

PROGRAMME REGULATIONS & CURRICULUM

2023-27

PRESIDENCY SCHOOL OF COMPUTER SCIENCE & ENGINEERING

BACHELOR OF TECHNOLOGY (B.TECH.) COMPUTER SCIENCE AND ENGINEERING (INTERNET OF THINGS-CIT)

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PRESIDENCY SCHOOL OF COMPUTER SCIENCE AND ENGINEERING

Program Regulations and Curriculum

2023-2027

BACHELOR OF TECHNOLOGY (B.Tech.) in

INTERNET OF THINGS(CIT)

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)

Regulations No.: PU/AC-24.05/SOCSE04/CIT/2023-27

Resolution No.7 of the 24th Meeting of the Academic Council held on 03rd August 2024, and ratified by the Board of Management in its 24th Meeting held on 05th August, 2024.

AUGUST-2024

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PART A – PROGRAM REGULATIONS

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

1.1 Vision of the University

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

1.2 Mission of the University

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

1.3 Vision of Presidency School of Computer Science and Engineering

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

1.4 Mission of Presidency School of Computer Science and Engineering

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

2. Preamble to the Program Regulations and Curriculum

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

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

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

3. Short Title and Applicability

- a. These Regulations shall be called the Bachelor of Technology Degree Program Regulations and Curriculum 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 2023-2027.

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, 2023-2027;
- 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, 2021;
- 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

The Bachelor of Technology Degree Program Regulations and Curriculum 2023-2027 are subject to, and, pursuant to the Academic Regulations. These Program Regulations shall be applicable to the following ongoing Bachelor of Technology (B.Tech.) Degree Programs of 2023-2027 offered by the Presidency School of Computer Science and Engineering (PSCS):

- 1. Bachelor of Technology in Computer Science and Engineering, abbreviated as B.Tech. Computer Science and Engineering;
- 2. Bachelor of Technology in Computer Science and Technology (Big Data), abbreviated as B.Tech. Computer Science and Technology (Big Data);
- 3. Bachelor of Technology in Computer Science and Engineering (Block Chain), abbreviated as B.Tech. Computer Science and Engineering (Block Chain);
- 4. Bachelor of Technology in Computer Science and Technology (Dev Ops), abbreviated as B.Tech. Computer Science and Technology (Dev Ops);
- Bachelor of Technology in Computer Science and Engineering (Cyber Security), abbreviated as B.Tech. Computer Science and Engineering (Cyber Security);
- Bachelor of Technology in Computer Science and Engineering (Internet of Things), abbreviated as B.Tech. Computer Science and Engineering (Internet of Things);
- 7. Bachelor of Technology in Computer Science and Engineering (Data Science), abbreviated as B.Tech. Computer Science and Engineering (Data Science);
- 8. Bachelor of Technology in Computer Science and Technology (Artificial Intelligence and Machine Learning), abbreviated as B.Tech. Computer Science and Technology (Artificial Intelligence and Machine Learning);
- 9. Bachelor of Technology in Information Science and Technology, abbreviated as B.Tech. Information Science and Technology;
- 10. Bachelor of Technology in Computer Science and Information Technology, abbreviated as B.Tech. Computer Science and Information Technology;
- 11. Bachelor of Technology in Computer Science and Engineering (Networks), abbreviated as B.Tech. Computer Science and Engineering (Networks);
- 12. Bachelor of Technology in Computer Engineering (Artificial Intelligence and Machine Learning), abbreviated as B.Tech. Computer Engineering (Artificial Intelligence and Machine Learning);
- 13. Bachelor of Technology in Information Science and Engineering (Artificial Intelligence and Robotics), abbreviated as B.Tech. Information Science and Engineering (Artificial Intelligence and Robotics); and
- 14. Bachelor of Technology in Computer Science and Engineering (Artificial Intelligence and Machine Learning) abbreviated as B.Tech. Computer Science and Engineering (Artificial Intelligence and Machine Learning);

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 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 Error! Reference source not found. 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 (Sub-Clauses 18.1 and 18.2 of Academic Regulations), shall stand terminated and no Degree shall be awarded.

7 Programme Educational Objectives (PEO)

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

PEO1. Demonstrate as a Computer Engineering Professional

PEO2. Engage in lifelong learning through research and professional development

 $\ensuremath{\text{PEO3.}}$ 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:

- **PO1. Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- **PO2. Problem Analysis:** Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- **PO3**. **Design/Development of Solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- **PO4. Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- **PO5. Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
- **PO6. The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- **PO7.** Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- **PO8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- **PO9.** Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- **PO10.** Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- **PO11. Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- **PO12. Life-Long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

8.2 Program Specific Outcomes (PSOs):

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

PSO 01: [**Problem Analysis**]: Identify, formulate, research literature, and analyze complex engineering problems related to Internet of Things principles and practices, Programming and Computing technologies reaching substantiated

conclusions using first principles of mathematics, natural sciences and engineering sciences.

- **PSO 02:** [Design/development of Solutions]: Design solutions for complex engineering problems related to Internet of Things principles and practices, Programming and Computing technologies and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, cultural, societal and environmental considerations.
- **PSO 03:** [Modern Tool usage]: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities related to Internet of Things principles and practices, Programming in Internet of Things Computing & analytics with an understanding of the limitations.

9 Admission Criteria (as per the concerned Statutory Body)

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

- 9.1 An applicant who has successfully completed Pre-University course or Senior Secondary School course (+2) or equivalent such as (11+1), 'A' level in Senior School Leaving Certificate Course from a recognized university of India or outside or from Senior Secondary Board or equivalent, constituted or recognized by the Union or by the State Government of that Country for the purpose of issue of qualifying certificate on successful completion of the course, may apply for and be admitted into the Program.
- 9.2 Provided further, the applicant must have taken Physics and Mathematics as compulsory subjects in the Pre-University / Higher Secondary / (10+2) / (11+1) examination, along with either Chemistry / Biology / Electronics / Computer Science / Biotechnology subject, and, the applicant must have obtained a minimum of 45% of the total marks (40% in case of candidates belonging to the Reserved Category as classified by the Government of Karnataka) in these subjects taken together.
- 9.3 The applicant must have appeared for Joint Entrance Examinations (JEE) Main
 / JEE (Advanced) / Karnataka CET / COMED-K, or any other State-level
 Engineering Entrance Examinations.
- 9.4 Reservation for the SC / ST and other backward classes shall be made in accordance with the directives issued by the Government of Karnataka from time to time.
- 9.5 Admissions are offered to Foreign Nationals and Indians living abroad in accordance with the rules applicable for such admission, issued from time to time, by the Government of India.
- 9.6 Candidates must fulfil the medical standards required for admission as

prescribed by the University.

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

10 Lateral Entry / Transfer Students requirements

10.1 Lateral Entry

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

- 10.1.1 Admission to 2nd year (3rd Semester) of the B.Tech. Degree program shall be open to the candidates who are holders of a 3-year Diploma in Engineering (or equivalent qualification as recognized by the University), who have secured not less than forty-five percentages (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, 2023-2027, 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. (Internet of Things) is "N" Credits, and, if the total credits prescribed in the 1st Year (total credits of the 1st and 2nd Semesters) of the Program concerned is "M" Credits, then the *Minimum Credit Requirements* for the award of the B.Tech. in Internet of Things 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 2^{nd} year (3^{rd} Semester) of the B.Tech. Program of the University

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

- 10.2.1 The concerned student fulfils the criteria specified in Sub-Clauses 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 3rd Semester of the B.Tech. Program.

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

- 12.1 The academic performance evaluation of a student in a Course shall be according to the University Letter Grading System based on the class performance distribution in the Course.
- 12.2 Academic performance evaluation of every registered student in every Course registered by the student is carried out through various components of Assessments spread across the Semester. The nature of components of Continuous Assessments and the weightage given to each component of Continuous Assessments (refer Clause 12.5 of Academic Regulation) 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 **Error! Reference source not found.** of Academic Regulation) 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.

			Table	1:Ass	essm	nent Co	mponent	ts and V	Veightag	e			
	Credi			CA		Mid-	Term	End	-term				
S. No	t Struc ture [L-T- P-C]	Percen tage/ Marks	Theory	, Pra	acti al	The ory	Pract ical	The ory	Pract ical	Proj ect	Tot al	Exam Conducted by	
1	3-0-0-	Percen tage	25%	-		25%	-	50%	-	-	10 0%	Mid-Term & End Term by	
	?	Marks	50	-		50	-	100	-	-	20 0	СоЕ	
2	2-0-2-	Percen tage	12.50%	, 12 9	.50 %	12.5 0%	12.50 %	25%	25%	-	10 0%	Mid-Term & End Term by CoE * Except	
	3	Marks	25	2	5	25	25	50	50	-	20 0	for full stack courses	
3	1-0-4-	Percen tage	-	25	5%	10%	40%	5%	20%	-	10 0%	Mid-Term & End Term by	
	2	Marks	-	2	5	10	40	5	20	-	10 0	School	
4	2-0-4- 4	Percen tage	12.50%	, 12 , ,	.50 ⁄₀	10%	15%	20%	30%	-	10 0%	*Mid-Term & End Term by	
	Ŧ	Marks	25	2	5	20	30	40	60	-	20 0	СоЕ	
5	0-0-4-	Percen tage	-	50)%	-	-	-	-	50%	10 0%	Project evaluated by	
	2	Marks	-	5	0	-	-	-	-	50	10 0	level	
6	0-0-2-	Percen tage	-	10	0%	-	-	-	-	-	10 0%	Only CA at	
	-	Marks	-	10	00	-	-	-	-	-	10 0	School Level	
7	3-0-2-	Percen tage	12.50%	12	.50 %	15%	10%	30%	20%	-	10 0%	Mid-Term & End Term by	
	4	Marks	25	2	5	30	20	60	40	-	20 0	СоЕ	
8	2-0-0-	Percen tage	25%	-	2	25%	-	50%	-	-	10 0%	Mid-Term & End Term by	
	2	Marks	50	-		50	-	100	-	-	20 0	CoE	

12.5 Assessment Components and Weightage

*CSE3150-Front End Full stack development

CSE3151-Java Full Stack Development

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 **Error! Reference source not found.** 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, reappear in the End Term Examinations of the same Course when it is scheduled at the end of the following Semester or Summer Term, if offered. The marks obtained in the Continuous Assessments (other than the End Term Examination) shall be carried forward and be included in computing the final grade, if the student secures the minimum requirements (as per Clause 12.6.1, 12.6.2 of Academic Regulation) in the "Make-Up Examinations" of the concerned Course. Further, the student has an option to reregister 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 Error! Reference source not found. of Academic Regulation) and approved by the Dean - Academics.
- 13.2 Students may earn credits from other Indian or foreign Universities/Institutions with which the University has an MOU, and that MOU shall have specific provisions, rules and guidelines for transfer of credits. These transferred credits shall be counted towards the minimum credit requirements for the award of the degree.
- 13.3 Students may earn credits by registering for Online Courses offered by *Study Web of Active Learning by Young and Aspiring Minds* (SWAYAM) and *National Program on Technology Enhanced Learning* (NPTEL), or other such recognized Bodies/ Universities/Institutions as approved by the concerned BOS and Academic Council from time to time. The concerned School/Parent Department shall publish/include the approved list of Courses and the rules and guidelines governing such transfer of credits of the concerned Program from time to time. The Rules and Guidelines for the transfer of credits specifically from the Online Courses conducted by SWAYAM/ NPTEL/ other approved MOOCs are as stated in the following Sub-Clauses:
 - 13.3.1 A student may complete SWAYAM/NPTEL/other approved MOOCs as mentioned in Clause 13.3 (As Per Academic Regulations) and transfer equivalent credits to partially or fully complete the mandatory credit requirements of Discipline Elective Courses and/or the mandatory credit requirements of Open Elective Courses as prescribed in the concerned Curriculum Structure. However, it is the sole responsibility of the student to complete the mandatory credit requirements of the Discipline Elective Courses and the Open Elective Courses as prescribed by the Curriculum Structure of the concerned Program.
 - 13.3.2 SWAYAM/NPTEL/ other approved MOOCs as mentioned in Clause 13.3 (As Per 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 **Error! Reference source not found.** in the Academic Regulations.

Ta Crec	Table 2: Durations and Credit Equivalence for Transfer of Credits 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.**Error! Reference source not found.**), 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. (Internet of Things) Program Structure (2023-2027) totalling 160 credits. Table 7 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 C	Table 3: B.Tech. (Internet of Things) 2023-2027: Summary of MandatoryCourses and Minimum Credit Contribution from various Baskets										
SI. No.	Baskets	Credit Contribution									
1	School Core	65									
2	Program Core	68									
3	Discipline Elective	18									
4	Open Elective	9									
	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. (Internet of Things) program of four years' duration.

15. Minimum Total Credit Requirements of Award of Degree

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

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

- 16.1 The award of the Degree shall be recommended by the Board of Examinations and approved by the Academic Council and Board of Management of the University.
- 16.2 A student shall be declared to be eligible for the award of the concerned Degree if she/he:
 - a. Fulfilled the Minimum Credit Requirements and the Minimum Credits requirements under various baskets;
 - b. Secure a minimum CGPA of 4.50 in the concerned Program at the end of the Semester/Academic Term in which she/he completes all the requirements for the award of the Degree as specified in Sub-Clause a of Academic Regulations;
 - c. No dues to the University, Departments, Hostels, Library, and any other such Centers/ Departments of the University; and
 - d. No disciplinary action is pending against her/him.

PART C: CURRICULUM STRUCTURE

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17.Curriculum Structure – Basket Wise Course List (not Semester Wise) List of Courses Tabled – aligned to the Program Structure (Course Code, Course Name, Credit Structure (LTPC), Contact Hours, Course Basket, Type of Skills etc., as applicable).

	Table 3.1 : List of School Core												
SI. No.	Course Code	Course Name	L	т	Ρ	Credits							
1	MAT1001	Calculus and Linear Algebra	3	0	2	4							
2	PHY1002	Optoelectronics and Device Physics	2	0	2	3							
3	ECE1001	Elements of Electronics Engineering	3	0	2	4							
4	ENG1002	Technical English	1	0	2	2							
5	PPS1001	Introduction to soft skills	0	0	2	1							
7	CHE1018	Environmental Science	1	0	2	0							
8	PPS1011	Introduction to Verbal Ability	0	1	0	0							
9	MAT1003	Applied Statistics	1	0	2	2							
10	ECE2007	Digital Design	2	0	2	3							
11	CIV1008	Basic Engineering Sciences	2	0	0	2							
12	MEC1006	Engineering Graphics	2	0	0	2							
13	CSE1006	Problem Solving using JAVA	1	0	4	3							
14	ENG2001	Advanced English	1	0	2	2							
15	PPS1002	Soft Skills for Engineers	0	0	2	1							
16	ECE2010	Innovative Projects Using Arduino	-	-	-	1							
17	MAT1002	Transform Techniques, Partial Differential Equations and Their Applications	3	0	0	3							
18	CSE2001	Data Structures and Algorithms	3	0	2	4							
19	MAT2004	Discrete Mathematical Structures	3	0	0	3							
20	ECE2011	Innovative Projects Using Raspberry Pi	-	-	-	1							
21	PPS4002	Introduction to Aptitude	0	0	2	1							
22	MAT2003	Numerical Methods for Engineers	3	0	0	3							
23	PPS4004	Aptitutde Training Intermediate	0	0	2	1							
24	CSE3216	Mastering Object-Oriented Concepts in Python	0	0	2	1							
25	CSE7000	Internship	-	-	-	2							
26	PPSXXXX	Industry Preparedness Program	2	0	0	0							
27	CSE2510	Competitive Programming and Problem Solving	0	0	4	2							
28	CSE7100	Mini Project	-	-	-	4							

29	CSE7300	Capstone Project	-	-	-	10
		Total				68

Table 3.2 : List of Program Core											
S. 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 Architecture300									
3	CSE3190	Fundamentals of Data Analytics	2	0	2	3					
4	CSE2014	Software Engineering	3	0	0	3					
5	CSE1005	Programming in Python	1	0	4	3					
6	CSE2007	Design and Analysis of Algorithms	3	0	0	3					
7	CSE3156	Database Management Systems	3	0	2	4					
8	CSE3351	Operating Systems	3	0	0	3					
9	CSE3078	Cryptography and Network Security	3	0	0	3					
10	CSE1700	Essentials of Al	3	0	0	3					
11	CIT2500	FoG Computing for IoT	3	0	0	3					
12	CIT2503	Mobile Application for IoT	3	0	0	3					
13	CSE2500	Theory of Computation	3	0	0	3					
14	CIT2501	Wireless Communication in IoT	3	0	0	3					
15	CSE1504	Web Technologies	2	0	0	2					
16	CSE1505	Web Technologies Lab	0	0	2	1					
17	CSE1701	Essentials of AI Lab	0	0	4	2					
18	CIT2504	AI and Deep Learning for IoT	3	0	0	3					
19	CIT2502	Privacy and Security in IoT	3	0	0	3					
20	CSE2506	Cloud Computing	2	0	0	2					
21	CSE2507	Cloud Computing Lab	0	0	2	1					
22	CIT2400	Cyber Physical Systems	3	0	0	3					
23	CSE2508	Mobile Application Development	2	0	0	2					
24	CSE2509	Mobile Application Development Lab	0	0	4	2					
Total No. of Credits 65											

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

Practical / Skill based Courses like internship, project work, capstone project, research project / dissertation, and such similar courses, where the pedagogy does not lend itself to a typical L-T-P-C Structure as defined in Clause 5.1 of the Academic Regulations, 2021, are simply assigned the number of Credits based on the quantum of work / effort required to fulfil the learning objectives and outcomes prescribed for the concerned Courses. Such courses are referred to as Non-Teaching Credit Courses (NTCC). These Courses are designed to provide students with hands-on experience and skills essential for their professional development. These courses aim to equip students with abilities in problem identification, root cause analysis, problem-solving, innovation, and design thinking through industry exposure and project-based learning. The expected outcomes are first level proficiency in problem solving and design thinking skills to better equip 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 4^{th} and 5^{th} 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 Project Work 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 Project Work shall be approved by the concerned HOD and be carried out under the guidance of a faculty member.
- 18.2.2 The student may do the project work in an Industry / Company or academic / research institution of her / his choice subject to the above mentioned condition (Sub-Clause 18.2.1). Provided further, that the Industry / Company or academic / research institution offering such project work confirms to the University that the project work will be conducted in accordance with the Program Regulations and requirements of the University.

18.3 Capstone Project

A student may undergo a Capstone Project for a period of 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 Policy of the University.

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

18.4 Research Project / Dissertation

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

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

The student may do the Research Project / Dissertation in an Industry / Company or academic / research institution of her / his choice subject to the above mentioned condition (Sub-Clause 18.4.4). 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.

_	Table 3.3: Discipline Electives Courses/Specialization Tracks – Minimum of 03 credits is to be earned by the student in a particular track and overall 18 credits.													
	Track 01: Security and Industry Applications Basket													
1	CIT3410	Secure IoT	3	0	0	3								
2		IoT for Healthcare and Wearable			0	3								
	CIT3412	Technology	3	0										
3	CIT3413	Industrial IoT (IIoT)	3	0	0	3								
4	CIT3414	Energy-Efficient IoT Systems	3	0	0	3								
Т	ack 02 :Netw	orking and Infrastructu	re Basket											
1	CIT3400	Architecting Smart IoT Devices	3	0	0	3								
2	CIT3401	Intelligent Sensors and Systems	3	0	0	3								

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

3	CIT3402	IoT Architecture and Protocols	2	0	2	3
	0110102		1	•	-	5
4		Edge and Fog				
	CIT3405	Computing for IoT	3	0	0	3
5		Cloud Computing				
	CIT3406	for IoT	3	0	0	3
Tr	ack 03: Al-Driv	ven IoT Intelligence Bas	sket			
1		Big Data Analytics				
	CIT3411	for IoT	2	0	2	3
2		Embedded Systems				
	CIT3403	for IoT	3	0	0	3
3		IoT System Design				
	CIT3404	and Development	3	0	0	3
4		IoT Data Analytics				
		and Machine				
	CIT3407	Learning	3	0	0	3
5		Al and Deep				
	CIT2504	Learning for IoT	3	0	0	3
6		Digital Twins and				
	CIT3408	Simulation in IoT	3	0	0	3
7		Autonomous				
		Systems and				
	CIT3409	Robotics with IoT	3	0	0	3

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

Та	Fable 3.4: Open Elective Courses Baskets: Minimum Credits to be earned from this Basket is 9													
SI. N o.	Cour se Code	Course Name	L	т	Ρ	с	Typ e of Skill / Foc us	Course Caters to	Prerequisit es/ Corequisite s	Antir equisi tes	Future Courses that need this as a Prerequisite			
Ch	emistr	y Basket			•	•	•			•				
1	CHE1 003	Fundamentals of Sensors	3	0	0	3	S	ES	-	-	-			
2	CHE1 004	Smart materials for IOT	3	0	0	3	S	ES	-	-	-			

3	CHE1 005	Computational Chemistry	2	0	0	2	s	ES	-	-	-
4	CHE1 006	Introduction to Nano technology	3	0	0	3	s	ES	-	-	-
5	CHE1 007	Biodegradable electronics	2	0	0	2	s	ES	-	-	-
6	CHE1 008	Energy and Sustainability	2	0	0	2	s	ES	-	-	-
7	CHE1 009	3D printing with Polymers	2	0	0	2	s	ES	-	-	-
8	CHE1 010	Bioinformatics and Healthcare IT	2	0	0	2	s	ES	-	-	-
9	CHE1 011	Chemical and Petrochemical catalysts	3	0	0	3	s	ES	-	-	-
10	CHE1 012	Introduction to Composite materials	2	0	0	2	s	ES	-	-	-
11	CHE1 013	Chemistry for Engineers	3	0	0	3	s	ES	-	-	-
12	CHE1 014	Surface and Coatings technology	3	0	0	3	s	ES	-	-	-
13	CHE1 015	Waste to Fuels	2	0	0	2	s	ES	-	-	-
14	CHE1 016	Forensic Science	3	0	0	3	s	ES	-	-	-
Civ	il Engi	neering Basket		I	1	1	1	1		1	
1	CIV1 001	Disaster mitigation and management	3	0	0	3	s	-	-	-	-
2	CIV1 002	Environment Science and Disaster Management	3	0	0	3	FC	-	-	-	-
3	CIV2 001	Sustainability Concepts in Engineering	3	0	0	3	s	-	-	-	-
4	CIV2 002	Occupational Health and Safety	3	0	0	3	s	-	-	-	-
5	CIV2 003	Sustainable Materials and Green Buildings	3	0	0	3	EM	-	-	-	-
6	CIV2 004	Integrated Project Management	3	0	0	3	EN	-	-	-	-

7	CIV2 005	Environmental Impact Assessment	3	0	0	3	EN	-	-	-	-
8	CIV2 006	Infrastructure Systems for Smart Cities	3	0	0	3	EN	-	-	-	-
9	CIV2 044	Geospatial Applications for Engineers	2	0	2	3	EM	-	-	-	-
10	CIV2 045	Environmental Meteorology	3	0	0	3	s	-	-	-	-
11	CIV3 046	Project Problem Based Learning	3	0	0	3	S	-	-	-	-
12	CIV3 059	Sustainability for Professional Practice	3	0	0	3	EN	-	-	-	-
Со	mmer	ce Basket									
1	COM 2001	Introduction to Human Resource Management	2	0	0	2	F	HP/GS	-	-	-
2	COM 2002	Finance for Non Finance	2	0	0	2	S	-	-	-	-
3	COM 2003	Contemporary Management	2	0	0	2	F	-	-	-	-
4	COM 2004	Introduction to Banking	2	0	0	2	F	-	-	-	-
5	COM 2005	Introduction to Insurance	2	0	0	2	F	-	-	-	-
6	COM 2006	Fundamentals of Management	2	0	0	2	F	-	-	-	-
7	COM 2007	Basics of Accounting	3	0	0	3	F	-	-	-	-
Со	mpute	r Science Basket (not t	to k	be o	offe	erec	d for	Comput	er Science ai	nd Engi	ineering students)
1	CSE2 002	Programming in Java	2	0	2	3	S/E M	-	-	-	-
2	CSE2 003	Social Network Analytics	3	0	0	3	S	GS	-	-	-
3	CSE2 004	Python Application Programming	2	0	2	3	S/ EM	-	-	-	-
4	CSE2 005	Web design fundamentals	2	0	2	3	S/ EM /EN	-	-	-	-

5	CSE3 111	Artificial Intelligence : Search Methods For Problem Solving	3	0	0	3	S/ EM /EN	-	-	-	-
6	CSE3 112	Privacy And Security In Online Social Media	3	0	0	3	S/ EM /EN	-	-	-	-
7	CSE3 113	Computational Complexity	3	0	0	3	S/ EM /EN	-	-	-	-
8	CSE3 114	Deep Learning for Computer Vision	3	0	0	3	S/ EM /EN	-	-	-	-
9	CSE3 115	Learning Analytics Tools	3	0	0	3	S/ EM /EN	-	-	-	-
De	sign B	asket						•		1	
1	DES1 001	Sketching and Painting	0	0	2	1	S	-	-	-	-
2	DES1 002	Innovation and Creativity	2	0	0	2	F	-	-	-	-
3	DES1 121	Introduction to UX design	1	0	2	2	S	-	-	-	-
4	DES1 122	Introduction to Jewellery Making	1	0	2	2	S	-	-	-	-
5	DES1 124	Spatial Stories	1	0	2	2	S	-	-	-	-
6	DES1 125	Polymer Clay	1	0	2	2	S	-	-	-	-
7	DES2 001	Design Thinking	3	0	0	3	S	-	-	-	-
8	DES1 003	Servicability of Fashion Products	1	0	2	2	F	ES	-	-	-
9	DES1 004	Choices in Virtual Fashion	1	0	2	2	F	ES, GS, HP	-	-	-
10	DES1 005	Fashion Lifestyle and Product Diversity	1	0	2	2	F	ES, GS, HP	-	-	-
11	DES1 006	Colour in Everyday Life	1	0	2	2	F	ES	-	-	-
12	DES2 080	Art of Design Language	3	0	0	3	S	-	-	-	-

13	DES2 081	Brand Building in Design	3	0	0	3	s	-	-	-	-			
14	DES2 085	Web Design Techniques	3	0	0	3	s	-	-	-	-			
15	DES2 089	3D Modeling for Professionals	1	0	4	3	s	-	-	-	-			
16	DES2 090	Creative Thinking for Professionals	3	0	0	3	s	-	-	-	-			
17	DES2 091	Idea Formulation	3	0	0	3	S	-	-	-	-			
Ele Ba:	ctrical sket	and Electronics												
1	EEE1 002	IoT based Smart Building Technology	3	0	0	3	S	-	-	-	-			
2	EEE1 003	Basic Circuit Analysis	3	0	0	3	S	-	-	-	-			
3	EEE1 004	Fundamentals of Industrial Automation	3	0	0	3	s	-	-	-	-			
4	EEE1 005	Electric Vehicles & Battery Technology	3	0	0	3	S	-	-	-	-			
5	EEE1 006	Smart Sensors for Engineering Applications	3	0	0	3	s	-	-	-	-			
Ele Co	ctroni mmun	cs and ication Basket			I	I	<u> </u>				I			
1	ECE1 003	Fundamentals of Electronics	3	0	0	3	F	-	-	-	-			
2	ECE1 004	Microprocessor based systems	3	0	0	3	F	-	-	-	-			
3	ECE3 089	Artificial Neural Networks	3	0	0	3	s	-	-	-	-			
4	ECE3 097	Smart Electronics in Agriculture	3	0	0	3	F/E M	-	-	-	-			
5	ECE3 098	Environment Monitoring Systems	3	0	0	3	F/E M	-	-	-	-			
6	ECE3 102	Consumer Electronics	3	0	0	3	F/E M	-	-	-	-			
7	ECE3 103	Product Design of Electronic Equipment	3	0	0	3	S/F/ EM / EN	-	-	-	-			

8	ECE3 106	Introduction to Data Analytics	3	0	0	3	F/E M	-	-	-	-		
9	ECE3 107	Machine Vision for Robotics	3	0	0	3	F/E M	-	-	-	-		
En	glish B	asket											
1	ENG 1008	Indian Literature	2	0	0	2	-	GS/ HP	-	-	-		
2	ENG 1009	Reading Advertisement	3	0	0	3	S	-	-	-	-		
3	ENG 1010	Verbal Aptitude for Placement	2	0	2	3	s	-	-	-	-		
4	ENG 1011	English for Career Development	3	0	0	3	s	-	-	-	-		
5	ENG 1012	Gender and Society in India	2	0	0	2	-	GS/ HP	-	-	-		
6	ENG 1013	Indian English Drama	3	0	0	3	-	-	-	-	-		
7	ENG 1014	Logic and Art of Negotiation	2	0	2	3	-	-	-	-	-		
8	ENG 1015	Professional Communication Skills for Engineers	1	0	0	1	-	-	-	-	-		
DS	A Bask	ket			<u> </u>					I			
1	DSA2 001	Spirituality for Health	2	0	0	2	F	НР	-	-	-		
2	DSA2 002	Yoga for Health	2	0	0	2	s	HP	-	-	-		
3	DSA2 003	Stress Management and Well Being	2	0	0	2	F	-	-	-	-		
Ka	nnada	Basket				1		1		1			
1	KAN 1001	Kali Kannada	1	0	0	1	S	-	-	-	-		
2	KAN 1003	Kannada Kaipidi	3	0	0	3	S	-	-	-	-		
3	KAN 2001	Thili Kannada	1	0	0	1	s	-	-	-	-		
4	KAN 2003	Pradharshana Kale	1	0	2	2	S	-	-	-	-		

5	KAN 2004	Sahithya Vimarshe	2	0	0	2	S	-	-	-	-
6	KAN 2005	Anuvadha Kala Sahithya	3	0	0	3	S	-	-	-	-
7	KAN 2006	Vichara Manthana	3	0	0	3	S	-	-	-	-
8	KAN 2007	Katha Sahithya Sampada	3	0	0	3	S	-	-	-	-
9	KAN 2008	Ranga Pradarshana Kala	3	0	0	3	S	-	-	-	-
Foi	reign L	anguage Basket					•		·		
1	FRL1 004	Introduction of French Language	2	0	0	2	S	S	-	-	-
2	FRL1 005	Fundamentals of French	2	0	0	2	S	S	-	-	-
3	FRL1 009	Mandarin Chinese for Beginners	3	0	0	3	S	s	-	-	-
Lav	v Bask	et						•		1	
1	LAW 1001	Introduction to Sociology	2	0	0	0	2	F	НР	-	-
2	LAW 2001	Indian Heritage and Culture	2	0	0	0	2	F	HP/GS	-	-
3	LAW 2002	Introdcution to Law of Succession	2	0	0	0	2	F	HP/GS	-	-
4	LAW 2003	Introduction to Company Law	2	0	0	0	2	F	НР	-	-
5	LAW 2004	Introduction to Contracts	2	0	0	2	F	HP	-	-	-
6	LAW 2005	Introduction to Copy Rights Law	2	0	0	2	F	HP	-	-	-
7	LAW 2006	Introduction to Criminal Law	2	0	0	2	F	HP	-	-	-
8	LAW 2007	Introduction to Insurance Law	2	0	0	2	F	HP	-	-	-
9	LAW 2008	Introduction to Labour Law	2	0	0	2	F	HP	-	-	-
10	LAW 2009	Introduction to Law of Marriages	2	0	0	2	F	HP/GS	-	-	-

11	LAW 2010	Introduction to Patent Law	2	0	0	2	F	НР	-	-	-
12	LAW 2011	Introduction to Personal Income Tax	2	0	0	2	F	ΗР	-	-	-
13	LAW 2012	Introduction to Real Estate Law	2	0	0	2	F	HP	-	-	-
14	LAW 2013	Introduction to Trademark Law	2	0	0	2	F	HP	-	-	-
15	LAW 2014	Introduction to Competition Law	3	0	0	3	F	HP	-	-	-
16	LAW 2015	Cyber Law	3	0	0	3	F	HP	-	-	-
17	LAW 2016	Law on Sexual Harrassment	2	0	0	2	F	HP/GS	-	-	-
18	LAW 2017	Media Laws and Ethics	2	0	0	2	F	HP/GS	-	-	-
Ma	thema	atics Basket			I	<u> </u>		I			
1	MAT 2008	Mathematical Reasoning	3	0	0	3	s	-	-	-	-
2	MAT 2014	Advanced Business Mathematics	3	0	0	3	s	-	-	-	-
3	MAT 2041	Functions of Complex Variables	3	0	0	3	s	-	-	-	-
4	MAT 2042	Probability and Random Processes	3	0	0	3	s	-	-	-	-
5	MAT 2043	Elements of Number Theory	3	0	0	3	s	-	-	-	-
6	MAT 2044	Mathematical Modelling and Applications	3	0	0	3	S	-	-	-	-
Me	echani	cal Basket									
1	MEC 1001	Fundamentals of Automobile Engineering	3	0	0	3	F	-	-	-	-
2	MEC 1002	Introduction to Matlab and Simulink	3	0	0	3	S/E M	-	-	-	-
3	MEC 1003	Engineering Drawing	1	0	4	3	S	-	-	-	-
4	MEC 2001	Renewable Energy Systems	3	0	0	3	F	ES	-	-	-

5	MEC 2002	Operations Research & Management	3	0	0	3	F	-	-	-	-
6	MEC 2003	Supply Chain Management	3	0	0	3	S/ EM / EN	-	-	-	-
7	MEC 2004	Six Sigma for Professionals	3	0	0	3	S/E M	-	-	MEC2 008	-
8	MEC 2005	Fundamentals of Aerospace Engineering	3	0	0	3	F	-	-	-	-
9	MEC 2006	Safety Engineering	3	0	0	3	S/E M	ES	-	-	-
10	MEC 2007	Additive Manufacturing	3	0	0	3	F/E M	-	-	-	-
11	MEC 3069	Engineering Optimisation	3	0	0	3	S/E M	-	-	-	-
12	MEC 3070	Electronics Waste Management	3	0	0	3	F/S	ES	-	-	-
13	MEC 3071	Hybrid Electric Vehicle Design	3	0	0	3	S/E M	ES	-	-	-
14	MEC 3072	Thermal Management of Electronic Appliances	3	0	0	3	S/E M	-	-	-	-
15	MEC 3200	Sustainable Technologies and Practices	3	0	0	3	S/E M	-	-	-	-
16	MEC 3201	Industry 4.0	3	0	0	3	S/E M	-	-	-	-
Pe	troleu	m Basket		1				1	I	I	L
1	PET1 011	Energy Industry Dynamics	3	0	0	3	FC	ES	-	NIL	-
2	PET1 012	Energy Sustainability Practices	3	0	0	3	FC	ES	-	NIL	-
Ph	ysics B	asket		1				1	I		
1	PHY1 003	Mechanics and Physics of Materials	3	0	0	3	FC / SD				
2	PHY1 004	Astronomy	3	0	0	3	FC				
3	PHY1 005	Game Physics	2	0	2	3	FC / SD				

4	PHY1 006	Statistical Mechanics	2	0	0	2	FC				
5	PHY1 007	Physics of Nanomaterials	3	0	0	3	FC				
6	PHY1 008	Adventures in nanoworld	2	0	0	2	FC				
7	PHY2 001	Medical Physics	2	0	0	2	FC	ES			
8	PHY2 002	Sensor Physics	1	0	2	2	FC / SD				
9	PHY2 003	Computational Physics	1	0	2	2	FC				
10	PHY2 004	Laser Physics	3	0	0	3	FC	ES			
11	PHY2 005	Science and Technology of Energy	3	0	0	3	FC	ES			
12	PHY2 009	Essentials of Physics	2	0	0	2	FC				
Ma	anager	nent Basket- I						•		1	
1	MGT 2007	Digital Entrepreneurship	3	0	0	3	S/E M/ EN	-	-	-	-
2	MGT 2015	Engineering Economics	3	0	0	3	S	-	-	-	-
3	MGT 2023	People Management	3	0	0	3	S/E M/ EN	НР	-	-	-
Ma	anager	nent Basket- II			1			1	I		
1	MGT 1001	Introduction to Psychology	3	0	0	3	F	НР	-	-	-
2	MGT 1002	Business Intelligence	3	0	0	3	EN	-	-	-	-
3	MGT 1003	NGO Management	3	0	0	3	S	-	-	-	-
4	MGT 1004	Essentials of Leadership	3	0	0	3	EM / EN	GS/ HP	-	-	-
5	MGT 1005	Cross Cultural Communication	3	0	0	3	S/E M/ EN	НР	-	-	-

6	MGT 2001	Business Analytics	3	0	0	3	S/ EM /EN	-	-	-	-
7	MGT 2002	Organizational Behaviour	3	0	0	3	F	НР	-	-	-
8	MGT 2003	Competitive Intelligence	3	0	0	3	S	-	-	-	-
9	MGT 2004	Development of Enterprises	3	0	0	3	S/E M/ EN	-	-	-	-
10	MGT 2005	Economics and Cost Estimation	3	0	0	3	S/E M	-	-	-	-
11	MGT 2006	Decision Making Under Uncertainty	3	0	0	3	s	-	-	-	-
12	MGT 2008	Econometrics for Managers	3	0	0	3	S	-	-	-	-
13	MGT 2009	Management Consulting	3	0	0	3	S/E M/ EN	-	-	-	-
14	MGT 2010	Managing People and Performance	3	0	0	3	S/E M/ EN	HP/GS	-	-	-
15	MGT 2011	Personal Finance	3	0	0	3	F	-	-	-	-
16	MGT 2012	E Business for Management	3	0	0	3	S/E M	-	-	-	-
17	MGT 2013	Project Management	3	0	0	3	EN / EM	GS/HP /ES	-	-	-
18	MGT 2014	Project Finance	3	0	0	3	EN / EM	НР	-	-	-
19	MGT 2016	Business of Entertainment	3	0	0	3	EM / EN	-	-	-	-
20	MGT 2017	Principles of Management	3	0	0	3	S/E M/ EN	-	-	-	-
21	MGT 2018	Professional and Business Ethics	3	0	0	3	S/E M/ EN	НР	-	-	-
22	MGT 2019	Sales Techniques	3	0	0	3	S/E M/ EN	НР	-	-	-
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23	MGT 2020	Marketing for Engineers	3	0	0	3	S/E M/ EN	НР	-	-	-
24	MGT 2021	Finance for Engineers	3	0	0	3	S/E M/ EN	НР	-	-	-
25	MGT 2022	Customer Relationship Management	3	0	0	3	S/E M/ EN	НР	-	-	-
Me	edia St	udies Basket						•		1	
1	BAJ3 050	Corporate Filmmaking and Film Business	0	0	4	2	EM	НР	-	-	-
2	BAJ3 051	Digital Photography	2	0	2	3	EM	HP	-	-	-
3	BAJ3 055	Introduction to News Anchoring and News Management	0	0	2	1	EM	-	-	-	-

21.List of MOOC (NPTEL) Courses

		<u> </u>		
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

21.1 NPTEL - Discipline Elective Courses for B. Tech. (IoT)

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

Semester Wise Course Grids/ Tables: First year - CYCLE 1

SI. No.	Course Code	Course Name	L	т	Ρ	Cre dits	Type of Skill/ Focus	Course Caters to	Basket
Se	mester 1	- Physics Cycle				17			
1	MAT1001	Calculus and Linear Algebra	3	0	2	4	F		SCHOOL CORE
2	PHY1002	Optoelectronics and Device Physics	2	0	2	3	F		SCHOOL CORE
3	ECE1001	Elements of Electronics Engineering	3	0	2	4	F		SCHOOL CORE
4	ENG1002	Technical English	1	0	2	2	S		SCHOOL CORE

5	PPS1001	Introduction to soft skills	0	0	2	1	S	HP	SCHOOL CORE
6	CSE1004	Problem Solving Using C	1	0	4	3	S		SCHOOL CORE
7	CHE1018	Environmental Science	1	0	2	0	F	ES	SCHOOL CORE
8	PPS1011	Introduction to Verbal Ability	0	1	0	0	S/ EM		SCHOOL CORE
Se	mester 2	- Engineering Science Cy	cle)		16			
1	MAT1003	Applied Statistics	1	0	2	2	EM		SCHOOL CORE
2	ECE2007	Digital Design	2	0	2	3	F/S		SCHOOL CORE
3	CIV1008	Basic Engineering Sciences	2	0	0	2	S		SCHOOL CORE
4	MEC1006	Engineering Graphics	2	0	0	2	S		SCHOOL CORE
5	CSE1006	Problem Solving using JAVA	1	0	4	3	S		SCHOOL CORE
6	ENG2001	Advanced English	1	0	2	2	S		SCHOOL CORE
7	PPS1002	Soft Skills for Engineers	0	0	2	1	S	HP	SCHOOL CORE
8	ECE2010	Innovative Projects Using Arduino	-	-	-	1	S		SCHOOL CORE

First year - CYCLE 2

SI. No.	Course Code	Course Name	L	т	Ρ	Cre dits	Type of Skill/ Focus	Course Caters to	Basket
Ser	nester 1	- Engineering Science Cy	cle			18			
1	MAT1001	Calculus and Linear Algebra	3	0	2	4	F		SCHOOL CORE
2	ECE1001	Elements of Electronics Engineering	3	0	2	4	F		SCHOOL CORE
3	ENG1002	Technical English	1	0	2	2	S		SCHOOL CORE
4	PPS1001	Introduction to soft skills	0	0	2	1	S	HP	SCHOOL CORE
5	CSE1004	Problem Solving Using C	1	0	4	3	S		SCHOOL CORE
6	PPS1011	Introduction to Verbal Ability	0	1	0	0	S/ EM		SCHOOL CORE
7	CIV1008	Basic Engineering Sciences	2	0	0	2	S		SCHOOL CORE
8	MEC1006	Engineering Graphics	2	0	0	2	S		SCHOOL CORE
Ser	nester 2	- Physics Cycle				15			
1	MAT1003	Applied Statistics	1	0	2	2	EM		SCHOOL CORE
2	ECE2007	Digital Design	2	0	2	3	F / S		SCHOOL CORE

3	CSE1006	Problem Solving using JAVA	1	0	4	3	S		SCHOOL CORE
4	ENG2001	Advanced English	1	0	2	2	S		SCHOOL CORE
5	PPS1002	Soft Skills for Engineers	0	0	2	1	S	HP	SCHOOL CORE
6	CHE1018	Environmental Science	1	0	2	0	F	ES	SCHOOL CORE
7	PHY1002	Optoelectronics and Device Physics	2	0	2	3	F		SCHOOL CORE
8	ECE2010	Innovative Projects Using Arduino	-	-	-	1	S		SCHOOL CORE

SI. No.	Course Code	Course Name	L	Т	Ρ	Cre dits	Type of Skill/ Focus	Course Caters to	Basket
Sen	nester 3					28			
1	MAT1002	Transform Techniques, Partial Differential Equations and Their Applications	3	0	0	3	F		SCHOOL CORE
2	CSE2001	Data Structures and Algorithms	3	0	2	4	S		SCHOOL CORE
3	CSE3155	Data Communications and Computer Networks	3	0	2	4	S		PROGRAM CORE
4	CSE2009	Computer Organization and Architecture	3	0	0	3	S		PROGRAM CORE
5	MAT2004	Discrete Mathematical Structures	3	0	0	3	EM		SCHOOL CORE
6	CSE3190	Fundamentals of Data Analytics	2	0	2	3	S		PROGRAM CORE
7	CSE2014	Software Engineering	3	0	0	3	S		PROGRAM CORE
8	ECE2011	Innovative Projects Using Raspberry Pi	-	-	-	1	S		SCHOOL CORE
9	CSE1005	Programming in Python	1	0	4	3	S		PROGRAM CORE
10	PPS4002	Introduction to Aptitude	0	0	2	1	S/EM	HP	SCHOOL CORE
Sen	nester 4					24			
1	MAT2003	Numerical Methods for Engineers	1	0	2	2	S		SCHOOL CORE
2	CSE2007	Design and Analysis of Algorithms	3	0	0	3	S		PROGRAM CORE
3	CSE3156	Database Management Systems	3	0	2	4	S		PROGRAM CORE

4	CSE3351	Operating Systems	3	0	0	3	S		PROGRAM CORE
5	CSE3078	Cryptography and Network Security	3	0	0	3	S		PROGRAM CORE
6	CSEXXXX	Professional Elective - I	3	0	0	3			DISCIPLINE ELECTIVE
7	xxxxxxx	Open Elective – I (Management Basket)	3	0	0	3			OPEN ELECTIVE
8	PPS4004	Aptitutde Training Intermediate	0	0	2	1	S/EM	HP	SCHOOL CORE
9	CSE3216	Mastering Object-Oriented Concepts in Python	0	0	2	1			SCHOOL CORE
Sen	nester 5					25			
1	CSE1700	Essentials of AI	3	0	0	3			PROGRAM CORE
2	CIT2500	FoG Computing for IoT	3	0	0	3	S		PROGRAM CORE
3	CIT2503	Mobile Application for IoT	3	0	0	3			PROGRAM CORE
4	CSE2500	Theory of Computation	3	0	0	3	S		PROGRAM CORE
5	CSE2501	Wireless Communication in IoT	3	0	0	3	S		PROGRAM CORE
6	CSE1504	Web Technologies	2	0	0	2	S		PROGRAM CORE
7	CSE1505	Web Technologies Lab	0	0	2	1			PROGRAM CORE
8	CITXXXX	Professional Elective - II	3	0	0	3	S		DISCIPLINE ELECTIVE
9	CSE1701	Essentials of AI Lab	0	0	4	2	S		PROGRAM CORE
10	CSE7000	Internship	-	-	-	2			SCHOOL CORE
Sen	nester 6			1		24			
1	CIT2504	AI and Deep Learning for IoT	3	0	0	3	S		PROGRAM CORE
2	CIT2502	Privacy and Security in IoT	3	0	0	3	S		PROGRAM CORE
3	CSE2506	Cloud Computing	2	0	0	2	S		PROGRAM CORE
4	CSE2507	Cloud Computing Lab	0	0	2	1	S		PROGRAM CORE
5	CIT2400	Cyber Physical Systems	3	0	0	3	S		PROGRAM CORE
6	CITXXXX	Professional Elective - III	3	0	0	3	S		DISCIPLINE ELECTIVE
7	xxxxxxx	Open Elective – II	3	0	0	3			OPEN ELECTIVE
8	CSE2508	Mobile Application Development	2	0	0	2	S		PROGRAM CORE

9	CSE2509	Mobile Application Development Lab	0	0	4	2	S	PROGRAM CORE
10	PPSXXXX	Industry Preparedness Program	2	0	0	0		SCHOOL CORE

Se	mester 7					16		
1	xxxxxx	Open Elective – III (Management Basket)	3	0	0	3		OPEN ELECTIVE
2	СІТХХХХ	Professional Elective -VIII	3	0	0	3		DISCIPLINE ELECTIVE
3	СІТХХХХ	Professional Elective – IX	3	0	0	3		DISCIPLINE ELECTIVE
4	СІТХХХХ	Professional Elective - X	3	0	0	3		DISCIPLINE ELECTIVE
5	CSE7100	Mini Project	-	-	-	4	S/ EM/ EN	SCHOOL CORE
Se	mester 8					10		
1	CSE7300	Capstone Project	-	-	-	10	S/ EM/ EN	SCHOOL CORE

23. Course Catalogue

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

Course Code: MAT1001	Course Title: Calculus and Linear Algebra Type of Course: School Core Lab Integrated	L-T- P- C	2	1	2	4			
Version No.	3.0								
Course Pre- requisites	Basic Concepts of Limits, Differentiation, Integration								
Anti-requisites	NIL								
Course Description	The course focuses on the concepts or reference to specific engineering p conceptual and analytical type in na with the course are concerned wit MATLAB software.	of calculu problems. hture. The h acquirin	s and I The lab se	inear a course essions ability	ilgebra is of assoc to us	with both iated e the			

Course Objective	The objective of the course is <u>Skill Development</u> of stude <u>Problem Solving Techniques.</u>	ent by using
Course Out Comes	 On successful completion of the course the students shall 1) Comprehend the knowledge of applications of matrix p 2) Understand the concept of partial derivatives applications. 3) Apply the principles of integral calculus to evaluate integral 4) Adopt the various analytical methods to solve equations. 5) Demonstrate the use of MATLAB software to deal with mathematical problems. 	be able to: rinciples. and their egrals. differential a variety of
Course Content:		
Module 1	Linear Algebra	10 Classes

Review: Types of matrices, elementary transformations, rank of a matrix, normal form, Solution of systems of linear equations: (Homogenous and non-homogenous system) AX = O and AX = B using rank method.

