recommen	BOG NO: SOCSE $2 \times BOG$ hold on $10/07/22$			
ded by the	DOS INO. SOCSE 2nd DOS field off 10/07/25			
Board of				
Studies on				
Date of	Academic Council Meeting No 21, Dated 06/09/2023			
Approval				
by the				
Academic Council				
Ittagalpura, Rajanukunte, Yelahanka, Bengaluru 560 119