Linear Algebra:

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

Engineering Applications of Linear Algebra.

Modulo 2	Partial		10
	Derivatives		CLASSES

Review: Differential calculus with single variable.

Partial Derivatives:

Homogeneous functions and Euler's theorem, Total derivative, Change of variables, Jacobians, Partial differentiation of implicit functions, Taylor's series for functions of two variables, Maxima and minima of functions of two variables, Lagrange's method of undetermined multipliers.

Engineering Applications of partial derivatives.

	Advanced		
Module 3	Integral		12 Classes
	calculus		

Review: Integral calculus for single integrals.

Advanced Integral calculus:

Beta and Gamma functions-interrelation-evaluation of integrals using gamma and beta functions; error function-properties. Multiple Integrals- Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves, evaluation of triple integrals-change of variables between Cartesian and cylindrical and spherical polar co-ordinates.

Engineering applications of partial derivations	atives.
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Module 4	Ordinary Differential Equations	Assignment	Programming	12 Classes

Review: First order and first-degree Ordinary Differential Equations, Method of separation of variables, Homogeneous and Non- Homogeneous Equations reducible to Homogeneous form.

Linear Differential Equations, Bernoulli's Differential Equation, Exact and Non- Exact Differential Equations, Higher order Differential Equation with constant coefficients and with right hand side of the form e^{ax} , sinax, cosax, $e^{ax}f(x)$, $x^nf(x)$ etc., Linear equations with variable coefficients such as Cauchy Equation and Lagrange's Equation, D-operators and Inverse D- operators, Method of Variation of Parameters.

Engineering applications of differential equations.

List of Laboratory Tasks:

Introductory Task: Introduction to usage of the software and simple programming tasks. [3 Sessions]

Experiment N0 1: Solution of Simple differentiation with single variable and use of chain Rule.

Experiment No. 2: Solution based on application of Tailors' Series using software

Experiment No. 3: Application of Maxima and Minima condition using software.

Experiment No. 4 Computation of different functions for a specific problem

Experiment No. 5 Computation of Area under a curve.

Experiment No. 6 Solution of a set of simultaneous equations in matrix method

Experiment No. 7 Computation of Eigen Values and Eigen Vectors.

Experiment No. 8 Solution of Partial Differential equation

Experiment No. 9 solution using Cauchy Equation and Lagrange's Equation

Targeted Application & Tools that can be used:

The contents of this course has direct applications in most of the core engineering courses for problem formulations, Problem Solution and system Design. Tools Used: MatLab, Zylink.

Assignment:

- 1. List at least 3 sets of Matrix Applications concerning the respective branch of Engineering and obtain the solution using MATLAB.
- 2. Select any one simple differential equation pertaining to the respective branch of engineering, identify the dependent and independent variable Obtain the solution and compare the solution sets by varying the values of the dependent variable.

Text Book

- 1. Sankara Rao, Introduction to Partial differential equations, Prentice Hall of India, edition, 2011
- 2. B. S. Grewal (2017), Higher Engineering Mathematics by, 44th Edition, Khanna Publishers.

References:

- 1. Victor Henner, Tatyana Belozerova, Mickhail Khenner, Ordinary and Partial Differential Equations, CRC Press, Edition, 2013.
- 2. Walter Ledermann, Multiple integrals, Springer, 1st edition
- 3. Lay, Linear Algebra ansd its applications, 3rd Ed., 2002, Pearson Education India.
- 4. Erwin Kreyzig, Advanced Engineering Mathematics, John Wiley and sons, Inc.10th Edition
- 5. MatLab usage manual

E-resources/ Web links:

- 1. https://nptel.ac.in/courses/109104124
- 2. https://nptel.ac.in/courses/111106051
- 3. https://nptel.ac.in/courses/111102137
- 4. https://www.cuemath.com/learn/mathematics/algebra-vs-calculus/
- 5. https://stanford.edu/~shervine/teaching/cs-229/refresher-algebra-calculus

6. https://math.hmc.edu/calculus/hmc-mathematics-calculus-online-tutorials/linear-algebra/

7. https://www.math.hkust.edu.hk/~maqian/ma006_0607F.html

8. https://www.scu.edu.au/study-at-scu/units/math1005/2022/

Topics relevant to the development of Foundation Skills: All solution methods

Topics relevant to development of Employability skills: Use of Matlab software.

Course Code: ECE1001	Course Title: Elements of Electronics Engineering Type of Course: School Core Theory & Integrated Laboratory	L-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 stu electronic devices and circuits. The course aim fundamental principles of electronics engineer applications. The nature of the course is conce of electronic components and their behavior u develops thinking skills of the students, encou electronic devices and their usage in higher se The associated laboratory provides an opportu classes and enable the students to work with b components.	dents to learn th s at nurturing the ing, prevailing in ptual and analyt nder various ope raging their ques mester courses. unity to validate to pasic electronic ci	e funda e stude variou ical wh erating t for kr the con ircuits u	amenta ents with s engin ich imp conditio nowledge cepts ta using el	l concept h the eering arts know ons. The ge about aught in t ectronics	s of vledge course heory
Course Objectives	The objective of the course is to familiarize the Electronics Engineering and attain SKILL DEVEL	e learners with th OPMENT throug	ie conc h EXPE	epts of ERIENTI	Elemer AL LEARN	nts of IING .

	On successful completion	on of this course the stu	udents shall be able to:				
	Identify various electric	al and electronic comp	onents and basic electrical laws.				
	Explainapplications of D	and BITs	onents and basic ciccurca laws.				
Course	Summarize the concept	s of Digital Electronics	and Communication Systems.				
Outcomes	Discuss the basic concer	Discuss the basic concepts of microprocessorand computer organization.					
	Perform experiments to	o familiarizevarious Elec	ctrical & Electronic components and				
	equipment.						
	Verify Basic Electrical Ci	rcuit configurations an	d Laws.				
Course							
Content:							
	Basic Electrical and						
Madula 1	Electronic	Assistant (Ouis	Identification of Practical electronic	10			
wodule I	Components	Assignment / Quiz	Momeny Recall based Quizzes	Sessions			
			Memory Recail based Quizzes				
Topics:							
ELECTRICAL	CIRCUITS AND LAWS:DC	Circuits: Classification of	of Electrical Elements, Ohm's law. Seri	es and			
Parallel Circu	uits, Kirchhoff's Voltage a	nd Current laws, Powe	r and Energy, Transformers and their	types.			
ELECTRONIC	MATERIALS AND COMPO	ONENTS: Conductors, Ir	nsulators, Semi-Conductor Material, P	P-N			
Junction dio	de, Characteristics and Pa	arameters, Ideal Diode	approximations, DC load line.				
Modulo 2	Applications of Diodes	Assignment / Quiz	Simulation Task/ Memory	12			
iviouule z	and Introduction to BJT	Assignment / Quiz	Recall based Quizzes	Sessions			
Topics:							
	Half wave restifier. Two	diada Full wava rastific	n Dridge restifier Conseitor filter size	wit (only			
qualitative a	pproach).	alode Full-wave rectifie	er, Bridge rectifier, Capacitor fliter circ	cuit (only			
ZENER DIOD	E: Zener diode, Zener Cha	aracteristics, Zener dio	de as a voltage regulator.				
BIPOLAR JUN	ICTION TRANSISTORS: BJ	T Construction and Op	eration, BJT Voltages and Currents, Co	ommon			
Base, Comm	on Emitter Configuration	and Characteristics, Cu	urrent amplification Factor alpha and	beta, DC			
Load line w.r	r.t. fixed bias circuit (Q-Po	pint), AC Analysis.					
	Digital Electronics and						
Module 3	Communication	Assignment / Quiz	Simulation Task / Memory	13			
	System		Recall based Quizzes	Sessions			
Topics:		I	II				
NUMBER SY	STEMS: Decimal Number	System, Binary Numbe	r System. Hexadecimal Number Syste	m.			
Conversions	: Binary to and from Hexa	adecimal; Hexadecimal	to and from Decimal;1's and 2's Com	plement			
of Binary Nu	mbers, Binary Addition.	,					
BOOLEAN AL	GEBRA: Boolean Laws ar	nd Theorems, De Morga	an's theorem. Digital Circuits: Logic ga	ites, NOT			
Gate, AND G	ate, OR Gate, XOR Gate,	X-NOR Gate, NAND Ga	te, NOR Gate.				
COMMUNIC	ATION SYSTEM: Block dia	igram of communicatio	n system, Modulation: Definition of				
Modulation,	Need of Modulation, Typ	bes of Modulation: Am	plitude Modulation and Frequency M	odulation			
, (Waveforms	only).		. ,				
	Microprocessors and			10			
Module 4	Computer	Assignment / Quiz	Memory recall based Quizzes	LU			
	Organization			Sessions			
Topics:	1	1	1	1			

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 100Ω 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 1KΩ 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.



Level 2: Verify KCL with the help of given circuit having # values and carry out the equivalent resistance of the circuit by experimental and analytical methods.



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:
	https://www.youtube.com/watch?v=LISrYOIsnDEg
	https://www.youtube.com/watch:v=osiTosspblg
	Lecture Series on "Introduction to Digital Electronics" by All About Electronics Youtube Channel:
	https://www.youtube.com/watch?v=DBTna2ydmC0&list=PLwiK_iyK4LLBC_so3odA64E2MLgIR
	<u>Kafl</u>
	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, 2 nd Chapter, by Shree
	Krishna Khadka (PDF) Bipolar Junction Transistor
	(researchgate.net)https://www.researchgate.net/publication/323384291_Bipolar_Junction_T
	ransistor
E-content:	
	V. Milovanovic, R. van der Toorn, P. Humphries, D. P. Vidal and A. Vafaneiad, "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
	<u> </u>
	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 E Jannuzzo E Blashierg X Wang W Li and X He "Elimination of hus voltage impact
	on temperature sensitive electrical parameter during turn-on transition for junction
	temperature estimation of high-nower IGBT modules " 2017 IEEE Energy Conversion Congress
	and Exposition (ECCE) 2017 pp 5892-5898 https://ieeexplore ieee.org/document/8096974
	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 relev	ant 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: PHY1002	Course Title: Physics Type of Cours integrated	Optoelect se: 1] Scho	ronics and Device ool Core & Laboratory	L-T-P-C	2-0-2-3
Version No.	1.0				
Course Pre- requisites	NIL				
Anti- requisites	NIL				
Course Description	The purpose of fundamentals to develop the microscopy a thinking, expe provides an o the ability to laboratory tas confidence a events and re suitable equ systems.	of this cour s, working a e basic abili nd quantur erimental a pportunity o use the sks aim to c nd ability esults, obse ipment, in	se is to enable the stud and applications of opto- ities to appreciate the a m computers. The cour and analytical skills. The to validate the concep- concepts for technolo- levelop following skills: to tackle new problem erve and measure physi- nstrument and mater	ents to unde pelectronic de pplications of se develops te associated ts taught and gical applica An attitude c ns, ability to ical phenome rials, locate	rstand the evices and advanced the critical laboratory enhances tions. The of enquiry, interpret ena, select faults in
Course Out Comes	On successful completion of the course the students shall be able to: CO1: Describe the concepts of semiconductors, magnetic materials and superconductors.				e able to: terials and pelectronic
	and magnetic CO3: Discuss	devices. the quantu	um concepts used in ad	vanced micro	scopy and
	CO4: Explain the applications of lasers and optical fibers in various technological fields.				in various
	CO5: Interpre used in optoe	t the result lectronics	s of various experiment and advanced devices.	s to verify the	e concepts I].
Course Objective	The objective concepts of Development	e of the co "Optoelect through E	ourse is to familiarize tronics and device ph xperiential Learning te	the learners ysics "and a echniques	with the ttain Skill
Course Content:					
Module 1	Fundament als of Materials.	Assignm ent	Plotting of magnetization (M) v/s Magnetic field (H) for diamagnetic, paramagnetic and	No. c	of Classes: 07

				ferromagnetic materials using excel/ origin software.	
	Topi cone	cs: Concept cept of Fermi le	of energy evel, Hall ef	bands, charge carriers, car ffect, Magnetic materials, Su	rier concentration, uperconductors:
Module	2	Advanced Devices and applications	Assignm ent	Data collection on efficiency of solar cells.	No. of Classes: 8
	Topi devi	cs: p-n junctio ces:, Solar cells	ns, Zener d s, I-V chara	liode, transistor characterist cteristics, and LEDs	ics, Optoelectronic
Module	3	Quantum concepts and Application s	Term paper	Seminar on quantum computers.	No. of classes: 8
	Topi Brog asso time	cs: Planck's glie hypothesi pciated with an e independent	quantum s, matter electron. H wave equa	theory, applications of Qua waves, properties. de-B leisenberg's uncertainty prin tion. Particle in a box	antum theory: de- roglie wavelength nciple. Schrodinger
Module	4	Lasers and Optical fibers	Term paper	Case study on medical applications of Lasers.	No. of classes :07
	Topics: Interaction conditions and req		ns of radia uisites of l Iding and D	ations with matter, Chara aser, Modern day applicatic prilling.	cteristics of laser, ons of laser: LIDAR,
	Prin (Qua bloc	ciple of optic alitative), Atter k diagram, app	al fibers, nuation, Ap llication of	Numerical aperture and plications: Point to point co optical fibers in endoscopy.	acceptance angle ommunication with
	List	of Laboratory 1	Tasks:		
	Expe	eriment No. 1:	Experimen	tal errors and uncertainty u	sing excel
	Leve	el 1: Calculatior	n of accura	cy and precision of a given c	lata
	Leve divis	el 2: propagationsion.	on of error	s in addition, subtraction, m	ultiplication and
	Expe Lase diffr	eriment NO 2: r and to estima action.	To determ ate the par	ine the wavelength of semi ticle size of lycopodium pov	conductor diode vder using
	 amraction. 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. 		lall Voltage,		

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.
bias and to determine knee voltage and forward resistance.
Experiment No. 5: To study input and output characteristics of a given Transistor.
Level 1: To determine the input resistance of a given transistor. Level 2: To determine current transfer characteristics and transistor parameters of a given transistor.
Experiment No. 6: Determination of Fermi energy and Fermi temperature of a given metal and bimetallic wire.
Level 1: Determination of Fermi energy and Fermi temperature of given metal wire.
Level 2: Determination of Fermi energy and Fermi temperature of given bimetallic wire.
Experiment No. 7: To study the current vs voltage characteristics of CdS photo-resistor at constant irradiance and To measure the photo-current as a function of the irradiance at constant voltage.
Level 1 To study the current vs voltage characteristics of CdS photo-resistor at constant irradiance.
Level 2: To measure the photo-current as a function of the irradiance at constant voltage.
Experiment No. 8: To study the I-V characteristics and I-R characteristics of a solar cell as a function of the irradiance.
Level 1: To study the FV characteristics Level 2: I-R characteristics of a solar cell as a function of the irradiance. Experiment No. 9: Calculate the numerical aperture and study the losses that occur in optical fiber cable Level 1: Calculate the numerical aperture.
Level 2: study the losses that occur in optical fiber cable.
Experiment No. 10: To determine the magnetic susceptibility of a given
diamagnetic and paramagnetic substances using Quincke's method.
substance.
Level 2: To determine the magnetic susceptibility of a given paramagnetic
substance.
Experiment No. 11: Plotting I-V characteristics in forward and reverse bias
and Determination of knee voltage.

Level 1: Plotting I-V characteristics in forward and reverse bias for LEDs
Level 2: Determination of knee voltage.
Experiment No. 12: Determination of Stefan's constant and verification of
Stefan-Boltzmann Law.
Level 1: Determination of Stefan's constant
Level 2: Verification of Stefan-Boltzmann Law.
Targeted Application & Tools that can be used:
1. Areas of application are optoelectronics industry, Solar panel
technologies, quantum computing software, electronic devices
using transistors and diodes, memory devices, endoscopy, SQUIDS
in MRI, Advanced material characterizations using SEM and STM.
 Origin, excel and Mat lab soft wares for programming and data analysis.
Project work/Assignment: Mention the Type of Project /Assignment
proposed for this course
Assessment Type
Midterm exam
 Assignment (review of digital/ e-resource from PU link given
in references section - mandatory to submit screen shot
accessing digital resource.)
• Quiz
End Term Exam
 Self-Learning
1. Prepare a comprehensive report on non-conventional energy
resources in Karnataka and their pros and cons.
2. Write a report on importance of quantum entanglement in
supercomputers.
Text Book
1. Engineering Physics by Avadhanalu, Revised edition, S. Chand
Publications,2018.
References: 1. Elementary Solid state Physics: Principles and Applications
by M.A. Omar, 1 st Edition, Pearson Publications, 2002.
2. Principles of Quantum Mechanics by R Shankar, 2 nd
edition, springer Publications, 2011.
3. Optoelectronics: An Introduction by John Wilson and John
Hawkes, 3 rd edition, Pearson Publications, 2017.
4. Engineering Physics by Gaur and Gupta, Dhanpat Rai
Publications, 2012.
5. Introduction to Quantum Mechanics, David J Griffiths,
Cambridge University Press, 2019
E-Resourses:
1. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=553
045&site=ehost-live

2.	https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=833
	068&site=ehost-live
3.	https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=323
	988&site=ehost-live
4.	https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=153
	0910&site=ehost-live
5.	https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=486
	032&site=ehost-live
Topics	relevant to "SKILL DEVELOPMENT": Fundamentals of materials,
Lasers	and optical fibers.
for Ski	ll Development through Participative Learning Techniques. This is
attain	ed through the Assignment/ Presentation as mentioned in the
attain	ed through the Assignment/ Presentation as mentioned in the ment component in course handout.

Course Code: ECE1001	Course Title: Elements of Electronics Engineering Type of Course: School Core Theory & Integrated Laboratory	L-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 fundamental principles of electronics engineering, prevailing in various engineering applications. The nature of the course is conceptual and analytical which imparts knowledge of electronic components and their behavior under various operating conditions. The course develops thinking skills of the students, encouraging their quest for knowledge 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 Electronics Engineering and attain SKILL DEV	the learners with th /ELOPMENT throug	ie conc h EXPI	epts of ERIENTI	Elemer AL LEARN	nts of IING .

	On successful completion	on of this course the stu	udents shall be able to:	
	Identify various electric	al and electronic comp	onents and basic electrical laws	
	Explainapplications of D	and BITs	onents and basic ciccurca laws.	
Course	Summarize the concept	s of Digital Electronics	and Communication Systems.	
Outcomes	Discuss the basic concer	pts of microprocessora	nd computer organization.	
	Perform experiments to	o familiarizevarious Elec	trical & Electronic components and	
	equipment.			
	Verify Basic Electrical Ci	rcuit configurations an	d Laws.	
Course				
Content:				
	Basic Electrical and		Identification of Deactical classes are	
Modulo 1	Electronic	Assignment / Quiz	and electrical components (10
INIGUUIE I	Components		Memory Recall based Quizzes	Sessions
Topics:				
ELECTRICAL	CIRCUITS AND LAWS:DC	Circuits: Classification o	of Electrical Elements, Ohm's law, Seri	es and
Parallel Circu	uits, Kirchhoff's Voltage a	nd Current laws, Powe	r and Energy, Transformers and their	types.
ELECTRONIC	MATERIALS AND COMPO	ONENTS: Conductors, Ir	nsulators, Semi-Conductor Material, P	P-N
Junction dio	de, Characteristics and Pa	arameters, Ideal Diode	approximations, DC load line.	
	Applications of Diodes	Assistant (Quin	Simulation Task/ Memory	12
iviodule 2	and Introduction to BJT	Assignment / Quiz	Recall based Quizzes	Sessions
Topics:				
RECTIFIERS: qualitative a	Half-wave rectifier, Two- pproach).	diode Full-wave rectifie	er, Bridge rectifier, Capacitor filter circ	cuit (only
ZENER DIOD	E: Zener diode, Zener Cha	aracteristics, Zener dio	de as a voltage regulator.	
BIPOLAR JUN	NCTION TRANSISTORS: BJ	T Construction and Op	eration, BJT Voltages and Currents, Co	ommon
Base, Comm	on Emitter Configuration	and Characteristics, Cu	urrent amplification Factor alpha and	beta, DC
Load line w.r	r.t. fixed bias circuit (Q-Po	pint), AC Analysis.		
	Digital Electronics and			
Module 3	Communication	Assignment / Quiz	Simulation Task / Memory	13
	System		Recall based Quizzes	Sessions
Topics:		I		
NUMBER SYS	STEMS: Decimal Number	System, Binary Numbe	r System, Hexadecimal Number Syste	m,
Conversions	: Binary to and from Hexa	adecimal; Hexadecimal	to and from Decimal;1's and 2's Com	plement
of Binary Nu	mbers, Binary Addition.	, <u> </u>		•
BOOLEAN AL	_GEBRA: Boolean Laws ar	nd Theorems, De Morga	an's theorem. Digital Circuits: Logic ga	ites, NOT
Gate, AND G	ate, OR Gate, XOR Gate,	X-NOR Gate, NAND Ga	te, NOR Gate.	
COMMUNIC	ATION SYSTEM: Block dia	igram of communicatio	n system, Modulation: Definition of	
Modulation,	Need of Modulation, Typ	bes of Modulation: Am	plitude Modulation and Frequency M	odulation
, (Waveforms	only).		. ,	
	Microprocessors and			10
Module 4	Computer	Assignment / Quiz	Memory recall based Quizzes	
	Organization			Sessions
Topics:	1			1

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 100Ω 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 1KΩ 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.



Level 2: Verify KCL with the help of given circuit having # values and carry out the equivalent resistance of the circuit by experimental and analytical methods.



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_so3odA64E2MLgIR Kafl
	Lecture Series on "Introduction to Microprocessors" by Bharat Acharya Education : <u>https://www.youtube.com/watch?v=0M74z5jEAyA</u>
	Lecture Notes on : "Electronic Devices", Bipolar Junction Transistors, 2 nd Chapter, by Shree Krishna Khadka (PDF) Bipolar Junction Transistor (researchgate.net)https://www.researchgate.net/publication/323384291_Bipolar_Junction_T ransistor
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," <i>2009 IEEE Bipolar/BiCMOS Circuits and Technology Meeting</i> , 2009, pp. 99-102, doi: 10.1109/BIPOL.2009.5314134. <u>https://ieeexplore.ieee.org/document/5314134</u>
	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. <u>https://ieeexplore.ieee.org/document/7348149</u>
	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," <i>2017 IEEE Energy Conversion Congress</i> <i>and Exposition (ECCE)</i> , 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 <i>IEEE Electron Device Letters</i> , vol. 33, no. 9, pp. 1288-1290, Sept. 2012 <u>https://ieeexplore.ieee.org/document/6246672</u>
	https://presiuniv.knimbus.com/user#/home
Topics releva Digital Electa Developmer mentioned i	ant to "SKILL DEVELOPMENT": Electrical & Electronic component and laws, Fundamentals of ronics, Communication Systems, Microprocessors and Computer Organization for Skill It through Experiential Learning techniques. This is attained through assessment component n course handout.

Course Code: ENG1002	Course Title: Technical English Type of Course:1] School Core 2] Laboratory integrated	L-T-P-C	1-0-2-2
Version No.	1.0 V. 3		

Course Pre- requisites	Intermediate Level En	nglish				
Course Anti-requisites	NIL					
Course Description	Technical English cou skills necessary for e contexts. The course styles, and communic including engineering	Technical English course is designed to equip students with the language skills necessary for effective communication in technical and scientific contexts. The course focuses on the specialized vocabulary, writing styles, and communication techniques used in various technical fields, including engineering and information technology.				
Course Objectives	The objective of EMPLOYABILITY LEARNING and PA	this course SKILLS RTICIPATIVE	is to develop by using EX E LEARNING TI	the learners' CPERIENTIAL ECHNIQUES.		
Course Outcomes	 On successful completion of the course, the students shall be able to: 1. Develop proficiency in using technical vocabulary and terminology. 2. Apply language skills for better speaking skills in technical fields. 3. Write technical descriptions 4. Demonstrate writing skills in writing technical documents such as reports, manuals, and articles. 					
Course Content:						
Module 1	Fundamentals of Technical Communication	Worksheets & Quiz	Vocabula ry building	9 Classes		
Introduction to Tech	nical English					
Differences between	Technical English and C	General English				
Technical Writing Ba	asics					
Technical Vocabular	У					
Module 2	Technical Presentation	Presentati ons	Speaking Skill	s 12 Classes		
Introduction Planning the Presenta Creating the Presenta Giving the Presentation	ation ation on					
Module 3	Technical Description	Assignme nt	Group Presentation	12 Classes		
Product Description		1 I		I		
Process Description						

User Manuals				
Transcoding: Diagra	ams, charts and images			
Module 4	Technical Writing	Assignme nt	Writing Skills	12 Clas ses
Email Writing				
Persuasive and Descripti	ve Language			
Professional Email Etiqu	iette			
Writing clear and concis	e technical emails			
Communicating technica	al information effectively			
Technical Report Writi	ing			
Types of technical reports	(Lab reports, research reports, (etc.)		
Components of technical r	eports			
Writing an abstract and ex-	ecutive summary			
Structure and content orga	nization			
Transcoding: diagrams, ch	arts and images			
 Module-1 Level 1: Worksheet Level 2: Worksheet Module 2 Level 1: Preparing 1 Level 2: Giving Pression Module-3 Level 1: Product Description Level 2: Process Description Module 4 Level 1: Email Writh Level 2: Report Writh Targeted Application Flipgrid Quizzes Youtube Videos Project work/Assign 	Presentation esentation (Individual) escription & User Manual escription & Transcoding ting iting ons & Tools that can be	used:	Assignment proposed for	this
course 1. Bring out the e	ssence of technical comr	nunication wit	h reference to the conver	ntions of
2. Prepare a technical commission of the second sec	nical presentation on the a technical field, with re	es e importance of eal-life example	f Technical Communicat es.	tion and
The following indiv 1. Presentation 2. Describing a pr 3. Individual Rep	vidual, as well as group a coduct/process orts	Assignments, w	ill be given to the studer	nts.
 Text Books 1. Kumar, Sanjay; Oxford Universi 2. Brieger, Nick ar 	Pushpalatha. <i>English Lan</i> ity Press. 2018. id Alison Paul. <i>Technical</i>	guage and Com English Vocabi	munication Skills for Engulary and Grammar.	gineers.
https://nmetau.edu.u Reference Book:	a/file/technical_english_v	vocabulary_and	grammar.pdf	

- Chauhan, Gajendra Singh, and Kashmiramka, Smita, *Technical Communication*. Cengage Publication. 2018.
- 2. 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.

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

Web Resources:

1:https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASE

D&unique_id=JSTOR1_3307.

2; https://puniversity.informaticsglobal.com: 2282/ehost/detail/detail?vid=5&sid=3a77d69b-1282/ehost/detail/detail?vid=5&sid=3a77d69b-1282/ehost/detail/detail?vid=5&sid=3a77d69b-1282/ehost/detail?vid=5&sid=3a78/ehost/detail?vid=5&sid=3a78/ehost/detail?vid=5&sid=3a78/ehost/detail?vid=3a78/ehost/detail?vid=3a78/ehost/detail?vid=3a78/ehost/detail?vid=3a78/ehost/detail?vid=3a78/ehost/detail?vid=3a78/ehost/detail?vid=3a78/ehost/detail?vid=3a78/ehost/detail?vid=3a78/ehost/detail?vid=3a78/ehost/detail?vid=3a78/ehost/detail?vid=3a78/ehost/detail?vid=3a78/ehost/detail?vid=3a78/ehost/detail?vid=3a78/ehost/detail?vid=3a78/ehost/detail?vid=3a78/ehost/detail?vid=3a78/ehost/detail

abe5-4681-b39d-

32dfdcb8f4a5%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#AN=154223466&db =iih

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

4 Wambui, Tabita Wangare, et al. *Communication Skills- Volume 1*, LAP LAMBRET, USA,

2012 (E Book)

Topics Relevant to the Development of Employability Skills: Speaking Skills, Writing Skills, Critical Thinking and Critical Analysis, and Group Communication.

Course Code: CSE1004	Course Title: Problem Solving Using C	L-T-P-C	1	0	4	3
	Type of Course: School Core Lab Integrated.	2110				
Version No.	1.0					
Course Pre-	NIL					
requisites						
Anti-requisites	NIL					
Course	The course is designed to provide comple	ete knowled	lge o	of C	langu	iage.
Description	Students will be able to develop logics w	hich will h	nelp	them	to ci	reate
	programs and applications in C. ACAlso by learning the basic programming					
	constructs they can easily switch over					
	to any other language in future.					

Course Object	The objective of the course is to familiarize the learners with the concepts of Problem Solving Using C and attain Employability through Problem Solving Methodologies.					
Course Outcomes	On successful completi	On successful completion of this course the students shall be able to:				
course outcomes	Write algorithms and to	on or una draw flo	wcharts fo	r solving pro	hlems	
	Demonstrate knowledg	e and dev	velon simpl	le application	s in C programming	
	constructs		ciop simpl	te application	s in c programming	
	Develop and implement	t annlicat	ions using	arrays and st	rings	
	Decompose a problem	into func	tions and d	evelop modul	lar reusable code	
	Solve applications in C	using str	uctures and	d Union		
	Design applications usi	ng Seque	ential and R	andom Acce	ss File Processing	
Course Content:	Design apprications asi	ng seque	intial and it		is The Trocessing.	
Course Content.						
			·		0.11	
Module I	Introduction to C Langu	uage Q	uiz F	Problem	9 Hrs.	
			5	Solving		
Topics:	Topics:					
Introduction to P	rogramming – Algorithn	ns – Pse	udo Code	- Flow Cha	rt – Compilation –	
Execution – Prepr	ocessor Directives (#defi	ine, #incl	ude, #unde	ef) - Overviev	w of $C - Constants$	
Variables and Data	a types – Operators and E	Expressio	ns – Manag	ging Input an	d Output Operations	
– Decision Making	g and Branching - Decisio	on Makin	g and Loop	ping.		
Module 2	Introduction to Arrays	and Q	uiz F	Problem	9 Hrs.	
	Strings		S	Solving		
Topics:			L	0		
Arrays: Introducti	on – One Dimensional A	Arrav – I	Initializatio	n of One Di	mensional Arrays -	
Example Program	s – Sorting (Bubble Sort	. Selectio	on Sort) – S	Searching (Li	inear Search) - Two	
Dimensional Arra	vs – Initialization of Tw	o Dimen	sional Arra	vs. Example	Programs – Matrix	
operations. Strings	: Introduction – Declarin	g and Ini	tializing St	ring	U	
Variables – Read	ing Strings from Termin	nal – W	riting Strin	ng to Screen	– String Handling	
Functions.	6		0	8	8	
Module 3	Functions and Pointers	O	uiz P	Problem	9 Hrs.	
			S	Solving		
Topics:			~	8		
Functions: Introdu	ction – Need for User-def	ined fund	tions – Fle	ments of User	-Defined Functions	
declaration defin	ition and function call	-Categoi	ies of Fu	$n_{\rm ctions} = R$	ecursion Pointers	
Introduction De	claring Pointer Variables	Initia	lization of	Variables	Pointer Operators	
Pointer Arithmetic	Arrays and Pointers	Doromote	nzation of	variables –	romer operators -	
Passing: Pass by V	A = A = A = A = A = A = A = A = A = A =	1 aramen	1			
Module 4	Structures and Unio	'n	Ouiz	Problem	0 Hrs	
Widdule 4	Structures and Onio	11	Quiz	Solving	91115.	
Taniaa				Solving		
Topics:			D 1 '		· 1 1	
Structures: Introd	uction – Defining a Stru	acture –	Declaring	Structure Va	ariable – Accessing	
Structure Member	s – Affay of Structures	- Arrays	within Su	ructures - Of	mon: introduction –	
Defining and Declaring Union – Difference Between						
Union and Structu	File her alling	Car	Ctu dr	Duchless C. 1		
iviodule 5	File handling	Case	Study	Problem Sol	ving 9 Hrs.	
Topics:						
Files: Defining and	1 Opening a File – Closing	g a File –	Input / Out	tput Operation	ns on File – Random	
Access Files	Access Files					

List of Practical Tasks Lab Sheet 1 (Module I) Programs using IO Statements, Conditional Statements and Looping Statements Lab Sheet 2 (Module II) Programs using Arrays and Strings Lab Sheet 3 (Module III) Programs using Functions and Pointers Lab Sheet 4 (Module IV) Programs using Structures and Unions Lab Sheet 5 (Module V) Programs using Files

Text Book(s):

1. E. Balaguruswamy, "Programming in ANSI C", 8th Edition, 2019, McGraw Hill Education, ISBN: 978-93-5316-513-0.

Reference Book(s):

Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020.

ReemaThareja, "Programming in C", Oxford University Press, Second Edition, 2016.

Kernighan, B.W and Ritchie, D.M, "The C Programming language", Second Edition, Pearson Education, 2015

Schildt Herbert, "C: The Complete Reference", Tata McGraw Hill Education, 4th Edition, 2014. Stephen G. Kochan, "Programming in C", Addison-Wesley Professional, 4th Edition, 2014.

Web Links and Video Lectures:

1. https://nptel.ac.in/courses/106/105/106105171/

2. https://archive.nptel.ac.in/courses/106/104/106104128/

Course	Course Title: Environmental Science			0		
Code:			1		<u>,</u>	~
CHE1018	Type of Course: School Core- Theory and Lab	L- I-P- C		4	2	0
Version No.	2.0					
Course	NIL					
Pre-						
requisites						
Anti-	NIL					
requisites						
Course	This course emphasizes the need to conserve biodiversity and adopt a more sustainable					
Description	lifestyle by utilizing resources in a responsible way. Topics covered include basic principles					
	of ecosystem functions; biodiversity and its conservation; human population growth;					
	water resources, pollution; climate change; energy resource	es, and su	stai	inat	oilit	iv;
	Sustaining human societies, policies, and education.					-
	This course is designed to cater to Environment and Sustainability	y				
Course	The objective of the course is to familiarize the learners with	the concep	ots /	of		
Objective	"Environmental Science" and attain SKILL DEVELOPMENT the	ough EXPE	RIE	NT	IAI	
	LEARNING techniques.	C				
Course	On successful completion of this course the students shall be able	to:				
Outcomes	tcomes Appreciate the historical context of human interactions with the environment and the need for eco-balance.					
	Describe basic knowledge about global climate change with parti Indian context.	cular refere	ence	e to	th	e
	Understand biodiversity and its conservation					
Develop an understanding on types of pollution and ways to protect the environmen Learn about various strategies on Global environmental management systems					ent	

Course								
Content:								
Module 1	Humans and the Environment	Assignm	ent Data Collectio	n 01 class				
Topics: The r	man-environment interaction: Mastery o	of fire; Origin of ag	griculture; Emer	gence of city				
states; Great	ancient civilizations and the environmen	it.						
Self-learning environment	Self-learning topics: Humans as hunter-gatherers; Industrial revolution and its impact on the environment; Environmental Ethics and emergence of environmentalism.							
Module 2	Natural Resources and Sustainable Development	Assignm	ent	03 Classes				
Topics:								
Overview of n	atural resources: Definition of resource; Cl	assification of natur	al resources- bio	tic and				
abiotic, renew	vable and non-renewable. Water resource	ces: Types of water	resources- fresh	water and				
marine resou	rces;							
Soil and mine degradation.	eral resources: Important minerals; Minera	al exploitation Soil a	as a resource and	l its				
Energy resou	Irces : Sources of energy and their class	ification, renewab	le and non-rene	ewable				
sources of e	nergy; Advantages and disadvantages.	,						
				_				
Self- learnin	g topics: Availability and use of wate	er resources; Env	ironmental imp	act of over-				
exploitation,	issues and challenges.; Environmental p	roblems due to ex	traction of mine	rals and use;				
Sustainable D	vevelopment Goals (SDGs)- targets, indica	itors, and challenge	es for SDGs.					
Module 3	Environmental Issues: Local, Regional an	d Case st	tudy	02 Classes				
Tonics:								
Environment waste; Trans- Land use and change: Ozon	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 -learnina	topics: Environmental issues and scales							
Madula	Conservation of Biodiversity and	Assistant		02 Classes				
would a	* Ecosystems	Assignment		UZ Classes				
Topics: Biodiversity-Introduction, types, Species interactions, Extinct, endemic, endangered and rare								
Self-learning	topics: Mega-biodiversity, Hot-spots, Maj	jor conservation po	licies. Biodiversit	y loss: past				
and current t	rends, impact.	Casa study		02 Classes				
iviodule :	Health	Case study		03 Classes				
Topics:		<u>I</u>	<u> </u>					
Pollution, Definition, point and nonpoint sources of pollution, Air pollution- sources, major air								
pollutants, he	ealth impacts of air pollution.							
Water pollut Water quality	i on – Pollution sources, adverse health im v parameters and standards.	pacts on human ar	d aquatic life an	d mitigation,				
Soil pollution human health	and solid waste- Soil pollutants and their n.	sources, solid and	hazardous waste	, Impact on				
Self-learning	topics: Noise pollution, Thermal and radio	oactive pollution.						
Module	Climate Change: Impacts,	Assignment/cas		02 Classes				
	Adaptation	e						
	and Mitigation	-						

65

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
Τοι	pics:				

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

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

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

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

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

List of laboratory tasks : Any eight experiments will be conducted

rmination of total alkalinity of a water sample (knowledge)

Estimation of water hardness by EDTA method and its removal (by zeolite/ ion exchange method) (Comprehensive)

mation of copper from industrial effluents by colorimetric method (Comprehensive)

nation of iron from industrial effluents by titrimetric method/potentiometric method (Comprehensive) nation of nickel from industrial effluents by titrimetric method (Comprehensive)

nation of chloride in drinking water by titrimetric method (Comprehensive)

nation of fluoride in ground water by colorimetric method (Comprehensive)

rmination of calcium in aqueous solution (Comprehensive)

ermination of Total Dissolved Salts, conductivity and pH of a water samples (Knowledge)

Determination of Chemical oxygen demand in the industrial effluent. (Comprehensive)

Biological oxygen demand of waste water sample (Comprehensive)

Determination of dissolved oxygen of an industrial effluent (Comprehensive)

Quality monitoring analysis of a soil sample (knowledge)

Flame photometric estimation of Sodium and potassium (Application)

Gas Chromatographic analysis of volatile organic compounds (Application)

Targeted Application & Tools that can be used:

Application areas are Energy, Environment and sustainability

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

Project work/Assignment:

Assessment Type

term exam

Assignment (review of digital/ e-resource from PU link given in references section - mandatory to submit screenshot accessing the digital resource.)

evaluation/Assignment

Term Exam

learning

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

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

lab manual and reference links to e-books.

Text Book

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=D O <u>AB_1_06082022_18126</u>

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

https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=D O AJ_1_02082022_3333

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

https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=D O AB_1_06082022_20719

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

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

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

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

https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=S <u>P</u>RINGER_INDEST_1_171

https://presiuniv.knimbus.com/user#/searchresult?searchId=3R%20principle&_t=168742722112 9

https://presiuniv.knimbus.com/user#/searchresult?searchId=eco%20labelling&_t=16874272799 79

https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=T E XTBOOK_LIBRARY01_06082022_395&xIndex=4

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 overexploitation 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: PPS 1001	Course Title: Introduction to Soft Skills Type of Course: Practical Only Course	L- T-P- C	0-0-2-1				
Version No.	1.0						
Course Pre- requisites	Students are expected to understand Basic English. Students should have desire and enthusiasm to involve, participate and learn.						
Anti-requisites	NIL						
Course Description	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 of this course the students shall be able to: CO1: Recognize significance of soft skills CO2: Illustrate effective communication while introducing oneself and others CO3: List techniques of forming healthy habits CO4: Apply SMART technique to achieve goals and increase productivity						
Course Content:							
Module 1	INTRODUCTION TO SOFT SKILLS	Classroom a	ctivity	04 Hours			
Topics: Setting Expectations, Ice Breaker, Significance of soft skills, Formal grooming, punctuality							

Module 2	EFFECTIVE COMMUNICATION		Individual Assessment	10 Hours		
Topics: Different styles of communication, Difference between hearing and listening, Effective communication for success, Email etiquette, Self-introduction framework, Video introduction, email- writing, Resume Building- Digital, Video, Traditional.						
Module 3	HABIT FORMATION		Worksheets & Assignment	4 Hours		
Topics: Profes	ssional and personal ethics f	or succ	ess, Identity based habits, [Domino		
effect, Habit Loo	op, Unlearning, standing up fo	or what	is right			
Module 4	Goal setting & Time Management		Goal sheet	8 Hours		
A session where	students will be introduced	to Time	management, setting SMAR	T		
Goals, Introduc	tion to OKR Techniques, Time	e Mana	gement Matrix, steps to man	aging		
time through ou	utbound group activity, makin	ng a sch	edule, Daily Plan and calenda	ars (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) IMS MCO						
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 Solving Using C		1	0	4	3
Code:		I - T-P-C				
CSE1004	Type of Course:	L- 1-r-C				
	School Core Lab					
	Integrated.					
Version No.	1.0					
Course Pre-	NIL					
requisites						
Anti-requisites	NIL					
Course Description	The course is designed to provide complete knowledge of C language. Students will be able to develop logics which will help them to create programs and applications in C. AC Also by learning the basic programming constructs they can easily switch over to any other language in future.					
Course Object	The objective of the course is to familiarize the learned Problem Solving Using C and attain Employability thro Methodologies.	rs with th ugh Probl	e co em	once Sol	epts ving	of

Course Outcomes	On successful completion of	this course t	he students sha	ll be able to:	
	1. Write algorithms and to draw flowcharts for solving problems				
	2. Demonstrate knowledge and develop simple applications in C				
	programming constructs				
	3. Develop and implement applications using arrays and strings				
	4. Decompose a problem	m into funct	ions and develo	p modular reusable	
	code				
	5. Solve applications in	C using strue	ctures and Unio	า	
	6. Design applications u	ising Sequen	tial and Randon	n Access File	
Course Content:					
Module 1	Introduction to C Language	Quiz	Problem Solving	9 Hrs.	
Topics:					
Introduction to Pro	gramming – Algorithms – Pse	udo Code - I	Flow Chart – Coi	mpilation – Executior	
– Preprocessor Dire	ectives (#define, #include, #u	ndef) - Over	view of C – Con	stants, Variables and	
Data types – Oper	rators and Expressions – Mar	naging Input	t and Output O	perations – Decisior	
Making and Branch	ning - Decision Making and Loc	oping.		-	
Module 2	Introduction to Arrays and	Quiz	Problem	9 Hrs.	
	Strings	-	Solving		
Topics:					
Arrays: Introduction	n – One Dimensional Array – I	nitialization	of One Dimensio	onal Arrays – Example	
Programs – Sorting	g (Bubble Sort, Selection Sort) – Searchin	g (Linear Search	n) - Two Dimensional	
Arrays – Initializatio	on of Two Dimensional Arrays	. Example Pi	rograms – Matri	x operations. Strings	
Introduction – Decl	laring and Initializing String		C		
Variables – Reading	g Strings from Terminal – Writ	ing String to	Screen – String	Handling Functions.	
Module 3	Functions and Pointers	Quiz	Problem Solving	9 Hrs.	
Topics:	-				
Functions: Introduc	ction – Need for User-defined	functions – I	Elements of Use	r-Defined Functions:	
declaration, definiti	ion and function call–Categori	ies of Functio	ons – Recursion.	Pointers:	
Introduction – Decl	laring Pointer Variables – Initia	alization of V	/ariables – Point	er Operators –	
Pointer Arithmetic -	- Arrays and Pointers - Param	neter Passing	g: Pass by Value,	Pass by Reference.	
Module 4	Structures and Union	Quiz	Problem Solving	9 Hrs.	
Topics:					
Structures: Introduc	ction – Defining a Structure –	Declaring St	ructure Variable	- Accessing	
Structure Members	s – Array of Structures – Array	s within Stru	ctures – Union:	Introduction –	
Defining and Declar	ring Union – Difference Betwe	en Union an	d Structure.		
Module 5	File handling Ca	ase Study	Problem Solv	ing 9 Hrs.	
Topics:					
Files: Defining and (Access Files	Opening a File – Closing a File	– Input / Ou	tput Operations	s on File – Random	
List of					
Practical					
Tasks Lab					
Sheet 1					
(Module I)					
CHE1018					
Lab Sheet 2 (Modul	le II)				
Programs using Arra	ays and Strings				
Lab Sheet 3 (Modul	le III)				
Programs using Fun	nctions and Pointers				
Lab Sheet 4 (Modul	le IV)				
Programs using Stru	uctures and Unions				
Lab Sheet 5 (Modul	le V)				

Progran	ns using	Files		
lext Bo	ok(s):			
1.	E. Balag	guruswamy, "Programming in ANSI C", 8th Edition, 2019, McGraw Hill		
Educati	on, ISBN	I: 978-93-5316- 513-0.		
Referer	nce			
Book(s)	:			
	1.	Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020.		
	2.	ReemaThareja, "Programming in C", Oxford University Press, Second Edition, 2016.		
	3.	Kernighan, B.W and Ritchie, D.M, "The C Programming language", Second Edition,		
	Pearson Education, 2015			
	4.	Schildt Herbert, "C: The Complete Reference", Tata McGraw Hill Education. 4th		
		Edition. 2014.		
	5.	Stephen G. Kochan, "Programming in C", Addison-Wesley Professional, 4th Edition, 2014.		
Web Lir	nks and '	Video Lectures:		
1.	https://	nptel.ac.in/courses/106/105/106105171/		
2.	https://	archive.nptel.ac.in/courses/106/104/106104128/		

Course Code: PPS 1011	Course Title: Introduction to Verbal Ability Type of Course: Theory Only	L- T- P- C	0	1	0	0
	Course					
Version No.	1.0		I			
Course Pre- requisites	Students are expected to understand Basic English. Students should have desire and enthusiasm to involve, participate and learn.					
Anti-requisites	NIL					
Course Description	This course is designed to en Verbal Ability and improve of skills to give them a competit in the professional world. The themselves effectively the methodologies.	able students understand the confidence, communication a ive advantage and increase ch ne course will benefit learner rough various worksheets	e importance of nd professional ances of success rs in presenting and learning			
-------------------------------	--	--	--			
Course Objective	The objective of the course i concepts of "Verbal Ability" and atta PARTICIPATIVE LEARNING to	s to familiarize the learners v in SKILL DEVELOPMENT thro echniques.	vith the ugh			
Course	On successful completion of	this course the students sha	II be able to:			
Comes	CO1: Recognize significan	ce of				
	verbal ability CO2: Utilize	the				
	rules of communication					
	CO3: Apply techniques effective communication	of vocabulary building t	to showcase			
Course						
Content:			01 110.07			
Module 1	ABILITY	Individual Assessment				
Topics: Setting	Expectations, Ice Breaker, Sig	nificance of verbal ability, pre	e-assessment			
Module 2	EFFECTIVE VERBAL COMMUNICATION	Practice Worksheets	06 Hours			
Topics: Differe	ent rules of grammar and app	lication, Subject-Verb Agreen	ient, Tenses			
Module 3	VOCABULARY BUILDING	Practice Worksheets	04 Hours			
Topics: Root	words, Synonyms and antony	yms, analogies, para-jumbles	l			
Module 4	READING COMPREHENSION	Individual Assessment	02 Hours			
A session where assessment	e students will be introduced t	o speed reading and compreh	nension, post-			
Target	ed Application & Tools that ca	an be used: LMS				
Project for this	: work/Assignment: Mention course	the Type of Project /Assignme	ent proposed			
Ind LM	ividual Assessment S MCQ					

The topics related to Skill Development: Communication, grammar rules, vocabulary 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: Appl	ied Statistics					
MAT1003			LTP	1	0	2	2
	Type of Course: So	chool Core	С	-	Ū	-	-
Version No.	3.0		1	1			
Course Pre-	None						
requisites							
Anti-requisites	None						
Course Description	The goal of this probability and sidescriptive statis keeping in mind the and probabilistic descriptive statistic variables and probabilistic	course is to p tatistics by mea tics, probability he future course components. Th cics, probability, obability distribution	rovide a ans of a / and es havin; ne cours , rules , rules putions, ns.	i firm thore proba g stat e cov for pi stanc	under bugh t bility istical, rers top robabil dard d	rstandi reatme distribu quanti pics su ity, ra iscrete	ng of ent of utions tative ich as ndom e and
Course Objective	The objective of t	he course is to t	familiari	<mark>ze the</mark>	learn	ers wit	h the
	concepts of "	Applied Stati	stics"	and	ati	tain	Skill
	Development Thr	ough Problem So	olving te	echnio	iues.		
Expected	At the end of this	course, students	will be i	n a po	sition t	0	
Outcome:				•			
	1. apply the t	echniques of des	scriptive	statis	tics effe	ectively	/
	2. interpret t	he ideas of prob	ability ar	nd con	ditiona	l proba	ability
	3. demonstrate the knowledge of probability distributions						
	4. Compute statistical parameters, correlation and regression,						
	probability	and sampling d	istributic	ons us	ing R so	oftware	2.
Module 1	Descriptive Statistics	Assignment	Coding needed			10 c	lasses
Introduction to St	tatistics Data and	statistical thin	king rev	/iew/	of has	ic stat	istical
naramotors Covar	ianco Corrolation		ros of Co	rrolat	ion - K	nt Door	rson's
Correlation Coeffi	cient Spearman R	ank Correlation	linear	rogro	ssion	Multi	linoar
	cient, spearman n		, inicai	regre	551011,	wutt	inicai
regression.							
Module 2	Probability					6 c	lasses
Introduction to Pr	obability, Probabilit	ty of an event,	Addition	Princ	iple, N	Iultiplic	cation
law, Conditional Pr	obability, Total Pro	bability and Baye	e's theor	em wi	ith exar	nples	

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 Theory	Coding	15 classes
		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

Course Code: ECE2007	Course Title: Digital Design Type of Course: Theory & Integra	ated	L- T-P- C	2	0	2	3
	Laboratory		_		_		-
Version No.	2.0	.0					
Course Pre-	[1] Elements of Electronics/Elec	trical Enginee	ring, 2] Basi	c con	icep	ts of	
requisites	number representation, Boolea	n Algebra	_		-		
Anti-requisites	NIL						
Course	The purpose of this course is	s to enable th	he students	to a	appi	reciat	e the
Description	fundamentals of digital logic ci	rcuits and Bo	olean algeb	ra fo	cusi	ng on	both
	combinational and sequential	logic circuit	s. The cou	rse e	emp	hasiz	es on
	minimization techniques for m	aking canonic	cal and low	-COST 1 da	: aig sign	of d	lrcult ligital
	electronic circuits. The course	also creates a	foundation	for	futr	ire co	urses
	which includes Compu	iter Arch	itecture,	Mi	cro	oroce	ssors,
	Microcontrollers, and Embedd	led Systems et	tc.		-		,
	The course enhances the Design	n, Implementa	tion and Pro	ograi	nmi	ng ab	ilities
	through laboratory tasks. The as	sociated labor	atory provid	es ar	n opj	ortur	nity to
	verify the theoretical knowledge.						
Course	The objective of the course is t	o familiarize	the learner	s wit	h th	e con	cepts
Objective	of Digital Design and attain the SKILL DEVELOPMENT through						
	EXPERIENTIAL LEARNING.						
Course	On successful completion of this course the students shall be able to:						
Outcomes	1. Describe the concepts of	of number syst	ems, Boolea	in alg	gebr	a and	logic
	gates.	niques to sim	nlify Dooloo	novi	aroo	iona	
	iii Demonstrate the Combi	inques to sim	pilly Doolea	n loc	pres.	sions.	
	iv Demonstrate the Sequen	tial and progra	mmable log	ic cir	sie cuit	c	
	v Implement various combinational and sequential logic circuits using						
	gates.						
Course							
Content:							
Modulo 1	Fundamentals of Number	Application	Data Analy	/sis		(06
would I	digital logic	Assignment	task			cla	sses
Topics:							
Review of Num	ber systems and logic gates, Nur	nber base con	versions, O	vervi	ew	of Bo	olean
functions and sir	nplifications, two, three, four varia	ble K-Maps- I	Don't care co	ondit	ions	- Botł	n SOP
and POS- Unive	rsal Gates (NAND & NOR) Imple	mentations. In	troduction to	o HD	DL.		
Module 2	Boolean function	Application	Data Analy	/sis			08
	simplification	Assignment	task			C	lasses
l'opics:	Some in a figural singuitation of the second s			- L L	I	C1.4	a a4 c
Magnitude com	combinational circuits, Analysis, D	esign procedu	vers-Demul	uuer	and	SUDU	actor,
Encoders and Pr	jority Encoders. HDL Models of c	ombinational	circuits.	upie	NCI 5 ,		ouers,
und 11			Programm	ing			
Module 3	Combinational Logic circuits:	Application	Task & Da	ta		-	08
		Assignment	Analysis ta	sk		C	asses
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):

- 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.): <u>Book Free Download</u> (studymaterialz.in)

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

Digital Design 5: LOGISIM Tutorial & Demo

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

E-content:

- 1. Z. Xin-Li and W. Hong-Ying, "The Application of Digital Electronics in Networking Communication," 2016 Eighth International Conference on Measuring Technology and Mechatronics Automation (ICMTMA), 2016, pp. 684-687, doi: 10.1109/ICMTMA.2016.168.
- 2. An encoding technique for design and optimization of combinational logic circuit DipayanBhadra;Tanvir Ahmed Tarique;Sultan Uddin Ahmed;Md. Shahjahan;KazuyukiMurase2010 13th International Conference on Computer and Information Technology (ICCIT)
- 3. A. Matrosova and V. Provkin, "Applying Incompletely Specified Boolean Functions for Patch Circuit Generation," 2021 IEEE East-West Design & Test Symposium (EWDTS), 2021, pp. 1-4, doi: 10.1109/EWDTS52692.2021.9581029.
- 4. A. Matrosova, V. Provkin and E. Nikolaeva, "Masking Internal Node Faults and Trojan Circuits in Logical Circuits," *2019 IEEE East-West Design & Test Symposium (EWDTS)*, 2019, pp. 1-4, doi: 10.1109/EWDTS.2019.8884434.

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

Course Code: CIV1008	Course Title: Basic Engineering Sciences Type of Course: Theory Only	L-T- P-C	2	0	0	2
Version No.	1.0					
Course Pre- requisites	NIL					
Anti-requisites	NIL					

Course	This basic co	urse on engine	ering science is design	ed to introduce
Description	students to	the fields o	f civil, mechanical	and petroleum
	engineering.	Student will I	pe exposed to variou	s fields in civil
	engineering a	nd different m	anufacturing technique	es in addition to
	machinery fo	or power produ	iction and consumption	on. Additionally,
	students will	be getting an c	verview of various sec	tors of oil & gas
	industries. Th	is course acqu	aints students to basics	s of Industry 4.0
	and Construe	ction 4.0. The	course aims to enal	ole students to
	appreciate th	e multidiscipli	nary nature of enginee	ering design and
	operations in	the current er	a with mechanization	and digitization
	transforming	every aspect o	f engineering.	-
Course Objective	The objective	of the course i	s skill development of s	student by using
	Participative	Learning techn	iques.	, .
Course Outcomes	On succossfu	- I completion of	this course the stude	ate chall he able
Course Outcomes	to:	r completion of		
	1] Recogni	ze the signific	cance of various disc	ciplines in Civil
	Engineerir	ıg		
	2] Discuss th	e recent evolut	ions in Civil Engineerin	g
	3] Explain va	arious energies	, energy generating n	nachineries and
	energy co	nsumption mad	chineries	
	4 Describe t	the fundament	al concept and terming	blogy associated
	with the P	etroleum indus	stry	
	5] Distinguisł	n between con	ventional and modern	n manufacturing
	technique	s.		
Course Content:				
	Introductio			
	n to various		Case studies on	
Module 1	fields in	Assignment	different Civil	6 Sessions
	Civil	-	Engineering	
	Engineering		Projects	
Topics: Introduction	to Civil Engine	ering: Definitio	on, scope and branches	s of Civil
Engineering, Role of	Civil Engineer	, Overview of In	nfrastructure.	
	Current			
Madula 2	Trends and	Assignment	Article Deview	6 Sociona
	Civil	Assignment	AILICIE REVIEW	0 565510115
	Engineering			
Topics: Mechanizati	on in Construc	tion. Applicatio	n of Digital Technologi	es in Planning.
Design, execution, r	nonitoring and	maintenance	of Construction. Overvi	ew of Smart
Cities.				
	Power			
Module 3	Production	Assignment	Data Collection	6 Sessions
	and	& Quiz		
	Consumpti			

				1
	on			
	Machinery			
Topics: Energy and	its types, Engi	ines and their	applications, Pumps-C	ompressors and
their applications.	1	1		1
	Overview			
Module 4	of	Assignment	Article Review	6 Sessions
Would 4	Petroleum	& Quiz	AITICIE NEVIEW	0 563510113
	Engineering			
Overview of the Pet	roleum Indust	ry, Importance	of Petroleum Engineer	ing, lifecycle of
Petroleum products	, Classification	s of E&P activit	ies: Key difference bet	ween Offshore
and Onshore, Onsho	ore facilities, of	ffshore platforr	ns, Digitization of petro	oleum
engineering				
	Inductry 4.0	Assignment	Data Collection	6 Soccions
would 5	muustiy 4.0	& Quiz		0 363510115
Topics: Conventiona	al manufacturi	ng process: Me	etal forming, metal ren	noval and metal
joining process.				
Modern Manufactu	ring process: 3	D Printing / Ad	ditive Manufacturing.	
Targeted Applicatio	on & Tools that	can be used:		
Application Areas in	clude design a	nd implementa	ition of Smart City proj	ects,
Infrastructure main	tenance, Powe	r production, I	C engines, Electric vehi	cles, onshore
and offshore explor	ation and prod	uction activitie	S	
Project work/Assign	ament:			
Assignment 1: Coll	ect data and	nrenare reno	rt on various Mega I	Projects in Civil
Engineering				
Assignment 2. Revie	w Articles on a	surrent evoluti	ons in Civil Engineering	
Assignment 3. Colle	ct data related	to renewable	energy generation (Wi	nd Solar)
Assignment 1. Pren:		consumption ch	part for a compressor of	na, solar j
Assignment 5: Pren	are a report on	role of 3D prir	iting across various ind	n pumps. Justrios
Assignment 6: Pren	are an assignm	ent on geonolit	rical influence on oil an	d gas industries
Text Book:		ent on geopoin		a gas maastries.
T1 Flement	s of Civil and M	lechanical Engi	neering IS lavagonal	& R
Rudram	oorthy, Vikas F	Publishers	neering, E.J. Jayagopai	<u>un</u>
T2 Flement	s of Mechanica	Engineering	ov VK Manglik	
T2 Fundam	entals of Oil &	Gas Industry f	or Reginners hy Samir I	Dalvi Notion
Press: 1	st 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=e host-live

2. Post-parametric Automation in Design and Construction

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

3. Smart Cities : Introducing Digital Innovation to Cities

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

- 5. Mechanical Engineering <u>https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE</u> <u>BASED&unique_id=EBSCO106_REDO_1705</u>
- 6. Additive Manufacturing: Opportunities, Challenges, Implications <u>https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1134464&si</u> <u>te=ehost-live</u>
- 7. Society of Petroleum Engineers (SPE) <u>https://www.spe.org/en/</u>
- 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

Code: Type of course: school core & Theory	Course Code:	Course Title: Engineering Graphics Type of Course: School Core & Theory	L- T-P- C	2-0-0-2
--	-----------------	--	-----------	---------

MEC1006	Only					
Version No.	1.2					
Course Pre- requisites	NIL					
Anti- requisites	NIL					
Course Description	The course is designed with the objective of giving an overview of engineering graphics. It is introductory in nature and acquaints the students with the techniques used to create engineering drawings. The course emphasizes on projection of points, lines, planes and solids and isometric projections.					
Course Objective	The objective o concepts of " Er through Proble	f the course is to fangineering Graphics m solving methodo	miliarize s″ and at logies.	the learn tain SKILL	ers with DEVELC	the IPMENT
	On successful co	ompletion of this co	ourse the	students	shall be	able to:
	(1) Demonstrate	competency of Eng	ineering	Graphics a	as per Bl	S
	conventionsand	standards.				
	(2) Comprehend	I the theory of proje	ection for	r drawing	projectio	ons of
Course	Points, Lines and	IPlanes under diffe	rent cond	ditions.		
Outco	(3) Prepare mult	tiview orthographic	c projecti	ions of Sol	ids by v	isualizing
mes	them indifferent	positions.				
	(4) Prepare picto	rial drawings using	the princ	ciples of iso	ometric	
	projections to vis	sualizeobjects in th	ree dime	nsions.		
	Course Content					
Module 1	Introduction	Assignment	Standa	rd technica	al	02
			drawin	g		Sessions
Topics:						
Introduction, o	drawing instrumer	its and their uses, r	elevant E	BIS conven	tions an	d
standards, Let	tering, Lineconver	itions, dimensionin	g, Select	ion of drav	wing sne	et size and
Comprehensio	on Levell			ĮU		
	Orthographic					
Module 2	projections of	Assignment	Project	ion metho	ds	10 Consistent
	Points, Straight		Anaiysi	S		Sessions
	Linesand Plane					
	Surfaces					

Topics:

Introduction, Definitions – Elements of projection and methods of projection, Planes of projection, reference line and conventions adopted. First angle and third angle projections. Projection of Points inall 4 quadrants.

Projections of Straight Lines (located in first quadrant/first angle projection only): True and apparent lengths, true and apparent Inclinations to reference planes. (No application problems). Projection of Plane surfaces (First angle projection): Regular plane surfaces – triangle, square, rectangle, pentagon, hexagon and circle – in different positions inclined to both the planes using change of position method only.

Level]

[10 Hours: Application

Module 3	Orthographi c Projections of Solids	Assignment	Multi-view drawing Analysis	10 Sessions

Topics:

Introduction, Projection of right regular prisms, pyramids, cone, hexahedron and tetrahedron indifferent positions (Problems resting on HP only and First angle projection).

[10 Hours: Application Level]

Module 4	Isometric Projections of Solids (Using	Assignment	Spatial Visualization	8 Sessions
	isometric			
	Scale			
	only)			

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: CSE1006	Course Title: Problem Solving using JAVA Type of Course: Lab Integrated	L - T-P- C	1	0	4	3
Version No.	2.0					<u> </u>
Course Pre- requisites	CSE1004 - Problem-Solving Using C					
Anti- requisites	Nil					
Course Description	This course introduces the core concepts of object-oriented programming. This course has theory and lab component which emphasizes understanding the implementation and application of object-oriented programming paradigm. It helps the student to puild real-time secure applications by applying these concepts and also for effective problem-solving. The students interpret and understand the need for object-oriented programming to build applications.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of Problem-Solving using JAVA and attain SKILL DEVELOPMENT through EXPERIENTIAL LEARNING techniques					
Course Out Comes	 On successful completion of the course, the students shall be able to: C.O. 1: Describe the basic programming concepts. [Knowledge] C.O. 2: Apply the concept of classes, objects and methods to solve problems. [Application] C.O. 3: Apply the concept of arrays and strings. [Application] C.O. 4: Implement inheritance and polymorphism in building secure applications. [Application] C.O. 5: Apply the concepts of interface and error handling mechanism. [Application] 					o le to: lge] solve n] ng
Course Content:						
Module 1	Basic Concepts of Programming and Assignment Java	nterpre	etati	on	12 9	Sessions
Topics: Introduction to Principles of Programming: Process of Problem Solving, Java program structure, Download Eclipse IDE to run Java programs, Sample program, Data types, Identifiers, Variables, Constants in java, Operators, Assignments and Expression, Basic Input/ Output functions, Control Statements: Branching and Looping.						

Classes, obje Module 2 methods and Constructors	c ts, Case studies / Case let	Case studies / Case let	12	Sessions
---	--	-------------------------	----	----------

Topics: Classes, Objects and Methods: Introduction to object Oriented Principles, defining a class, adding data members and methods to the class, access specifiers, instantiating objects, reference variable, accessing class members and methods.

Static Polymorphism: Method overloading, constructors, constructor overloading, this keyword, static keyword, Nested classes, Accessing members in nested classes.

Module 3	Arrays, String and String buffer	Quiz	Case studies / Case let	14	Sessions

Topics: Arrays: Defining an Array, Initializing & Accessing Array, Multi– Dimensional Array, Array of objects. String: Creation & Operation. String builder class, methods in String Buffer<mark>.</mark>

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

Topics: Inheritance: Defining a subclass, Types of Inheritance, super keyword. Dynamic Polymorphism: Method overriding. Final keyword: with data members, with member functions and with class. Abstract keyword: with data members, with member functions and with class, Exception handling<mark>.</mark>

Module 5Operation in JavaQuizCase studies / Case let14Sessions	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] [7qmsenjl97t0] (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 Engl	ish		L- T- P-	1	0	2	2		
Version No	13			L	L	0	Z	Z		
Course Pre-	ENG1002 Tech	nical English								
requisites										
Anti-requisites	NIL	NIL								
Course	The course em	The course emphasizes on technical communication at advanced level								
Description	by exploring	by exploring critical reading, technical presentation and review								
	writing. The pu	writing. The purpose of the course is to enable learners to review								
	literature in ar	literature in any form or any technical article and deliver technical								
	presentations.	Extensive activities in	n pr	actical se	ession	s e	qui	p to		
	express thems	elves in various forms	of t	technical	comn	nun	icat	ions.		
	Technical prese	entations and the mode	ule d	on career	setti	ng f	focu	is on		
	learners' area d	of interests and enhance	e the	eir English	ı langı	Jage	e wr	riting		
	skills to commu	inicate effectively.								
Course Out	On successful c	ompletion of the course	e the	students	shall	be	able	e to:		
Come	1. Develop a c	ritical and informed res	pons	se reflecti	vely, a	ana	lvtic	ally,		
	discursivelv	and creatively to their	read	ding.	,,		'			
	2. Communica	, ate effectively, creatively	v. ac	curately a	and ar	opro	opria	atelv		
	in their writ	ing.	,,		.	. 19 . 9	, p	,		
	3 Deliver tech	mical presentations								
	4 Design resu	me and create profession	onal	nortfolio	to fin	c h	suit	ahle		
	career		onar	portiono		uu	Jure	ubic		
Course Content:	Theory									
	Critical									
Module 1	Reasoning	Writing Essays	Crit	ical Read	ing	2	1 Cla	asses		
	and Writing				-					
Topics:	·									
A Catalog	g of Reading Strat	tegies								
The Myth	n of Multitasking									
A Guide t	o Writing Essays	Speculating about Caus	ses o	r Effects						
 Is Google 	Making Us Stup	id (Self Study)								
Module 2	Technical Presentation	Presentation	Ora	l Skills			3 Cla	asses		
Topics:										
Planning	the presentation	l								
Creating	the presentation									
Giving the	e presentation									
Module 3	Writing Reviews	Prezi	Rev	iew Writi	ing	4	1 Cla	asses		
Topics:										
Review W	Vriting									
 Short film 	n reviews									

•	Advanced	d English Gramma	ar (Self Study)					
Modu	e 4	Starting your Career	Online Writing Lab	Writing Skills		4 Classes		
Topics								
•	Preparing a Resume							
•	Writing Effective Application Letter							
•	Creating	a Professional Po	ortfolio					
Course	e Content:	Practical Session	าร					
Modu	e 1	Critical Reason	ing and Writing		8 Class	es		
1.	Reading a	and Analyzing						
	Level 1 –	Annotation						
	Level 2 - /	Assumptions						
2.	Writing N	larrative Essays						
	Level 1 –	Draft 1						
	Level 2 –	Draft 2						
Modu	e 2	Technical Prese	entation		10 Clas	ses		
4. Modu 5.	 Fishbowl In Fishbowl, students form concentric circles with a small group inside and a larger group outside. Students in the inner circle engage in an in-depth discussion, while students in the outer circle listen and critique content, logic, and group interaction. Level 1 – within group Level 2 – Among 2 group Technical Group Presentation Module 3 Writing Reviews Practice Worksheets Level 1 – Eliminating the Passive Voice 							
0.	writing 5		3					
Modu	e 4	Starting your C	areer		6	Classes		
7.	Collabora	tive Proiect						
	Job searc	h and writing reg	ort					
	Writing R	esume						
Modu	e 1-4	Academic Journ	nal		2 Class	es		
8.	Academi	c Journal Writing	5					
	Level 1- N	ر Aid Term						
	Level 2 –	End Term						
Target	ed Applica	ation & Tools tha	it can be used: Writing	reports, Revie	w writin	g, Group		
Discus	sion, Dyad	ic interviews, Gra	ammarly.com					

Project work/Assignment:

Academic Journal – Assignment

In Academic Journal (CIJ), students compile task and activities completed in each module and submit to the instructor at the middle and end of the semester.

References

- 1. Hering, Heik. *How to Write Technical Reports: Understanding Structure, Good Design, Convincing Presentation*. Springer.
- 2. Johnson, Richard. (2010) Technical Communication Today. Pearson, 2015
- 3. Rice B. Adelrod, Charles R. Cooper and Ellen C. Carillo. (2020) *Reading Critically Writing Well: A Reader and Guide*. Beford/St. Martin's Macmillan Learning, New York.
- 4. The Princeton Review. (2010) *MCAT Verbal Reasoning & Writing.* The Princeton Review, Inc.
- 5. <u>https://www.hitbullseye.com/Strong-and-Weak-Arguments.php</u> Accessed on 10 Dec 2021
- 6. <u>https://www.inc.com/guides/how-to-improve-your-presentation-skills.html</u> <u>Accessed on 10 Dec 2021</u>

Topics Relevant to "employability": Critical Reasoning, Presentation, Review Writing and Starting Career

Topics Relevant to "Human Values and Professional Ethics": Critical reasoning

Course Code: ECE2010	Course Title: Innovative Projects using Arduino	L- T-P- C	_	-	-	1
Version No.	1.0					
Course Pre- requisites	NIL					
Anti- requisites	NIL					

Course	This course is de	esigned to provide a	an in-depth understandin	ig of				
Description	Arduino microcontrollers and their application in various real time							
	projects involvi	ng sensors. Through	nout the course, students	will learn				
	the fundamentals of Arduino programming and gain hands-on							
	experience with a wide range of sensors. Students will explore how to							
	connect and interface sensors with Arduino boards, read sensor data,							
	and use it to control various output devices This course is suitable for							
	beginners who a	are interested in exp	oloring the world of electr	conics and				
	developing prac	ctical applications u	sing Arduino and sensors	5.				
Course Objective	The objective of the course is Employability Skills of student by using PARTICIPATIVE LEARNING techniques.							
Course	On successful c	ompletion of the co	ourse the students shall h	oe able to				
Outcomes	1) Explain th	ne main features of t	he Arduino prototype bo	ard				
	2) Demonstr	ate the hardware	interfacing of the perij	pherals to				
	Arduino sy	/stem.						
	3) Understar	nd the types of sense	ors and its functions					
	4) Demonstr	ate the functioning	; of live projects carried	out using				
	Arduino sy	/stem.						
Course Content:								
Module 1	Basic concepts of Arduino	Hands-on	Interfacing Task and Analysis	4 Sessions				
Topics: Introduction to features, Conce Board, API's, In and variables, A Cloud Platforms	• Arduino, Pin o pt of digital and ntroduction to En arduino i/o Funct s.	configuration and a analog ports, Fami nbedded C and Arc ions, Arduino Com	architecture, Device and liarizing with Arduino I luino platform, Arduino munications, Arduino ID	platform nterfacing Datatypes E, Various				
Module 2	Sensory	Hands-on	Interfacing Task and	4				
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.								
Arduino Sensor Sensor, Ultraso Arduino. Introduction to Applications. In	S: Humidity Sens nic Sensor, Conn 3D Printer: 31 troduction to onl	sor, Temperature Se tecting Switches an D Printer technolo ine Simulators: Wor	Analysis ensor, Water Detector / S ad actuators, sensor inter ogy and its working I rking with Tinkercad Sim	Sessions ensor, PIR rface with Principles, ulator.				
Arduino Sensor Sensor, Ultraso Arduino. Introduction to Applications. In Topics: Types o	s: Humidity Sens nic Sensor, Conn 3D Printer: 31 troduction to onl f Arduino board	sor, Temperature Senecting Switches an D Printer technolo ine Simulators: Wor	Analysis ensor, Water Detector / S ad actuators, sensor inter ogy and its working i cking with Tinkercad Sim	Sessions ensor, PIR rface with Principles, ulator.				
Arduino Sensor Sensor, Ultraso Arduino. Introduction to Applications. In Topics: Types o Targeted Appli	s: Humidity Sens nic Sensor, Conn 3D Printer: 3 troduction to onl f Arduino board cation & Tools th	sor, Temperature Senecting Switches an D Printer technologine Simulators: Wor s, sensors, 3D Print	Analysis ensor, Water Detector / S ad actuators, sensor inter ogy and its working 1 cking with Tinkercad Sim	Sessions ensor, PIR rface with Principles, ulator.				

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 < <u>https://onlinecourses.swayam2.ac.in/aic20_sp04/preview></u>
- 3. Case studies on Wearable technology< <u>https://www.hticiitm.org/wearables></u>

E-content:

- 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.

4.	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 Code: PPS 1002	Course Title: Soft Skills for Engineers	L- T-P- C	0-0-2-1			
	Type of Course: Practical Only					
version No.	1.0					
Course Pre- requisites	Students are expected to understan Students should have desire and er and learn.	Students are expected to understand Basic English. Students should have desire and enthusiasm to involve, participate and learn.				
Anti-requisites	NIL					

Course Description	This course is designed to enable students 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	On successful completion of this course the students shall be able to:						
Comes	CO1: Recognize significance	of soft	skills				
	CO2: Illustrate effective cor and others CO3: List techniques of form	CO2: Illustrate effective communication while introducing oneselfand othersCO3: List techniques of forming healthy habits					
	CO4: Apply SMART techniqu productivity	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	oming,			
Module 2	EFFECTIVE COMMUNICATION		Individual Assessment	10 Hours			
Topics: Differe Effective comm Video introduct	nt styles of communication, nunication for success, Emai ion, email- writing, Resume E	Differe I etiqu Building	nce between hearing and lis lette, Self-introduction fram g- Digital, Video, Traditional.	itening, iework,			
Module 3	HABIT FORMATION		Worksheets & Assignment	4 Hours			
Topics: Profese effect, Habit Loc	ssional and personal ethics for the personal e	or succ or what	ess, Identity based habits, [is right	Domino			
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							
Targeteo	Application & Tools that can	be use	ed: 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 Title: Trai	nsform Techniques, Pa	artial					
Course Code:	Differential Equa	tions and Their Applic	ations	L-T-	2	0	0	3
MAT1002				P- C	3	U	U	
	Type of Course:	School Core						
Version No.	2.0							
Course Pre-	MAT1001 - Linea	r Algebra and Calculus	S					
requisites								
Anti-requisites	NIL							
Course	This course aims	to introduce various	transform	technic	lues	s su	ch as La	aplace
Description	transform, Four	ier transform and Z	transform	in ado	ditio	n t	o expr	essing
	functions in term	ns of Fourier series. The	e course co	overs ap	plic	atio	ns of La	aplace
	transform to LO	CR circuits and soluti	ion of diff	erence	eq	uati	ons us	ing z-
	transform. The	course also deals wit	th the ana	lytical i	net	hod	s for s	olving
	partial different	tial equations and t	the classic	cal app	lica	tion	s of p	partial
	differential equa	tions.						
Course	The objective o	f the course is <u>Skill</u>	Developr	nent o	f st	ude	ent by	using
Objective	Problem Solving	<u>g Techniques.</u>						
Course	On successful co	ompletion of this cou	urse the st	udents	sha	all b	e able	to:
Outcomes	CO 1. Europe 6							
	CO-1: Express fu	inctions in terms of l	uniformiy	conver	ger	IT FO	burier	
	series.							
	CO-2: Apply Lap	lace transform techr	nique to so	olve dif	fere	enti	al	
	equations.							
	CO-3: Employ z-	transform technique	e to solve (differei	nce	equ	uations	j.
	CO-4: Solve a var	iety of partial differen	itial equation	ons ana	lytic	ally		
Course								
Content:								
								10
Module 1	Fourier Series						CL	ASSES
Fourier series:	Fourier series -	Euler's formulae -	Dirichlet's	s cond	itio	ns -	Chan	ge of
Interval - half ra	- half range series – RMS value – Parseval's identity – Computation of harmonics.							
Engineering Ap	Engineering Applications of Fourier series.							
	Integral						15.0	
Module 2	Transforms						150	185565

Laplace Transform: Definition and Laplace transforms of elementary functions. Properties of Laplace transform. Laplace transform of periodic function, unit-step function and impulse function and the related problems. Inverse Laplace transform 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 Difference		8 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 Classes
iviodule 4	Differential		
	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:

- 1. B. S. Grewal, 2017: "Higher Engineering Mathematics" 45th Edition, Khanna Publishers.
- 2. Peter V O'Neil, 2015: "Advanced Engineering Mathematics", 7th Edition, Cengage Learning.
- 3. Glyn James, 2016: "Advanced Modern Engineering Mathematics", 4th Edition, Pearson Education.
- 4. 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: CSE2001	Course Title: Data Struct Type of Course: Integrate	ures and Algori	thms L- T-P- C	3-	-0-2-4			
Version No.	1.0	1.0						
Course Pre- requisites	Problem Solving Using .	Java						
Anti-requisites	NIL							
Course Description	This course introduces the fundamental concepts of data structures and to emphasize the importance of choosing an appropriate data structure and technique for program development. This course has theory and lab component which emphasizes on understanding the implementation and applications of data structures using Java programming language. With a good knowledge in the fundamental concepts of data structures and practical experience in implementing them, the student can be an effective designer, developer for new software applications.							
Course Objective	The objective of the course is to familiarize the learners with the concepts of Data Structures and Algorithms and attain Skill Development through Experiential Learning techniques.							
Course Out C omes	 On successful completion of the course the students shall be able to: CO1: Implement program for given problems using fundamentals of data structures. [Application] CO2: Apply an appropriate linear data structure for a given scenarios. [Application] CO3: Apply an appropriate non-linear data structure for a given scenarios. [Application] CO4: Explain the performance analysis of given searching and sorting algorithms. 							
Course Content:								
Module 1	Introduction to Data Structure and Linear	Assignment	Program activity		18 Sessions			

Data Structure –		
Stacks and Queues		

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

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

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

Module 2	Linear Data Structure- Linked List	Assignment	Program activity	17 Sessions
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Topics: Linked List - Singly Linked List, Operation on linear list using singly linked storage structures, Circular List, Applications of Linked list.

Recursion - Recursive Definition and Processes, Programming examples.

Module 3	Non-linear Data Structures - Trees and Graph	Assignment	Program activity	15	Sessions
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Topics: Trees - Introduction to Trees, Binary tree: Terminology and Properties, Use of Doubly Linked List, Binary tree traversals: Pre-Order traversal, In-Order traversal, Post - Order traversal. **Graph** - Basic Concept of Graph Theory and its Properties, Representation of Graphs.

Oruphi Duble con	eepe of oraph theo	i j una no i roperne	s, representation o	i Olupiio.
	Searching & Sorting			
Module 4	Performance	Assignment	Program activity	14sessions
	Analysis			

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

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

List of Laboratory Tasks:

Lab sheet -1

Level 1: Prompt the user, read input and print messages. Programs using class, methods and objects Level 2: Programming Exercises on fundamental Data structure - Arrays based on Scenario.

Lab sheet -2

Level 1: Programming Exercises on Stack and its operations

Level 2: Programming Exercises on Stack and its operations with condition Lab sheet -3

Level 1: Programming on Stack application infix to postfix Conversion

Level 2: -

Lab sheet -4

Level 1: Programming Exercises on Queues and its operations with conditions

Level 2: -

Lab sheet -5

Level 1: Programming Exercises on Linked list and its operations.

Level 2: Programming Exercises on Linked list and its operations with various positions

Lab sheet -6

Level 1:

Level 2: Programming scenario based application using Linked List

Lab sheet -7

Level 1: Programming Exercises on factorial of a number

Level 2: Programming the tower of Hanoi using recursion

Lab sheet -8

Level 1:

Level 2: Programming the tower of Hanoi using recursion

Lab sheet -9

Level 1: Programming Exercise on Doubly linked list and its operations

Level 2:

Lab sheet -10

Level 1: Program to Construct Binary Search Tree and Graph

Level 2: Program to traverse the Binary Search Tree in three ways(in-order, pre-order and post-order) and implement BFS and DFS

Lab sheet -11

Level 1: Program to Implement the Linear Search & Binary Search

Level 2: Program to Estimate the Time complexity of Linear Search

Lab sheet -12

Level 1: Program to Implement and Estimate the Time complexity of Insertion Sort

Level 2: Program to Implement and Estimate the Time complexity of Insertion Sort Lab sheet -13

Level 1: Program to Implement and Estimate the Time complexity of Selection Sort Program to Implement and Estimate the Time complexity of Selection Sort

Targeted Application & Tools that can be used

Use of PowerPoint software for lecture slides and use of Ubuntu for lab programs to execute. Tool is Codetantra tool.

Project work/Assignment:

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

Text Book

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

References

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

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

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

Web resources:

- 1. For theory: <u>https://onlinecourses.nptel.ac.in/noc20_cs85/preview</u>
- 2. For Lab : codetantra tool
- 3. <u>https://puniversity.informaticsglobal.com/login</u>

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

Course Code:	Course Title: Data	Communications	and					
CSE3155	Computer Networ	ks		L-T-P-	2	0	2	4
	Type of Course: P Laboratory integr	rogram Core The ated	ory–	C 3-0-2-4	3	0	2	4
Version No.	1.0							
Course Pre- requisites	Digital Design							
Anti-requisites	NIL							
Course Description	The objective of this course is to provide knowledge in data communications and computer networks, its organization and its implementation, and gain practical experience in the installation, monitoring, and troubleshooting of _AN systems The associated laboratory is designed to implement and simulate various networks using Cisco packet tracer, NS2. All the lab exercises will focus on the fundamentals of creating multiple networks, topologies and analyzing the network traffics							
Course Objective	The objective of the course is to familiarize the learners with the concepts of Data Communications and Computer Networks and attain Employability through Problem Solving Methodologies.							
Course Out Comes	On successful completion of the course, the students shall be able to: 1] I llustrate the Basic Concepts Of Data Communication and Computer Networks. 2] Analyze the functionalities of the Data Link Layer. 3] Apply the Knowledge of IP Addressing and Routing Mechanisms in Computer Networks. 4] Demonstrate the working principles of the Transport layer and Application							
Course Content:								
Module 1	Introduction and Physical Layer- CO1	Assignment	Problem So	lving	0	7 C	Classe	es
Introduction to Topologies, Trar Physical Layer Multiplexing and	Computer Network nsmission Media –R -Analog and Digita I Spread Spectrum.	s and Data comn eference Models - l Signals – Digital	nunications, DSI Model – and Analog	Networ TCP/IP Signals	k (Su -7	Con ite. Frai	npon nsmi	ents – ssion -

Module 2	Reference Models and Data Link Layer – CO2	Assignment	Problem Solving	7 Classes
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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
Module 3	Network Layer – CO 3	Assignment	Problem Solving	10 Classes

Network Layer Services - Network Layer Services, Switching Techniques, IP Addressing methods- IPv4 IPV6 – Subnetting. Routing, - Distance Vector Routing – RIP-BGP-Link State Routing –OSPF-Multi cast Routing-MOSPF- DVMRP – Broad Cast Routing. EVPN-VXLAN, VPLS, ELAN.

Module 4	Transport and Application Layer -CO3	Assignment	Problem Solving	10 Classes
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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. Forouzan, "Data Communications and Networking 5E", 5th Edition, Tata McGraw-Hill, 2017.

2. Andrew S Tanenbaum, Nick Feamster & David J Wetherall, "Computer Networks" Sixth Edition, Pearson Publication, 2022

References

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

2. William Stallings, Data and Computer Communication, 8th Edition, Pearson Education, 2007.

3. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007. E-Resources: 1.https://archive.nptel.ac.in/courses/106/105/106105183/

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

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

4.<u>https://www.youtube.com/watch?v=_fIdQ4yfsfM</u> 5.<u>https://www.digimat.in/keyword/106.html</u>

https://www.uginat.ii/keyword/100.itiii https://puniversity.informaticsglobal.com/login

Course Code: CSE2009	Course Title: Computer Organization and Architecture	L-T- P- C	3-0-0-3
Version No.	2.0		
Course Pre- requisites	CSE 2015 Digital Design		
Anti-requisites	NIL		

Course	This course introduc	ces the core prin	ciples of computer ar	chitecture and			
Description	organization from basic to intermediate level. This theory based course emphasizes						
	on understanding the interaction between computer hardware and software. It						
	equips the students	equips the students with the intuition behind assembly-level instruction set					
	architectures. It help	s the students to	interpret the operation	al concepts of			
	computer technology	as well as performa	nce enhancement.				
Course	The objective of the	course is to familia	arize the learners with t	he concepts of			
Objective	Computer Organization	on and Architecture	e and attain Skill Develo	pment through			
-	Participative Learning	techniques.					
Course	On successful complet	ion of the course th	e students shall be able t	0:			
Outcomes	1] Describe the basic	components of a	computer, their interco	nnections, and			
	instruction set archite	cture [Comprehens	ion]				
	2] Apply appropriate t	echniques to carry o	out selected arithmetic op	perations			
	3] Explain the organiza	3] Explain the organization of memory and processor sub-system					
Course Content:							
Module 1	Basic Structure of computers	Assignment	Data Analysis task	12 Classes			

Topics:

Computer Types, Functional Units, Basic Operational concepts, Bus Structures, Computer systems RISC & CISC, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. Arithmetic Operations on Signed numbers. Instructions and Instruction Sequencing, Instruction formats, Memory Instructions.

Module 2 Memory Unit	Set andAssignment	Analysis, Data Collection	12 Classes
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Topics:

Instruction Set Architecture: Addressing Modes, Stacks and Subroutines.

Memory System: Memory Location and Addresses, Memory Operations, Semiconductor RAM Memories, Internal Organization of Memory chips, Cache memory mapping Techniques.

Module 3	Arithmet and	tic Input/output	Case Study	Data analysis task	10 Classes
	Design	• • •		-	

Topics:

Arithmetic: Carry lookahead Adder, Signed-Operand Multiplication, Integer Division, and Floating point operations.

Input/output Design: Accessing I/O Devices, I/O communication, Interrupt Hardware, Direct Memory Access, Buses, Interface Circuits

Module 4	BPU and Pipelining	Assignment	Analysis, Data Collection	11 Classes

Topics:

Basic Processing Unit: Fundamental Concepts, Single Bus organization, Control sequence, Execution of a Complete Instruction, Multiple Bus Organization.

Pipelining: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, Hazards. Targeted Application & Tools that can be used:

Targeted employment sector is processor manufacturing and memory chip fabrication vendors like Intel, AMD, Motorola, NVidia, Samsung, Micron Technology, western Digital etc. Targeted job profiles include Memory circuit design and verification engineers, Physical system design engineer, System programmer, Fabrication engineer etc.

Tools:

- Virtual Lab, IIT KGP
- Tejas Java Based Architectural Simulator, IIT Delhi

Text Book

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, "Computer Organization", Fifth Edition, McGraw-Hill Higher Education, 2016 reprint.

References

1. William Stallings, "Computer Organization & Architecture – Designing for Performance", 11th

Edition, Pearson Education Inc., 2019

2. David A. Patterson & John L. Hennessy, "Computer Organization and Design MIPS Edition-The Hardware/Software Interface", 6th Edition, Morgan Kaufmann, Elsevier Publications, November 2020.

Web References:

1. NPTEL Course on "Computer architecture and organization" IIT Kharagpur By Prof. Indranil Sengupta, Prof. Kamalika Datta. https://nptel.ac.in/courses/106105163

2. NPTEL Course on "Computer Organization", IIT Madras By Prof. S. Raman. https://nptel.ac.in/courses/106106092

3. https://puniversity.informaticsglobal.com:2229/login.aspx

Topics relevant to "SKILL DEVELOPMENT": Generation of Computers, CISC and RISC processors, Bus Arbitration, Collaboration and Data collection for Term assignments and Case Studies for Skill Development through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code: MAT2004	Course Title: Discrete Mathematical Structures Type of Course: Program Core	L-T- P- C	3	0	0	3	
Version No.	1.0						
Course	Nil						
Pre-requisites							
Anti-requisites	Nil						
Course Description	The course provides insights into the fundamental aspects of mathematical logic and predicate calculus. The course delves deeply into the concepts of algebraic structures, lattices and Boolean algebras which are widely used in computer science and engineering. It also highlights the principles of counting techniques and their applications.						
Course Objective	The objective of the course is Skill Develop Problem Solving Techniques.	oment of	stud	ent b	y usi	ng	

Course	On successful completion	of the course the stu	idents shall be able to:			
Outcomes	CO1: Explain logical sentences through predicates, quantifiers and logical					
	connectives.					
	CO2: Comprehend the basic principles of set theory and different types of					
	relations.					
	CO3: Elucidate the conception	ots of lattices and Boo	olean algebra.	_		
	CO4: Deploy the counting	techniques to tackle	combinatorial problem	s.		
Course						
Content:	Mathematical Logic and			12		
Module 1	Predicate Calculus			classes		
Propositional Log to Proofs, Conver of the Predicate (gic, Propositional Logic Equi sion to clausal form, Predica Calculus.	valences, Normal for ate calculus, The State	ms, Inference rules, Interenter function, Inferenter	roduction ce theory		
Module 2	Algebraic Structures			10 classes		
Sets and set-oper	rations, functions, relations	and their properties	& representations of re	elation by		
matrix, closure o	f different type of relations,	, equivalence relatior	s, primitive recursive for	unction.		
Module 3	Lattices and Boolean Algebra			11 classes		
Partial ordering, systems by lattice Boolean algebra,	Posset, Lattices & Algebraic es, Distributive lattices, com cancellation laws and uniqu	structures, Sub latti nplement of an eleme ue complement theor	ce, Basic properties of ent in a lattice, Boolean rem.	algebraic lattice &		
Module 4	Principles of Counting Techniques			12 classes		
Chinese Remainder Theorem, pigeonhole principle, generalized pigeonhole principle, Generalized Permutations and Combinations, Recurrence Relations.						
Targeted Applica	tion & Tools that can be us	sed:				
Discrete mathematics provides the mathematical foundations for many computer science courses including data structures, algorithms, database theory, automata theory, formal languages, compiler theory, computer security, and operating systems.						
Project work/Ass	signment: Mention the Typ	e of Project /Assignr	ment proposed for this	course		
Assignment 1: Logic Equivalences and Predicate calculus.Assignment 2: Equivalence Relations and LatticesAssignment 3: Recurrence Relations						

Text Books

- 1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", McGraw-Hill's 7th Edition, 2011.
- 2. Kolman, Bernard; Busby, Robert C; Ross, Sharon Cutler," Discrete mathematical structures", Pearson India, 6th Edition, 2015.
- 3. Liu, C L Mohapatra, D P.," Elements of Discrete Mathematics a Computer oriented
- approach", New Delhi McGraw Hill Education, 4th Edition, 2015.
 Mott, Joe L; Kandel, Abraham; Baker, Theodore P, "Discrete Mathematics for Computer Scientists and Mathematicians", Pearson India, 2nd Edition, 2015.
- 5. Epp, Susanna S, "Discrete Mathematics with applications", New Delhi Cengage Learing, 4th Edition, 2016.

References:

- 1. Tremblay, J.P. and Manohar.R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011.
- 2. Grimaldi, R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", 4th Edition, Pearson Education Asia, Delhi, 2007.
- Discrete Mathematics, Richard Johnsonbaugh, 8th Edition, Prentice Hall, 2017. 3.

Course Code:	Course Title: Fundamentals of Data Analytics		2	0	2	3
CSE3190	Type of Course: Theory-embedded Lab	L-T- P- C				
Version No.	3.0	•				•
Course Pre- requisites	NIL					
Anti-requisites	NIL					
Course Description	Fundamentals of Data Analytics is design transforming, and modeling data with the goal o and supports in decision-making. The course beg pre-processing, and transformation. It delivers th intuitive way to analysis the data. This course w knowledge on data analysis to a wide range of ap	ed for i f discoveri gins by cov e basic sta ill help the oplications	inspec ing us vering tistics e stud	cting eful g Dat s and ents	;, c info a ex tau to a	leansing, rmation, traction, ght in an apply the

Course Objective	The objective of the course is to familiarize the learners with the concepts of Fundamentals of Data Analytics and attain SKILL DEVELOPMENT through PROBLEM SOLVING Methodologies.					
Course Out Comes	On successful con	npletion of the course t	he students shall be able	to:		
	 Explain di Interpret Demonstratingiven ap methods. Apply the 	ifferent types of data a data using appropriate rate the collection, pr plication and Illustra Data Analysis techniq	nd variables. e statistical methods. rocessing and analysis of te various charts using ues by R Programming	f data for any ; visualization		
Course Content:						
Module 1	Introduction to Data Analysis	Assignment	Data Collection, data analysis, Programming	8 Sessions		
Topics: Introducing	Data, overview of	data analysis: Data in t	he Real World, Data vs. In	formation, The		
Many "Vs" of Data	a, Structured Data	and Unstructured Data	a, Types of Data, Data An	alysis Defined,		
Types of Variables.	Central Tendency	of Data. Scales of Data.	Sources of Data. Data pre	eparation.		
K Studio: Base R-R Scripts and Comm More ways to save	Studio IDE-Introdu ents-R Variables. I -Data I/O in Base R	Iction to R Projects and Data I/O: Working Dire 	к Markdown. Basic R: R a ectories-Importing Data E	as a Calculator- xporting Data-		
Module 2	Visualization	Case studies	Programming	8 Sessions		
Topics: Data Sum	marization: One	Quantitative and Cat	tegorical Variable. Data	Classes: One		
Dimensional Data (Classes-Data Frame	es and Matrices-Lists. D	ata Cleaning: Dealing with	n Missing Data-		
Strings and Recod	ing Variables. Mai	nipulating Data in R: F	Reshaping Data-Merging	Datasets. Data		
Visualizations: Plot	ting with ggplot2-	Plotting with Base R				
Module 3	Statistical Analysis	Case studies	R programming	7 Sessions		
Topics : Proportior tests-Wilcoxon sigr	n tests-Chi squared ned rank test- one-	d test-Fisher exact test way ANOVA test- Krusk	t-Correlation-T test-Wilco al Wallis test	xon Rank sum		
Module 4	Predictive Analysis	Case studies	Programming	8 Sessions		
Topics: Linear le	ast-squares – imp	lementation – the goo	dness of fit – testing a	inear model –		
weighted resampli	ng. Regression usir	ıg Stats models – multip	ole regression – nonlinear	relationships –		
logistic regression missing values – se	 estimating para rial correlation – a 	meters – accuracy. Tir utocorrelation. Introdu	ne series analysis – mov ction to survival analysis	ing averages –		
List of Laboratory	Tasks:					
Experiment No. 1:	Introduction to R a	and RStudio				
Level 1: Getting St	arted with R and R	Studio				
 Installing R 	and RStudio.					
Basic R syn	tax and commands	5.				
	ding the DStudie in	torface				
	ung the Rotuulo III	iterrate.				

• Creating and managing R scripts.

Experiment No. 2: Basic Data Handling in R

Level 1: Data Types and Structures in R

- Vectors, matrices, and data frames.
- Lists and factors.

Level 2: Data Import and Export

- Reading data from CSV, Excel, and text files.
- Exporting data to different formats.
- Level 3: Exploring Datasets
 - Using functions like head(), summary(), and str().

Experiment No. 3: Basic Data structure in R

Level 1: a. Demonstrate a program to join columns and rows in a data frame using cbind() and rbind() in R.

b.Implement different data structures in R (Vectors, Lists, Data Frames)

Level 2: R AS CALCULATOR APPLICATION a. Using with and without R objects on console

a. Using mathematical functions on console

b. Write an R script, to create R objects for the calculator application **Experiment No. 4**: Data Cleaning and Preprocessing

Level 1: Handling Missing Data in R

- Identifying missing values.
- Imputing missing values using mean, median, or other methods.

Level 2: Data Transformation in R

- Standardizing and normalizing data.
- Log-transformations and scaling.

Experiment No. 5: Exploratory Data Analysis (EDA) with R

Level 1: Descriptive Statistics

- Calculating mean, median, and standard deviation.
- Visualizing data using histograms, box plots, and scatter plots.

Experiment No. 6: Data Visualization with ggplot2

Level 1: Demonstrate various graphs that can be made and altered using the ggplot2 package.

Level 2: Create 500 random temperature readings for six cities over a season and then plot the generated data using ggplot2 packages in R

Experiment No. 7: Perform Tests of Hypotheses hypothesis test (parametric)

Level 1: How to perform tests of hypotheses about the mean when the variance is known. How to compute the p-value. Explore the connection between the critical region, the test statistic, and the p-value.

Level 2: A teacher claims that people who work for only five hours per week will score significantly lower than people who work for ten hours per week on a quantitative abilities test. He brings twenty people and randomly assigned them to one or two groups. In one group he has participants who work for ten hours and in another group, he has participants who work for five hours. He conducts the test for all participants. Scores on the test range from one to ten with higher scores representing better
performance. Test if there is any significant difference between those who work for five hours per week versus those who work for ten hours per week based on the test performance.

Experiment No 8: Hypothesis – Non-Parametric Test

Level 1: A car manufacturing company like to find the sales of three types of cars produced by them in three regions and is given. Test if there is an association between the regions and types of cars purchased.

Experiment No 9: Correlation and Covariance

Level 1: Using the iris data set in R

- a. Find the correlation matrix.
- b. Plot the correlation plot on dataset and visualize giving an overview of relationships among data on iris data.
- c. Analysis of covariance: variance (ANOVA), if data have categorical variables on iris data.

Level 2: Ramesh is doing a statistics paper in his post-graduation course. He met his friend Amal who is a textile engineer. Ramesh, who is doing his internship at ABC Researchers, is interested in a question. He poses this question to Amal and tries to find if he can answer. The question is as follows: The data regarding sales of soft- drinks and sales of cotton clothes in a place during the last 12 months are given. Find if there is any association between sales of soft drinks and sales of cotton clothes. Also explain the reason if there is any relationship.

Experiment No 11: Regression Model

Level 1: Import data from web storage (http://www.ats.ucla.edu/stat/data/binary.csv). Name the dataset and now do Logistic Regression to find out the relation between variables that are affecting the admission of a student in an institute based on his or her GRE score, GPA obtained, and rank of the student. Also check the model is fit or not. Require (foreign), require (MASS).

Level 2: Demonstrate multiple regressions, if data have a continuous Independent variable. Apply on the above dataset

Experiment No. 12: Time Series Analysis in R

Level 1: Demonstrate Time series analysis using Time Series Data Library at http://robjhyndman.com/TSDL/.

Targeted Application & Tools that can be used:

Application Area are Decision making in business, health care, financial sector, Medical diagnosis etc.

Text Books

- 2. Glenn J. Myatt and Wayne P. Johnson, "Making Sense of Data I: A Practical Guide to Exploratory Data Analysis and Data Mining Paperback", Import, 22 July 2014.
- 3. Introduction to statistics and Data analytics, Christian H, Michael S, Springer, 2016
- 4. Introduction to R- Robert Parker, John Mushcelli and Andrew Jaffe, Johns Hopkins University, 2020 (E-resource)
- 5. Introduction to Time Series and Forecasting (Springer Texts in Statistics), Peter Brockwell, Richard A. Davis, Springer, 2016.

References

- 1. Making Sense of Data I: A Practical Guide to Exploratory Data Analysis and Data Mining Paperback, Glenn J. Myatt and Wayne P. Johnson, Import, 22 July 2014.
- 2. The R Software-Fundamentals of Programming and Statistical Analysis -Pierre Lafaye de Micheaux, Remy Drouilhet, Benoit Liquet, Springer 2013.

Online resources:

http://www.modernstatisticswithr.com/solutions.html#solutionsch3

https://johnmuschelli.com/intro_to_r/

https://users.phhp.ufl.edu/rlp176/Courses/PHC6089/R_notes/

Topics relevant to development of "FOUNDATION SKILLS":

- 1. Statistical Concepts for data, visualization techniques.
- 2. Data collection for project based assignments.
- 3. Inferential Statistics (T test, Z test)
- 4. Probability Calculation

for Skill Development through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.

Course Code: CSE2014	Course Title: Software E Type of Course: School C	Engineering Core [Theory	Only]	L-T- P- C	3-	·0-0-3
Version No.	1.0					
Course Pre- requisites	NIL					
Anti-requisites	NIL					
Course Description	The objective of this course is to provide the fundamentals concepts of Software Engineering process and principles. The course covers software requirement engineering processes, system analysis, design, implementation and testing aspects of software system development. The course covers software quality, configuration management and maintenance.					
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Software Engineering and attain Skill Development through Participative Learning techniques.					
Course Out Comes	On successful completion 1] Describe the Soft models(Knowledge) 2] Identify the requirement application(Comprehens 3] Understand the Agile 4] Apply an appropriat principles involved in sof	On successful completion of this course the students shall be able to: 1] Describe the Software Engineering principles, ethics and process models(Knowledge) 2] Identify the requirements, analysis and appropriate design models for a given application(Comprehension) 3] Understand the Agile Principles(Knowledge) 4] Apply an appropriate planning, scheduling, evaluation and maintenance principles involved in coftware(Application)				
Module 1	Introduction to Software Engineering and Process Models (Knowledge level)	Quiz				09 Hours
Introduction: N	eed for Software Engine	ering, Profes	sional Soft	ware De	velopmei	nt, Software
Development Lif	e Cycle	Tactice-Essen	ce of Practi	ce, Gener	ai Princip	nes software

Models: Waterfall Model – Classical Waterfall Model, Iterative Waterfall Model, Evolutionary model-Spiral, Prototype.

Software Development of SRS Module 2 Assignment documents for a given 11 H			<i>,</i> ,		
Analysis and Design (Comprehension level)	Module 2	ent o	Software Requirements, Analysis and Design (Comprehension level)	Development of SRS documents for a given scenario	11 Hours

Requirements Engineering: Eliciting requirements, Functional and non-Functional requirements, Software Requirements Specification (SRS), Requirement Analysis and validation. Requirements modelling- Introduction to Use Cases, Activity diagram and Swim lane diagram. CASE support in Software Life Cycle, Characteristics of CASE Tools, Architecture of a CASE Environment.

Design: Design concepts, Architectural design, Component based design, User interface design.

	Agile Principles &		
Module 3	Devops	Quiz	09 Hours
	(Knowledge level)		

Agile: Scrum Roles and activities, Sprint Agile software development methods - Scaling, User Stories, Agile estimation techniques, Product backlogs, Stake holder roles, Dynamic System Development Method.

Devops: Introduction, definition, history, tools.

Module 4	Software Testing and	Assignment	Apply the testing concepts	
	Maintenance		using Programing	12 Hours
	(Application Level)			

Software Testing-verification and validation, Test Strategies - White Box Testing, Black box Testing. Automation Tools for Testing.

Software Quality Assurance-Elements of software quality assurance, SQA Tasks, Goals and Metrics, Software configuration management- SCM process, SCM Tools (GitHub).

Maintenance- Characteristics of Software Maintenance, Software Reverse Engineering, Software Maintenance Process Models.

Targeted Application & Tools that can be used: Selenium, GitHub, CASE Tools

Text Book

1] Roger S. Pressman, "Software Engineering – A Practitioner's Approach", VII Edition, Fraw-Hill, 2017.

2] Bob Hughes, Mike Cotterell, Rajib Mall, "Software Project Management", VI Edition, Fraw-Hill, 2018.

References

Rajib Mall, "Fundamentals of Software Engineering", VI Edition, PHI learning private ted, 2015.

Ian Sommerville, "Software Engineering", IX Edition, Pearson Education Asia, 2011. Agile Software Development Principles, Patterns and Practices.1st Edition, Wiley, 2002

Topics Relevant to "Skill Development: Balck box Testing, White box Testing, Automated Testing for Skill development through Participative Learning Techniques. This is attained through assessment mentioned in the course handout

Course Code:	Course Title: Innovation Project-Raspberry Pi		0	4	2
ECE2001	Using Python	L- T-P-		This includes	
		С		few lecture	
	Type of Course: School Core & Practical Only.			sessions	
Version No.	1.0				
Course Pre- requisites	NIL				

Anti-requisites	NIL					
Course	The Raspberry Pi	is an amazing single	e board computer (SBC) capa	able of running		
Description	Linus and a w	hole host of app	lications. Python is a be	ginner-friendly		
	programming lar	nguage that is used	in schools, web developm	nent, scientific		
	research, and in	many other indust	tries. This course will enab	le students in		
	writing own prog	grams with Python	to blink lights, respond to k	outton pushes,		
	read sensors, log	g data on the Raspl	perry Pi and many more. The	ne course also		
	offers in-depth k	nowledge of design	ing, developing, coding and	implementing		
	projects using Raspberry Pi.					
Course	On successful completion of this course the students shall be able to:					
Outcomes	1. Write a program in Python.					
	2. Explain th	ne main features of	the Raspberry Pi board			
	3. Demonst	rate the hardware i	nterfacing of the peripheral	s to Raspberry		
	Prsystem.	rata tha functioning	a of live various projects ca	riad out using		
	4. Demonst	system	g of five various projects car	neu out using		
Course Content:	Паэрьспутта	ystem.				
course content.						
	Basics of Python,			4 Lab		
Module 1	functions	Quiz	Problem Solving	Sessions		
Topics:	·	•				
Introduction, Strue	cture of Python Pr	ogram, Data Types a	and Variables, Input and Outp	out, Operators,		
Importing libraries	s, Functions, Deve	lopment Tool.				
Concepts will be t	aught by solving	problems through p	programs.			
Madula 2	Python	0	Droblem Coluina	4 Lab		
iviodule 2	Programming	Quiz	Problem Solving	Sessions		
Control statement	s, Lists and Dictio	naries, Problem solv	/ing using Python.			
Concepts will be t	aught by solving	problems through p	programs.			
	Overview of	Project	System Design Task and	4 I ah		
Module 3	Raspherry Pi	Development	Analysis	Sessions		
	naspoerty i i	Development	, maryono	DUSSION		
Topics:						
An exploration of	GPIO pins, LED an	d switch control. Ins	stallation of libraries, PuTTY	SSH.		
Raspberry Pi to int	terface with more	complicated sensor	rs and actuators like Pi Came	era, servo		
motor ADS51115	through PIP librar	ies. Arduino with Ra	spberry-pi			
	Interaction with	Project	Modeling and Simulation	3 Lab		
Woulle 4	API Services	Development	task	Sessions		
Topics:						
Raspberry Pi inte	ract with online	API services throug	h the use of public APIs a	nd SDKs using		
Firebase, Gspread	API.					
Node-RED – a pro	gramming tool for	r wiring together ha	rdware devices, MQTT.			
Android/Case stud	dy.					
Targeted Applicat	ion & Tools that o	can be used:				
Making it a reality	(Raspberry Pi Pro	ojects) :				
Projects will includ	de but not limited	to :				
1) Intelligent hom	ie locking system.					
 Intelligent wate 	er level managem	ent system.				
3) Home automat	ion using KHD.					
4) Keal time clock	-based nome auto					
Brofossionally Us	ad Software: Bee	phorny P :				
Project work (Put)	eu Sultware: Kas	puerry Pl.				
Project work/Pyti	ION LOD TEST:					

Project work
Python test.
ext Book(s):
) Ashok Namdev Kamthane, Amit Ashok Kamthane, "Problem Solving and Python
<i>rogramming"</i> , Mc Graw Hill Education, 2018.
eference(s):
1. <u>https://github.com/thibmaek/awesome-raspberry-pi</u>
2. <u>MagPi magazine</u>
opics relevant to development of "Foundation Skills": Basic Concepts of Python-Programming,
nd Raspberry Pi.
opics related to development of "Employability Skills": Problem solving, Creative Thinking, Team
vork, Prototype Development.
opics related to development of "Entrepreneurship": Effective Communication, Strategic
hinking, Creative Thinking.

0		
Evaluation:	Review-1-20%, Review-2-25%, Python test-25%, Project Expo-30%	

Course Code:	Course Title: Programming in Python		1	0	4	3
CSEIUUS	Type of Course: School Core Lab Integrated	L- T-P- C				
Version No.	1.0					
Course Pre-requisites	Basic knowledge of Computers and Mathe	ematics				
Anti-requisites	NIL					
Course Description	The purpose of this course is to enable the students to develop python scripts using its basic programming features and also to familiarize the Python IDLE and other software's. This course develops analytical skills to enhance the programming abilities. The associated laboratory provides an opportunity to validate the concepts taught and enhances the ability to build real time applications					
Course Object	The objective of the course is to familiariz concepts of Programming in Python a through Problem Solving Methodologies.	e the lea nd attain	rnei Em	rs w ploy	ith the /ability	

Course Outcomes	Course Outcomes On successful completion of this course the students shall be able to:			
	1. Su	ummarize the basic	Concepts of python.	
	2. Demonstrate pr	roficiency in using d	lata structures.	
	3. Illustrate user-d	lefined functions ar	nd exception handling.	
	4. Identify the var	rious python librarie	es.	
Course Content:				
Module 1	Basics of Python programming	Assignment	Programming	14 Classes
Topics: Data types, oper	ators and Expressio	ons, Input and Outp	ut Statements. Control	Structures –
Selective and Repetitive	structures			
	Indexed and	Cimple		
Module 2	Associative Data	Simple	Programming	20 Classes
	Structures	applications		
Topics: Strings, Lists, Set	s, Tuples, Dictionar	ies		
	Functions			
	Exception	Case study		
Module 3	handling and		Programming	10 Classes
	libraries			
Topics: User defined fur	nctions, exception h	andling. Introduction		praries
Targeted Application &	Tools that can be u	used:		
Targeted Application : V	Veb application dev	velopment, AI, Ope	erating systems	
Tools: Python IDLE, AN	ACONDA			
Application Are	as:			
Web Developme	ent			
Game Developm	nent			
Scientific and Nu	umeric Applications			
Artificial Intellige	ence and Machine L	earning		
Software Development	pment			
 Enterprise-level, 	Business Applicatio	ons		
Education progr	ams and training co	ourses		
Language Devel	opment			
Operating System	ms			
Web Scrapping /	Applications			
Image Processin	g and Graphic Desi	gn Applications		
Professionally Used Sof	tware: Python IDL	E, Spyder, Jupyter N	Notebook, Google Cola	b
Project work/Assignme	nt:	• • • • • •		
Project Assignment: De	veloping python sci	ripts using built in r	methods and functions	5
Text Books:				
Martin C. Brow	n, "Python: The C	Complete Reference	e", McGraw Hill Educ	ation, Forth
edition (20	0 March 2018).			
Alex Campbell,	"Python for Be	ginners: Compreh	ensive Guide to the	e Basics of
Programming, Mach	ine Learning, Data	Science and Analysi	s with Python", August	29, 2021.
Charles Dierbac	ch, "Introduction	to Computer Scie	ence Using Python",	Wiley India
Edition,2015.				
References:				

1. E. Balagurusamy, "Introduction to Computing and Problem Solving Using Python", Tata McGraw-Hill, 2016

2. Y. Daniel Liang, "Introduction to Programming Using Python", Pearson, 2017

3. Brady Ellison, "Python for Beginners: A crash course to learn Python Programming in 1 Week (Programming Languages for Beginners)", August 25, 2021.

4. Python Tutor - Visualize Python, Java, C, C++, JavaScript, TypeScript, and Ruby code execution

5. <u>https://practice.geeksforgeeks.org/courses/Python-Foundation</u>

Topics relevant to development of "FOUNDATIONS SKILLS"- Solve the real time problems by analyzing and visualizing the data.

Topics relevant to "HUMAN VALUES & PROFESSIONAL ETHICS"- Data collection and its arrangement

Course Code: PPS4002	Course Title: Introduction to Aptitude Type of Course: Practical Only Course			L- P- C	0	2	1	
Version No.	1.0							
Course Pre- requisites	Students sh understandi	Students should know the basic Mathematics & aptitude along with understanding of English						
Anti-requisites	Nil	lil						
Course Description	The object questions Quantitativ drives. The the topics, focus of this answers, b their emplo	The objective of this course is to prepare the trainees to tackle the questions on various topics and various difficulty levels based on Quantitative Ability, and Logical Reasoning asked during the placement drives. There will be sufficient focus on building the fundamentals of all the topics, as well as on solving the higher order thinking questions. The focus of this course is to teach the students to not only get to the correct answers, but to get there faster than ever before, which will improve their employability factor.						
Course Objective	The objecti concepts o Solving tec	The objective of the course is to familiarize the learners with the concepts of Aptitude and attain Skill Development through Problem Solving techniques.						
Course Outcomes	On successfu CO1] Recall school. CO2] CO3] Solve appropriate CO4] Analyz CO5] Rearr	On successful completion of the course the students shall be able to: CO1] Recall all the basic mathematical concepts they learnt in high school. CO2] Identify the principle concept needed in a question. CO3] Solve the quantitative and logical ability questions with the appropriate concept. CO4] Analyze the data given in complex problems. CO5] Rearrange the information to simplify the question						
Course Content:								
Module 1	Quantitative Ability	Assignment	Bloom's Le Applicatior	evel : n		02 He	2 Durs	
Topics: Introduction to A	ptitude, workir	ng of Tables, Squares, Cul	bes			•		

Module 2	Logical Reasoning	Assignment	Bloom's Level : Application	18 Hours
Topics: Linear & Circula Ordering and Ra Reasoning	r Arrangemen nking, Clocks a	t Puzzle, Coding 8 nd Calendars, Nur	& Decoding, Blood Relations, nber Series, Wrong number se	Directions, ries, Visual
Targeted Applica Application area:	tion & Tools tl	nat can be used: ivities and Compet	itive	
Text Book Quantitative Verbal & No	e Aptitude by F on-Verbal Reas	S Aggarwal oning by R S Aggary	wal	
References <u>www.indiab</u> <u>www.youtu</u>	i <u>x.com</u> be.com/c/The/	AptitudeGuy/videos	5	
Topics relevant for Skill Develor	to Skill deve oment throug	lopment: Quar h Problem solvin	ntitative and reasoning aptit g Techniques. This is attaine	ude d
through assessr component me	ment ntioned in cou	urse handout.		

Course Code: MAT2003	Course Title: NUMERICAL METHODS FOR ENGINEERS Type of Course: School CoreL-T- P-C102								
Version No.	1.0		1		1				
Course Pre- requisites	MAT1002 – Transform Techniques, Partial Their Applications	Differenti	al Ec	quatio	ons a	ind			
Anti-requisites	Nil								
Course Description	The course focuses on formulating and solving problems concerning real-world engineering applications numerically as well as statistically. This course provides an introduction to basic numerical methods to deal with algebraic and transcendental equations, system of equations, interpolation, differentiation and integration. This course also deals with numerical solution of ordinary differential equations by means of Taylor's series method, modified Euler's method and Runge-Kutta methods.								
Course Objective	The objective of the course is to famili concepts of " NUMERICAL METHODS FOR Development Through Problem Solving.	arize the ENGINEER	lear S"a	ners nd a	witl ttain	n the I <u>Skill</u>			
Course Outcomes	On successful completion of the course the stu 1] Solve algebraic and transcendental equatio 2] Adopt numerical techniques to differentiate 3] Apply numerical methods to solve ordinary	udents shal ns numeric e and integi differentia	l be a ally. rate i l equ	able t functi ation	o: ons. s.				

Course Content:						
Module 1	Numerical solution of Algebraic and Transcendental Equations			15 Classes		
Algebraic and T (Self study), Se Equations, Fixe	Transcendental Equation cant method, Newton- ed-point iteration metho	ons, Regula Raphson me od.	- Falsi method, Bisection r thod, and NR method for no	nethod on-linear		
System of Line method, Gauss- vector by Powe	ar Equations: Introduc Seidel iteration metho r method & Jacobi Me	tion, LU dec d, Largest Ei ethod.	omposition method, Gauss- gen value and correspondin	Jacobi 1g Eigen		
Module 2	Numerical Interpolation, differentiation and			15 Classes		
Integration Numerical Interpolation: Newton's forward and backward interpolation method, Newton's divided difference method, Lagrange's method, numerical differentiation. Numerical integration: Trapezoidal rule, Simpson's one-third rule, Simpson's three-eighth rule, Weddle's Rule. Area between the two curves						
Module 3	Numerical solution of ODEs and PDEs			15 Classes		
Solution of ordinary differential equations: Initial Value problems: Taylor's series method, Picard's method, Euler's Method, Modified Euler's method, Runge-Kutta method, Milne's predictor-corrector formula. Adams -Bashforth method, Boundary value problems - Finite difference methods for ODE. Numerical solution for LCR & damped forced oscillatory equations. Solution of partial differential equations: Schmidt Explicit Formula for Heat Equation, Crank-Nicolson method. Numerical solution to Wave, Laplace & Heat Equation. Targeted Application & Tools that can be used:						
The objective of the course is to familiarize students with a variety of numerical techniques and the theoretical concepts of probability and statistics so as to equip them with the necessary numerical approaches and basic statistical tools to tackle engineering and real-life problems.						
Assignment:						
 Gauss-Ja Numeria Gaussia Taylor se Implicit a 	acobi iteration method cal differentiation. n quadrature rule for eries method for ODEs. and explicit schemes for	d. numerical int PDEs.	egration.			
Text Books T1: M.K. Jai Enginee	n, S.R.K. Iyengar and R ring Computations, 6t	.K. Jain, Nun h Edition, Ne	nerical Methods for Scientif w age Publishing House, 20	ic and)15.		

T2: Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, John Wiley& Sons (India), 2014.

References:

R1: B.S. Grewal, Numerical methods in engineering and science, 10th Edition, Khanna publishers, 2016.

R2: B.S. Grewal, "Higher Engineering Mathematics", 44th edition, Khanna Publishers. R3: Steven C Chapra and Raymond P Canale, "Numerical Methods for Engineers," 7th

Ed., McGraw-Hill Edition, 2015.

R4: C. Ray Wylie and Louis C Barrett, "Advanced Engineering Mathematics", 6th Edition, McGraw-Hill, 2012.

Topics relevant to SKILL DEVELOPMENT: This course focuses on formulating and solving problems concerning real-world engineering applications numerically as well as statistically. This course provides an introduction to basic numerical methods to deal with algebraic and transcendental equations, system of equations, interpolation, differentiation and integration with numerical solution of ordinary differential equations by means of Taylor's series method, modified Euler's method and Runge-Kutta methods for **Skill Development through Problem Solving methodologies**. This is attained through assessment component mentioned in course handout.

Course Code: CSE2007	Course Title: Design and Analysis of Algorithms3003Type of Course: Program Core & Theory onlyL- T- P- C3003
Version No.	2.1
Course Pre- requisites	CSE2001, Data Structure and Algorithms
Anti- requisites	NIL
Course Description	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 the learners' EMPLOYABILITY SKILLS by using PROBLEM SOLVING Methodologies.
Course Outcomes	On successful completion of the course the students shall be able to: 1] Identify the efficiency of a given algorithm. [Comprehension] 2] Employ divide and conquer approach to solve a problem. [Application]

		3] Illustrate dynamic programming approach to solve a given problem. [Application]						
		4] Solve	4] Solve a problem using the greedy method. [Application]					
		5] Disc com	uss the techniques to plexity classes. [Comp	solve orehen	a real-world problem ba sion]	sed on its		
Cours Conte	se ent:							
Modu	ule 1	Introduction to Algorithms	Assignment		Problem Solving	06 Sessions		
	Topics: Algorithr and merg	n Design and eff ge sort, Asympto	iciency, measuring of totation	runnin ons. R	ng time of algorithms. Inse ecurrencesMasters met	ertion sort hod.		
	Assignm	ent: Comparativ	ely evaluate bubble so l	rt, inse	ertion sort and mergesort	•		
Modu	ule 2	Searching and Sorting techniques	Assignment		Programming/ Problem Solving	12 Sessions		
	comparis Search: F	con-based sortin Review of Linear ent: Design and	g: Radix sort. Search and Binary Sea develop an algorithm	rch, H using I	ashing and hash tables. Divide and Conquer techr	hique for a		
Modu	ule 3	Greedy Algorithms	Assignment		Programming/ Problem Solving	09 Sessions		
	Topics: Introduct	tion, Fractional k	Knapsack Problem, Min	imal S	panning Tree: Prim's Algo	orithm and		
	Kruskal's	Algorithm, Sing	le-source Shortest Path	n: Dijk	stra's Algorithm. Huffman	Codes.		
	Assignm	ent: Design and	Develop a solution to a	a giver	n scenario using greedy m	ethod.		
Modu	ule 4	Dynamic Programming	Assignment		Programming/ Problem Solving	09 Sessions		
	Topics:	•						
1	Introduct Ford algo Multiplic Assignm argue the	tion with examp prithm, Floyd-Wa pation. ent: For a given best approach	les, Principles of Mem arshall's Algorithms. O scenario, attempt the to solve the problem	oizatio ptimal three o	on, 0-1 Knapsack Problem Binary Search Trees, Ch design paradigms learned	, Bellman- ain Matrix so far and		
Modu	ule 5	Complexity Classes and Heuristics	Assignment		Programming/ Problem Solving	09 Hours		
	Topics: plexity clas	sses: P, NP, and	NP-Complete Problem	ns. Ba	cktracking: n-Queens. I	Branch		

	Assign proble	ment: Apply backtracking algorithmic designing technique for solving queen's ms for 4, 8 and 16 inputs.
	Target	ed Application & Tools that can be used:
	Applic fundar	ation Area is to Design and Analyzing the efficiency of Algorithms. This nental course is used by all application developers.
	Profes	sionally Used Software: GCC compiler.
	Projec	t work/Assignment:
1	2. 3.	Problem Solving: Design of Algorithms and implementation of programs. Programming: Implementation of given scenario using Java.
	Text B	ook:
	T1.	Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, 'Introduction to Algorithms', MIT Press, 2022.
	T2.	J. Kleinberg and E. Tardos, 'Algorithm Design', Addison-Wesley, 2005.
	Refere	nces
	R1.	Anany Levitin, 'Introduction to the Design and Analysis of Algorithms', Pearson Education, 2003.
	R2.	Tim Roughgarden, ' <i>Algorithms Illuminated</i> ' (books 1 through 3), Soundlikeyourself Publishing, 2017,18,19 respectively.
	R3.	AV Aho, J Hopcroft, JD Ullman, 'The Design and Analysis of Algorithms', Addison-Wesley, 1974.

Course Code:	Course Title: Database Management Systems							
CSE3156	Type of Course: 1) School Core 2) Laboratory Integrated	L-T-P-C	3	0	2	4		
Version No.	1.0							
Course Pre- requisites	NIL							
Anti-requisites	NIL							
Course Description	This course introduces the core principles and techniques required in the design and mplementation of database systems. It covers concepts of relational database systems (RDBMS). More emphasis is set on how to design, develop, organize, maintain and retrieve information efficiently. It helps the students to learn and practice data modeling and database designs. The course also introduces the concept of object oriented and object relational databases. The associated laboratory is designed to implement database design using MySQL DATABASE in information technology applications. All the exercises will focus on the fundamentals for creating, populating, sophisticated, interactive way of querying, and simultaneous execution of the transactions of database.							
Course Objective	The objective of the course is to familiarize the learners DatabaseManagement Systems and attain Employability t Methodologies.	s with the o hrough Pro l	onc blen	ept n Sc	s of olving	5		

Course Out Comes	 On successful completion of the course the students shall be able to: 1] Demonstrate a database system using ER model and relational algebra. [Understanding]2] Build databases using SQL queries query processing. [Applying] 3] Apply the functional dependencies and design the database using normalization. [Applying] 4] Interpret the concept of object-oriented databases and object-relational databases. [Understanding] 							
Course Content:								
Module 1	Introduction to Database Modelling and Relational Algebra (Understanding)		Assignment Problem Solving		Problem Solving	8 Classes		
Topics: Introduction to D Data isolation pro Relationship (ER) Relational Algebr outer joins), and c	atabase: Schema, Instan blem in traditional file sy Model, ER Model to Rela a with selection, project division operator. Examp	ce, 3 /stem itiona tion, les o	-shema architectu n, advantages of c al Model, Example rename, set ope n Relational Algel	ure, data es o eratio bra (physical and logical base over traditiona n ER model. ons, Cartesian prod Operations.	data independence al file systems. Entity uct, joins (inner and		
Module 2	Fundamentals of SQL andQuery Optimization (Applying)	ı	Assignment		Assignment Programn		Programming	8 Classes
SQL Database Qu Views, Procedure: Database program Query Optimizati expression, choos Module 3	erying, DDL, DML, Const s, Functions and Triggers nming issues and technic on: Purpose, transforma ing evaluation plans, line Relational Database De & Transac Management(Applying)	raint ques tion ear an sign tion)	s, Operators, Set Embedded SQL, of relational expr nd bushy plans, d Assignment	: Ope , Dyr ressi lynai	erators, Aggregate F namic SQL; SQL / PSI ions, estimating cost mic programming al Problem Solving	unctions, Joins, M and NoSQL. t and statistics of gorithms. 12 Classes		
Topics: Relational databa on Primary Keys-(JoinDependencies Transaction Man Transactions; Loc Introduction to cr log protocol; Che interactionwith co	ase design: Problems in s 1NF,2NF, 3NF), Boyce-Co s (Fifth Normal Form), los agement: The ACID Pro ck- Based Concurrency rash recovery; 2PL, Seria eck pointing; Recovering poncurrency control.	schei odd N ssy ai opert Cont lizab	ma design, redun ormal Form, Mult nd lossless decom ties; Transactions trol; Performance ility and Recovera n a System Crash	ndan ti va npos s an e of rabili h; N	ncy and anomalies, I lued Dependency (F sitions, Database De nd Schedules; Conc f locking; Transacti ity; Lock Manageme Aedia Recovery; Otl	Normal Forms based ourth Normal Form) -normalization. urrent Execution of on support in SQL ent; The write-ahead her approaches and		
Module 4	Advanced DBMS Topics(Understanding)		Assignment Case Study		8 Classes			
Topics: Advanced topics: management syst Constraint databa New database ap NativeXML databa	Object oriented databas ems, Spatial database m ise management systems plications and architectu ases (NXD), Document-or	se ma anag s. ures s riente	inagement systen rement systems, 1 such as Data ware ed databases, Sta	ns, E Tem ehou	Deductive database poral database man using, Multimedia, M ical databases.	agement systems, Iobility, NoSQL,		

List of Laboratory Tasks:

Create Employee, Student, Banking and Library databases and populate them with required data. Do thefollowing experiments of different lab sheets on those databases.

Labsheet-1 [3 Practical

Sessions]Experiment No 1: [1 Session]

1. To study and implement the different language of Structured Query Language.

Level 1: Perform operations using Data Definition Language and Data Manipulation Language commands including different variants of SELECT on Student DB.

Level 2: Identify the given requirements; valid attributes and data types and Perform DDL and DML operationson a given scenario. [Banking Databases]

Experiment No. 2: [2 Sessions]

2. To study and implement the concept of integrity constraints in SQL.

Level 1: Create tables on Banking database using PRIMARY KEY, NOT NULL, UNIQUE, FOREIGN KEY and demonstrate the working of relational, logical, pattern matching, BETWEEN, IS NULL, IN and NOT IN Special Operators on Student Database.

Level 2: Enforce different types of data and referential integrity constraints. Then try queries with special operators based on the student database. [Banking Database].

Labsheet-2 [3 Practical

Sessions]Experiment No. 3: [

1 Session]

3. Implement complex queries in SQL.

Level 1: Implement the conjugate of GROUP BY, ORDER BY and aggregate functions on Banking Database. Level 2: Implement MySQL DB queries on library database using appropriate clauses and aggregate functions.Also order the data either in ascending and descending order using corresponding clause. [Library databases].

Experiment No. 4: [2 Session]

4. To study and implement different types of Set and Join Operations [2 Slots]

Level 1: Demonstrate different types of Set Operations (UNION, UNION ALL, INTERSECT, MINUS) and Join Operations (INNER JOINs, OUTER JOINS, CROSS JOIN, NATURAL JOIN) on two or more tables of Airline Database. **Level 2:** Use Set and Join operations to retrieve the data from two or more relations(tables) as per the given

scenario. [Airline Database]

Labsheet-3 [2 Practical Sessions]Experiment No. 5: [2 sessions] 5. To study and implement Views, and Procedures in MySQL DB. Level 1: Implement MySQL Views, and Procedures in ORACLE DB on Employee database. Level 2: Analyze the requirement and construct views, and Procedures on Mini Project Domain. [Banking Database] Labsheet-4 [2 Practical Sessions]Experiment No. 6: [2 Sessions1 6. To study and implement Functions, and Triggers in MySQL DB. Level 1: Implement Oracle Functions and Triggers in Oracle on Employee database. Level 2: Analyze the requirement and construct Functions and Triggers. [Supply chain Database] Labsheet-5 [2 Practical Sessions]Experiment No. 7: [2 Sessions] To implement the concept of forms and reports. Level 1: Implement the concept of forms and reports. Level 2: Analyze the schema relationship. Labsheet-6 [2 Practical Sessions]Experiment No. 8: [2 Sessions1 Design a mini project based on the databases such as Inventory Management System, University Management System, Hospital Management System, etc. Level 1: Implement the real time database. Level 2: Analyze the working of database in real time. Targeted Application & Tools that can be used: Application Area: Relational database systems for Business, Scientific and Engineering Applications. Tools/Simulator used: MySQL DB for student practice. Also demonstration of ORACLE DB on object-relational database creation and JDBC connection. Percentage of changes in this version: 50% of changes from earlier version. New topics are highlighted in italic. 1. Problem Solving: Constructing ER-Diagrams for a given real time requirements, Normalizing the databases, querying the databases using relational algebra. 2. Programming: Implementation of any given scenario using MySQL. Text Book 1] RamaKrishna & Gehrke, "Database Management Systems" 3rd Edition, 2018, McGraw-Hill Education. 2] Avi Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", McGraw-Hill ,7th Edition, 2019.3] W. Lemahieu, S. vanden Broucke and B. Baesens, "Principles of Database Management: Practical Guide to Storing, Managing and Analyzing Big and Small Data", Cambridge University Press, 2018. References 1] Elmasri R and Navathe S B, "Fundamentals of Database System", Pearson Publication, 7th Edition, 2018. 2] M. Kleppmann, "Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems", O'Reilly, 2017. Topics relevant to development of "FOUNDATION SKILLS": S - Skill Development: Relational database designusing ER- Relational mapping, Implementation of given database scenario using MYSQLDB. Topics relevant to development of Employability: Develop, test and implement computer databases, creatingsophisticated, interactive and secure database applications Topics relevant to "HUMAN VALUES & PROFESSIONAL ETHICS": Nil

Course Code: CSE3351	Course Title: Ope	erating Systems			3	0 0)	3
	Type of Course:	Program Core and The	eory	L-T- P- C				
	Only							
Version No.	1.0							
Course Pre-	CSE2009- Compu	iter Organization, Pro	blem solv	ing using C		4		0
requisites	Students should	nave basic knowledge	e on comp	outers, comp	uter	SOI	tware	& Cic
	recommended.		i. Friði þí	ogramming	sxhe	ilei		C 15
Anti-requisites	NIL							
Course	This course intro	duces the concepts o	of operati	ing system o	pera	atior	ns, ope	erating
Description	system structure	e and its design and	implem	entation. It	cov	ers	the cl	assical
	operating syste	ems internal algor	ithms s	such as p	roce	ess	sche	duling,
	synchronization,	deadlocks detection	and reco	overy and me	emoi	ry n	nanage	ement.
	i ne course also e	ennances the problem	solving,	systems prog	gram	nmir	ng abili	ity and
Course Object	The objective of	the course is to fam	iliarizo th	o loarners v	vith	tho	conce	onts of
Course Object	Operating Syste	and attain F	malovah	ility throug	h P	roh	lem (Solving
	Methodologies.		Inployab	inty throug		100		Johning
Course Out	On successful cor	mpletion of the cours	e the stu	dents shall be	e ab	le to):	
Comes	1] Describe the f	undamental concepts	of opera	ting Systems	and	cas	se stud	ies.
	[Knowledge]	·	•	0,				
	2] Demonstrate v	various CPU schedulin	g algorith	nms[Applic	atic	on]		
	3] Apply various	tools to handle synch	ronizatio	on problems.[Apr	olica	ation]	
	4] Demonstrate d	leadlock detection and	l recovery	methods [A	ppli	icati	ion]	
Course Courteast	5] Illustrate vario	ous memory manager	nent tech	niques.[Ap	lica	tior	ן ו	
Course Content:								
	Introduction to							
Module 1	Operating	Assignment	Program	ming			9	Hours
	System			0				
Topics:	<u> </u>	1						
Introduction to C	OS, Operating-Sys	stem Operations, Ope	rating Sy	stem Service	s, , S	Syst	em Ca	lls and
its types, Opera	ting System Stru	icture, System Progr	am and	its types, L	inke	rs a	and Lo	aders,
Overview of OS d	lesign and implem	nentation, Open-source	ce operat	ing system				
Module 2	Process Management	Assignment/Case	Program	ming/Simula	tion		11	Hours
Topics:	Indiagement	Study						
Process Concept	, Operations on	Processes, Inter Pro	cess Cor	nmunication	, Co	mm	nunicat	ion in
client-server syst	tems (sockets, R	PC, Pipes), Introducti	ion to th	reads - Mu	tith	read	ding N	1odels,
Thread Libraries	, Threading Issue	es, Process Schedulii	ng– Basi	c concepts,	Sch	edu	ling C	riteria,
Scheduling Algori	ithms: FCFS, SJF, S	SRTF, RR and Priority.						
	Process							
Module 3	Synchronization	Assignment	Program	ming			11 H	ours
	and Deadlocks							
Topics:								
The Critical-Section	on Problem- Pete	rson's Solution, Synch	ronizatio	on hardware,	Sem	napł	nores,	Classic
Problems of Syn	chronization with	n Semaphore Solutio	n- Produ	cer-Consume	er Pi	robl	em, R	eader-
Writer problems,	Dining Philosoph	ier's Problem, . Introd	uction to	Deadlocks, I	vece	essa	ry con	ditions

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

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:

1. 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.

2. 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

- 1. Demonstrate process concepts in LINUX OS.
- 2. Simulation of CPU scheduling algorithms.
- 3. Develop program to demonstrate use of Semaphores in threads.
- 4. Develop program to demonstrate use of deadlock avoidance algorithms.
- 5. Develop program to demonstrate use of page replacement algorithms.
- 6. Simulation of memory allocation strategies [first fit, best fit and worst fit].

Text Book

1. Silberschatz A, Galvin P B and Gagne G , "Silberschatz's Operating System Concepts", Paperback, Global Edition Wiley, 2019

References

1. Silberschatz A, Galvin P B and Gagne G, "Operating System Concepts", 10th edition Wiley, 2018.

2. William Stallings, "Operating Systems", Ninth Edition, By Pearson Paperback ,1 March 2018.

3. Sundaram RMD, Shriram K V, Abhishek S N, B Chella Prabha, "Cracking the Operating System skills", Dreamtech, paperback, 2020

4. Remzi H. Arpaci-Dusseau Andrea C. Arpaci-dusseau , "Operating Systems: Three Easy Pieces, Amazon digital Services", September 2018.

E-resources/Weblinks

5. https://www.os-book.com/OS9/

- 6. <u>https://pages.cs.wisc.edu/~remzi/OSTEP/</u>
 - 7. https://codex.cs.yale.edu/avi/os-book/OS10/index.html

Course Code: CSE 3078	Course Title: Cryptography and Network Security Type of Course: Program Core & Theory only	L- T-P- C	3	0	0	3
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Version No.	1						
Course Pre-	"Data Communications and Computer Networks".						
requisites							
Anti- requisites	NIL	NIL					
	The Course covers	the principles	s and practice of cryptograph	ny and network			
	security, focusing in	particular on	the security aspects of the we	eb and Internet.			
	Topics: The crypto	graphic tools	such as shared key encrypt	ion public key			
Course	Topics. The crypto						
Description	encryption, key ex	change, and	digital signature are explored	d. The use and			
	utilization of the in	ternet protoc	ols and applications such as	SSL/ TLS, IPSEC,			
	Kerberos, PGP, and	S/ MIME, SET	are reviewed. System securit	y issues such as			
	viruses, intrusion ar	nd firewalls ar	e also explored.				
Course	The objective of t	he course is	SKILL DEVELOPMENT of st	udent by using			
Objective	PARTICIPATIVE LEA	RNING techni	<mark>ques.</mark>				
	On successful comp	letion of this o	course the students shall be a	ble to:			
	CO1: Identifies the	basic concept	of Cryptography (Knowledge)	1			
	CO2: Express the dif	ferent types o	f Cryptographic Algorithms. (C	comprehension)			
Course	CO3: Recognize t	he Public k	ey Cryptographic Technique	es for various			
Outcomes	applications. (Com	prehension)					
	CO4: Apply the ne	twork securit	y concepts during their imp	elementation of			
	network security ap	plication deve	elopments. (Application)				
Course Content:							
Module 1	Introduction to	Assignmen t	Identify the Concepts	08 Sessions			
Topics:	e. (prog. ap)						
Introduction to	Cryptography, Mod	el of Network	Security, OSI Security archit	ecture, Security			
Attacks: active	e attacks, passive a	attacks, servi	ces: Authentication, Access	Control, Data			
Confidentiality,	Data Integrity, Nonre Play-fair and Hill Cin	epudiation, Su	ion to Block Ciphers : Caesar, M	ono alphabetic, m Cinher Festal			
Structure.				n cipiler, i esta			
	Private Key		Analysis of requirement of	13 Sessions			
Module 2	Cryptography and	Assignmen	complexity in				
	Number Theory	l	cryptography				
Topics:	I						
Symmetric Er	cryption Algorithm	ns : Data En	cryption Standard, Introduc	ction to Galois			
Field, Advand	Field, Advanced Encryption Standard, Modular Arithmetic, Prime numbers, Fermat's						
Inthe theorem, brief about primality testing and factorization, Discrete Logarithmic Problem Euclidean and Extended Euclidean Algorithm Euler Totiont European Chinese							
Remainder Theorem							
	Public Key		Decognize the intersector	10 Sessions			
	Cryptography and	Assignmen	of various security				
Module 3	its Applications	t	concepts to achieve				
			sufficient solutions				
Topics:	I	1					

Overview o	of Public Key Cryptogra	aphy, RSA, Dif	fie - Helman Key exchange, M e Hash Algorithm Message	an in the middle Authentication
Codes – HN	MAC, Digital Signature	, Discussion o	n real time practices of Crypto	ography.
Module 4	Network Security	Assignmen t	Implement the advanced network security algorithms in recent applications.	07 Sessions
Topics:				
Network Sec Kerberos, PK Security appli Web Security.	curity fundamentals I, Network Security cations: IP Security	s, Network applications 7: IP Sec arc	Security applications: A s: e-mail security: PGP, M hitecture, Network Securit	Authentication: IME, Network y applications:
Targeted Appli Students get th encryption and messages.	cation & Tools that ca he knowledge about ca decryptions & the tea	an be used: ryptography to chniques for a	echniques followed, the algor authentication and confidentia	ithms used for ality of
Assignment:				
Assignment 1: Assignment 2:	Solve the problems of Solve and analyze the	f basic encryp problems on	tion techniques. symmetric and asymmetric e	ncryption.
Textbooks: 1.William Stallin	ngs, "Cryptography an	d Network Se	curity - Principles and Practice	s", Prentice Hall,
8 th Edition, 20)19.			
2. Wade Trapp	pe and Lawrence C	Washington,	"Introduction to Cryptograp	hy with Coding
Theory", Pearso	on, 2020.			
Reference Boo	ks:			
1.Behrouz A H McGraw Hill, th	Forouzan, Debdeep hird edition, 2010.	Mukhopadhy	ay, "Cryptography and Net	work Security",
2. R.Rajaram, "	'Network Security and	d Cryptograph	y" SciTech Publication.3 rd Edit	ion, 2014.
3. AtulKahate, ' 4. BruceSchneid	"Cryptography and Ne er, "Applied Cryptogra	etwork Securit aphy", John W	ry", Tata McGraw-Hill, 2 nd Edit /iley and Sons Inc. Second Edit	ion, 2019. tion, 2015.
Web references:	:			
1. <u>https://onlinec</u>	courses.nptel.ac.in/noc2	2 cs90/preview	<u>N</u>	
2.e-pgpathshala	UGC lecture series : E-Se	eries and Self le	earning Materials.	
https://epgp.in	flibnet.ac.in/Home/Viev	wSubject?catid	=fBYckQKJvP3a/8Vd3L08tQ==	
3. <u>http://182.72.</u>	188.195/cgi-bin/koha/c	<u>pac-</u>		
detail.pl?biblion	umber=10133&query_d	<u>esc=kw%2Cwrc</u>	ll%3A%20Cryptography%20and%	<u>%20Network%20S</u>
<u>ecurity</u>				
4. <u>http://182.72.2</u> detail.pl?biblionu	188.195/cgi-bin/koha/o umber=5875&query_de	<u>pac-</u> sc=kw%2Cwrdl	%3A%20Cryptography%20and%	20Network%20Se
<u>curity</u> .				
Topics relevant its problems.	to "Skill Developmen	t": Symmetr	ic and Asymmetric Encryption	Algorithms and

Course Code:	Course Title:	Aptitude Training-						
PPS4004	Intermediate			L-T P- C	0	0	2	1
	Type of Cours	e: Practical Only Course	9					
Version No.	1.0							
Course Pre-	Students sh	ould have the basic co	once	epts of Qu	antita	tive	aptituo	de
requisites	along with it	s applications in real	life	problems.				
Anti-requisites	Nil							
Course	This is a skill-b	based training program f	or th	ne students	(Unde	ergrad	luate).	This
Description	course is desi Quantitative	gned to enable the stude Aptitude.	ents	to enhance	e their	skills	in	
Course	The objective	of the course is to famil	iariz	e the learn	ers wit	h the	conce	pts of
Objective	Aptitude and	attain Skill Development	t thre	ough Probl	em So	lving t	echniq	ues.
Course	On successful	completion of the cours	se th	e students	shall k	e abl	e to:	
Outcomes	CO1] Underst	and all the concepts.						
	CO21 Annly th	e concents in problem s	olvir	ng (Bloom's	tavor	omv	ا امریدا	١
						ioniy		/
Course								
Content:								
Module 1	Quantitative Ability	Assignment					24	Hours
Topics:								
Number System,	Percentage, Ra	tio and Proportion, Aver	age,	, Mixture a	nd Alle	egatio	n, Time	e and
Work, Profit and	Loss, Time Spe	ed and Distance, Boats a	nd S	treams, Sir	nple Ir	nteres	t and	
Compound Intere	est, Probability,	Permutation and Combi	inati	on.			-1	
Targeted Areas								
Application area: Tools: LMS	Placement act	ivities and Competitive e	exam	inations.				
Text Book								
Fast Track Object	ive by Rajesh V	'erma						
R S Aggarwal								
Rakesh Yadav								
References								
www.indiabix.co	<u>m</u>							
www.testbook.co	<u>)m</u> 	do Cum /vido co						
www.youtube.co	m/c/ineAptitu	aeguy/viaeos						

Topics relevant to Skill development: Quantitative aptitude for Skill Development through Problem solving Techniques. This is attained through assessment component mentioned in course handout.

Evaluation – Continuous Evaluation (Topic wise evaluation Mid-Term & End term)

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	NIL							
Course Description	This course covers mastering object-oriented con- classes, inheritance, polymorphism, and encapsul design and implement robust, reusable code using for those with basic Python knowledge, it enhance software development proficiency.	cepts in ation. St g real-w es probl	Python, including udents will learn to orld examples. Ideal em-solving skills and						
Course Objective	The objective of the course is to familiarize the le Mastering Object Oriented Concepts in Python a through Experiential Learning.	earners nd attai	with the concepts of n Skill Development						
Course Out Comes	 CO1: Explain features of Oops along with creation objects to represent real world Objects. [Understate co2: Demonstrate inheritance, polymorphism, and build maintainable and extendable software system co3: Demonstrate exception handling in Python thandling mechanisms and debugging tool and Assistechniques in Python. [Apply] 	 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
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Topics:

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 Super Class Constructors and Methods, The Super() Method, Types of Inheritance – Single Inheritance, Multiple Inheritance, Method Resolution 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	MCO	Assignment	10
would 5	in Python	NICQ	Assignment	Sessions

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

- 1. Alex Martelli, Anna Ravenscroft & Steve Holden, "Python in a Nutshell The Definitive Reference", O'Reilly Media, 3rd edition, 2017.
- 2. Luciano Ramalho, "Fluent Python Clear, Concise, and Effective Programming", O'Reilly Media, 2nd edition, 2022.
- 3. Mark Lutz, "Learning Python: Powerful Object-Oriented Programming", O'Reilly Media, 5th edition, 2013.
- 4. David Beazley, Brian K. Jones, "Python Cookbook: Recipes for Mastering Python 3", O'Reilly Media, 3rd edition, 2013.

Weblinks:

- 1. www.learnpython.org
- 2. <u>https://realpython.com/python3-object-oriented</u>
- 3. <u>https://www.tutorialspoint.com/python/python_oops_concepts.htm</u>

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 Al					
CSE1700		L- T-P- C	3	0	0	3
	Type of Course: Theory					
Version No.	2.0					
Course Pre-	Basic knowledge of programming, mathematic	s, understa	ndin	g of	data ł	nandling
requisi Data						
tes						
Anti-requisites	NIL					
Course	This course is a comprehensive introductory	course desi	gned	to	equip	learners
Description	with the fundamental Python programming sk	ills necessar	y to	wor	k with	artificial
	intelligence (AI) technologies. This course is ai	med at indi	vidua	als w	ho ar	e new to
	AI but have a basic understanding of program	ning concep	ots. I	t cor	nbine	s Python
	programming fundamentals with hands-on	experience	e in	imp	oleme	nting Al
	techniques such as machine learning, neura	l networks,	and	l nat	tural	language
	processing.					
Course	The objective of the course is to Understand Py	thon Progra	amm	ing l	Funda	mentals,
Objective	Manipulate and Process Data with Python	n, Impleme	ent l	Mac	hine	Learning
	Algorithms and Build and Train Neural Networ	ks for Al Ap	plica	tions	s.	
Course	On successful completion of the course the stu	idents shall	be a	ble 1	to:	
Outcomes	CO 1: Apply Python Programming to AI Projec	ts				
	CO 2: Build and Train Machine Learning Model	S				
	CO 3: Develop Deep Learning Models with Neu	ural Networ	ks			
	CO 4: Deploy AI Solutions and Understand Ethi	cal Implicat	ions			

Course Content:					
Module 1	Introduction to Python Programming for AI	Assignment	Implementa	tion	10 Sessions
Topics:	ariables Data Tunas Onorators	and Control Fla	w. Functions	Loops	and
Conditionals sta	tements, Data Types, Operators,	funles. Dictiona	ries Sets Intr	oductio	anu on to
Libraries: NumP	y and Pandas for data manipulat	ion, Basic Input	/Output and F	ile Har	ndling
Introduction to I	Python for AI: Libraries and Fram	eworks Overvie	ew		
Module 2	Data Processing, Visualization	Assignment	Implementa	tion	10 Sessions
Topics:					
cleaning and pre	processing with Pandas, Handlin	g missing data,	outliers, and o	duplica	tes, Data
transformation (Normalization, Encoding), Introc	luction to Matp	lotlib and Sea	born to	or Data
relationships.	pioratory Data Analysis (EDA), Vi	sualizing uatase		anu pa	
	Introduction to Machine	Mini -	Implementa	tion	10 Sessions
Module 3	Learning	Project			
Topics:					
What is Machine	e Learning? Types of ML algorith	ms Supervised I	earning: Regr	ession	,
Classification, U	Insupervised Learning: Clustering	g, Key ML Algori	thms: Linear I	Regress	sion, Decision
Irees, K-Ivieans	Introduction to Scikit-learn libra	ry Natusian Matrix	N N		
would evaluatio	in (Accuracy, Frecision, Recail, CC)		
Module 4	Neural Networks Quiz	Impler	mentation	10 Ses	sions
Tonics:					
Introduction to I	Neural Networks and Deep Learr	ning, Perceptror	n Model and B	ackpro	pagation
Deep Neural Ne	tworks and Activation Functions,	Introduction to	TensorFlow a	and Kei	ras, Building
and Training Net	ural Networks for Image and Text	t Classification,	Overview of C	onvolu	itional Neural
Networks (CNNs	and Recurrent Neural Network	s (RNNs)			
Targeted Applic	ation & Tools that can be used:				
Applications:					
1. Data Pre	eprocessing: Clean and manipula	ite data from va	rious sources	such a	s CSV, Excel,
SQL data	abases, and APIs.			c	
	tory Data Analysis (EDA): Gain in	isignts into data	isets by identi	tying ti	renas,
3 Prodicti	y e Modeling : Ruild models for a	assification (e.g	snam deter	tion) a	nd regression
(e.g., ho	use price prediction).		,, spann actee		
4. Clusteri	ng: Group data into clusters for ι	Insupervised lea	arning tasks (e	e.g., cu	stomer
segmen	tation).				
5. Model E	valuation: Assess model perforr	nance using app	propriate met	rics suc	ch as accuracy,
Tools:					
Pandas:	For data manipulation and clear	ning (e.g., handl	ing missing va	lues. n	nerging
datasets	;).	0.00,00,000	0	, .	0.0
NumPy:	For numerical operations and w	orking with arra	ays and matric	ces.	
 Matplot 	lib: For creating static, animated	l, and interactiv	e visualization	IS.	
 Seaborn 	: For advanced data visualization	ns (e.g., heatma	ps, pair plots)		
Plotly: F	or creating interactive visualization	ions, especially	useful for larg	e data	sets.
 Scikit-le 	arn : The go-to library for implem	nenting machine	e learning algo	orithms	s (e.g., linear
regressi	on, decision trees, k-means clust	ering).			
XGBoos	t: For advanced gradient boostin	g models, parti	cularly for larg	ge-scale	e 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

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 Transformerbased 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):

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

Course Code:	Course Title: Essentials of AI Lab		L- T-P- C	0	0	4	2		
CSE1701	Type of Course: Lab						<u> </u>		
Version No.	2.U Desig lave Drogramming Knowledge Mathematics Linear Alasha and								
Prerequisites	Probability Basic Data Structures an	Algorithn	ns Familiari	tv w	лаа ith I	ihrari	es		
recquisites	and Tools, Understanding of Basic M	achine Lea	rning Conce	epts.		librari	23		
Anti-	NIL		0	<u> </u>					
requisites									
Course	This course introduces students to	the essent	ial concepts	s and	d teo	chniqu	les of		
Description	Artificial Intelligence (AI) with a f	ocus on p	ractical im	plem	ent	ation	using		
	Python. Students will explore cor	e Al topic	s such as	sear	rch	algori	thms,		
	knowledge representation, machin	e learning	, and neur	al n	etw	orks,	while		
	gaining proficiency in using popular	ython libra	aries like Nu	IMPy d nr	, pa	ndas,	SCIKIT-		
	will apply AL principles to solve	ies of iable	nrobloms	dov	olon	intol	ligont		
	apply Al principles to solve	systems fi	inction at a	four	ndati	ional l	ovol		
Course	The primary objectives of the course	are to Gair	Proficienc	v in /		ncep	ts and		
Objective	Python Implementation. Develop a	nd Implem	ent Machin	e Le	arni	ng M	odels.		
	Understand and Build Neural Netwo	rks, Apply A	AI to Real-W	/orld	Pro	blems	5		
Course	On successful completion of the cou	rse the stu	dents shall l	oe ał	ole t	0:			
Outcomes	1. Proficiency in Implementing	AI Algorith	ms Using P	ytho	n				
	2. Ability to Build and Evaluate	Machine L	earning Mo	dels					
	3. Hands-on Experience with N	eural Netw	orks and De	eep l	ear	ning			
	4. Practical Application of AI to	Solve Real	-World Prob	blem	S				
Course									
Content:									
Module 1	Introduction to AI and Python for AI	nplem	entation		8 9	Sessio	ns		
Lab Assignment	1: Setting Up the Python Environment								
 Objectiv 	/e: Get familiar with setting up a Pyth	on environi	ment for Al	proje	ects.				

• Tasks:

- 1. Install Python, Anaconda, and Jupyter Notebook.
- 2. Set up a virtual environment for AI development.
- 3. Install essential Python libraries: numpy, pandas, matplotlib, and scikit-learn.
- 4. Write and execute simple Python code to verify installation (e.g., print a "Hello AI" message).

Lab Assignment 2: Basic Python Programming for AI

- **Objective:** Understand and practice the basic Python syntax and data structures used in AI.
- 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.

Module 2	Data Processing, Visualization	Assignment	Implementation	8 Sessions

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:

- 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).
- \circ 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.
- \circ $\;$ 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.
- 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.
- 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	Introduction to Machine	Assignments	Implementation	8
wodule 5	Learning			Sessions

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_.

Module 4	Neural Networks	Quiz	Implementation	6 Sessions
	and Deep Learning			

Lab Assignment 7: Introduction to Perceptron and Activation Functions

Tasks:

- 1. Implement a single-layer perceptron using NumPy.
- 2. Train the perceptron to classify **AND**, **OR**, **XOR** gates.
- 3. Experiment with different activation functions (Sigmoid, ReLU, Tanh).
- 4. Visualize decision boundaries.

Lab Assignment 8: Building a Simple Neural Network with Keras

Tasks:

- 1. Load the **MNIST dataset** from keras.datasets.
- 2. Preprocess the data (normalize pixel values, reshape input).
- 3. Create a fully connected neural network using Sequential API.
- 4. Train and evaluate the model using **categorical cross-entropy loss** and **accuracy**.

Lab Assignment 9: Implementing CNN from Scratch

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:

- 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:

- 1. **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 Transformerbased models like BERT, GPT, and others for advanced NLP tasks.

Text Book(s):

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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

Course Code: CIT2500	Course Title: Fog Computin Type of Course: Theory On	g for IoT Iv Course		L- T -P- C	3	0	0	3
Version No.	1.0					j <u> </u>		
Course Pre-	Innovative Projects using A	Aurdino						
requisites								
Anti-requisites	NIL							
Course Description	The course will provide a solid base for understanding the challenges and problems underlying the design and development of fog computing systems and applications. Thus, this course will teach how to specify, design, program, analyze and implement such systems and applications. Fog computing is a decentralized computing infrastructure in which data, compute, storage and applications are located somewhere between the data source and the cloud. Like edge computing, fog computing brings the advantages and power of the cloud closer to where data is created and acted upon. Many people use the terms fog computing and edge computing interchangeably because both involve bringing intelligence and processing closer to where the data is created. This is often done to improve efficiency, though it might also be done for courting and compliance reasons.							
Course	The objective of the c	ourse is to fa	miliariz	ze the lear	ners	with	n tl	he
Objectives	concepts of Network S DEVELOPMENT throug	licing, Big Da gh <mark>PARTICIP</mark> 4	ata Ana <mark>ATIVE</mark>	lytics and LEARNIN	attai <mark>G</mark> tec	n <mark>SI</mark> hniq	KIL ues	<mark>.L</mark> 5.
Course Out Comes	 On successful completion of this course the students shall be able to: 1] Describe the basic principles and concepts of fog computing systems and their relation to other models such as Cloud Computing and Near-Far computing. [Understand] 2] Identify the challenges of developing fog-based applications and middleware, and the possible solutions. [Apply] 3] Solve various issues related to fog computing, programming model and Software Defined Network. [Apply] 4] Apply best approach for a particular problem regarding the design and 							
Course Content:								
Module 1	INTRODUCTION TO FOG COMPUTING	Assignment	Program	mming activi	ty	See	ssio	10 Ins
Topics: Fog Computing, Internet of Thing Fog Computing a	Characteristics, Application s-Pros and Cons-Myths of Fo nd Edge Computing-IoT , FO	Scenarios, Issue g Computing -N G, Cloud Benefit	es and c eed and ts.	challenges. F Reasons for	og Co Fog C	omp Comp	utin outii	ng, ng
Module 2	FOG ARCHITECTURE	Assignment	Program	mming activi	ty	Se	ssio	10 Ins
Topics: Communication and Network Model, Programming Models, Fog Architecture for smart cities, healthcare and vehicles. Fog Computing Communication Technologies: Introduction, IEEE 802.11,4G,5G standards, WPAN, Short-Range Technologies, LPWAN and other medium and Long- Range Technologies.								

			1		1					
Module	3	MANAGEMENT AND ORCHESTRATION	Assignment	Programming activity	10 Sessions					
Topics:										
Manage	Management and Orchestration of Network Slices in 5G, Fog, Edge, and Clouds: Introduction,									
Backgro	Background, Network Slicing in 5G, Network Slicing in Software-Defined Clouds, Network Slicing									
Manage	ement in E	Edge and Fog, Middleware f	for Fog and Edge	e Computing, Need for Fo	og and Edge					
Comput	ing Middl	eware, Clusters for Lightwe	eight Edge Cloud	S.	T					
		FOG INTEGRATION			10					
Module	4	TECHNOLOGIES WITH	Assignment	Programming activity	Sessions					
		IOT								
lopics:										
for Dig D	egration, S	ecurity Management for E	age Cloud Archit	ectures. Fog Computing	Realization					
for Big D	ata Anaiy	tics: Introduction to Big Dat	a Analytics, Data	Analytics in the Fog, Pro	totypes and					
Smart T	un. Case	tion Applications Fog IoT:	architectural mo	ndel Challenges on IoT S	Hiputing for					
via TCP/	ΊΡ Δrchite	ecture Data Management	security and priv	acy issues						
	d Applicat	ion & Tools that can be used	d: Case Study: W	/ind Farm - Smart Traffic	Light					
System.	Wearable	e Sensing Devices. Wearabl	e Event Device .\	Wearable System. Demoi	nstrations .					
Post Apr	plication [Example Event Applicatio	ns Example.	, ,	/					
Project v	work/Assi	gnment: Mention the Type	of Project /Assign	nment proposed for this o	course					
11 Prot	hlem Solv	ing: Choose an appropria	ate set of visua	lization elements and d	lesign for a					
dack	1] Problem Solving: Choose an appropriate set of visualization elements and design for a									
aasnboard.										
2] Programming: Implementation of the chosen dashboard										
Text Book										
1	Abbag A	and Samaa II Khan and	Albert V. Zomer	10 ada Fac Computing	Theory and					
1.	Autors, A	Issau, Saillee U. Kilaii, aliu	Albert 1. Zolliay	ya, eus. rog Computing.	Theory and					
	Practice.	John whey α Sons, 2020.		The same land Duration						
2	Duran D	aikumar and Satish Naraya	<u>_omputing%3A-</u>	<u>+Ineory+and+Practice</u>	nninginlag					
۷.	buyya, K	diama John Wilov & Song	2010	r og und edge computing	. principies					
	https://ww	<i>uignis</i> . John whey & Sons,	, 2019.							
	nups://w	nd Edge Computing%3A	Principles and	Paradiam						
3	Misra Si	udin Subhadeen Sarkar ar	<u>+1 Interpres+and</u>	<u>+1 aradigin</u> tteriee Sensors cloud a	and for the					
5.	enabling	technologies for the Interne	t of Things CR	C Press 2019	ind log. the					
	https://w	www.routledge.com/Sensors-	Cloud-and-Fog-	The-Enabling-Technolog	gies_for					
	the-Interr	ww.rouncuge.com/sensors- net-of-Things/Misra-Sarkar	- <u>Chatteriee</u>	The-Endomig-Teenholog	2103-101					
	the men	iet of Things/Whiste Sarker	Chatterjee							
Reference	ce Books:									
1.	Mahmoo	d, Zaigham, ed. Fog cor	nputing: concep	ots, frameworks and te	chnologies.					
	Springer, 2018.									
	https://link.springer.com/book/10.1007/978-3-319-94890-4									
2.	Tanwar,	Sudeep, and Tanwar. Fog c	omputing for He	ealthcare 4.0 environmen	ts. Springer					
	Internatio	onal	Publishing	, ,	2021.					
	https://ww	ww.sciencedirect.com/scien	nce/article/pii/S0	<u>045790618303860</u>						
3.	Tomar, I	R., Katal, A., Dahiya, S.,	Singh, N., & (Choudhury, T. (Eds.). (2022). Fog					
	Computi	ng: Concepts, Frameworks,	and Application	s (1st ed.). Chapman and	I Hall/CRC.					
	https://ww	ww.taylorfrancis.com/book	s/edit/10.1201/9	781003188230/fog-comp	<u>puting-ravi-</u>					
	tomar-av	ita-katal-susheela-dahiya-ni	iharika-singh-tar	nupriya-choudhury						
Web Ba	ased Reso	ources and E-books:								
1.	https://w	<pre>/ww.codecademy.com/lear</pre>	<u>m/learn-c-sharp</u>							

2. https://dotnet.microsoft.com/en-us/learn/csharp

3. <u>https://www.learncs.org/</u>

- 4. <u>https://www.codechef.com/learn/course/c-sharp</u>
- 5. <u>https://csharp-station.com/</u>

Topics relevant to "SKILL DEVELOPMENT": Network Slices in 5G, Big Data Analytics, Fog, Prototypes and Evaluation for developing Skills through PARTICIPATIVE LEARNING techniques. This is attained through assessment component mentioned in the course handout.

Course	Course Title: Mobile	Application for		3	0	0	3			
Code:	IOT		L-T- P- C							
CIT2503										
Version	1									
No.										
Course	Computational Thinking Using Python									
Pre-										
requisites										
Anti-	Nil									
requisites										
Course Description	This is a course on Mobile Application for IoT which provides basics concepts of IoT, and understanding of mobile operating systems, Architecture of Mobile OS, basics of programming for mobile application concepts, IOT Overview and HardwarePlatforms, IoT sensors, Integration of IoT sensors with Mobile, Edge and Cloud Platforms.									
Course Objective	The objective of the course is to familiarize the learners with the concepts of Mobile Application for IoT and attain SKILL DEVELOPMENT through PARTICIPATIVE LEARNING techniques									
	On successful completion of the course the students shall be able to:									
Course Out Comes	Course Out Comes Comes Comes Comes Comes CO1: Discuss the fundamental concepts of Mobile operating systems [Understand] CO2: Illustrate the various mobile app development concepts for different application [Apply] CO3: Outline the uses of IoT devices for mobile application [Understand] CO4: Examine the various applications of IoT that integrates with Mobile technologies .[Apply]									
Course Content:										
Module 1	Introduction	Assignment	Knov	vledg	e	1	LO Sessions			
Topics: Overview of IoT Architecture : Physical Design Of IoT, IoT Protocols: LOGICAL DESIGN of IoT, IoT Communication APIs: IoT Enabling Technologies DOMAIN SPECIFIC IoTs										

Introduction to Android Operating System and its interface: Android: History and features,						
Architecture, Development Tools, Android Debug Bridge (ADB), and Lifecycle. Views, Layout,						
Menu, Intent and Fragments						
Module 2	Android					
	Programming	Assignment	Analysis	10 Sessions		
	Concepts					

Topics: Mobile app development: Android Development environment, Simple UI Layouts and layout properties, GUI objects, Event Driven Programming, opening and closing a Database.

Module 3 IoT Components Case Study	Knowledge	12 Sessions
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Topics:, Characteristics IoT sensor nodes, Edge computer, cloud and peripheral cloud, single board computers, open sourcehardware's, Examples of IoT infrastructure IoT Components: Considering the sensor specifications, ADC processing and Actuator specifications, DAC processing

	Module 4	Mobile applications with IOT	Assignment	Analysis,	13 Sessions
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Topics: SENSOR FOR MOBILE AND HANDHELD DEVICES [Temperature sensors, Proximity sensor, IR sensors, Image sensors, Motion detection sensors, Accelerometer sensors, Gyroscope sensors, Optical sensors][Sensor APIs in Android], Actuators and Protocols of IoT related to smart devices, smart objects connection.

Case Study:Edge and Cloud Based IOT Applications

Case Study in IoT: Smart Environment

Text Book

T1. Wei-Meng Lee (Author) "Beginning Android Application Development" Wrox – Wiley India Private Limited, 1st edition, 2011.

T2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1st Edition, Pearson Education (CiscoPress Indian Reprint). (ISBN: 978-9386873743),2017

References

R1. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014. (ISBN: 978-8173719547)

R2. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017.(ISBN: 978-9352605224)

Web References: W1. <u>https://presiuniv.knimbus.com/user#/home</u> (PU Library Link) W2.<u>https://developer.android.com/reference/classes.ml</u> ⁻ W3. https://www.iotforall.com/mobile-iot **Topics relevant to "SKILL DEVELOPMENT** ": Understanding Bluetooth, Zigbee, Wi-Fi **Topics related to "PARTICIPATIVE LEARNING** ": Project implementations in software

Course Code: CSE2018	Course Title: Theory of C Type of Course: Theory	Computation Only		L- T-P- C	3	0	0	3		
Version No.	2.0									
Course Pre-	The students should hav	e the Knowle	dge c	on Set Theor	У					
requisites										
Anti-requisites	Nil									
Course Description	The course deals with int between language classe Topics include: Formal o and Nondeterministic sys automata; normal forms	ne course deals with introduction of formal languages and the correspondence etween language classes and the automata that recognize them. opics include: Formal definitions of grammars and acceptors, Deterministic nd Nondeterministic systems, Grammar ambiguity, finite state and push-down utomata; normal forms; Turing machines and its relations with algorithms.								
Course Objective	The objective of the course is to familiarize the learners with the concepts of Theory of Computation as mentioned above and attain Skill Development through Problem Solving Methodologies.									
Course Out	Out On successful completion of the course the students shall be able to:									
Comes	1. Describe various components of Automata. (Knowledge)									
	2. Illustrate Finite Automata for the given Language. (Application)									
	3. Distinguish between Regular grammar and Context free grammar									
	(Comprehension)	U	0				U			
	4. Construct Push c	lown Automa	ta. (A	(noitcation						
	5. Construct Turing	machine for	a Lar	nguage. (App	olicati	ion)				
Course Content:				00- ()-		- /				
Module 1	Introduction to automata theory	Assignment	Prok Lang	olems on Stri guage operat	ings a tions	and (06 Ses	sions		
Topics:										
Introduction to Au & operations on	tomata Theory, Application languages, Representation	ons of Automa on of autom	ata Tl ata.	heory, Alpha Language	ibets, ecogi	, String nizers <mark>.</mark>	gs, Lar Finit	iguages e State		
Machines (FSM): D	Deterministic FSM,		,	0 0	0	•				
Regular languages, Designing FSM, Nondeterministic FSMs										
Module 2	Finite Automata	Assignment	Prot NFA	olems on DF/ 's	۹,	1	13 Ses	sions		
Topics:	•		•							
Basic concepts of	Finite automata, DFA- d	efinitions of	DFA,	Determinis	tic A	ccepte	ers Tra	ansition		
Graphs and Langu	uages and DFA's, Regula	r Languages,	NFA	- Definition	ofa	a Non	deter	ministic		
Accepter, Langua	ges and NFA's Why Ne	on-determinis	sm?	Equivalence	e of	Deter	minis	tic and		
Nondeterministic	Finite Accepters, Reduction	on of the Num	ber o	of States in F	inite	Autor	mata.			
Module 3	Regular Expressions & Context Free Grammar	Assignment	Prot PT, I	plems on RE, PL and Ambi	CFG, guity	, 1	12 Ses	sions		

Topics:

Formal	Definition	ofa	a Regular	Expression,	Languages	Associated	with	Regular	Expres	ssions,
Langua	ges, Regulai	r Lan	guages (RI) and Non-re	gular Langu	ages: Closur	e pro	perties of	RLs, to	show
some la	inguages ar	e								

not RLs, Closure Properties of Regular Context Free Grammars-Examples of Context-Free Languages, Leftmost and Rightmost Derivations, Derivation Trees, Relation Between Sentential Forms and Derivation Trees, Ambiguity in Grammars and Languages: Ambiguous Grammars, Removing Ambiguity, Chomsky Normal Form, Gribiche Normal Form.

Module 4	Push down Automata	Assignment	Problems on pushdown Automaton	08 Sessions
Topics				

Topics:

Definition of a Pushdown Automaton, Language Accepted by a Pushdown

Automaton, Acceptance by Final State, Acceptance by Empty Stack, From Empty Stack to Final State, From Final State to Empty Stack Equivalence of PDA's and CFG's: From Grammars to Pushdown Automata.

Module 5 Turing Machine	Assignment	Problems on Turning Machine	07 Sessions
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Topics:

Definition of a Turing Machine, Turing Machines as Language Accepters, Example Languages to construct Turing machine, Turing Machines as Transducers, Halting Programming Techniques for Turing Machines

Targeted Application & Tools that can be used:

Targeted Application:

- 1. Text Processing
- 2. Compilers
- 3. Text Editors
- 4. Robotics Applications
- 5. Artificial Intelligence

Tools:

1. JFLAP (Java Formal Language and Automata Package) Software simulation tool. It's

- interactive educational software written in Java to experiment topics in automata theory.
- 2. Turing machine Online simulators.

Text Book

1. Peter Linz, "An introduction to Formal Languages and Automata", Jones and Bartlett Publications 6th Ed, 2018.

References

1. Aho, Ullman and Hopcroft, "Theory of Computation", Pearson India 3rd Edition 2008.

2. Michael Sipser, "Theory of Computation", Cengage India 3rd Ed, 2014.

E-Resources

NPTEL course – <u>https://onlinecourses.nptel.ac.in/noc21_cs83/preview</u>

Topics relevant to "SKILL DEVELOPMENT": Deterministic and Non-Deterministic Automaton, Regular Expressions, CFGs, Turning Machine and Pushdown automaton for Skill Development through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.

Course Code: CIT2501	Course Title: Wireless Communication in IOT	L-T-P-C	3 -0	0	3
Version No.	1.0				
Course Pre- requisites	DCCN				
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Anti-requisites	NIL				
Course Description	Wireless commun which acts as the collection and co expose the stude and problems rel conceptual and a	nication system is bridge for dual din ntrol message deli nts to understand ated to real-world nalytical in nature	the essential part for IoT in rectional communication for very. The purpose of this c the fundamentals of wirely scenarios. This course is b	ifrastructure, or data ourse is to ess network oth	
Course Objective	The objective of of Wireless comn Participative Lear	the course is to fa nunication in IOT a ming techniques.	miliarize the learners with and attain Skill Developme	the concepts nt through	
Course Out Comes	On successful cor To under Analyze t Explain tl Design ar	mpletion of the constand the fundame the standards of lo the use of various w and develop various	urse the students shall be a entals of wireless networks T which employed for wire vireless technologies in IoT s applications of IoT	able to: s eless networks	
Course Content:					
Module 1	Cellular standards	Assignment	Programming Task	9 Sessions	
Topics: Cellular carriers a Picocells, Handoff, 1 EDGE,UMTS), Mobile	nd Frequencies, Cł .st, 2nd, 3rd and 4 e IP, WCDMA	nannel allocation, o th Generation Cell	Cell coverage, Cell Splitting ular Systems (GSM, CDMA	;, Microcells, , GPRS,	
Assignment: Case st	udy on generation	i cellular systems.			
Module 2	Radio Frequency (RF) Fundamentals	Assignment	Data Collection/Excel	10 Sessions	
Topics: Introduction Analysis, Communica Analysis of RF Enviro Factors affecting net differences between spectral Analysis	to RF & Wireless C ation Standards, U nment, Protocol A work range and sp physical layers- O	Communications Synderstanding RF & Inderstanding RF & Inalysis of RF Envir Deed, Environment FDM. Assignment:	ystems, RF and Microwave Microwave Specifications conment, Units of RF measu , Line-of-sight, Interferenc Determination of RF and I	Spectral . Spectrum urements, e, Defining Microwave	
Module 3	WLAN: Wi-Fi Organizations and Standards	Assignment	Programming/Data analysis task	9 Sessions	
Topics: IEEE, Wi-Fi A Standards,802.11- connectivity	lliance, WLAN Cor 2007,802.11a/b/	nectivity, WLAN C g, 802.11e/h/I,802	205 & Power-Save, IEEE 80 2.11n Assignment: Protoco	2.11 ls on WLAN	

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

Topics:

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

Targeted Protocols & Tools that can be used:

Bluetooth, ZigBee, LoRa, NBIoT, WiFi, and Thread

Text Book

T1: Wireless Communications – Principles and Practice; by Theodore S Rappaport, Pearson Education Pte. Ltd.

T2: Wireless Communications and Networking; By: Stallings, William; Pearson Education Pte. Ltd.

References

R1:Bluetooth Revealed; By: Miller, Brent A, Bisdikian, Chatschik; Addison Wesley Longman Pte Ltd., Delhi 4. R2:Wilson , "Sensor Technology hand book," Elsevier publications 2005. 5.

R3: Andrea Goldsmith, "Wireless Communications," Cambridge University Press, 2005

Weblinks:

W1: https://pianalytix.com/wireless-communication-protocols-in-iot/

W2: https://behrtech.com/blog/6-leading-types-of-iot-wireless-tech-and-their-best-usecases/

Topics relevant to "SKILL DEVELOPMENT":

GSM, CDMA for developing Skill Development through Participative Learning Techniques. This is attained through the assessment component mentioned in the course handout.

Course Code:	Course Title: Web Technology		2-0-0-2
CSE1504	Type of Course: Program core	L- T-P- C	
	Theory Only		
Version No.	2.0		
Course Pre-	NIL		
requisites			
Anti-requisites	NIL		
Course	This course highlights the basic web design using H	Hypertext	Markup Language
Description	and Cascading Style Sheets. Students will be traine effective web pages by writing code using current domain, enhancing web pages with the use of pa formatting, graphics, images, and multimedia. Th	d in plann : leading t age layout ie focus is	ing and designing rends in the web techniques, text s on popular key

	technologies that will he applications that interact w	elp students to vith other applica	build Internet- and tions and with databases	web-based
Course Objective	The objective of the cours Web Technology and atta techniques.	se is to familiariz iin Skill Develop	ze the learners with the ment through Experien	concepts of tial Learn <mark>ing</mark>
Course Outcomes	CO4: Apply server-side so	n of this course sed application evel) rructs to enhanc oncepts to demo	the students shall be using client-side scripti to the appearance of a nstration dynamic web	able to: ng website.
	to a database. (Application	on level)		Be milled
Course Content:				
Module 1	Introduction to XHTML	Quizzes and Assignments	Quizzes on various features of XHTML, simple applications	8 Sessions
Document St Frames, Synt	tructure, Basic Text Marku actic Differences between	ip, Images, Hyp HTML and XHTN	bertext Links, Lists, Tal ML.	oles, Forms,
XHTML: Orig Document S ⁱ Frames, Synt	gins and Evolution of HTM tructure, Basic Text Marku actic Differences between	ML and XHTMI ip, Images, Hyp HTML and XHTM	.: Basic Syntax, Stand pertext Links, Lists, Tal <u>ML.</u> Comprehension based Ouizzes and	ard XHTML ples, Forms,
Module 2	Advanced CSS	assignments	assignments; Application of CSS in designing webpages	8 Sessions
Topics:				
CSS: Introduc selectors, CSS elements <mark>.</mark> Advanced CS Responsive E	tion to CSS, Defining & Apply font properties, border prope SS: Layout, Normal Flow, Po Design, CSS Frameworks XIV	ring a style, Creat rties, Box model, ositioning Eleme 1L: Basics, demo	ting style sheets, types o opacity, CSS pseudo class ents, Floating Elements, onstration of applicatio	f style sheet, and pseudo- ns using
XML		-		
Module 3	Fundamentals of JavaScript	Quizzes and assignments	Application of JavaScript for dynamic web page designing	7 Sessions
Topics:				
JavaScript: Int Objects, Decis ups, JavaScrip	troduction to JavaScript, Basic ions and Loops, Document Ol t validation.	z JavaScript Instru pject Model, Ever	uctions, Functions, Methons It handling, handling win	ods & dow pop-
Module 4	PHP – Application Level	Quizzes and assignments	Application of PHP in web designing	7 Sessions
Topics:	·		•	

PHP: Introduction to server-side Development with PHP, Arrays, \$GET and \$ POST, \$________\$_Files Array, Reading/Writing Files, PHP Classes and Objects, Working with Databases, SQL, Database APIs, Managing a MySQL Database. Accessing MySQL in PHP.

Targeted Application & Tools that can be used:

Xampp web server to be used to demonstrate PHP.

Project work/Assignment:

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

Textbook(s):

1] Robert. W. Sebesta, "*Programming the World Wide Web*", Pearson Education, 8th Edition, 2015.

2] CSS Notes for Professionals, ebook available at

https://books.goalkicker.com/CSSBook/ (Retrieved on Jan. 20, 2022)

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

References

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

2] Jeffrey C. Jackson, "Web Technologies: A Computer Science Perspective", Pearson Education, 1st Edition, 2016.

- Topics related to development of "FOUNDATION":
 - 1. Web, WWW, Web browsers, Web servers, Internet.
 - 2. CSS, PHP.
 - 3. Designing for healthcare.

for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.

E-References

pu.informatics.global, https://sm-nitk.vlabs.ac.in/

Course	Course Title: Web						
Code:	Technologies Lab	L-T-	0	0	2	1	
CSE1505	Type of Course:	P- C					
	Program core lab						
	course						
Version No.	1.0						
Course	Database Management Systems-CSE3156						
Pre-							
requisites							
Anti-requisites	NIL						
Course	This course highlights the comprehens	ve intro	ducti	on to	scripti	ing	
Description	languages that are used for creating we	eb-base	d app	licati	ons.		
	The associated laboratory provides an	opportu	inity t	o im	plemer	nt the	
	concepts and enhance critical thinking	and ana	lytica	l skil	ls.		
Course	The objective of the course is to familia	rize the	learr	ners v	with th	е	
Objective	concepts of Web Technology and attair	Skill D	evelo	pmei	<mark>nt</mark> thro	ugh	
	Experiential Learning techniques.						
Course	On successful completion of this course	the stu	Ident	s sha	ll be at	ole	
Outcomes	to:						
	CO1: Implement web-based application	CO1: Implement web-based application using client-side scripting					
	languages.	languages.					
	(Apply)						
	CO2: Apply various constructs to enhance	e the a	ppear	ance	of a		
	website. (Apply)						

W3. docs.microsoft.com

W4. informit.com/articles/ The Relationship Between Web 2.0 and Social Networking <u>https://presiuniv.knimbus.com/user#/home</u>

Topics related to development of "FOUNDATION":

- 1. Web, WWW, Web browsers, Web servers, Internet.
- 2. CSS, PHP.
- 3. Designing the website for healthcare.

The objective of the course is to familiarize the learners with the concepts of Web Technology and attain Skill Development through Experiential Learning techniques.

Course Code: CIT2400	Course Title: Cyber-Physical Systems Type of Course: Theory	L- P- T-C	3	0	0	3
Version No.	1.0					
Course Pre- requisites	Nil					
Anti-requisites	NIL					
Course Description	This course introduces students to an Cyber-Physical Systems which include computing and communication syste networking protocols, security and vari This course helps to make students in them with the domain knowledge need Cyber-Physical Systems Topics include Computational foundation Cyber Physical System Design and syste System Platforms Embedded Systems vs Physical System and Concurrent Models o	NIL This course introduces students to an industrial viewpoint of Cyber-Physical Systems which includes sensors and actuators, computing and communication systems. It will also include networking protocols, security and various CPS/IoT applications. This course helps to make students industry-ready and equip them with the domain knowledge needed to take up projects in Cyber-Physical Systems Topics include Computational foundation of Cyber Physical Systems, Cyber Physical System Design and system requirements Physical System Platforms Embedded Systems vs Internet of Things vs Cyber				

Course	On successful con	mpletion of this	s course the students shall	be able to:	
Outcomes	1 Doccribo	the need and nu	rnace of the different compa	nonts of	
	1. Describe	une need and pu	Inderstand)	onents of	
	2 Scribo t	ho ability to	interact with Cyber Dhys	ical System	
	2. Stribe th	tand)	interact with Cyber Phys	ical system	
	2 Domonst	ialiu). rato a now systo	m and with which a product c	an ho mado	
	5. Demonst	rate a new syste	in and with which a product c	an be made.	
	(Appry). A Classify	common met	hade used to secure cyb	er_physical	
	systems	(Understand)	nous used to secure cyt	oci-pitysicai	
Course Content:	5,500115.	(enderstand)			
Module 1	Introduction	Assignment		12 Sessions	
Topics:					
Sensors and Actuato Finite State Machine Reactive, Timed, Dat Synchronization, Des	ors, Embedded Proces es in Hardware, Hybri taflow, Hierarchical St adlocks and Race Cond	sors and Memory d Systems: Modal ate Machines, Mu ditions, Timed Aut	Models, Input/Output and Devi Models, Concurrency Models: Iltitasking and Threads, Messag omata, Design Case Study	ce Interfaces, Synchronous- e Passing and	
Module 2	Foundations of CPS	Assignment		11 Sessions	
Introduction to Cyber-Physical Systems (CPS), CPS Characteristics and Applications, Reactive Systems and Concurrency, Synchronous Models: Components, Inputs/Outputs, Extended State Machines, Finite-State and Nondeterministic Systems, Composition of Components, Modeling Behaviors: Traces and Execution, Continuous-Time Models & Newtonian Mechanics, Linear and Non-linear Dynamics, Overview of Model- Based Design					
Basea Besign					
Module 3	Scheduling, Real-Time Systems, and Verification	Assignment		12 Sessions	
Module 3 Topics:	Scheduling, Real-Time Systems, and Verification	Assignment		12 Sessions	
Module 3 Topics: Real-Time Constrain Deadline First Sched Logic (LTL), Safety Techniques & BDDs,	Scheduling, Real-Time Systems, and Verification hts and Requirements luling, Multiprocessor and Invariant Prope Formal Verification To	Assignment s, Periodic Job N Scheduling, Mutu erties, Model Ch pols Overview	Iodels, Rate Monotonic Schedu Ial Exclusion and Resource Shari ecking (Reachability & Livene	12 Sessions uling, Earliest ing, Temporal ss), Symbolic	
Module 3 Topics: Real-Time Constrain Deadline First Sched Logic (LTL), Safety Techniques & BDDs, Module-4	Scheduling, Real-Time Systems, and Verification and Requirements luling, Multiprocessor and Invariant Prope Formal Verification To Applications	Assignment 5, Periodic Job M Scheduling, Mutu erties, Model Ch pols Overview Assignment	lodels, Rate Monotonic Schedu al Exclusion and Resource Shari ecking (Reachability & Livene	12 Sessions uling, Earliest ing, Temporal ss), Symbolic 10 Sessions	
Module 3 Topics: Real-Time Constrain Deadline First Sched Logic (LTL), Safety Techniques & BDDs, Module-4 Topics:	Scheduling, Real-Time Systems, and Verification and Requirements luling, Multiprocessor and Invariant Prope Formal Verification To Applications	Assignment s, Periodic Job M Scheduling, Mutu erties, Model Ch pols Overview Assignment	lodels, Rate Monotonic Schedu Ial Exclusion and Resource Shari ecking (Reachability & Livene	12 Sessions uling, Earliest ing, Temporal ss), Symbolic 10 Sessions	
Module 3 Topics: Real-Time Constrain Deadline First Sched Logic (LTL), Safety Techniques & BDDs, Module-4 Topics: Hybrid Systems and Simulation and Num Messaging, CPS Secu Case Study: Automo	Scheduling, Real-Time Systems, and Verification hts and Requirements luling, Multiprocessor and Invariant Prope Formal Verification To Applications d Zeno Behavior, Sta erical Methods, Distrik urity Principles, Softwa tive or Medical CPS	Assignment s, Periodic Job M Scheduling, Mutu erties, Model Ch pols Overview Assignment bility and Contro puted Coordinatio re and Network Se	lodels, Rate Monotonic Schedu Ial Exclusion and Resource Shari ecking (Reachability & Livene Deller Design, Feedback and PIE n and Consensus, Leader Election ecurity in CPS, Fault Tolerance and	12 Sessions uling, Earliest ing, Temporal ss), Symbolic 10 Sessions 0 Controllers, n and Reliable d Robustness,	
Module 3 Topics: Real-Time Constrain Deadline First Sched Logic (LTL), Safety Techniques & BDDs, Module-4 Topics: Hybrid Systems and Simulation and Num Messaging, CPS Secu Case Study: Automo Project work/Ass	Scheduling, Real-Time Systems, and Verification ots and Requirements luling, Multiprocessor and Invariant Prope Formal Verification To Applications d Zeno Behavior, Sta erical Methods, Distribu- rity Principles, Softwa tive or Medical CPS signment:	Assignment s, Periodic Job N Scheduling, Mutu erties, Model Ch pols Overview Assignment bility and Contro puted Coordinatio re and Network Se	Iodels, Rate Monotonic Schedu Ial Exclusion and Resource Shari ecking (Reachability & Livene oller Design, Feedback and PIE n and Consensus, Leader Election ecurity in CPS, Fault Tolerance and	12 Sessions uling, Earliest ing, Temporal ss), Symbolic 10 Sessions 0 Controllers, n and Reliable d Robustness,	
Module 3 Topics: Real-Time Constrain Deadline First Sched Logic (LTL), Safety Techniques & BDDs, Module-4 Topics: Hybrid Systems and Simulation and Num Messaging, CPS Secu Case Study: Automo Project work/Ass 1. Assignm 2. Assignm	Scheduling, Real-Time Systems, and Verification Auts and Requirements Uling, Multiprocessor and Invariant Prope Formal Verification To Applications d Zeno Behavior, Sta erical Methods, Distrik rity Principles, Softwa tive or Medical CPS signment: ent 1 on (Module ent 2 on (Module	Assignment s, Periodic Job M Scheduling, Mutu erties, Model Ch pols Overview Assignment bility and Contro puted Coordinatio re and Network Se 1 and Module 3 and Module	Iodels, Rate Monotonic Schedu Ial Exclusion and Resource Shari ecking (Reachability & Livene oller Design, Feedback and PIE n and Consensus, Leader Election ecurity in CPS, Fault Tolerance and 2)	12 Sessions uling, Earliest ing, Temporal ss), Symbolic 10 Sessions 0 Controllers, n and Reliable d Robustness,	
Module 3 Topics: Real-Time Constrain Deadline First Sched Logic (LTL), Safety Techniques & BDDs, Module-4 Topics: Hybrid Systems and Simulation and Num Messaging, CPS Secu Case Study: Automo Project work/Ass 1. Assignm 2. Assignm REFERENCE MA	Scheduling, Real-Time Systems, and Verification ots and Requirements luling, Multiprocessor and Invariant Prope Formal Verification To Applications d Zeno Behavior, Sta erical Methods, Distrik rity Principles, Softwa tive or Medical CPS signment: ent 1 on (Module ent 2 on (Module ATERIALS:	Assignment s, Periodic Job N Scheduling, Mutu erties, Model Ch pols Overview Assignment bility and Contro puted Coordinatio re and Network Se 1 and Module 3 and Module	lodels, Rate Monotonic Schedu Ial Exclusion and Resource Shari ecking (Reachability & Livene oller Design, Feedback and PIE n and Consensus, Leader Election ecurity in CPS, Fault Tolerance and 2) 4)	12 Sessions uling, Earliest ing, Temporal ss), Symbolic 10 Sessions 0 Controllers, n and Reliable d Robustness,	
Module 3 Topics: Real-Time Constrain Deadline First Sched Logic (LTL), Safety Techniques & BDDs, Module-4 Topics: Hybrid Systems and Simulation and Num Messaging, CPS Secu Case Study: Automo Project work/Ass 1. Assignm 2. Assignm REFERENCE MA	Scheduling, Real-Time Systems, and Verification ots and Requirements luling, Multiprocessor and Invariant Prope Formal Verification To Applications d Zeno Behavior, Sta erical Methods, Distributive rity Principles, Softwa tive or Medical CPS signment: ent 1 on (Module ATERIALS:	Assignment s, Periodic Job M Scheduling, Mutu erties, Model Ch pols Overview Assignment bility and Contro puted Coordinatio re and Network Se 1 and Module 3 and Module	Iodels, Rate Monotonic Schedu Ial Exclusion and Resource Shari ecking (Reachability & Livene oller Design, Feedback and PIE n and Consensus, Leader Election ecurity in CPS, Fault Tolerance and 2) 4)	12 Sessions uling, Earliest ing, Temporal ss), Symbolic 10 Sessions O Controllers, n and Reliable d Robustness,	

1.	Raj 978	eev Alur, "Principles of Cyber Physical Systems", MIT Press, 2023, ISBN: 20262548922
2. REFER	e. A Sys REN(A. Lee, Sanjit Seshia , "Introduction to Embedded Systems – A Cyber–Physical tems Approach", Second Edition, MIT Press, 2017, ISBN: 978-0-262-53381-2 CES
	1.	Pedro H. J. Nardelli, "Cyber-physical Systems: Theory, Methodology, and Applications", wiley publications, 2022,
JOUR	2. NAI	S/MAGAZINES
	1.	IEEE Transactions on Industrial Cyber-Physical Systems https://www.ieee-ies.org/pubs/transactions-on-industrial-cyberphysical-systems
	2.	ACM Transactions on Cyber-Physical Systems
	3.	IET Cyber-Physical Systems: Theory & Applications https://ietresearch.onlinelibrary.wiley.com/journal/23983396
SWAY	'AM	/NPTEL/MOOCs:
		 NPTEL - Foundations of Cyber Physical Systems Coursera - Cyber-Physical Systems: Modelling and Simulation TCS - Cyber-Physical Systems

Course Code: CIT2506	Course Title: AI and Deep Learning for IoT Type of Course: Program Core -Theory	L-T- P-C	3	0	0	3
Version No.						

Course Pre- requisites	Essentials of AI			
Anti- requisites	NIL			
Course Description	This course ex Deep Learning driven data p applications. S neural network deployment or The course c efficiency, sec agriculture, he	plores the integration of A (DL) with the Internet of T rocessing, decision-making tudents will learn key con s, edge AI, federated learn I IoT edge devices like Rasp covers cloud-based AI, m urity challenges, and pra- althcare, and industrial IoT	rtificial Intelligenc Things (IoT), focus g, and automation ncepts of machine ing, and TinyML, a oberry Pi and NVII real-time inferenc ctical applications	e (AI) and ing on AI- in smart e learning, along with DIA Jetson. e, energy in smart
Course Objective	The objective concepts of <mark>Development</mark> t	of the course is to famili Wireless Communication hrough <mark>Participative Learn</mark>	iarize the learners for IoT and a <mark>ing techniques</mark>	with the ttain <mark>Skill</mark>
Course Out	On successful o	completion of the course the	e students shall be	able to:
Comes	1 Understand the concepts of AIoT and their significance in modern industries.			
	2. Apply tech bridging the ga	niques to connect mobile ap between different netwo	e devices to IoT rks.	gateways,
	3. Analyze sen to showcase pr	sor technologies in IoT and actical understanding.	l their academic fo	oundations
	4. Develop an challenges.	nd Evaluate AIoT applica	tions to address	real-world
Course Content				
Module 1	Introduction to Artificial Intelligence and Internet of Things (AIoT)	Assignment	Problem Solving	12 Classes
Introduction to	Artificial Inte	lligence and Internet of	Things (AIoT) Ov	erview of
Artificial Intelli the Internet of Understanding revolutionize te	gence (AI) and it Things (IoT) an the concept of A chnology integr	ts applications across variou d its significance in the ma artificial Intelligence of Thin ation.	us industries. Intro odern interconnec ugs (AIoT) and its p	duction to ted world. otential to
Module 2	Connecting Mobile Devices to IoT Gateways	Assignment	Problem Solving	10 Classes

Connecting Mobile Devices to IoT Gateways Exploring the role of IoT gateways in bridging the gap between mobile devices and IoT networks. Techniques for establishing seamless connections between mobile devices and IoT gateways. Hands-on exercises demonstrating the setup and configuration of mobileto-IoT connections.

Module 3	Sensor Technologies and Academic Concepts	Assignment	Problem Solving	12 Classes
	Concepts			

Sensor Technologies and Academic Concepts Comprehensive overview of sensor technologies commonly employed in IoT applications. In-depth exploration of various types of sensors and their academic underpinnings. Practical demonstrations and experiments showcasing the functionality and applications of sensors in IoT systems.

Module 4	AIoT Application Development	Assignment	Problem Solving	11 Classes
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AIoT Application Development Introduction to tools and platforms essential for building AIoT applications. Practical Aspects of AIoT applications, including: Smart Traffic Signal System for Color Blind Individuals Plant Health Analysis Smart Door Access Control System.

Targeted Application & Tools that can be used:

Text Book

1. Michael Negnevitsky, "Artificial Intelligence: A Guide to Intelligent Systems", Pearson Education, 2021

2. Rajkumar Buyya, Amir Vahid Dastjerdi, "Internet of Things: Principles and Paradigms", Morgan Kaufmann, 2016

3. Michael J. McGrath, "Sensor Technologies: Healthcare, Wellness and Environmental Applications", Apress, 2013

References

R1. Chandra Singh, K V S S S S Sairam, Niranjan N Chiplunkar, Rathishchandra R Gatti Create citation, "Self-Powered Aiot Systems": Apple Academic Press 2024

R2. Kashif Naseer Qureshi, Thomas Newe Artificial Intelligence of Things (AIoT): New Standards, Technologies and Communication Systems, CRC Press 2024

Web Based Resources and E-books:

W1.https://www.linkedin.com/learning/ai-in-connected-products-aiot

W2. <u>https://www.coursera.org/learn/iot</u>

W3. https://www.tinkercad.com/things?type=circuits&sort=staff&view_mode=small

Topics relevant to "SKILL DEVELOPMENT":

AI and Deep Learning for IOT for **Skill development** through **Participative Learning t**echniques. This is attained through the assessment component mentioned in the course handout.

Course Code: CIT2502	Course Title: Priva	cy and Security in Io	Г	L- T-P- C	3	0	0	3	
Version No.	1.0					1			
Course Pre- requisites	Cryptography and	Cryptography and Network Security							
Anti-requisites	NIL	NIL							
Course	The purpose of th	The purpose of this course is to enable the students to appreciate the need for							
Description	cryptography and Things (IoT). The of fair knowledge of thinking and analy through assignme	cryptography and to identify the applications of cryptography in the Internet of Things (IoT). The course is both conceptual and analytical in nature and needs fair knowledge of mathematics and computing. The course develops critical thinking and analytical skills. The course also enhances programming abilities through assignments.							
Course Objective	The objective of t Privacy and Securit Methodologies.	The objective of the course is to familiarize the learners with the concepts of Privacy and Security in IoT and attain Skill Development through Problem-Solving Methodologies.							
Course	On successful com	pletion of this course	e, the stu	dents shall b	be able	to:			
Outcomes	 (1) Explain the benefits of modern cryptographic algorithms [Understand] (2) Apply the Elliptic curve Diffie Hellman and digital signature algorithms to encrypt-decrypt, generate, and verify the signatures [Apply] (3) Estimate the performance of ECC with other traditional cryptography algorithms [Apply] 								
		Course Content							
Module 1	Introduction to Elliptic Curves	Quiz	Compre Quizzes assignn	ehension ba s and nents	ised	15	5 Ses	sions	
Topics:	I					1			
Elliptic Curve Cryptosystems (ECC): Introduction to ECC, Method of Diophantus, Elliptic curves in Cryptography, Discrete Logarithms in Finite Fields, Elliptic Curve on a finite set of Integers, Definition of Elliptic curves, General form of an EC, Weierstrass Equation, Points on the Elliptic Curve (EC), The Abelian Group, Operations on ECC- Point addition, Point doubling.									
Module 2	Elliptic Curve Cryptosystems	Quizzes and assignments	Compre Quizzes assignn	ehension ba s and nents	ised	15	5 Se	ssions	
Topics:Elliptic Curve Cryptosystems (ECC): Public-Key Cryptosystems, Public-Key Cryptography, What IsElliptic Curve Cryptography (ECC)?, Using Elliptic Curves In Cryptography, Generic Procedures ofECC, Example – Elliptic Curve Cryptosystem Analog to El Gamal, Diffie-Hellman (DH) Key Exchange,ECC Diffie-Hellman, Example – Elliptic Curve Diffie-Hellman Exchange, Elliptic Curve DigitalSignature Algorithm (ECDSA) Why use ECC?, Security of ECC, Applications of ECC, Benefits of ECC.Module 3IoT ProtocolsAssignmentComprehension based assignments15 Sessions									
lopics: IoT Communicat	IoT Communication model and Protocols :								

Communication/Transport Protocols: Bluetooth. Data Protocols: Message Queue Telemetry							
Transport (MQTT), Constrained Application Protocol (COAP), Advanced Message Queuing							
Protocol (AMQP), Extensible Messaging and Presence Protocol (XMPP), Introduction, Principle of							
RFID, Components of an RFID system.							
Targeted Applications & Tools that can be used:							
Application areas are to secure cryptocurrency-Bitcoin, Ethereum and Ripple using ECC in key							
agreements, and digital signatures.							
Professionally Used Software: elliptic2							
: https://www.graui.de/code/elliptic2/							
Project work/Assignment:							
Project/Assignment:							
Assignment 1: Collect the running time of ECC on different standard NIST curves.							
Assignment 2: Prepare a compressive report on the efficiency of NIST Vs SECP curves.							
Textbook(s):							
T1. I. Blake, G. Seroussi, N. Smart, Elliptic Curves in Cryptography, Cambridge University							
2020,							
T2. Arshdeep Bagha, Vijay Madisetti, "Internet of Things - A hands-on approach", Universities							
Press, 2021., Second Edition							
References							
R1. Joseph H Silver man The Arithmetic of Elliptic Curves: Springer; 2 nd Edition April 2016							
R2. Darrel Hankerson, Scott Vanstone, Alfred J. Menezes Guide to Elliptic Curve Cryptography							
Springer 2018							
R3. Elliptic curve cryptography, Elliptic Curve Cryptography, Debdeep							
Mukhopadhyay							
Dept of Computer Sc and Engg, IIT Madras (Lecture Notes)							
R4. Simoni Cirani, Internet of things, Architecture, Protocols and Standards, Wiley, 1 st							
Edition, 2019							

Topics related to the development of **"SKILL DEVELOPMENT"**: IOT Protocols, Elliptic Curve Cryptosystem, for **Skill Development through Participative Learning Techniques**. This is attained through assessment components as mentioned in the course handout.

Course Code: CIT2506	Course Title: Cloud Computing Type of Course: Theory	L- T-P- C	2	0	0	2
Version No.	1.0	·				
Course Pre- requisite s	Data Communication and Computer Net	works (CSE20	11)			
Anti- requisites	Nil					

Course Description	Cloud Computing provides a hands-on comprehensive study of Cloud concepts and capabilities across the various Cloud service models including Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). It dives into all of the details that a student needs to know in order to plan for developing applications on the cloud and what to look for when using applications or services hosted on a cloud.						
Course Objectives	The objective of the objective objecti	ne course is to fan is designed to imp <mark>ARNING</mark> TECHNIQU	niliarize the learners wi prove the learners' <mark>SKII</mark> <mark>ES</mark> .	th the concepts LL DEVELOPMEN	of <mark>CLOUD</mark> I <mark>T</mark> through		
Course	On successful cor	npletion of the co	ourse the students sha	ll be able to:			
Out Comes	1. Describe Architect	1. Describe the fundamental components and layers of Cloud Computing Architecture. [Remember]					
	2. Identify a [Understa	2. Identify appropriate Virtualization techniques to virtualize infrastructures [Understand]					
	3. Summari [Underst	ze various Cloud m and]	echanisms to optimize t	he QoS paramete	ers		
	4. Apply clo	ud platforms to de	velop various application	ns [Apply]			
Course Content:							
Module 1	Introduction to Cloud services	Assignment	Theory		L: 10		
Evolution of clo PaaS, SaaS, Typ	ud computing, Comp es of Clouds, Cloud C	uting Platforms and computing Environr	d Technologies, Cloud Co nents. [Understanding]	omputing Archite	cture, laaS,		
Module 2	Virtualization Techniques	Assignment	Theory		L: 10		
Basics of Virtu Implementation	alization - Types of n Levels of Virtualiza	Virtualizations, Ta ation. [Understandi	xonomy of Virtualizatic ng]	on Techniques,			
Module 3	Cloud QoS and Management	Assignment	Theory		L: 10		
Cloud Infrastrue	cture Mechanisms- L	ogical Network Per	imeter, Virtual Server, C	Cloud Storage De	vice, Cloud		
Usage Monitor	r, Ready-Made Envi	ronment, SLAs, Sp	ecialized Cloud Mecha	nisms- Automat	ed Scaling		
[Understanding		JI, Fay-Fei-Ose Mic	finitor, Addit Monitor, C				
Module 4	Cloud Application development in Cloud	Assignment	Theory		L: 10		
Programming N environments f	Aodels for Cloud Cor	mputing – MapRed	uce, CGL Mapreduce, C	loud Haskell, De	velopment		
service develop	ment (Demonstratio	n using AWS Cloud,	/Saturn Cloud); Dockers	and Containers.	Apply]		
Targeted App	lication & Tools th	at can be used :					
Applications:	Use of cloud techno	logy in different an	nlications like healthcare	a agriculture etc			
Tools:							
1. Google App Engine							
Z. AWS, Project work/	Assignment: Ment	ion the Type of P	Project /Assignment p	roposed for thi	s course		
Stude	nts can design an	d implement dv	namic resource alloca	ation for virtue	l machine		
using	cloud computing e	environment.					
Design	n and Implementa	tion of a Scalable	Cloud-Based Data Sto	orage System			
Devel	opment of a Multi	-Cloud Managem	ent Platform				

Text Book
1. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, "Mastering Cloud
Computing", McGraw Hill Education, 2013 edition.
2. John Rittinghouse and James Ransome, "Cloud Computing, Implementation,
Management and Security", CRC Press, 2010 edition.
References
1. Thomas Erl, Zaigham Mahmood, and Ricardo Puttini, "Cloud Computing Concepts,
Technology & Architecture", PHI publisher 2013 edition.
2. K. Chandrasekaran, "Essentials of CLOUD COMPUTING", CRC Press, 2015 edition.
3. David E.Y. Sarna, "Implementing and Developing Cloud Applications", CRC Press, 2018 edition.
4. Manvi, Sunilkumar, and Gopal K. Shyam. "Cloud Computing: Concepts and Technologies". CRC Press, 2021.
Web Based Resources and E-books:
W1. IEEE Transactions on Cloud Computing-
https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=6245519 W2. International
Journal of Cloud Computing- https://www.inderscience.com/jhome.php?jcode=ijcc
W3. CloudSim Resources
https://javadoc.io/doc/org.cloudsimplus/cloudsim-
plus/latest/org/cloudbus/cloudsim/resources/class-use/Resource.html
W4. Journal of Network and Computer Networking-
https://www.journals.elsevier.com/journal-of-network-and-computer-applications
Topics relevant to "Skill Development": AWS, Azure, APIs, Aneka Cloud Platform,
Virtualization, Cloud Platforms in Industry, EC2, Installation of VM Workstation, Cloud
Infrastructure and Challenges for Skill Development through
Participative Learning techniques. This is attained through assessment component mentioned
in course nandout.

Course Code: CIT2507	Course Title: Cloud Computing Lab	L- T-P- C	0	0	2	1			
Version No.	1.0								
Course Pre- requisite s	Data Communication and Computer Networks (CSE2011)								
Anti- requisites	Nil								
Course Description	Cloud Computing provides a hands-on capabilities across the various Cloud serv (IaaS), Platform as a Service (PaaS), and So details that a student needs to know in o cloud and what to look for when using ap	comprehens vice models ir oftware as a S order to plan plications or	ive stud ncluding ervice (S for devo services	dy of C Infrast SaaS). I eloping hosted	Cloud conc ructure as t dives into applicatio I on a cloud	epts and a Service all of the ns on the d.			

Course Objectives	CourseThe objective of the course is to familiarize the learners with the concepts of COMPUTING and is designed to improve the learners'SKILL DEVELOPMENT SKILL DEVELOPMENTPARTICIPATIVE LEARNINGTECHNIQUES.						
Course							
Content: Targeted App Applications:	lication & Tools that can be used :						
Cloud Platform Tools: 1. Goog	, Use of cloud technology in different applications like healthcare, agriculture etc. gle App Engine						
Project work	Assignment: Mention the Type of Project /Assignment proposed for this course						
• Stude	ents can design and implement dynamic resource allocation for virtual machine						
using Desig Deve	cloud computing environment. n and Implementation of a Scalable Cloud-Based Data Storage System opment of a Multi-Cloud Management Platform						
List of Labora	tory Tasks:						
Experiments: 1. Creat Servio	e a simple cloud software application and provide it as a service using any Cloud ce Provider to demonstrate Software as a Service (SaaS).						
2. Creat Virtu	e a Virtual Machine with 1 vCPU, 2GB RAM and 15GB storage disk using a Type 2 alization Software						
3. Creat 4. Creat Versio	e a Virtual Hard Disk and allocate the storage using VM ware Workstation e a Snapshot and Cloning of a VM and Test it by loading the Previous on/Cloned VM						
5. Demo Public and S	onstrate Infrastructure as a Service (IaaS) by Creating a Virtual Machine using a c Cloud Service Provider (Azure/GCP/AWS), configure with minimum CPU, RAM, torage and Launch the VM image.						
6. Creat Servio	e a Simple Web Application using Java or Python and host it in any Public Cloud ce Provider (Azure/GCP/AWS) to demonstrate Platform as a Service (PaaS)						
7. Creat check	e a Storage service using any Public Cloud Service Provider (Azure/GCP/AWS) and the public accessibility of the stored file to demonstrate Storage as a Service a s SQL storage convice and perform a basic query using any Public Cloud Service						
9. Perfo	der (Azure/GCP/AWS) to demonstrate Database as a Service (DaaS) rm the basic configuration setup for Installing Hadoop 2.x like Creating the HDUSER						
and S	SH localhost						
10. Instal 11. Laund	l Hadoop 2.x and configure the Name Node and Data Node. h the Hadoop 2.x and perform MapReduce Program for a Word Count problem:						
Text Book 3. Rajkumai Computing"	[.] Buyya, Christian Vecchiola, and Thamarai Selvi, "Mastering Cloud , McGraw Hill Education, 2013 edition.						
4. John Ritti Managemer	nghouse and James Ransome, "Cloud Computing, Implementation, It and Security", CRC Press, 2010 edition.						
References Thomas Erl, Technology	Zaigham Mahmood, and Ricardo Puttini, "Cloud Computing Concepts, & Architecture", PHI publisher 2013 edition.						
K. Chandras	ekaran, "Essentials of CLOUD COMPUTING", CRC Press, 2015 edition.						

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

Manvi, Sunilkumar, and Gopal K. Shyam. "Cloud Computing: Concepts and Technologies". CRC Press, 2021.

Web Based Resources and E-books: W1. IEEE Transactions on Cloud Computinghttps://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=6245519 W2. International Journal of Cloud Computing- https://<u>www.inderscience.com/jhome.php?jcode=ijcc</u> W3. CloudSim Resources https://javadoc.io/doc/org.cloudsimplus/cloudsimplus/latest/org/cloudbus/cloudsim/resources/class-use/Resource.html W4. Journal of Network and Computer Networking-<u>https://www.journals.elsevier.com/journal-of-network-and-computer- applications</u> Topics relevant to "Skill Development": AWS, Azure, APIs, Aneka Cloud Platform, Virtualization, Cloud Platforms in Industry, EC2, Installation of VM Workstation, Cloud Infrastructure and Challenges for Skill Development through Participative Learning techniques. This is attained through assessment component mentioned in course handout.

Course Code:	Course Title: Internet of Things	L- T-P-	1	0	4	2				
CI13415	Type of Course: Integrated	С	Т	0	4	5				
Version No.	2.0									
Course Pre-	Students should know basic python programming.									
requisites	2. Students have basic knowledge basic electronic co	omponer	its su	ch as	sens	ors –				
	temperature, motion, pressure, and actuators etc.									
	3. Students should have basic idea about Cloud and	its uses.								
Anti-requisites	NIL									
Course Description	The Internet of Things (IoT) is an emerging paradigm combining heterogeneous devices at an unprecedented scale, thereby enabling individuals and organizations to gain greater value from networked connections among people, processes, data, and things. The Internet of Things (IoT) is a course of objects interacting with people, with information systems, and with other objects. The course will focus on creative thinking. IoT concepts & IoT technologies.									
Course	The objective of the course is to familiarize the le	arners w	ith t	he co	ncep	ts of				
Objective	Internet of Things and attain SKILL EXPERIENTIAL LEARNING techniques	DEVELO	OPME	INT	thr	ough				

		C • I • I					
Course Out	On successful completion of the course the students shall be able to:						
Comes	1. Identify the ap	oplication areas of IoT	Г				
	Understand bu	ilding blocks of Interi	net of Things and charac	teristics			
	3. Describe IoT Pr	rotocols					
	4. Demonstrate ι	ise of IoT devices for	simple application				
Course							
Content:							
Modulo 1	INTRODUCTION TO	Accianment	Simulation/Data	19 Socions			
	INTERNET OF THINGS	Assignment	Analysis	10 363310113			
Introduction, De	finition & Characteristic	cs of IOT, Physical Des	sign of IoT- Things in IoT, I	IoT Protocols,			
Logical design of	f IoT- IoT functional blo	cks, IoT Communicat	ion Models, IoT Commu	nication APIs,			
IoT Enabling Tec	hnologies- Wireless ser	nsor networks, Cloud	computing, Big data Ana	alytics			
	IOT COMMUNICATION						
Module 2	MODEL AND	Assignment	Numerical from E-	18 Sessions			
	PROTOCOLS		Resources				
Connectivity Pro	tocols: 6LoWPAN, IEE	E 802.15.4, Zigbee, V	Vireless HART, Z-Wave,	ISA 100,NFC,			
RFID. Communic	ation/Transport Proto	cols: Bluetooth. Data	Protocols: Message Que	ue Telemetry			
Transport (MQT	T), Constrained Applica	tion Protocol (CoAP),	Advanced Message Que	uing Protocol			
(AMQP), XMPP -	- Extensible Messaging	and Presence Protoc	ol	C			
	IOT COMMUNICATION						
Module 3	MODEL AND	Term	Simulation/Data	19 Sessions			
	PROTOCOLS	paper/Assignment	Analysis				
Communication	/Transport Protocols:	Bluetooth. Data Pro	otocols: Message Queu	le Telemetry			
Transport (MOT	T). Constrained Applica	tion Protocol (CoAP).	Advanced Message Que	uing Protocol			
(AMOP), XMPP	 Extensible Messagin 	g and Presence Prot	ocol. RFID: Introduction	. Principle of			
RFID. Componer	its of an RFID system.	0		,			
List of Laborato	ry Tasks						
1 Installation of	arduino IDE & Arduino I	program to implemen	nt scrolling LED, to glow e	ven/odd LED			
2 Arduino progra	am to demonstrate usa	ge of push button to	control the LED				
3 Arduino progra	am to demonstrates tra	affic control system					
4 Arduino progra	am to demonstrates us	, age of servo motor w	ith potentio meter.				
5.Arduino progra	am to Control an LED u	sing Bluetooth.					
6.Arduino progra	am to implement RFID	reader for security ac	cess.				
7 Arduino Progr	am to detect obstacle	using IR sensor					
8 Arduino Progr	am to detect motion us	ing PIR sensor					
9 Installation of	Raspherry ni software						
10 Working has	ic commands on Rasnh	erry ni & to demonst	rate remote logging in ra	spherry ni			
11 Raspherry ni	program to implement	hlinking I FD		ispocity pr			
12 Raspberry pi	program to implement	t camera module for y	video				
13. Raspberry pi	program to obtain the	temperature using D	HT sensors				
14.Using a Raspl	program to obtain the perry Pi with distance s	ensor (ultrasonic sen	sor HCSR04)				
15. Raspberry pi	program to implement	t Garage spot light					
	ation & Tools that can	he used:					
Interfacing of A	RDI IINO and Rasnherry	v ni for develoning sn	nart CITIES				
Tools:	bonto una haspberry						
Tinker c	ad						
Cooia si	mulator						
Contiki							
Thingspe	eak						
Text Book							
T1 Arshdeen Ba	agha. Vijav Madisetti	Internet of Things 4	A hands on approach	First Edition			
Universities	ond, thuy manacelly			et Eartion,			
Press, 2018							
T2 Hakima Chao	uchi, The internet of Th	nings Connecting Obie	ects to web Wilev 2017				

References

R1 Vinit Kumar Gunjan, MohdDilshad Ansari,Mohammed Usman, ThiDieuLinh Nguyen Internet of Things Technology, Communications and Computing Springer January 2023

R2 Dr. Hassan Internet of Things A to Z: Technologies and Applications IEEE Press 2018 E-Resources

NPTEL course -

a) https://onlinecourses.nptel.ac.in/noc22_cs53/preview

b) https://www.udemy.com/course/complete-guide-to-build-iot-things-from-scratch-tomarket/

c) https://puniversity.informaticsglobal.com:2229/login.aspx

Topics relevant to "SKILL DEVELOPMENT": Case studies of water supply projects – Design criteria through group discussion. Interpolation of sensors through group presentation for **Skill Development** through **Experiential Learning** techniques. This is attained through assessment component mentioned in course handout.

Course Code:	Course Title: Fire	wall and Intern	et security		2-0-2-3				
CSE 2058	Type of Course: In	tegrated		L- 1-P- C					
Version No.	1								
Course Pre-	Computer Netwo	orks							
requisites									
Anti-									
requisites									
Course Description	This course provides an in-depth study of various network attacks techniques and methods to defend against them. A number of threats and vulnerabilities of the Internet will be covered, including various vulnerabilities of TCP/IP protocols, denial of service (DOS), attacks on routing, attacks on DNS servers, TCP session hijacking, and so on. This course will also cover defending mechanisms, including intrusion detection, firewalls, tracing the source of attacks, anonymous communication, IPsec, virtual private network, and PKI. To make it easy for students to understand these attacks, basics of the TCP/IP protocols will also be covered in the course.								
Course	The objective of t	the course is t	o familiarize	the learne	ers with	the concepts of			
Objective	Firewall and Inte	rnet security a	ind attain Sk i	ill Develo	pment t	hrough Problem			
	Solving Methodol	ogies.							
Course Out Comes	 On successful completion of the course the students shall be able to: To identify elements of firewall design, types of security threats and responses to security attacks. Examine security incident postmortem reporting and ongoing network security activities. Construct code for authentication algorithms. Develop a signature scheme using Digital signature standard. Demonstrate the network security system using open source tools 								
Course Content:									
Module 1	Introduction to Firewall	Assignment	Data Collectic	on/Interpr	etation	12 Sessions			
ntroduction of Firewall in computer network, Categories of firewall, How firewall works, Types of firewall, Firewall location and Configuration, Firewall Policies, Firewall Biasing, Network Architecture, Net masks, Packet filters, Stateful firewalls, Resources									

Module 2	Computer security	Case studies / Case let	Case studies / Case let	12 Sessions					
Topics: Att Principles of S Secure Sockets	acks on Computer ecurity Types of a Layer, Transport	's and Computer S Attacks. Transpor Layer Security, H7	Security: Need for Security, Security Level Security: Web Security TTPS, Secure Shell (SSH)	rity Approaches, Considerations,					
Module 3	Network Security	Quiz	Case studies / Case let	10 Sessions					
Topics: Ove	erview of Networ	k Security:Eleme	ents of Network Security , Cl	assification of					
Network A	ttacks ,Security	Methods ,Symm	netric-Key Cryptography :Da	ta Encryption					
Standard ([Standard (DES), Advanced Encryption Standard (AES), Public-Key Cryptography :RSA								
Algorithm	Algorithm ,Diffie-Hellman Key-Exchange Protocol , Authentication :Hash Function ,								
Secure Has	h Algorithm (SHA	 A) , Digital Signa 	tures.						
Module 4	Cyber laws and Compliance (Standards	Quiz	Case studies / Case let	11 Sessions					
 defamation, Crime against individual, Government, Property. List of Laboratory Tasks: Perform encryption, decryption using the following substitution techniques Ceaser cipher, (ii) playfair cipher iii) Hill Cipher iv) Vigenere cipher Perform encryption and decryption using following transposition techniques Rail fence ii) row & Column Transformation Apply DES algorithm for practical applications. Apply AES algorithm for practical applications. Implement RSA Algorithm using HTML and JavaScript Implement the Diffie-Hellman Key Exchange algorithm for a given problem. Calculate the message digest of a text using the SHA-1 algorithm. Implement the SIGNATURE SCHEME – Digital Signature Standard. Demonstrate intrusion detection system (ids) using any tool eg. Snort or any other s/w. Automated Attack and Penetration Tools Exploring N-Stalker, a Vulnerability Assessment Tool 									
Targeted Appl	ication & Tools th	at can be used							
Text Book T1 : Behrouz A Forouzan, Data and Communications and Networking, Fifth Edition, McGraw Hill, Indian Edition T2: James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth edition, Pearson,2017									
References R1: Andrew S Tanenbaum, Computer Networks, fifth edition, Pearson Edition R2 : Nader F Mir, Computer and Communication Networks, 2nd Edition, Pearson, 2014.									
Web resources 1. <u>https:</u> 2. https: 3. https:	;: //networklesson //www.udemy.c [,] //geekflare.com,	<u>s.com/cisco/asa</u> om/course/cisco /learn-network-	<u>ı-firewall</u> ɔ-asa-firewall-lab-guide security						

• Topics relevant to development of "Skill Development": AES, Network Security for Skill Development through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.

Course Code:	Course Title:									
CIT3411	Big Data Analytics for I	оТ								
				L- P- C	1	4	3			
	Type of Course: Progra	m Core								
	Theory with embedde	d lab								
Version No.	1.0									
Course Pre-	-									
requisites										
Anti-requisites	NIL									
Course	The course covers ba	asic concepts for IOT	Γ Analytic	cs, colle	ection	of d	ata for			
Description	IOT, Integration of I	OT with Cloud, Big	Data Env	ironme	nts. S	tude	nts can			
	learn about applying §	geospatial analytics ar	nd applyin	g mach	ine lea	rning	g to the			
	IOT data. The cours	se also covers the or	rganizatio	n of th	e IOT	dat	a, cost			
	benefits of using IOT	and review of IOT in	n various s	sectors.						
	The objective of the o	course is to familiariz	the lear	ners wit	th the	conc	epts of			
Course	Big Data Analytics	for IoT and attain	SKILL I	DEVELC) PMEN	NT ť	hrough			
Objective	EXPERIENTIAL LEARN	NING techniques.								
Course	On successful comple	etion of the course the	e students	shall be	e able	to:				
Outcomes	CO1: Demonstrate IOT Data Analytics and machine learning application in IOT									
	(Apply)									
	CO2: Apply appropria	te Hadoop Ecosystem	tools to p	erform o	lata an	alyti	es for a			
	given problem (Apply))								
	CO3: Examine concer	ots of cloud based IOT,	Big data a	nd IOT	(Appl	y)				
	CO4: Illustrate techniq	ues and strategies for da	ata collectio	on and G	eospat	al A	nalytics			
	to IOT Data (Apply)									
Course Content:										
Module 1	IOT Analytics	Assignment				5 ses	sions			
Introduction – IC	T Data, Challenges of IOT	analytics Applications –	IOT analyt	ics Lifec	ycle an	d Tec	hniques.			
IOT Cloud and B	ig Data Integration – Clou	id based IOT platform –	Data Analy	tics for	IOT, IO	OT de	vices in			
different domains.	IOI Analytics for the Clou	1d.								
Module 2	Hadoop Ecosystem				4	5 ses	sions			
			<u></u>		C					
Introduction – Big	Data and Big Data Analyti	cs – Hadoop Ecosystem –	- Hadoop Di	stributed	File Sy	/stem	(HDFS)			
– MapKeuuce – 1 HRase – Anache Z	AKN AICHHECHHE – FIG F	Architecture – Apache III	V E = Wallo	ui – Apa	che sp	атк —	Арасис			
TiDase - Apache Z	Overview of AWS									
Module 3	and Thingwory	Assignment			4	5 ses	sions			
AWS overview	WS kov sorvices for IOT	analytics. Thingwork over	ruiou Croo	ting on A	WS CI	oud A	nalytics			
environment	AWS KEY SERVICES IOI IOI	anarytics. Thingwork ove	I VIEW. CIEd	ung an A	ws ci	ouu A	marytics			
environment.										

Module 4	Geospatial Analytics to		Data Collection and
	IOT Data	Case Study	Analysis
		Cuse Study	r mary 515
Strategies and Techniques	in Data collection: Designing	data processing for analy	tics – Applying big data to
storage for Geospatial.			
List of Practical Tasks:			
Experiment 1:[Module 1	.]		
Level 1: Installation	on of Raspbian OS, working	basic commands on rasp	oberry pi
Level 2: Demonst	rate to obtain the temperat	ture using DHT22 sensor	rs.
Experiment 2: [Module	1]		
Level 1: Design a	nd Simulate the RADAR S	YSTEM Using Arduino a	and display on the serial
monitor using ultraso	inic sensor/PIR WITH &WIT	H OUT BUZZER/Servo m	otor
Level 2: using a ra	spberry pi to Demonstrate	e to find the distance us	sing ultrasonic sensor hc-
sr04			
Experiment 3: [Module :	1]		
Level 1: using a ras	pberry pi Set the connection	ons of healthcare senso	rs
Level 2: using a rasp	oberry pi to Demonstrate to	o find the ECG, Tempera	ture, etc using Healthcare
sensors			
Experiment 4: [Module 2	2]		
Level 1: Hadoop Sin	gle node cluster installation	n on ubuntu	
Level 2: Hadoop	Multiple node cluster installati	on, windows installation	
Experiment 5: [Module 2	2]		
Level 1: Basic hadoo	p commands and Word co	ount analysis for given d	ataset
Level 2: Analysis on	particular matching word c	on huge dataset	
Experiment 6: [Iviodule /	<mark>2</mark>] 		
Level 1: Basic hadoo	op commands and stock an	alysis on given dataset	
Level 2: Analysis wit	in max, min, average function	ons on particular field w	ith missing values
Experiment 7: [Iviodule A	2] n commondo and Tananan	atura analusia an siyan s	latacat
Level 1: Basic nadoo	b max min average function	ature analysis on given o	lataset
Ever 2. Analysis wit	al	ons on particular neiù wi	itil missing values
Experiment 8: [Working on	oj Nivo commando		
	ckoting tochnique to brin	a out the difference h	otwoon partitioning and
Level 2. Apply but	cketing technique to bring	g out the unterence b	etween partitioning and
Experiment 9: [Module 3	21		
Level 1: Working on) Hhase commands		
Level 2: Apply Hbas	e commands on Insurance	datahase/employee data	acet
Ever 2. Apply ribus			aset.
Level 1: Installation	of spark and word count :	analysis	
Level 2: Using RDD a	and ElatMan count how may	ny times each word anne	ears in a file and write out
a list of words whose cou	int is strictly greater than 4	using Snark	
Experiment 11: [Module	4]		
Level 1: Temperatu	re Data stored in cloud thr	ough IoT devices	
Level 2: Retrieve th	e data set for cloud and Ap	poly data analytics techn	iques
Experiment 12: Module	4]		-1
Level 1: Healthcare	Data stored through IoT se	nsors in Cloud	
Level 2: Retrieve the	e data set for cloud and Ap	ply data analytics techni	ques
Targeted Application &	Tools that can be used:	, , ,	
Hadoop ecosystem tools	, Thingworx . AWS Cloud	d	
Project work/Assignmen	<u>,,,,</u> ,,		
Student will be asked to	o carry out a mini project	integrating IoT & dat	a Analytics
			<i>a</i> 1 mai <i>j</i> 105.
lext Book			

T1. Big Data Analytics, Seema Acharya, Subhashini Chellappan, Wiley., 2nd Edition, 2019.

T2. Analytics for the Internet of things, Andrew Minteer. Packt publishing, 1st Edition, 2017.

T3. Big Data and the Internet of Things, Robert Stackowiak, Art Licht, Venu Mantha and Louis Nagode, Apress, 2nd Edition, 2020

References

R1. IOT and Analytics in Agriculture.,Prasant Kumar Pattnaik, Raghvendra Kumar, Souvik Pal, S. N. Panda. Springer, First Edition, 2020.

R2. Building blocks for IOT Analytics. Internet-of-Things Analytics. John Soldatos (Editor). River Publisher Series in Signal Image and Speech Processing.2020

(iii) web resources

W1. NPTEL: <u>https://onlinecourses.nptel.ac.in/noc20_cs92/preview</u>

W2. Coursera: https://www.coursera.org/learn/big-data-introduction

W3. EDX: <u>https://www.edx.org/course/big-data-fundamentals</u>

W4. E-book Link : https://www.wiley.com /en-us/Internet+of+Things+and+ Data+ Analytics + Handbook -p-9781119173625

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

Topics relevant to "SKILL DEVELOPMENT": Organize IOT data – Linked analytics datasets – Managing data lakes for **Skill Development** through **Experiential Learning** techniques. This is attained through assessment component mentioned in course handout.

Course Code: CIT3400	Course Title: Architecting Smart IoT Devices Type of Course: Program Core -Theory	L-T- P-C	3	0	0	3	
Version No.							
Course Pre- requisites	Innovative Projects Using Arduino						
Anti- requisites	NIL						
Course Description	The Architecting Smart IoT Devices course, offered by EIT Digital through Coursera, guides learners through the development of embedded systems devices, emphasizing the use of pre-made hardware and software components to expedite time-to-market. Participants will explore processor families, operating systems, boards, and networks, gaining insights into their selection and integration. The curriculum encompasses debugging techniques, device fine-tuning, and strategies for achieving low power consumption. By course completion, students will be equipped to architect and implement their own embedded devices						
Course Objective	The objective of the course is to familiarize the concepts of Architecting Smart IoT Deviced Development through Participative Learning tech	e learne es and <mark>niques</mark>	ers atta	wit ain	h t <mark>Sk</mark>	he <mark>till</mark>	

Course Out	On successful c	On successful completion of the course the students shall be able to:					
Comes	1. Understand l	1. Understand how the IoT is different from traditional systems.					
	2. Demonstrate	2. Demonstrate the revolution of internet in mobile and cloud.					
	3. Examine the	architecture and operation	of IoT.				
	4. Explore va applications.	rious tools and program	nming paradigms	s for IoT			
Course Content							
Module 1	Design Principles of IoT and Prototyping the	Assignment	Problem	12 Classes			
	Embedded Devices for IoT		Solving	C1035C5			
Design Princip	oles of IoT: Des	sign principles of connect	ed devices, data	acquiring			
organizing and	analytics in 101,	system architecture of 101.					
Prototyping the and actuators fo web, software co	Embedded Dev r IoT, Radio mod omponents.	ices for IoT: System hardwa lule and wireless sensor net	are and prototypir work, gateways in	ng, sensors ternet and			
Module 2	Embedded Programming for IoT	Assignment	Problem Solving	10 Classes			
Embedded Prog IoT, Case study:	gramming for Io Temperature co	T: Programming connected ntroller, Smart irrigation sy	l devices, C and p stem.	bython for			
Module 3	Embedded RTOS	Assignment	Problem Solving	12 Classes			
Embedded RTC services, signals Nucleus SE initi	DS: Program stru , semaphores, N alization and sta	cture and real time, multita ucleus SE, application time rn1p.	sking and schedul ers, interrupts in n	ing, RTOS ucleus ES,			
Module 4	Tools for IoT and loT physical Devices	Assignment	Problem Solving	11 Classes			
Tools for IoT: Introduction, chef puppet, NETCONF - YANG case studies. IoT physical Devices: Basic building blocks of an IoT device and endpoints, family of ploT devices, pcDuino, Beagle bone black, cubie board, domain specific IoTs.							
Targeted Appli	cation & Tools t	hat can be used:					
Text Book							

1. Raj Kamal, Internet of Things, Architecture and Design Principles, lst edition, McGraw Hill Education, May 2017.

2. Arsheep Baga and Vijay Madisetti, Internet of Things: A Hands-On Approach, 1st Edition, Universities press, 2015.

References

R1. David Etter, IoT (Internet of Things Programming: A simple and fast way of Learning IoT, Kindle edition 2016.

R2. Fei HU, Security and Privacy in Internet of Things (loTs): Models, Algorithms, and Implementations, 1st Edition, CRC Press, 2016.

R3. Colin Walls, Embedded RTOS Design Insights and Implementation. 1st edition. Elsevier. December 2020.

Web Resources:

W1. https://www.coursera.org/learn/iot-architecture

W2. https://www.mooc-list.com/course/architecting-smart-iot-devices-coursera

W3. https://www.classcentral.com/course/iot-architecture-6839

Topics relevant to "SKILL DEVELOPMENT":

Architecting Smart IoT Devices for **Skill development** through **Participative Learning t**echniques. This is attained through the assessment component mentioned in the course handout.

Course Code: CIT3401	Course Title: Intelligent Sensor and System	L-T- P-C	3	0	0	3
Version No.		1				
Course Pre- requisites	DCCN					
Anti- requisites	NIL					
Course Description	The Intelligent Sensor and System course ex development, and application of smart sensors an in IoT and automation. It covers sensor principle data acquisition, and wireless communication to BLE, Zigbee, and LoRa. The course also delves into analytics, sensor fusion techniques, edge compu- decision-making for smart applications in he automation, and smart cities. By the end, learners	xplores d intellig s, signal echnolog o AI-pow iting, ar ealthcare will gain	the gent gies vere nd , in exp	de : sys oces suc ed so real ndu pert	esig ster ssin ch ens -tin istri	n, ns as or ne ial in

	building intellige and autonomy.	nt sensing systems with enl	nanced accuracy,	efficiency,
Course Objective	The objective of concepts of Intel through Participa	the course is to familian tigent Sensor and System ar tive Learning techniques	rize the learners nd attain <mark>Skill Dev</mark>	with the <mark>zelopment</mark>
Course Out	On successful con	mpletion of the course the s	students shall be	able to:
Comes	1. Analyze th requirements and	e sensors available in I 1 the Sensing methods.	oT based on a	pplication
	2. Create a Real- temperature mor	time application by choosi nitoring.	ng appropriate s	ensors for
	3. Interfacing diff	ferent types of Sensors with	n MCU.	
	4. Infer Wireless	Sensing, RF Sensing and RI	F MEMS.	
Course				
Content	Basics of			
Module 1	Sensors and Application Specific Sensors	Assignment	Problem Solving	12 Classes
Basics of Sens	ors: Introduction	- Sensor Vs Transducer,	Nature of Sensor	rs, Sensor
Output Charact	teristics, Sensing T	echnologies, Digital Outpu	t Sensors.	
Application Sp - capacitive d phototransistor thermos-resistiv	ecific Sensors: Oc etectors- optical – photoresistorCo ve sensors – therm	cupancy and motion detector presence sensor, Light E CD and CMOS image sens oelectric contact sensor.	ors: ultrasonic – n Detectors: Photo sors, Temperatur	nicrowave diodes – e Sensors:
Module 2	Sensor with Microcontroller	Assignment	Problem Solving	11 Classes
Sensor with M Integrated Sign Interface, Techr	licrocontroller: In al Conditioning, I niques and System	troduction, Amplification Digital Conversion, MCU s Considerations, Sensor In	and Signal Con Control, MCUs f tegration.	iditioning, for Sensor
Module 3	Wireless Sensing	Assignment	Problem Solving	12 Classes
Wireless Sensi Industrial Wire System Conside	ng: Wireless Data eless Sensing Netw eration.	a and Communications, W works, RF Sensing, Teleme	Vireless Sensing E etry, RF MEMS,	Networks, Complete

	Smart			
Module 4	Applications and System	Assignment	Problem Solving	10 Classes

Smart Applications and System Requirements: Automotive Applications, Industrial (Robotic) Applications, Consumer Applications, Future Sensor Plus Semiconductor Capabilities, Future System Requirements.

Targeted Application & Tools that can be used:

Text Book

1. Frank, Randy, "Understanding smart sensors", Artech House integrated microsystems series, 3rd Edition, 2013.

2. Jacob Fraden, "Handbook of Modern Sensors: Physics, Designs, and Applications", 5th Edition, Springer, 2016.

References

R1. Vlasios Tsiatsis, Stamatis Karnouskos, Jan Holler, David Boyle, Catherine Mulligan, "Internet of Things: Technologies and Applications for a New Age of Intelligence", Academic Press, 16- Nov- 2018.

R2. Henry Leung, Subhas Chandra Mukhopadhyay, "Intelligent Environmental Sensing", Springer, 22-Jan-2015.

Web Resources:

W1.https://www.sciencedirect.com/topics/engineering/smart-sensors

W2. https://www.azosensors.com/article.aspx?ArticleID=1289

Topics relevant to "SKILL DEVELOPMENT":

Intelligent Sensor and System for **Skill development** through **Participative Learning t**echniques. This is attained through the assessment component mentioned in the course handout.

Course Code: CIT3402	Course Title: IoT Architecture and Protocol Type of Course: Theory & Integrated Laboratory	L-T-P- C	2	0	2	3
Version No.						
Course Pre- requisites	DCCN					
Anti- requisites	NIL					

Course Description	The IoT Architecture and Protocols course provides a comprehensive understanding of the layered architecture of IoT systems, including perception, network, edge, and application layers. It covers key IoT communication protocols such as UPnP, CoAP, MQTT, XMPP. SCADA, Web Socket, IP-based Protocols: 6LoWPAN, RPL; Authentication Protocols; IEEE 802.15.4. The course also explores IoT data flow, interoperability challenges, security considerations, and real-world use cases in smart cities, healthcare, and industrial automation, equipping learners with the knowledge to design and implement efficient and secure IoT solutions.						
Course Objective	The objective concepts of I through Probl	The objective of the course is to familiarize the learners with the concepts of IoT Architecture and Protocol and attain Employability through Problem Solving Methodologies.					
Course Out	On successful	completion of the course th	e students shall be	able to:			
Comes	1. Compreher	nd the essentials of IoT and	its applications				
	2. Explain the Reference Arc	e concepts of IoT Architectu hitecture	are Reference mod	el and IoT			
	3. Analyse var	rious IoT Application layer	Protocols.				
	4. Apply IP ba	ased protocols for IoT based	systems.				
Course Content							
Module 1	Introduction and IoT Reference Model	Assignment	Problem Solving	8 sessions			
Introduction to	IOT, Applicatio	ons of IOT, Use cases of IOT	1				
IoT Reference Model: Domain, information, functional and communication models. Amazon Web Services for IoT: Amazon EC2, Amazon Auto Scaling, Amazon S3, Amazon RDS, Amazon DynamoDB, Amazon Kinesis, Amazon SQS, Amazon EMR, SkyNet IoT Messaging Platform.							
Module 2	IoT Reference Architecture	Assignment	Problem Solving	8 sessions			
IoT Reference Architecture: Architecture, Functional, information, deployment and operation views, SOA based Architecture, API-based Architecture, OPENIoT Architecture for IoT/Cloud Convergence.							

Module 3	Application Protocols for IoT	Assignment	Problem Solving	8 sessions
----------	-------------------------------------	------------	-----------------	---------------

Application Probased Protocols	otocols for IoT: s: 6LoWPAN, R	UPnP, CoAP, MQTT, XM PL; Authentication Protocol	PP. SCADA, Web S s; IEEE 802.15.4.	Socket, IP-
Module 4	Case study	Assignment	Problem Solving	06 Sessions
Case study: C Monitoring Sys	Cloud-Based Sr stem	nart-Facilities Managemen	it, Healthcare, En	vironment
Targeted Appl	ication & Tools	that can be used:		
Experiments	1. Execute Hel	lo world in cooja Simulator	[15 sessions	s]
	2. Study of 6L	oWPAN protocol		
	3. Analysis of	CoAP Mesh Network		
	4. Study of HT	TP Protocol		
	5. Testing MQ IoT based topo	TT based IoT based Protocc plogies on MQTT topologies	ol or Experimental s	tudy of
	6. Simulation	of Bluetooth Low Energy an	d Zigbee Smart Ene	ergy
Text Book				
1. Bassi, Alessa	andro, et al, "En	abling things to talk", Sprin	ger-Verlag Berlin A	.n, 2016.
2. David Hanes "IoT Fundamer Internet of Thir	s, Gonzalo Salgu ntals: Networkin ngs", CISCO Pre	ieiro, Patrick Grossetete, Ro ng Technologies, Protocols, ess, 2017	bert Barton, Jerome and Use Cases for t	Henry, he
3. Vijay Madise 1st Edition, VP	etti and Arshdee T, 2014.	p Bagha, "Internet of Thing	s (A Hands-on- Ap	proach)",
References				
R1. Hersent, C Key applicatior	Olivier, David H ns and protocols	Boswarthick, and Omar Ello ", John Wiley & Sons, 2011.	oumi. "The internet	of things:
R2. Bunya, Rajk paradigms", El	kumar, and Am sevier, 2016.	ir Vahid Dastjerdi, eds "Inte	ernet of Things:Prin	ciples and
Web Resources	5:			
W1. https://	www.slideshar	e.net/slideshow/unit-vpdf-	-258200283/2582002	283
Topics relevan	t to "SKILL DE	VELOPMENT":		
IoT Architectur Methodologies course handout	e and Protocols <mark>.</mark> This is attaine t.	for Employability throug l d through the assessment co	n Problem Solving omponent mentione	ed in the

Course	Course Title: Embe	edded Systems For IoT						
Code:		-		L-T-	3	0	0	З
	Type of Course: Tl	neory		P-C	5	0	0	5
CIT3403								
Version No.								
Course Pre- requisites	Innovative Projects	Using Arduino						
Anti-	NIL							
requisites								
Course Description	This course provides an in-depth understanding of embedded systems and the Internet of Things (IoT), focusing on hardware architecture, programming, and real-world applications. Students will learn about microcontrollers, interfacing techniques, and embedded C programming. The course covers IoT concepts, including communication protocols, data acquisition, and cloud integration. Practical lab sessions will enable students to develop and implement IoT-based applications using platforms like Arduino and Raspberry Pi. By the end of the course, students will be able to design, build, and deploy smart embedded systems for applications in home automation, healthcare agriculture and industrial IoT							
Course	The objective of the	course is to familiarize the l	earn	ers witl	h th	eco	nce	nts
Objective	of Embedded Syste	m for IoT and attain Emplo	vabi	lity thro)110	h <mark>P</mark> 1	obl	em
	Solving Methodolog	zies.	J	- J	0			
Course Out	On successful comp	oletion of the course the stud	dent	s shall l	be a	ble	to:	
Comes	1. To learn the inter processor.	rnal architecture and progra	amm	ning of	an e	emb	edc	led
	2. To introduce inte	rfacing I/O devices to the p	proce	essor.				
	3. To introduce the	evolution of the Internet of	Thir	ngs (IoT	[•]).			
	4. To build a sn Arduino/Raspberry	nall low-cost embedded yPi/ openplatform.	and	IoT s	syst	em	us	ing
Course Content								
Module 1	8-BIT EMBEDDED PROCESSOR and EMBEDDED C PROGRAMMING	Assignment	Pro So	oblem olving		ses	10 sio	ns
Microcontrolle	r - Architecture - l	Instruction Set and Progra	amm	ing – I	Prog	grai	nm	ing
Parallel Ports -	Timers and Serial Po	ort – Interrupt Handling.		0	Ċ	ر		0
EMBEDDED	C PROGRAMMING	G: Memory And I/O	De	vices 1	Inte	rfac	ing	-
Programming Embedded Systems in C – Need For RTOS – Multiple Tasks and Processes								
- Context Switching - Priority Based Scheduling Policies								

Module 2	IOT AND ARDUINO PROGRAMMIN	Assignment	Problem Solving	10 sessions				
Introduction to Configurations Arduino Toolc From Pins Usin Actuators with	o the Concept of Io s – Basic Componen hain – Arduino Prog ng Sketches – Introdu Arduino.	T Devices – IoT Devices ts – Introduction to Ardu ramming Structure – Sketc action to Arduino Shields –	Versus Compu ino – Types of hes – Pins – Inpu Integration of Se	ters – IoT Arduino– at/Output ensors and				
Module 3	IoT Communication And Open Platforms	Assignment	Problem Solving	06 sessions				
IoT Communie WiFi – ZigBee- – Programmin Using GPIO Pi	IoT Communication Models and APIs – IoT Communication Protocols – Bluetooth – WiFi – ZigBee– GPS – GSM modules – Open Platform (like Raspberry Pi) – Architecture – Programming –Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins –Connecting to the Cloud.							
Module 4	APPLICATIONS DEVELOPMENT	Assignment	Problem Solving	04 sessions				
Complete Design of Embedded Systems – Development of IoT Applications – Home Automation –Smart Agriculture – Smart Cities – Smart Healthcare								
Targeted App	lication & Tools that	can be used:						
 Muhammad Ali Mazidi, Janice Gillispie Mazidi, and Rolin D. McKinlay – <i>The 8051 Microcontroller and Embedded Systems Using Assembly and C</i> (2nd Edition, Pearson) Raj Kamal – Internet of Things: Architecture and Design Principles (McGraw Hill) Jonathan Valvano – Embedded Systems: Introduction to ARM Cortex-M Microcontrollers (CreateSpace) Michael Margolis – Arduino Cookbook (O'Reilly Media) Simon Monk – Programming the Raspberry Pi: Getting Started with Python (McGraw Hill) 								
References								
R1. David E. Simon – An Embedded Software Primer (Pearson)								
R2. Frank Vahid and Tony Givargis – Embedded System Design: A Unified Hardware/Software Introduction (Wiley)								
R3. Adrian McEwen & Hakim Cassimally - Designing the Internet of Things (Wiley)								
R4. Pethuru Ra Platforms, and	ij & Anupama Rama Use Cases (CRC Pre	n – The Internet of Things: ss)	Enabling Techn	ologies,				
R5. Daniel Minoli – Building the Internet of Things with IPv6 and MIPv6: The Evolving								

R5. Daniel Minoli – Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications (Wiley)

Web Based Resources and E-books:

W1. https://archive.nptel.ac.in/courses/108/102/108102169/

W2. https://archive.nptel.ac.in/courses/106/105/106105193/

W3. https://www.coursera.org/learn/iot

W4. <u>https://www.edx.org/course/collaborative-data-science-for-healthcare</u>

W4. <u>https://ocw.mit.edu/courses/6-087-practical-programming-in-c-january-iap-2010/</u>

Topics relevant to "SKILL DEVELOPMENT":

Embedded System for **Employability through Problem Solving Methodologies.** This is attained through the assessment component mentioned in the course handout.

Course Code:	Course Title: IoT System Design and						
	Development	L-T-	З	0	0	З	
CIT3404		P-C	5	0	0	5	
	Type of Course: Theory						
Version No.							
Course Pre-	Innovative Projects using Aurdino						
requisites							
Anti-	NIL						
requisites							
Course	The Lat System Design and Development	CO11#00	nro	wid	00	2	
Description	and Development	itosturo	pro h		les	a	
	comprehensive understanding of IoI architecture, hardware						
	components, communication protocols, data management, and real-						
	world applications. Students will gain hands-on experience with						
	embedded platforms like Arduino, Raspberry Pi, and Jetson Nano,						
	integrating sensors, actuators, and microcontrollers for IoT solutions.						
	The course covers Wi-Fi, Bluetooth, LPWAN, and CoAP protocols,						
	along with IoT data storage, analytics, and visual	ization. I	lear	ner	s w	rill	
	explore IoT applications in smart homes, healthcare, agriculture.						
	industrial automation, and smart cities, while addressing design						
	challenges security concerns and emerging technologies such as AloT						
	Blockchain and 5G integration. Through participative learning and						
	problem-solving activities students will develop practical skills to						
	design and implement IoT driven smart application	p prucu	cui	5111	110	10	
	design and implement for-driven smart application	0115.					
Course	The objective of the course is to familiarize the	ne learne	ers	wit	h t	he	
Objective	concepts of IoT system Design and Development and attain						
	Employability through Problem Solving Methodo	logies.					
Course Out	On successful completion of the course the studer	te chall 1		bla	to		
Comes	On succession completion of the course the students shall be able to:						
Comes	1. Understand the basic concepts, principles and c	hallenge	s in	Ю	Γ.		
		0					

4. Apply IoT for developing real life applications using Arduino programming.Course ContentIntroduction to Internet of Things (IoT) and Hardware for IoTProblem Solving11 ClassesModule 1Introduction to Internet of Things (IoT): and Hardware for IoTAssignment IoT: Vision, Definition, IoT architecture: Layers and protocols, technology behind IoT, Sources of the IoT, M2M Communication, IoT Examples. Sensing, Actuation. IoT communication models: Device-to-device, device- tocloud, device-to-gateway, Challenges and opportunities in IoTHardware for IoT: Sensors, Digital sensors, actuators, radio frequency identification (RFID) technology, microcontrollers, and single-board computers, Embedded Platforms for IoT: Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, Raspberry pi, Jetson nano Beagle Bone, and Intel Galileo boards11 ClassesModule 2IoT Protocols and Arduino BenorrammingAssignmentProblem Solving11 Classes						
Course ContentIntroduction to Internet of Things (IoT) and Hardware for IoTAssignmentProblem Solving11 ClassesIntroduction to Internet of Things (IoT): IoTAssignmentProblem Solving11 ClassesIntroduction to Internet of Things (IoT): Vision, Definition, IoT architecture: Layers and protocols, technology behind IoT, Sources of the IoT, M2M Communication, IoT Examples. Sensing, Actuation. IoT communication models: Device-to-device, device- tocloud, device-to-gateway, Challenges and opportunities in IoTHardware for IoT: Sensors, Digital sensors, actuators, radio frequency identification (RFID) technology, microcontrollers, and single-board computers, Embedded Platforms for IoT: Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, Raspberry pi, Jetson nano Beagle Bone, and Intel Galileo boards11 ClassesModule 2IoT Protocols and Arduino ProgrammingAssignmentProblem Solving11 Classes						
Module 1Introduction to Internet of Things (IoT) and Hardware for IoTAssignmentProblem Solving11 ClassesIntroduction to Internet of Things (IoT): IoTIoTSolving11 ClassesIntroduction to Internet of Things (IoT): Vision, Definition, IoT architecture: Law LawLaw Law11 ClassesIntroduction to Internet of Things (IoT): Vision, Definition, IoT architecture: Law LawLaw LawLaw LawIntroduction to Internet of Things (IoT): Vision, Definition, IoT architecture: Law L						
Introduction to Internet of Things (IoT): Vision, Definition, IoT architecture: Layers and protocols, technology behind IoT, Sources of the IoT, M2M Communication, IoT Examples. Sensing, Actuation. IoT communication models: Device-to-device, device- tocloud, device-to-gateway, Challenges and opportunities in IoTHardware for IoT: Sensors, Digital sensors, actuators, radio frequency identification (RFID) technology, microcontrollers, and single-board computers, Embedded Platforms for IoT: Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, Raspberry pi, Jetson nano Beagle Bone, and Intel Galileo boardsModule 2IoT Protocols and Arduino BrogrammingAssignmentProblem Solving11 Classes						
protocols, technology behind IoT, Sources of the IoT, M2M Communication, IoT Examples. Sensing, Actuation. IoT communication models: Device-to-device, device- tocloud, device-to-gateway, Challenges and opportunities in IoTHardware for IoT: Sensors, Digital sensors, actuators, radio frequency identification (RFID) technology, microcontrollers, and single-board computers, Embedded Platforms for IoT: Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, Raspberry pi, Jetson nano Beagle Bone, and Intel Galileo boardsModule 2IoT Protocols and Arduino ProgrammingAssignmentProblem Solving11 Classes						
Examples. Sensing, Actuation. IoT communication models: Device-to-device, device- tocloud, device-to-gateway, Challenges and opportunities in IoTHardware for IoT: Sensors, Digital sensors, actuators, radio frequency identification (RFID) technology, microcontrollers, and single-board computers, Embedded Platforms for IoT: Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, Raspberry pi, Jetson nano Beagle Bone, and Intel Galileo boardsModule 2IoT Protocols and Arduino ProgrammingAssignmentProblem Solving11 Classes						
tocloud, device-to-gateway, Challenges and opportunities in IoTHardware for IoT: Sensors, Digital sensors, actuators, radio frequency identification (RFID) technology, microcontrollers, and single-board computers, Embedded Platforms for IoT: Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, Raspberry pi, Jetson nano Beagle Bone, and Intel Galileo boardsModule 2IoT Protocols and Arduino ProgrammingAssignmentProblem Solving11 Classes						
Hardware for IoT: Sensors, Digital sensors, actuators, radio frequency identification (RFID) technology, microcontrollers, and single-board computers, Embedded Platforms for IoT: Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, Raspberry pi, Jetson nano Beagle Bone, and Intel Galileo boardsModule 2IoT Protocols and Arduino ProgrammingAssignmentProblem Solving11 Classes						
Module 2IoT Protocols and ArduinoAssignmentProblem Solving11 Classes						
IoT Protocols and Arduino Programming: Wi-Fi, Bluetooth, CoAP, LPWAN protocol.						
Sensor Networks: Sensor deployment & Node discovery, Introduction to Arduino						
Programming: Arduino Platform Boards Anatomy, Arduino IDE, coding, using						
emulator, using libraries, additions in Arduino, programming the Arduino for IoT,						
Integration of Sensors and Actuators with Arduino						
IoT Data						
Module 3Management and AnalyticsAssignmentProblem Solving12 Classes						
I I I I I I I I I I I I I I I I I I I						
data storage, Cloud-based and local storage, Data preprocessing and analysis, Basics of						
analytics for IoT data, IoT dashboards, Visualization and interpretation of data, Role of						
machine learning and AI in IoT						
Challen ago in						
Module 4IoT Design challengesAssignmentProblem Solving11 Classes						
Challenges in IoT Design challenges: IoT applications: Smart homes, smart cities,						
healthcare, agriculture, Smart Metering, City Automation, Automotive Applications,						
home automation, smart cards, and industry, IoT and automation: Role in industrial IoT						
(IIoT), Emerging technologies: AIoT, Blockchain for IoT, and 5G integration IoT,						
Development Challenges, Security Challenges.						

Targeted Application & Tools that can be used:

Text Book

1. Olivier Hersent, David Boswarthick, Omar Elloumi "The Internet of Things key applications and protocols", willey.

References

R1. Jeeva Jose, Internet of Things, Khanna Publishing House.

R2. Michael Miller "The Internet of Things" by Pearson.

R3. Raj Kamal "INTERNET OF THINGS", McGraw-Hill, 1ST Edition, 2016.

R4. Arshdeep Bahga, Vijay Madisetti "Internet of Things (A hands on approach)" 1ST edition, VPI publications,2014.

R5. Adrian McEwen, Hakin Cassimally "Designing the Internet of Things" Wiley India.

Web Based Resources and E-books:

W1. <u>https://avigna.ai/what-are-protocols-in-iot-a-guide-to-communication-</u> <u>standards-for-smart-devices/</u>

W2. https://www.arduino.cc/en/Guide

W3. <u>https://www.startertutorials.com/blog/wireless-protocols-for-iot.html</u>

W4. <u>https://www.edx.org/course/collaborative-data-science-for-healthcare</u>

Topics relevant to "SKILL DEVELOPMENT":

IoT System Design and Development for **Employability through Problem Solving Methodologies**. This is attained through the assessment component mentioned in the course handout.

Course Code: CIT3405	Course Title: Edge and Fog Computing for IoT	L-T- P-C	3	0	0	3
Version No.						
Course Pre- requisites	Fog Computing for IoT					
Anti- requisites	NIL					

Course Description	This course explores the concepts, architecture, and technologies behind Edge and Fog Computing as essential components of modern Internet of Things (IoT) ecosystems. Students will learn how these paradigms address the limitations of cloud computing by bringing computation closer to data sources, thus enabling low latency, bandwidth efficiency, and real-time decision-making. Topics include distributed processing, resource management, latency optimization, security, and real-world applications across domains such as smart cities, healthcare, industrial IoT (IIoT), and autonomous systems.				
Course Objective	The objective of the course is to familiarize the learners with the concepts of Edge and Fog Computing for IoT and attain Skill Development through Participative Learning techniques				
Course Out	On successful completion of the course the students shall be able to:				
Comes	 Explore technologies behind the communication and management of fogs and edge resources. 				
	2. Learn the techniques for storage and computation in fogs, edges, 5G and clouds.				
	3. Implement Internet of Everything (IoE) applications through fog computing architecture and use optimization techniques for the same.				
	4. Analyze the performance and issues of the applications developed using fog and edge architecture.				
Course					
Content	T A A A				
Module 1	Internet of Things (IoT) and New Computing Paradigms and Challenges in Federating Edge Resources	Assignment	Problem Solving	12 Classes	
Internet of Th	nings (IoT) and	New Computing Parad	igms: Introductio	n - Relevant	
Technologies - Fog and Edge Computing Completing the Cloud - Hierarchy of Fog and Edge Computing - Business Models – Edge Computing Platforms - Opportunities and Challenges					
Challenges in Federating Edge Resources: Introduction - Methodology - Integrated C2F2T Literature by Modeling Technique - Integrated C2F2T Literature by Use - Case Scenarios - Integrated C2F2T Literature by Metrics – Threads - Standards					
Module 2	Orchestration of Network Slices in Fog, Edge, and Clouds and Optimization Problems in	Assignment	Problem Solvin	g 12 Classes	
Fog and					
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Edge					
computing					

Orchestration of Network Slices in Fog, Edge, and Clouds: Introduction – Background - Network Slicing - Network Slicing in Software-Defined CloudsNetwork Slicing Management in Edge and Fog - Internet of Vehicles (IoV): Architecture, Protocols and Seven-layer security model architecture for Internet of Vehicles - IoV: Network Models, Challenges and future aspects

Optimization Problems in Fog and Edge Computing: Preliminaries - The Case for Optimization in Fog Computing-Formal Modeling Framework for Fog Computing – Metrics - Further Quality Attributes - Optimization Opportunities along the Fog Architecture - Optimization Opportunities along the Service Life Cycle - Toward a Taxonomy of Optimization Problems in Fog Computing

Module 3	Middleware for Fog and Edge Computing and Technologies in Fog Computing	Assignment	Problem Solving	8 Classes

Middleware for Fog and Edge Computing: Need for Fog and Edge Computing Middleware - Design Goals-State-of-the-Art Middleware Infrastructures - System Model - Case Study.

Technologies in Fog Computing: Fog Data Management - Smart Building - Predictive Analysis with FogTorch - Machine Learning in Fog Computing - Data Analytics in the Fog - Data Analytics in the Fog Architecture.

Module 4	Applications of Fog and Edge Computing	Assignment	Problem Solving	8 Classes

Exploiting Fog Computing in Health Monitoring-Smart Surveillance Video Stream Processing at the Edge for Real - Time Human Objects Tracking-Fog Computing Model for Evolving Smart Transportation Applications - Testing Perspectives of Fog - Based IoT Applications - Legal Aspects of Operating IoT Applications in the Fog

Targeted Application & Tools that can be used:

Text Book

1. Buyya, Rajkumar, and Satish Narayana Srirama, Fog and Edge computing: Principles and Paradigms, 2019, 1st edition, John Wiley & Sons, USA.

References

R1. Bahga, Arshdeep, and Vijay Madisetti, Cloud computing: A hands-on approach, 2014, 2 ndedition, CreateSpace Independent Publishing Platform, USA.

R2. OvidiuVermesan, Peter Friess, "Internet of Things – From Research and Innovation to Market Deployment", 2014, 1st edition, River Publishers, India.

Web Based Resources and E-books:

W1. https://www.cisco.com/c/en/us/solutions/internet-of-things/fog-computing.html

W2. <u>https://www.fogcomputingconsortium.org/architecture/</u>

W3. https://www.technologyreview.com/2015/03/17/247693/fog-computing/

W4. https://www.etsi.org/technologies/multi-access-edge-computing

Topics relevant to "SKILL DEVELOPMENT":

Edge and Fog computing for IOT for **Skill development** through **Participative Learning** techniques. This is attained through the assessment component mentioned in the course handout.

Course Code:	Course Title: Cloud Computing for IOT	L-T-						
		P-C	3	0	0	3		
CIT3406	Type of Course: Theory	• •						
Version No.								
Course Pre-								
requisites								
Anti-	NIL							
requisites								
Course Description	This course offers a comprehensive introduction to the Internet Things (IoT) and Cloud Computing, focusing on key conce- technologies, and hands-on experience. The course starts we understanding the fundamentals of IoT, including its components Arduino architecture, sensors, and actuators. Students will explore communication protocols, networking using the ESP8266 We module, and cloud integration for data storage and processing. course will provide an overview of cloud platforms such as A Microsoft Azure, and Google Cloud Platform. Additionally, stud- will delve deeper into cloud services, with a focus on AWS architect compute, and storage services. By the end of the course, students have a solid understanding of designing IoT systems and integra them with cloud platforms for data management and analytics.							
Course Objective	The objective of the course is to familiarize the concepts of Cloud Computing for IoT and a through Problem Solving Methodologies	ne learne ttain <mark>E</mark> i	ers <mark>mpl</mark>	witl <mark>oya</mark>	h t <mark>bil</mark>	he <mark>ity</mark>		
Course Out	On successful completion of the course the studer	nts shall l	oe a	ble	to:			
Comes	1. Understand the fundamental concepts of IoT and how sensors and actuators work with Arduino.							
	2. Understand cloud computing and how to mana data on cloud platforms.	ge, store,	ano	d pr	'OC€	ess		
	3.Work with major cloud platforms such as An (AWS), Microsoft Azure, and Google Cloud Platfo	nazon W orm.	Veb	Sei	vic	es		

	4. Understand the core architecture of AWS and its services such as Lambda, EC2, and S3 for building and scaling cloud-based IoT applications.						
Course Content							
Module 1	Introduction of IoT	Assignment	Problem Solving	12 Classes			
Introduction of Simulation Env Arduino and Ov	IoT Introductio rironment. Ardu verview of Senso	n to IoT. Understanding ino Uno Architecture, and rs working.	loT fundamentals, l Sensor & Actua	Arduino tors with			
Module 2	Updation in IoT Systems	Assignment	Problem Solving	11 Classes			
Updation in Io Wireless Netwo minor projects.	Updation in IoT Systems Basic Networking with ESP8266 WiFi module. Basics of Wireless Networking, IoT Protocols, and Cloud Platforms for IOT with some real live minor projects.						
Module 3	Cloud Computing	Assignment	Problem Solving	12 Classes			
Cloud Comput networks of the Introduction to Cloud Platform	Cloud Computing: Introduction, Management, storage and processing of data on networks of the internet server, and On-demand IT resources over the internet etc. Introduction to platforms such as Amazon Web Services, Microsoft Azure and Google Cloud Platform.						
Module 4	Advancement in Cloud Computing	Assignment	Problem Solving	10 Classes			
Advancement in Cloud Computing: Brief on AWS Architecture and different models of Cloud Computing. Compute Services: AWS Lambda, Elastic Beanstalk, AWS EC2, Auto Scaling, and Load Balancing. Storage Services: Amazon EBS, Amazon S3, Amazon EFS, Amazon Glacier, Amazon Global Accelerator, Amazon FSx, and Storage Gateway							
Targeted Appli	cation & Tools t	hat can be used:					
 Text Book Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547 2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759 3. Raspberry Pi Cookbook, Software and Hardware Problems and solutions, Simon Monk, O'Reilly (SPD), 2016, ISBN 7989352133895 							

References

R1. Peter Waher, 'Learning Internet of Things', Packt Publishing, 2015 3. Editors Ovidiu Vermesan

R2. Peter Friess, 'Internet of Things – From Research and Innovation to Market Deployment', River Publishers, 2014

R3. N. Ida, Sensors, Actuators and Their Interfaces, SciTech Publishers, 2014**Web Based Resources and E-books:**

W1.https://www.coursera.org/learn/iot-wireless-cloud-computing

W2. <u>https://www.edx.org/learn/amazon-web-services-aws/amazon-web-services-aws-iot-developing-and-deploying-an-internet-of-things</u>

Topics relevant to "SKILL DEVELOPMENT":

Cloud Computing for **Skill development** through **Participative Learning** techniques. This is attained through the assessment component mentioned in the course handout.

Course Code:	Course Title: IOT Data Analytics and					
CIT3407	Machine Learning	L-T- P-C	3	0	0	3
	Type of Course: Theory					
Version No.						
Course Pre- requisites	Essentials of AI					
Anti- requisites	NIL					
Course Description	This course provides an in-depth understanding machine learning techniques for IoT applic explore how IoT devices generate data, metho processing, and real-time analytics. The cou analysis, feature engineering, and predictive mo learning techniques tailored for IoT enviror students will learn about edge and cloud-base decision-making, and anomaly detection for efficiency.	g of data ations. S ds for da urse cove odeling u uments. d analyti or IoT s	ana Stud ita c ers sing Adc cs, secu	lyti lent sta g ma ditio AI-o urity	cs a s v ectio tisti achi onal driv z a	nd vill on, cal ine lly, ven ind
Course Objective	The objective of the course is to familiarize concepts of IOT Data Analytics and Machine Le Development through Participative Learning te	the learr arning ar <mark>chniques</mark>	ners nd a	wi ittai	th 1 n <mark>Sl</mark>	the <mark>kill</mark>

Course Out	On successful	l completion of the course t	he students shall b	be able to:			
Comes	1. Understand	. Understand the fundamentals of IoT Analytics and Challenges					
	2. Understand	2. Understand and analyze IoT Devices and Networking Protocols					
	3. Understand	3. Understand exploring and visualizing data					
	4.Apply IoT An	alytics for the Cloud					
Course							
Content							
Module 1	Analytics and Challenges and IoT Devices and Networking Protocols	Assignment	Problem Solving	12 Classes			
Defining IoT Ana introduction to a	alytics and Chal nalytics, loT ana	lenges: Introduction to IoT, lytics challenges	applications, IoT a	rchitectures,			
IoT Devices and Networking Protocols: IoT devices, Networking basics, IoT networking connectivity protocols, IoT networking data messaging protocols, Analyzing data to infer protocol and device characteristics.							
Module 2	Exploring IoT Data	Assignment	Problem Solving	12 Classes			
Exploring IoT Data: Exploring and visualizing data, Techniques to understand data quality, Basic time series analysis, Statistical analysis.							
Module 3	Data Science for IoT Analytics	Assignment	Problem Solving	8 Classes			
Data Science for IoT Analytics: Introduction to Machine Learning, Feature engineering with IoT data, Validation methods, Understanding the bias–variance tradeoff, Use cases for deep learning with IoT data.							
Module 4	ML in Industrial IoT	Assignment	Problem Solving	8 Classes			
ML in Industrial Introduction, Ma Management wit	IoT Big Data chine Learning a h Hadoop.	Analytics and Software Defi nd Data Science - Part I, Part I	ned Networks: IIoT I, R and Julia Progra	Analytics - mming, Data			
Targeted Application & Tools that can be used:							

Text Book

1. Minteer, Andrew, Analytics for the Internet of Things (IoT), Packt Publishing Ltd. July 2017, ISBN 9781787120730.

References

1. Kai Hwang, Min Chen, Big-Data Analytics for Cloud, IoT and Cognitive Computing, Wiley.

2. Hwaiyu Geng, Internet of Things and Data Analytics Handbook, Wiley.

3. John Soldatos, Building Blocks for IoT Analytics Internet-of-Things Analytics, River Publishers Gerardus Blokdyk.

4. IoT Analytics A Complete Guide, 5starcooks

Web Based Resources and E-books:

W1: Coursera - IoT Data Analytics & Machine Learning

W2: Udacity – AI for IoT

W3: edX – Data Analytics for IoT

Topics relevant to "SKILL DEVELOPMENT":

Industrial and Medical IOT for **Skill development** through **Participative Learning** techniques. This is attained through the assessment component mentioned in the course handout.

Course Code:	Course Title: Digital Twin and Simulation in IoT	L-T-P- C	3	0	0	3
CIT3408	Type of Course: Theory					
Version No.						
Course Pre- requisites	Cryptography and Network Security					
Anti- requisites	NIL					
Course Description	This course covers the foundations and advar of Things (IoT), communication protocols, an Twins. It emphasizes the integration of IoT with such as edge computing, cloud computing, a data-driven insights in manufacturing, healt more. The course will also explore the ro automation, control systems, and process in world case studies and applications.	nced conce nd the de th emergin nd machin hcare, sm le of IoT ndustry, p	epts sign ng to ne l nart l'ir	of of ech cit cit ir vidi	Inter Dig nolog ning ies, idust ng r	rnet gital gies for and trial real-
Course Objective	The objective of the course is to familiarize the le of Wearable Technology and IOT and attain <mark>Sk</mark> Participative Learning techniques	earners wi <mark>ill Develo</mark>	ith t <mark>pm</mark>	he o <mark>ent</mark>	conce thro	epts ugh

Comes1. Enumerate different communication technologies used in Industry 4.0.2. Perform edge, and cloud computing and visualize the data 3. Introduce the concept of Digital Twins in manufacturing the industry 4. Design Digital Twins for discrete and process industriesCourse ContentProblem Solving12 ClassesIntroduction: The various industrial revolutions, digitalization, and the networked economy, drivers, enablers, comparison of industry 4.0 factory and today's factory, challenges. Communication Technologies of IIoT Communication Protocols: IEEE 802.15.4, ZigBee, Z. Wave, Bluetooth, BLE, NFC, RFID, Industry standards communication technology, wireless network.12 ClassesModule 2Visualization and Data Types of IIoT CommunicationAssignmentProblem Solving12 ClassesVisualization and Data Types of IIoT Communication and Data Types of IIoT Communication. Front-end EDGE devices, Emerging descriptive data standards for IIoT, Cloud database, Could computing, Fog/Edge computing, Pushing data to the cloud. Grabbing the content from a web page, Sending data on the web, Troubleshooting, Application of IIOT Case study: Health monitoring, smart city, Smart irrigation, Robot surveillance.12 ClassesModule 3Design of Digital TwinsAssignmentProblem Solving12 ClassesDesign of Digital Twins for Prototype, Product, and Performance.10 Classes12 Classes	Comes 1 4 2 3 4 Course Content 1 Module 1 Introduction: The conomy, driver challenges. Com 802.15.4, ZigBer communication 4 Modbus and Pro Module 2 4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	 Enumerate dif 4.0. Perform edge, a Introduce the c Introduce the c Design Digital ntroduction he various indus rs, enablers, communication Tec ee, Z Wave, B technology (LoR ofibus technology Visualization 	ferent communication tech and cloud computing and oncept of Digital Twins in Twins for discrete and pro Assignment Strial revolutions, digitalized parison of industry 4.0 fection chnologies of IIoT Comm Suetooth, BLE, NFC, F A, WAN, OPC UA, MQT c, wireless network.	hnologies used visualize the dat manufacturing t cess industries Problem Solving zation, and the actory and toda nunication Proto RFID, Industry T), connecting in	in Industry ta the industry 12 Classes networked ty's factory, ocols: IEEE standards nto existing			
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Module 4Digital Twins validationAssignmentProblem Solving10 Classes	Design of Digi identification, M ML/DL models.	ital Twins: Tecl Model creation. Digital twins for	hnological needs. Physic Data- driven approach: D Prototype, Product, and P	s-based approa Model develop Performance.	ach: Model ment using			
	Module 4	Digital Twins validation	Assignment	Problem Solving	10 Classes			
Digital Twins validation. Control system requirements in a Discrete Industry, Digital Twins of a Product, Digital Thread in a Discrete Industry, Data Collection & Analysis for Product & production improvements, Automation Simulation, and Digital Enterprise. Process Industry: Basics of Process Industry, Trends in the process industry, control system requirements in a process industry, Digital Twins of a plant, Digital Thread in Process Industry								
	Targeted Applic	ss Industry.	Targeted Application & Tools that can be used:					

Text Book

- 1. Bruno Sergi, Elena G.Popkova, Aleksei V. Bogoviz and Tatiana N. Litvinova, "Understanding Industry 4.0: AI, The internet of things, and the future of work", Emerald publishing limited, 2019.
- 2. Alp Ustundag and Emre Cevikcan, "Industry 0: Managing the Digital Transformation", Springer Series in Advanced Manufacturing., Switzerland, 2017.

References

R1. Andrew Yeh Chris Nee, Fei Tao, and Meng Zhang, "Digital Twin Driven Smart Manufacturing", Elsevier Science., United States, 2019.

R2. Shyam Varan Nath, Pieter van Schalkwyk, Dan Isaacs, "Building Industrial Digital Twins Design, Develop, and Deploy Digital Twin Solutions for Real-world Industries Using Azure Digital Twins", Packt Publishing, 2021.

Web Based Resources and E-books:

W1.https://docs.oracle.com/en/cloud/paas/iot-cloud/iotgs/iot-digital-twin-framework.html

W2. https://www.cumulocity.com/resource-library/what-are-iot-digital-twins/

W3. https://www.ptc.com/en/blogs/corporate/iot-digital-twin

Topics relevant to "SKILL DEVELOPMENT":

IIoT, Digital Twin and IEEE802.15.4 for Skill development through Participative Learning techniques. This is attained through the assessment component mentioned in the course handout.

Course Code: CIT3409	Course Title: Autonomous System & Robotics with IOT	L-T-P- C	3	0	0	3
X7 • NT	Type of Course: Theory	l				
Version No.						
Course Pre- requisites	Cloud Computing					
Anti-	NIL					
requisites						
Course Description	Robotics and IoT are converging to create intersystems that enhance efficiency across industries healthcare, manufacturing, and transportation. sensors, cloud computing, AI, and machine perceive, analyze, and act in real time, enabling a warehouses, autonomous vehicles, precision f healthcare. IoT-driven robotics allows for repredictive maintenance, and adaptive decisis systems more efficient and responsive.	elligent, s such as By inte learning, pplication arming, eal-time ion-maki	auto agra ro ns li and mo ng,	ono: ricu ting bots ike s ike s ike s ike s mito mito	mo ltur g Io s ca sma emo orin akir	us re, oT an art ote ng, ng

Course Objective	The objective concepts of Au Development	The objective of the course is to familiarize the learners with the concepts of Autonomous System and Robotics with IoT and attain <mark>Skill Development</mark> through <mark>Participative Learning techniques</mark>				
Course Out Comes	On successful 1. Understand 2. Analyze IoT 3. Apply IoT in 4. Implement 0	On successful completion of the course the students shall be able to: 1. Understand IoT ecosystem in robotic paradigm 2. Analyze IoT infrastructure and develop IoRT applications 3. Apply IoT in robotics over different platforms 4. Implement Cloud robotics in automations				
Course Content						
Module 1	Introduction to IoT and Vision systems and Robotic Sensors	Assignment	Problem Solving	12 Classes		
 Introduction to IoT and Vision systems: History and evolution of IoT, AI, ML, Machine Vision, optoelectronic sensors, 3D & 2D machine vision technologies, robot navigation, control schemes, motion controllers, intelligent algorithms and vision systems. Robotic Sensors: Optical sensors and actuators; Mechanical sensors and actuators; Acoustic sensors and actuators: Performance characteristics of sensors and actuators 						
Module 2	ule 2Internet of Robotic ThingsAssignmentProblem Solving10 Classes					
Internet of Robotic Things: Communication architecture for IoRT; Decentralized and automated IoT infrastructure using Blockchain; IoRT Platforms Architecture, IoRT applications						
Module 3	Autonomous Vehicle Systems and Industrial Internet of Things	Assignment	Problem Solving	12 Classes		
Introduction to Operating Syste planning and co Driving.	Autonomous em (ROS) Overvi ontrol in autonom	Driving; Perception in A iew - Client Systems for Aut mous vehicle systems - Clou	utonomous Drivir tonomous Driving ad Platform for Au	ng; Robot - Decision tonomous		
Industrial Intern Standards and H	net of Things: II Frameworks; IIo	oT Architecture; IIoT Appli T security concerns.	cations and Challer	nges; IIoT		

Module 4	IoMT and Robotics in Healthcare and Cloud Robotics and Industrial Automation	Assignment	Problem Solving	11 Classes
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IoMT and Robotics in Healthcare: IoMT Driven connected healthcare, Efficient design for IoMT based healthcare design, Robotics in healthcare.

Cloud Robotics and Industrial Automation: Components of Cloud Robotics; Limitations and challenges of Cloud Robotics; Applications: Autonomous mobile robots, Cloud medical robots, Industrial robots

Targeted Application & Tools that can be used:

Text Book

1. Vermesan, Ovidiu, and Joël Bacquet, eds.,Cognitive Hyperconnected Digital Transformation: Internet of Things Intelligence Evolution, 1st edition, River Publishers, 2017.

2. A.K.Gupta, S.K.Arora, and J.Riescher, Industrial Automation and Robotics, 1st edition, Mercury Learning and Information LLC,2017

References

R1. A.K Dubey, A.Kumar, and S.R Kumar., AI and IoT-based Intelligent Automation in Robotics, 1st edition. Wiley, 2020

R2. A.E.Hassanien, N.Dey, and S.Borra, Medical Big Data and Internet of Medical Things: Advances, Challenges and Applications, 1st edition ,Taylor & Francis Group,2019

R3. S.Liu, L.Li and J.Tang, Creating Autonomous Vehicle Systems, Synthesis Lectures on Computer Science, 1st edition ,Morgan & Claypool,2018

R4. Nathan Ida, Sensors, Actuators, and Their Interfaces: A multidisciplinary introduction, 2nd edition The Institution of Engineering and Technology, 2017

Web Resources:

W1. https://www.iotforall.com/

W2. <u>https://www.iotforall.com/future-iot-robotics</u>

W3.https://www.iotforall.com/is-the-internet-of-robotic-things-the-future-ofmanufacturing

Topics relevant to "SKILL DEVELOPMENT":

Autonomous System and robotics for Skill development through Participative Learning techniques. This is attained through the assessment component mentioned in the course handout.

<u> </u>				-				1
Course Code:	Course Title:	Secure IoT		L-T-P-	3	0	0	3
CIT3410	Type of Cour	se: Theory		C				
Version No.								
Course Pre- requisites	Cryptography and Network Security							
Anti-	NIL							
requisites								
Course Description	This course is network secu skills necessa the rapidly gr	This course is ideal for those pursuing careers in IoT development, network security, and privacy management, providing them with the skills necessary to tackle the unique security challenges presented by the rapidly growing IoT ecosystem.						
Course Objective	The objective concepts of 1 through Partie	The objective of the course is to familiarize the learners with the concepts of IoT security and Privacy and attain Skill Development through Participative Learning techniques						
Course Out	On successful	completion of the course the	stude	nts shall	be a	ble	to:	
Comes	1. Identify of applications. 2 Internet of Th	1. Identify different Internet of Things technologies and their applications. 2. Assess the need for Privacy and security model for the Internet of Things.						
	3. Explore various Trust Model for IoT and customize real time data for IoT applications.							
	4. Design secu	4. Design security framework and solve IoT security issues						
Course Content								
Module 1	Security in IoT and Network Robustness and Malware Propagation Control in	Assignment	Pro So	oblem lving		Cla	8 sse	s
IoT security: Vi	ulnerabilities, A	Attacks and Countermeasures	s - Sec	urity Eng	rine	erin	lg f	or
IoT developmer	nt - IoT security	lifecycle			,		.9 -	
Network Robustness and Malware Propagation Control in IoT: Network Robustness - Fusion Based Defense Scheme - Sequential Defense Scheme - Location Certificate Based Scheme - Sybil node detection scheme - Formal Modeling and Verification -Sybil Attack Detection in Vehicular Networks - Performance evaluation of various Malware Dynamics Models - Analysis of Attack Vectors on Smart Home Systems.								
Module 2	Privacy Preservation in IoT and Privacy Protection	Assignment	Proble	em Solvir	ıg	Cl	9 ass	es

in IoT

Privacy Preservation in IoT: Privacy Preservation Data Dissemination: Network Model, Threat Model – Problem formulation and definition - Baseline data dissemination -Spatial Privacy Graph based data dissemination -Experiment Validation - Smart building concept-Privacy Threats in Smart Building - Privacy Preserving Approaches in Smart Building - Smart Meter Privacy Preserving Approaches.

Privacy Protection in IoT: Lightweight and Robust Schemes for Privacy Protection in IoT Applications: One Time Mask Scheme, One Time Permutation Scheme - Mobile Wireless Body Sensor Network - Participatory Sensing.

Module 3Trust Models for IoTAssignment	nt Problem Solving	12 Classes
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Trust Model Concepts - Public Key Infrastructures Architecture Components - Public Key Certificate Formats - Design Considerations for Digital Certificates - Public Key Reference Infrastructure for the IoT - Authentication in IoT - Computational Security for IoT

Module 4	Security Protocols for IoT Access Networks	Assignment	Problem Solving	08 Classes

Time Based Secure Key Generation -Security Access Algorithm: Unidirectional, Bidirectional Transmission - Cognitive Security - IoT Security Framework - Secure IoT Layers – Secure Communication Links in IoT - Secure Resource Management, Secure IoT Databases.

Targeted Application & Tools that can be used:

Text Book

1. Hu, Fei. Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations, 2016, 1st edition, CRC Press, USA.

References

R1. Russell, Brian and Drew Van Duren. Practical Internet of Things Security, 2016,1st edition, PACKT Publishing Ltd, UK

R2. Kim, S., Deka, G. C., & Zhang, P. (2019). Role of blockchain technology in IoT applications. Academic Press.

R3. Whitehouse O Security of things: An Implementers' guide to cyber security for internet of things devices and beyond, 2014, 1st edition, NCC Group, UK.

Web Based Resources and E-books:

W1. https://www.iotsecurityfoundation.org/

W2. https://owasp.org/www-project-internet-of-things/

W3. https://www.csail.mit.edu/research/internet-things

W4. https://www.nist.gov/programs-projects/cybersecurity-internet-things

Topics relevant to "SKILL DEVELOPMENT":

IOT Security and Privacy for **Skill development** through **Participative Learning** techniques. This is attained through the assessment component mentioned in the course handout.

Course	Course Title Io	T for boolth care and Was	rahla					
Code	Course Title: 10	I for healthcare and wea	rable	тт				
Code:	rechnology			L-1- P C	3	0	0	3
CIT3412	Type of Course	: Theory		1-C				
Version No.		-						
Course Pre- requisites	Data Communi	Data Communication and Network						
Anti- requisites	NIL							
Course Description	A course on Io context of the Ir of both, focusing the applications	A course on Iot for healthcare and wearable technology within the context of the Internet of Things (IoT) would explore the fundamentals of both, focusing on how wearable devices collect and transmit data, and the applications of this technology across various sectors						
Course Objective	The objective of of IoT for hea Development th	The objective of the course is to familiarize the learners with the concepts of IoT for healthcare and Wearable Technology and attain <mark>Skill</mark> Development through <mark>Participative Learning techniques</mark>						
Course Out	On successful co	ompletion of the course the	e stude	nts shall	l be	able	e to:	
Comes	1. To provide a b modules.	1. To provide a basic understanding of evolution of IoT and its functional modules.						
	2. To develop applications.	skillset to implement	IoT s	systems	for	(W	veara	ıble
	3. To identify th	e real world problem and	give Io	T solutio	ons.			
	4. To analyse ar the problem	nd select appropriate prot	cocols, v	wireless	tec	hnic	ques	for
Course Content								
Module 1	Role of IoT in wearable devices and IoT supported technologies: Internet/Web and networking basics	Assignment	Pro So	oblem lving		12	Clas	ses

Role of IoT in wearable devices: Smart connectivity and Big picture of IoT-smart devices, networks, Wireless technologies and need for data analysis. Evolution of wearable technology, Wearable IoT use cases- Smart watches, Android wear, Smart glasses, fitness trackers, health care devices, cameras, smart clothing etc

IoT supported technologies: Internet/Web and networking basics: OSI model, data transfer referred with OSI model, IP Addressing, point to point data transfer, point to multi point data transfer & network topologies, sub-nets, network topologies referred with web, introduction to web servers and cloud computing

Module 2	IoT supported technologies: Hardware platforms and Wireless communicatio n standards	Assignment	Problem Solving	12 Classes

IoT supported technologies: Hardware platforms: Overview of single board computers (Raspberry pi/Beagle bone black), ARM Cortex Processors, Arduino. Network Fundamentals: Overview and working principle of wired and wireless networking equipment's – router, switches, access points, and hubs. Networking configurations in Linux accessing hardware & device files interactions.

Wireless communication standards: Bluetooth - IEEE 802.15.1, Wireless LAN- IEEE 802.11(WiFi), Near Field communication, WiMaxIEEE 802.16, LR-WPAN- IEEE 802.15.4 (Zigbee), 6LoWPAN, mobile network, GPS

Module 3	IOT architecture:	Assignment	Problem Solving	10 Classes				
IoT functional requirements, building blocks, IoT architecture layers, cloud and fog								
based architect	ture, M2M – Mac	hine to Machine archited	ture, Web of Things,	physical				
layer, MAC lay	yer, 6LoWPAN se	curity aspects in IoT	Ũ					
5	-	J						
	IOT							
	Application			11				
Module 4	Development	Assignment	Problem Solving					
	1	0	0	Classes				

IoTApplication Protocols: MQTT, REST/HTTP, CoAP, MySQL Back-end ApplicationDesigning: Apache for handling HTTP Requests, PHP & MySQL for data processing,MongoDB Object type Database, HTML, CSS &jQuery for UI Designing, JSON lib fordata processing, Security & Privacy during development, Application Development formobile Platforms: Overview of Android / IOS App Development tools

Wearable IoT: Case studies – Health care, fitness and sports, industrial, defence and security, home automation, gaming, fashion and apparel

Targeted Application & Tools that can be used:

and Wearable

Text Book

 Alessandro Bassi, Martin Bauer, Martin Fiedler, Thorsten Kramp, Rob van Kranenburg, Sebastian Lange, Stefan Meissner, "Enabling things to talk – Designing IoT solutions with the IoT Architecture Reference Model", Springer Open, 2013

References

1. The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World 1st Edition

2. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, StamatisKarnouskos, Stefan Avesand, David Boyle, "From Machine to Machine to Internet of Things", Elsevier Publications, 2014.

3. IEEE Standards Association Working Group for an Architectural Framework for the Internet of Things (IoT) (P2413) - <u>http://grouper.ieee.org/groups/2413/</u>

4. Internet of Things – Architecture – Final Architectural Reference Model for the IoT v3.0, http://www.iot-a.eu/publi

Web Based Resources and E-books:

W1.<u>https://www.techtarget.com/searchmobilecomputing/definition/wearable-technology</u>

W2. https://www.investopedia.com/terms/w/wearable-technology.asp

Topics relevant to "SKILL DEVELOPMENT":

Wireless Communication Standards, Application protocols and wearable devices for Skill development through Participative Learning techniques. This is attained through the assessment component mentioned in the course handout.

Course Code:	Course Title: Industrial IOT	L-T-P- C	3	0	0	3	
Version No.							
Course Pre- requisites	DCCN						
Anti- requisites	NIL						
Course Description	The Industrial Internet of Things (IIoT) course ex of smart sensors, edge computing, and conn settings to enhance automation, efficiency, and making. It covers IIoT architecture, communicati challenges, real-world applications in manufa healthcare, and the role of AI and machine le maintenance. The course also delves into indus digital twins, and cybersecurity best pra	The Industrial Internet of Things (IIoT) course explores the integration of smart sensors, edge computing, and connectivity in industria settings to enhance automation, efficiency, and data-driven decision making. It covers IIoT architecture, communication protocols, securit challenges, real-world applications in manufacturing, energy, and healthcare, and the role of AI and machine learning in predictiv maintenance. The course also delves into industrial cloud platforms					

	comprehensiv smart factorie	ve understanding of IIoT's s.	impact on Industr	y 4.0 and	
Course Objective	The objective concepts of Participative l	of the course is to famil Industrial IoT and attain Learning techniques	iarize the learners <mark>Skill Developmen</mark>	with the <mark>t</mark> through	
Course Out	On successful	completion of the course th	e students shall be	able to:	
Comes	1. Identify the	Key opportunities and ben	efits in Industrial Io	оТ	
	2. Apply virtu IoT 3. Analyze system	al network to demonstrate industrial IoT Three tier top	the use of Cloud in pology and data ma	Industrial nagement	
	4. Summariz Protocols	e Legacy Industrial and	l Modern Comn	nunication	
Course Content					
Module 1	Introduction	Assignment	Problem Solving	12 Classes	
Introduction To Technologies- In Human Workfo Technical and B (CPS), – IP Mob Cloud and Fog -	 Industrial Ir Inovation and t rce - Logistics a Business Innova ility - Network Role of Big Da 	nternet and Use-Cases: In he IIoT -Key Opportunities a nd the Industrial Internet-IG tors of The Industrial Inter Virtualization - SDN (Softw nta in IIOT - Role of Machine	dustrial Internet- and Benefits - The I OT Innovations in I met: Cyber Physica vare Defined Netw e learning and AI ir	Key IIoT Digital and Retail. The al Systems orks)- The n IIOT	
Module 2	IIOT Reference Architecture	Assignment	Problem Solving	10 Classes	
IIOT Reference Industrial Interr System Characte	e Architecture: net Viewpoints eristics- Data M	Industrial Internet Archi Architectural Topology: T anagement- Advanced data	tecture Frameworl he Three Tier Topc analytics	k (IIAF) - ology- Key	
Module 3	Protocols for Industrial Internet Systems	Assignment	Problem Solving	12 Classes	
Protocols for Industrial Internet Systems: Legacy Industrial Protocols - Modern Communication Protocols-Proximity Network Communication Protocols- Wireless Communication Technologies- Gateways: industrial gateways - CoAP (Constrained Application Protocol)- NFC.					

	Middleware			
	Software			
Module 4	Patterns and	Assignment	Problem Solving	
	IIOT	_		Classes
	Platforms			

Middleware Software Patterns and IIOT Platforms: Publish/Subscribe Pattern: MQTT, XMPP, AMQP, DDS- Middleware Architecture- SigFoxLoRaWAN Augmented reality-Real-World Smart Factories, Application of IIOT: Case study: Health monitoring, IoT smart city, Smart irrigation, Robot surveillance

Targeted Application & Tools that can be used:

Text Book

1. Gilchrist, Alasdair, "Industry 4.0 The Industrial Internet of Things", Apress, 2017.

References

R1. Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat "Industrial Internet of Things: Cyber manufacturing Systems" (Springer), 2017.

R2. Zaigham Mahmood, "The Internet of Things in the Industrial Sector: Security and Device connectivity, smart environments and Industry 4.0 (Springer), 2019.

R3. Industrial IoT Challenges, Design Principles, Applications, and Security by Ismail Butun (editor)

R4. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-onApproach)", 1st Edition, VPT, 2014.

R5. Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer

R6. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 20132 Cuno Pfister, Getting Started with the Internet of Things, O "Reilly Media, 2011, ISBN: 978-1-4493-9357-1

Web Resources:

W1. https://www.coursera.org/learn/applied-industrial-internet-of-things

W2. <u>https://www.isa.org/training/course-description/dt101</u>

W3. https://www.coursera.org/certificates/iiot-boulder

Topics relevant to "SKILL DEVELOPMENT":

Industrial IOT for **Skill development** through **Participative Learning t**echniques. This is attained through the assessment component mentioned in the course handout.

Course Code: CIT3414	Course Title: IOT Data Analytics and Machine Learning Type of Course: Theory	L-T- P-C	3	0	0	3
Version No.						
Course Pre- requisites	DCCN					

Anti-	NIL				
Course	This course provides a comprehensive understanding of energy management principles and techniques in IoT systems. It covers various energy sources, storage solutions, and power management strategies, focusing on optimizing energy consumption in IoT devices. Students will explore energy-efficient sensors, low-power communication technologies, and AI-driven energy optimization techniques. The course also delves into designing and implementing energy-efficient IoT solutions, including renewable energy integration and performance optimization. Additionally, it addresses advanced topics such as energy management in smart cities, industrial IoT applications, and sustainability challenges.				
Objective	concepts of Er through Partic	nergy Efficient IOT system a pergy Learning technique	and attain <mark>Skill D</mark> s	evelopment	
Course Out Comes	 On successful Understand management te Analyze ener optimization. Design and ir energy sources. Evaluate real cities, industries 	 On successful completion of the course the students shall be able to: 1. Understand various energy sources, consumption patterns, and management techniques in IoT systems. 2. Analyze energy-efficient hardware and software solutions for IoT energy optimization. 3. Design and implement energy-efficient IoT solutions using renewable energy sources. 4. Evaluate real-world applications of IoT energy management in smart cities industries and sustainable development 			
Course Content					
Module 1	Energy Management Basics in IoT	Assignment	Problem Solving	12 Classes	
Energy Managen and renewable management stra	nent Basics in Io energy solutior ategies, Energy-e	T: Energy sources and storag ns, Energy consumption pa fficient design principles.	e options, Battery tterns in IoT dev	technologies ices, Power	
Module 2	Technologies for IoT Energy Management	Assignment	Problem Solving	12 Classes	
Technologies for communication t based energy and	IoT Energy Man echnologies (LoR alytics, Networkir	agement: Energy-efficient ser aWAN, Zigbee, BLE), Al-driver ng and connectivity considerat	nsors and actuators n energy optimization ions for energy efficient	, Low-power on, Software- ciency.	
Module 3	Designing and Implementing IoT Energy Solutions	Assignment	Problem Solving	8 Classes	

Designing and Implementing IoT Energy Solutions: Efficient design principles, Component selection and integration, Renewable energy integration in IoT, Prototyping and testing methodologies, Deployment and performance optimization strategies.

Module 4 Advanced Topics in IoT Energy Management	Assignment	Problem Solving	8 Classes
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Advanced Topics in IoT Energy Management: Smart cities and smart grids, Energy management in industrial IoT, Sustainable development and environmental considerations, Emerging trends and challenges, Ethical and regulatory aspects of IoT energy solutions.

Targeted Application & Tools that can be used:

Text Book

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis Karnouskos, Stefan Avesand, and David Boyle, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, 2014, First Edition, Academic Press.

2. Shuang-Hua Yang, Wireless Sensor Networks: Principles, Design, and Applications, 2013, First Edition, Springer.

References

R1. Mischa Dohler, Burkhard Rätting, Energy Harvesting for Autonomous Systems, 2010, First Edition, Artech House.

R2. Sudip Misra, Anandarup Mukherjee, Arijit Roy, Introduction to IoT, 2021, First Edition, Cambridge University Press.

R3. Mohammad S. Obaidat, Mieso K. Denko, Isaac Woungang, Handbook of Green Information and Communication Systems, 2013, First Edition, Elsevier. Web Based Resources and E-books:

W1: https://iot-analytics.com/

W2: https://www.coursera.org/certificates/iiot-boulder

W3: https://www.coursera.org/learn/energy-management-for-iot-devices

Topics relevant to "SKILL DEVELOPMENT":

Energy Efficiency for IOT System for **Skill development** through **Participative Learning** techniques. This is attained through the assessment component mentioned in the course handout.

Course Code:	Course Title: Service	e Oriented Architect	ure	3-0-0-3		
CSE3125			L-T-P-			
Version No	Type of Course: Prog	ram Core	L			
Course Pro	Z.U CSE207 Data Base	Managamant S	ustom CSE264	Wab		
course Pre-	CSE207-Data Dast	e Management S	ystem, CSE204	- WED		
Anti-requisites	NII					
Anti-requisites						
Course	The study of the	course is to enab	le the students	to understand the		
Description	different architectu	iral styles and XM	L based web ap	plications which is		
	two enprocessos	e the basics of services	(WS) and Bar	resentational State		
	Transfer (REST) a	rchitecture	(ws) and kep	resentational State		
Course	The objective of the c	rourse is to familiariz	e the learners wit	h the concents of		
Objective	Service Oriented Arch	ervice Oriented Architecture and attain Skill Development through				
,	Particinative Learning	techniques	okin Development	through		
		, teeninques.				
Course Out	On successful completion of this course the students shall be able to:					
Comes						
	1. Discuss the XML F	undamentals and to	manipulate the d	ata using XML.		
	[Comprehension]					
	2.Define the key principles of SOA [Knowledge]					
	3. Discuss the web services technology elements for realizing					
	4 Illustrate the various Web Service Standards[Application]					
Course Content:						
Version No.	2.0					
	Introduction to XML	Assignment	Programming	Task 08		
iviodule 1				Sessions		
Topics: XML de	ocument structure ,We	ll formed and valid d	locuments ,Names	paces – DTD – xml		
Schema – X-Files	,Parsing XML – using	DOM, SAX – XML	Transformation a	nd XSL Formatting		
– Modelling Data	bases in XML.	A : +	A	4. 10		
Module 2	Architecture	Assignment	Architectural stu	Sessions		
Topics: Types of	Architecture, Objectiv	es of Software archi	tecture, SOA Plan	ning and analysis,		
Architecture patte	erns and styles ,Chara	cteristics of SOA, Cor	mparing SOA with	Client-Server and		
Distributed archit	ectures – Benefits of S	SOA ,Security and im	plementation ,Pri	nciples of Service		
orientation ,Servi	ce Layers, Application	development proces	ss, SOA methodol	ogy for Enterprise.		
		0	1			
Module 3	Web Services	Quiz	Data patter	ns Sossions		
Tonics: Service D	escriptions _ WSDL _	Messaging with SC	$ $ $\Delta P - Service Dis$	covery _ UDDI _		
Message Exchange	e Patterns – Orchestra	tion – Choreography	V - WS Transactio	rs.		
	sitessage Exchange Fatterins Orenestration Choreography was fransactions.					
	Building SOA based	Quiz	Security aspe	ects 11		
Module 4	Applications		, .	Sessions		
Topics: Business	Process Design, Bus	siness case for SOA	A, Stake holder of	bjectives, Service		
Oriented Analysi	s and Design - Ser	vice Modeling - I	Design standards	and guidelines -		
Composition – W	S-BPEL – WS-Coord	ination – WS-Policy	– WS-Security , '	Tools available for		
Implementing SO	A, SUA Security, apples in Relation to SOA	roach for enterprise v Advances in SOA	where SOA implem	entation, Frends in		
sori, reemologi	es in Relation to SOA,		Sorr Support III J	-L/L/.		
Targeted Applicat	tion & Tools that can	be used:				
Basic HTML and X	(ML					

Textbo	ok(s):
1. Edu	Thomas Erl, "Service Oriented Architecture: Concepts, Technology, and Design", Pearson Jacation, 2016. http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=6532
2.	Ron Schmelzer et al. "XML and Web Services", Pearson Education, 2013 http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=6645
Referei	nces
1.	Frank P.Coyle, " <i>XML, Web Services and the Data Revolution</i> ", Pearson Education, 2002 http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=6647
2. Edu	Eric Newcomer, Greg Lomow, "Understanding SOA with Web Services", Pearson acation, 2005 http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=6619
3. Arc	Sandeep Chatterjee and James Webber, " <i>Developing Enterprise Web Services: An</i> <i>chitect's Guide</i> ", Prentice Hall, 2004. <u>http://182.72.188.195/cgi-bin/koha/opac-detail.pl?biblionumber=5906</u>
4. Arc	James McGovern, Sameer Tyagi, Michael E.Stevens, Sunil Mathew, " <i>Java Web Services</i> <i>chitecture</i> ", Morgan Kaufmann Publishers, 2003. <u>https://www.elsevier.com/books/java-web-services-architecture/mcgovern/978-1-55860-900-6</u>
	Web Resources:
1. 2. 3.	https://presiuniv.knimbus.com/user#/home https://www.coursera.org/learn/service-oriented-architecture https://nptel.ac.in/courses/soa
Topics	relevant to "SKILL DEVELOPMENT": Based on an understanding of architectural styles,
underst	tanding web applications based on XML, review architectures for web applications, Service
Oriente	d Architecture (SOA) in two approaches: Web Services (WS*) and Representational State؛

Transfer (REST) architecture for Skill Development through Participative Learning techniques. This

is attained through the Presentation as mentioned in the assessment component.

Course Code:	Course Title: Fron	t-end Full Stack				
CSE3150	Development				2-(0_2_3
				L- 1-P- C	2-0	0-2-3
Version No.	1.0					
Course Pre-	Nil					
requisites						
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					
Course Objectives	This course is designed to improve the learners' EMPLOYABILITY SKILLS by using PROBLEM SOLVING Methodologies.					
Course Outcomes	 On successful completion of the course the students shall be able to: 1] Describe the fundamentals of DevOps and Front-end full stack development. [Comprehension] 2] Illustrate development of a responsive web. [Application] 3] Apply concepts of Angular.js to develop a web front-end. [Application] 4] Apply concepts of Angular is to develop a web front-end. [Application] 					
Course Content:						
Module 1	Fundamentals of DevOps and Web Development	Project	Programı	ming		04 Sessions
Topics:						
Introduction to Agil	e Methodology; So	crum Fundamer	ntals; Scru	um Roles,	Artifacts	and Rituals;
DevOps – Architectu	re, Lifecycle, Workfl	ow & Principles;	DevOps T	ools Overv	riew – Jenl	kins, Docker,
Kubernetes.			- .			
Review of GIT source	e control. HTML5 –	Syntax, Attribut	tes, Event	s, Web For	ms 2.0, v	Veb Storage,
Assignment: Develo	n a website for man	aging HR policie	ansionn as of a der	artment		
Module 2	Responsive web design	Project	Program	ming	(03 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 3	Fundamentals of Angular.js	Project	Programming	08 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).

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

|--|

Topics:

Overview of React.js.; Reactive Programming; React Components; Render Method; Virtual DOM and Bandwidth Salvation; Two Distinct Ways of Initializing a React Class; States & Life Cycles; Component Mounting; Node.js & NPM; JSX Walkthrough; React Testing.

Assignment: Develop a web-based application to book movies/events (like bookmyshow).

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 work/Assignment:

- 1. Problem Solving: Design of Algorithms and implementation of programs.
- 2. Programming: Implementation of given scenario using Java.

Text Book:

- T1. Fender, Young, "Front-end Fundamentals", Leanpub, 2015
- T2. 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.
- R2. Alex Libby, Gaurav Gupta, and Asoj Talesra. "Responsive Web Design with HTML5 and CSS3 Essentials", Packt Publishing, 2016
- R3. Duckett J Ruppert G Moore J. *"Javascript & Jquery : Interactive Front-End Web Development.";* Wiley; 2014.
- R4. Greg Sidelnikov, *"React.js Book_ Learning React JavaScript Library"*, 1 edition, Scratch-River Tigris LLC 2016

R5. Web Reference:

https://www.youtube.com/watch?v=JGNTYXkVCVY&list=PLd3UqWTnYXOkTSBCBNyyhxo_j xlY_uTWA&index=2

Course Code:	Course Title: Java Full Stack Development		
CSE3151		L- T-P- C	2-0-2-3

Version No.	1.0						
Course Pre-	Nil						
requisites							
Anti-requisites	CSE3152 .NET F	SE3152 .NET Full Stack Development					
Course Description	This advance development u technologies u technology or Java, and the Hibernate, Ma course, the s development. as part of this	This advanced level course enables students to perform full stack levelopment using Java, with emphasis on employability skills. The key echnologies used for Full Stack development is based on either Java echnology or .NET technology. In this course, the focus is on using Java, and the related technologies/tools like Java EE, Java Persistence, Hibernate, Maven, Spring Core, etc. 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					
Course	This course is	designed to improve th	e learners' EMPLOYABILITY	SKILLS by			
Objectives	using PROBLE	EM SOLVING Methodo	ologies.	5			
Course Outcomes	OutcomesOn successful completion of the course the students shall be able to:1] Practice the use of Java for full stack development [Application]2] Show web applications using Java EE. [Application]3] Solve simple applications using Java Persistence and Hibernate [Application]4] Apply concepts of Spring to develop a Full Stack application. [Application]5] Employ automation tools like Maven, Selenium for Full Stack development.						
Course Content:		-					
Module 1	Introduction	Project	Programming	03 Sessions			
Topics: Review of Java; Ad tools	vanced concept	s of Java; Java generics;	; Java IO; New Features of Java.	Unit Testing			
Module 2	Java EE Web Applications	Project	Programming	05 Sessions			
Topics: Introduction to E- Management with ServletContext, Se JSP; Complete App Assignment: Deve	Topics: Introduction to Eclipse & Tomcat; JSP Fundamentals; Reading HTML form Data with JSP; State Management with JSP; JSP Standard Tag Library - Core & Function Tags; Servlet API Fundamentals; ServletContext, Session, Cookies; Request Redirection Techniques; Building MVC App with Servlets & JSP; Complete App - Integrating JDBC with MVC App Assignment: Develop an application for managing HR policies of a department.						
Module 3	Persistence using JPA and Hibernate	Project	Programming	06 Sessions			
Topics: Fundamentals of Caching, Performa Locking & Version database using JPC Assignment: Desig housing society	Java Persistenc ince and Concu ing; Entity Rela QL and Criteria A mand develop a	e with Hibernate; JPA Irrency; First & Seconc tionships, Inheritance API (JPA) a website that can activ	for Object/Relational Mapping I Level Caching, Batch Fetching Mapping & Polymorphic Querie rely keep track of entry-exit infor	, Querying, , Optimistic s; Querying mation of a			
Module 4	Spring Core	Project	Programming	Sessions			
Topics: Spring Core, Sprin MVC; Building a	ng MVC, Spring Database Web	Boot REST API; Und App with Spring and	erstanding Spring Framework; U Hibernate o Spring AOP (Aspe	sing Spring ect Oriented			

Programming); Implementing Spring Security; Developing Spring REST API; Using Spring Boot for Rapid Development

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

Module 5	Automation tools	Project	Programming	06 Sessions
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Topics:

Introduction to Automation Tools; Apache Maven: Maven Fundamentals, Software Setup -Commandline and Eclipse, pom.xml and Directory Structure, Multi-Module Project Creation, Scopes, Dependency Management, Profiles; Functional/BDD Testing using Selenium, Selenium Fundamentals and IDE, Selenium WebDriver, Installation and Configuration, Locating WebElements, Driver Commands, WebElement Commands

Assignment: Illustrate the use of automation tools in the development of a small software project. 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: Eclipse, NetBeans, Hibernate, Selenium, Maven, GIT.

Project work/Assignment:

- 1. Problem Solving: Design of Algorithms and implementation of programs.
- 2. Programming: Implementation of given scenario using Java.

Text Book:

T1. Fender, Young, "Front-end Fundamentals", Leanpub, 2015

References

R1. Soni, Ravi Kant. "Full Stack AngularJS for Java Developers: Build a Full-Featured Web Application from Scratch Using AngularJS with Spring RESTful.", Apress, 2017.

R2.	Mardan, Azat. <i>"Full</i>	Stack	JavaScript:	Learn	Backbone.js,	Node.js	and
Mon	<i>goDB."</i> , Apress, 2015						

Course Code: CSE3152	Course Title: .NET Full Stack Development	L-T- P- C	2-0-2-3
Version No.	1.0		
Course Pre- requisites	Nil		
Anti-requisites	CSE3151 Java Full Stack Development		
Course Description	This advanced level course enables stude development using .NET, with emphasis o key technologies used for Full Stack deve Java technology or .NET technology. In t using .NET and the related technologies. Entity Framework Core, etc. On successful the student shall be able to pursue a career The students shall develop strong problem this course.	ents to per n employab lopment is his course, /tools like l completion in full-stac m-solving s	form full stack bility skills. The based on either the focus is on C#, ASP.NET, n of this course, k development. skills as part of
Course Objectives	This course is designed to improve the learner using PROBLEM SOLVING Methodologies.	s' EMPLOY	ABILITY SKILLS by

Course	On successful completion of the course the students shall be able to:					
Outcomes	1] Practice the	use of C# for develop	ing a small application [Application]	ation		
	2] Show web a	web applications using Enti	ty Framework. [Application]	ation		
	4] Apply cor	web applications that	to develop a Full Stack a	annlication		
				ppileacion.		
Course Content:		.1				
course content.						
	C#					
	C# Drogramming			10		
Module 1	for Full Stock	Project	Programming	IU		
				Sessions		
L .	Development					
Topics:						
NET Framework F	-undamentals,	Visual Studio IDE Fund	lamentals, C# Language Feature	es, Working		
with arrays and o	collections, Wo	rking with variables,	operators, and expressions, D	ecision and		
iteration statemer	nts, Managing p	rogram flow and even	ts, Working with classes and me	thods, OOP		
concepts, Propert	ies, Auto Impler	mented, Delegates, An	onymous Methods and Anonyr	nous Types,		
Extension methe	ods, Sealed	Classes/Methods, P	artial Classes/Methods, As	ynchronous		
programming and	l threading, Dat	ta validation and wor	king with data collections inclu	uding LINQ,		
Handling errors ar	nd exceptions, V	Vorking with Files, Uni	it Testing – Nunit framework			
Assignment: Deve	elop a small app	lication for managing	library using C#.			
	Entity			06		
Module 2	Framework	Project	Programming	06		
	Core 2.0			Sessions		
Topics:						
Entity Framework	Core 2.0 Code	e First Approach: Intr	oduction To Entity Framework	and EDM:		
Querving the EDN	1: Working Wit	h Stored Procedures:	Advanced Entity Framework -	DbContext		
[FF6]: Advanced C	perations: Perf	ormance Optimization	: Data Access with ADO NFT			
Assignment: Deve	lon an applicati	ion for managing HR p	olicies of a department.			
		Project		06		
Module 3	ASP.NET		Programming	Sessions		
Tonics:				000010110		
ASP NET Core	ASP Net Core	3.1 MVC ASPINET	Core Middleware and Reque	st nineline		
Review of SOL	using MS SOI	Working With Dat	a In Asn Net Razor View Fr	ogine State		
Management In A	sp. Net MVC &	Lavouts:		ignie, state		
B	Spr 1.00 111 - 0 - 0	24) • 440,				
Assignment: Dev	elop a web appl	ication to mark entry/e	exit of guests in a building.			
				08		
Module 4	ASP.NET	Project	Programming	Sessions		
Topics:						
Introduction To	Models Valida	tions In Asn Net M	VC Authentication and Autho	prization In		
Asp.Net MVC. Ad	dvanced Asp. N	et MVC - Aiax Action	Link In MVC. Advanced Asp.	Net MVC -		
Aiax Forms In MV	VC. Microsoft T	esting Framework – I	Init Testing the NET Application	on		
Assignment: Dev	elop a software	tool to do inventory m	anagement in a warehouse.			
Targeted Applicat	ion & Tools tha	it can be used:				
i al Secca / ipplicat						
Application Area i	is to Design and	Δnalyzing the efficie	ncy of Algorithms This fundam	pental		
course is used by	all application (develoners				
Course is used by		acacioheis.				
Professionally La	ad Softwaras M	icual Studio				
FIDIESSIDITALLY US	eu Suitware: V	isual studio				
Project work/Assi	gnment:					

1. Problem Solving: Design of Algorithms and implementation of programs.

2. Programming: Implementation of given scenario using .NET.

Text Book:

- T1. Fender, Young, "Front-end Fundamentals", Leanpub, 2015
- T2. Valerio De Sanctis, "ASP.NET Core 5 and Angular: Full-stack web development with .NET 5 and Angular 11", 4th Edition, Packt, 2021.

References

- R1. Benjamin Perkins, Jon D. Reid, "Beginning C# and .NET", Wiley, 2021 Reid, 2021.
- R2. Piotr Gankiewicz, "Full Stack .NET Web Development", Packt Publishing, 2017.
- R3. Tamir Dresher, Amir Zuker, Shay Friedman, "Hands-On Full-Stack Web Development with ASP.NET Core", Packt Publishing, 2018.
- R4. Dustin Metzgar, "Exploring .NET core with microservices, ASP.NET core, and Entity Framework Core", Manning, 2017.

Course Code:	Course Title: Mobi	le Application						
CSE2508	Development		L-T-P-C	2	0	0	2	
	Type of Course: The	eory						
Version No.	2.0			•		•		
Course Pre-	The student needs to	The student needs to have fundamental understanding of object-oriented						
requisites	programming concep	ots with Java/C#, XML,	usage of an	y int	egra	ated		
	development environ	iment.						
Anti-	NIL							
requisites								
Course	The course deals wi	he course deals with the basics of android platform and application life						
Description	cycle. The goal of the	e course is to develop m	obile applic	ation	ıs wi	ith An	droid	
	containing at least or	ontaining at least one of the following phone material components: GPS,						
	accelerometer or pho	ne camera, use simple	GUI applica	tions	and	l work	with	
	database to store dat	a locally or in a server	r. Topics in	clude	e use	er inte	rface	
	design; user interfac	ce building; input me	thods; data	han	dlin	g; net	work	
	techniques and URL loading; GPS and motion sensing. Android application							
	framework and deployment. Power management, Screen resolution, Touc						'ouch	
	interface, Store data	on the device.						
Course	The objective of the o	course is to familiarize t	the learners	with	the	conce	pts of	
Objective	Mobile Applications	s and Development as	s mentioned	1 ab	ove	and	attain	
	Employability Skills	through Experiential L	earning Tec	hniq	ues.			
Course	On successful compl	etion of the course the	students sha	ll be	able	e to:		
Outcomes	1. Discuss the fund	amentals of mobile ap	oplication d	evelo	opm	ent ar	id its	
	architecture. (Compr	ehension)						
	2. Illustrate mobi	le applications with	appropria	te a	andr	oid	view.	
	(Application)							
	3. Demonstrate the	use of services, broadd	cast receive	r, No	otific	cation	s and	
	content provider.(Ap	plication)	C	CDI	ID			
	4. Apply data pers	sistence techniques, to	o perform	CRU	JD	operat	tions.	
	(Application) 5. Use	(Application) 5. Use advanced concepts for mobile application development.						
C	(Application)							
Course								
Content:	T 1 1 1 1							
	Introduction and	A	Simulation/	'Data	l	1	0	
wodule 1	Architecture of	Assignment	Analysis			Sessi	ions	
	Android		Ĩ					

Topics								
Android Histo	ry and features	Arch	nitecture Develo	nment	Tools Andro	oid Del	nug Bridge	
(ADB), and Lif	e cycle.	nu		pinein	10015, 711010		bug bridge	
	User Interfaces.	User Interfaces		Term		ata	15	
Module 2	Intent and		paper/Assignme	nt	Analysis		Sessions	
	Fragments				5			
Topics:								
Views, Layout,	Menu, Intent and	Fra	gments.					
Madula 2	Components of		Term		Simulation/D	15		
wiouule 5	Android		paper/Assignme	nt	Analysis		Sessions	
Topics:								
Activities, Serv	vices, Broadcast re	eceiv	vers, Content prov	viders,	User Navigat	ion		
Module 4	Notifications	Ter	m	Simu	lation/Data	15 Ses	ssions	
	and Data	pap	er/Assignment	Analy	ysis			
	Persistence							
Topics:			T •. 1 . 1		D 11	• 7•		
Notification, SI	hared Preferences,	<u>, SQ</u>	Lite database, Ar	ndroid	Room with a	View,	Firebase.	
Module 5	Advance App	Te	rm	Sim	$\frac{1}{1}$	15 Se	essions	
т. ·	Development	paj	per/Assignment	Ana	lysis			
Topics:	nimetion Ann W	:	ta Canaana Dauf		a. Lagation I		Manuina	
Graphics and A	Canvas	luge	ets, Sensors, Perio	orman	ce, Location, f	laces,	Mapping,	
Torgeted App	Callvas.	that	aan ha ucad.					
Applications:		mai	can be used.					
Applications:	roid Applications							
Native Allo	Applications							
Cross Platf	Applications							
Mobile web	Applications							
	Applications							
Text Book(s)								
T1 Pradeep ko	thari "Android Ar	mlic	ation Developme	ent - B	lack Book" di	reamte	chnress	
T2. Barry Burd	(Author), "Andro	oid A	Application Devel	lonme	nt" ALL – IN	– ONF	FOR	
Dummies	(1144101), 111410	/10/1	ippireation Devel	opme		0112		
T3. Jeff Mcher	ter (Author).Scott	Gov	well (Author), "P	rofessi	ional mobile A	oplica	tion	
Development"	naperback. Wrox	- W	ilev India Private	Limit	ed			
T4. Wei-Meng Lee (Author) "Beginning Android Application Development" Wrox –								
Wiley		0	8 11		1			
India Private L	imited							
Reference (s):								
1. Bill Phillips,	Chris Stewart, an	d K	ristin Marsicano (Autho	or) "Android P	rogran	nming" 3rd	
edition,								
2017. The Big Nerd Ranch Guide, Big Nerd Ranch LLC, 5. The Big Nerd Ranch Guide,								
by"								
2. Erik Hellman, "Android Programming – Pushing the Limits", 1st Edition, Wiley India								
Pvt Ltd,								
2014.								
3. Dawn Griffiths and David Griffiths, "Head First Android Development", 1st Edition.								
O'Reilly SPD								
Publishers, 201	5.							
4. J F DiMarzio	o, "Beginning And	lroic	l Programming w	rith Ar	ndroid Studio"	, 4th E	dition,	
Wiley India Pvt								
Ltd, 2016. ISB	N-13: 978-812656	5558	0					

5. Anubhav Pradhan, Anil V Deshpande, "Composing Mobile Apps" using Android, Wiley 2014,

ISBN: 978-81-265-4660-2

6. Reto Meier "Professional Android Application Development"

E-Resources: https://puniversity.informaticsglobal.com/login Or http://182.72.188.193/

Course Code:	Course Title: Mob	ile Application							
CSE2509	Development Lab		L- T-P- C	0	0	4	2		
	Type of Course: La	ab							
Version No.	2.0								
Course Pre-	The student needs to have fundamental understanding of object-oriented								
requisites	programming concepts with Java/C#, XML, usage of any integrated								
	levelopment environment.								
Anti-requisites	NIL								
Course	The course provide	es hands-on experience	in designir	ng, d	evel	oping	, and		
Description	Description deploying mobile applications for Android and iOS platforms. Stud						s will		
	work with native	work with native development frameworks such as Android Studio							
	(Java/Kotlin) and X	Kcode (Swift), as well	as explore c	cross	-plat	form	tools		
	like Flutter or React	t Native.							
Course	The objective of the	course is to develop Na	tive and Cro	oss-P	latfo	orm M	obile		
Objective	Applications, design	n Interactive and Respo	onsive User	Inter	tace	s, inte	grate		
	Backend Services	and APIs, implem	ent State	Mar		ment	and		
	Performance Opur	Performance Optimization, ensure Mobile App Security and Data							
Course	On successful comm	lation of the course the	students sh	all be	ahl	a to:			
Outcomes	1 Develop Function	nal Mobile Applications				c 10.			
Outcomes	2 Design and Imple	2 Design and Implement Interactive IIIs							
	3. Integrate Cloud S	ntegrate Cloud Services and APIs							
	4. Integrate Backen	d Systems and Data Ma	nagement						
	5. Deploy, Publish, and Maintain advanced Mobile Application								
Course			*	-					
Content:									
	Introduction and		Simulation	'Doto		1/	0		
Module 1	Architecture of	Assignment	Analysis			Sessions			
	Android		r mary sis						
1.a. Design an a	pp to read user inputs	s using edit text and dis	play the resu	ılt of	arit	hmetio	с		
operations using	g toast message.								
1.b. Create an a	ndroid app to calculat	te the current age of you	urself, select	you	: DC)B usi	ng		
date picker.	, · ,	1.C (* TT	. 1		<i>.</i>				
2. Design an app	p to input your person	hal information. Use an	autocomple	te tex	t vi	ew to			
select your place	e of dirth.								
	User Interfaces	Term	Simulation/	Data		15			
Module 2	Intent and	naper/Assignment	Analysis	Dutu		Sessi	ons		
	Fragments Full and for the second sec								
3. a. Design an a	app to select elective	course using spinner vi	ew and on c	lick o	of th	e disp	lay		
button,						Г	5		
toast your ID an	d selected elective co	ourse.							
3. b. Design a re	estaurant menu app to	print the total amount	of orders.						

Module 3	Components of	Term	Simulation/Data	15	
	Android	paper/Assignment	Analysis	Sessions	

4. Develop an android app that uses intent to maintain the following scenario. Check the eligibility criteria for voting. Input the Aadhar no., Name & age in the first activity. If the age is above 18, display the voter's detail in the second activity. Else, display, "You are not eligible to vote" in the second Activity.

5. Demonstrate the use of fragment with list of buttons representing various colors, and on click of these buttons, the appropriate color is filled in the next fragment. Create an Android application to input the vitals of a person (temperature, BP). If the vitals are abnormal, give proper notification to the user.

6. Create an android app to for movie ticket booking. Save the user name of the customer using shared preferences. After completion of booking, retrieve the username from the shared preferences and print the ticket details.

Module 4	Notifications	Term	Simulation/Data	15 Sessions
	and Data	paper/Assignment	Analysis	
	Persistence			

7. Create an android application to manage the details of students' database using SQLite.Use necessary UI components, which perform the operations such as insertion, modification, removal and

view.Presidency University needs an APP for Admission eligibility checking for students, for that you need to take the following information from the Student: registration ID,

physics, chemistry and mathematics marks (PCM), fees is allotted as below criteria. PCM (Total marks %) Fee concession

90 above 80 %

70 to 89 60 %

Below 69 % no concession

On click on the button "Registration" details should be stored in the database using SQLite. Create button DISPLAY ALL (full students list) on click on the button it should display the students list per the fee

concession.

8. A company need to design an app that plays soft music automatically in the background. Create an app to achieve this functionality.

9. Create an android application such that your view object in the Activity can be Animated with fade-in effect. Create an appropriate XML file named fade-in and write the application to perform the property animation.

Module 5	Advance App	Term	Simulation/Data	15 Sessions
	Development	paper/Assignment	Analysis	

10. Demonstrate how to send SMS and email.

11. Create an android application to transfer a file using WiFi. Create an android

application "Where am I" with an Activity that uses the GPS Location provider to find the device's last known location.

Targeted Application & Tools that can be used: Applications:

- 1. Native Android Applications (Java/Kotlin)
 - Android Mobile Apps built for Android smartphones and tablets using Java
 - or Kotlin programming languages.
 - Target audience: Android users.
- 2. Native iOS Applications (Swift)
 - iOS Mobile Apps designed for iPhone and iPad using Swift.
 - Target audience: iOS users (Apple ecosystem).
- 3. Cross-Platform Mobile Apps (Flutter, React Native)

 \circ Cross-platform apps designed to run on both Android and iOS from a single codebase using frameworks like Flutter or React Native.

- Target audience: Users on both Android and iOS platforms.
- 4. Mobile Web Applications (Progressive Web Apps PWA)

• Mobile-optimized web applications using HTML5, CSS3, and JavaScript that run in a browser with native-like functionality (offline support, push notifications).

• Target audience: Users accessing apps via mobile browsers.

Development Tools and Frameworks

1. Integrated Development Environments (IDEs)

• Android Studio (for Android): The official IDE for Android development, supporting Java, Kotlin, and Android SDK.

• Xcode (for iOS): The official IDE for iOS development with Swift and Objective-C, providing a comprehensive suite of development tools for iPhone/iPad applications.

• Visual Studio Code (VS Code): Lightweight IDE for working with Flutter, React Native, and web development projects.

2. Cross-Platform Development Frameworks

• Flutter: Open-source UI framework by Google for building natively compiled applications for mobile, web, and desktop from a single codebase.

- React Native: Open-source framework developed by Facebook for building
- cross-platform apps with JavaScript and React.
- 3. Backend & Cloud Tools

• Firebase: Google's backend-as-a-service (BaaS) platform offering authentication, real-time databases, cloud storage, and push notifications for mobile apps.

• AWS Amplify: Cloud platform for backend services (API, storage, authentication) and mobile deployment.

• SQLite / Realm: Local storage solutions for mobile apps to manage data storage and retrieval on-device.

4. Mobile App Testing and Debugging Tools

• Android Emulator (for Android): A virtual device to run and test Android apps without needing physical devices.

• Xcode Simulator (for iOS): A tool to simulate different iOS devices and test apps during development.

• Appium: Open-source tool for automated testing across native, hybrid, and mobile web applications.

5. Version Control and Collaboration

 $\circ~$ Git: Version control system for managing code changes and collaborating with teams.

• GitHub / GitLab / Bitbucket: Online platforms for hosting Git repositories, collaboration, and version control management.

6. Mobile App Deployment Tools

• Google Play Console: For managing Android app publishing, distribution, and monitoring.

• Apple App Store Connect: For managing iOS app submissions, reviews, and releases on the Apple App Store.

7. UI/UX Design Tools

• Figma / Adobe XD: Tools for UI/UX design and wireframing to create the visual elements of mobile applications before development.

• Sketch: Vector-based design tool for iOS UI design and prototyping

Text Book(s):

T1. Pradeep kothari "Android Application Development - Black Book", dreamtechpress T2. Barry Burd (Author), "Android Application Development" ALL – IN – ONE FOR Dummies

T3. Jeff Mcherter (Author),Scott Gowell (Author), "Professional mobile Application Development" paperback, Wrox - Wiley India Private Limited

T4. Wei-Meng Lee (Author) "Beginning Android Application Development" Wrox – Wiley

India Private Limited

Reference(s):

1. Bill Phillips, Chris Stewart, and Kristin Marsicano (Author) "Android Programming" 3rd edition,

2017. The Big Nerd Ranch Guide, Big Nerd Ranch LLC, 5. The Big Nerd Ranch Guide, by"

2. Erik Hellman, "Android Programming – Pushing the Limits", 1st Edition, Wiley India Pvt Ltd,

2014.

3. Dawn Griffiths and David Griffiths, "Head First Android Development", 1st Edition, O'Reilly SPD

Publishers, 2015.

4. J F DiMarzio, "Beginning Android Programming with Android Studio", 4th Edition, Wiley India Pvt

Ltd, 2016. ISBN-13: 978-8126565580

5. Anubhav Pradhan, Anil V Deshpande, " Composing Mobile Apps" using Android, Wiley 2014,

ISBN: 978-81-265-4660-2

6. Reto Meier "Professional Android Application Development"

E-Resources: https://puniversity.informaticsglobal.com/login Or http://182.72.188.193/

Course Code: CSE2510	Course Title: Competitive Programming and Problem Solving Type of Course: Program Core	L-T-P- C	0	0	4	2	
Version No.	1.0		•	•	•		
Course Pre- requisites	NIL						
Anti-requisites	NIL						
Course Description	The Competitive Programming and Problem Solving course equips students with efficient problem-solving skills for coding competitions and real-world challenges. Starting with brute-force solutions, students learn to optimize time and space complexity using advanced techniques like dynamic programming, greedy algorithms, and backtracking. Hands-on practice on platforms like CodeChef and Codeforces helps tackle problems involving number theory, data structures, and algorithmic paradigms. By understanding CP constraints and fostering a strategic mindset, students gain the confidence to excel in competitions, technical interviews, and practical applications.						
Course Out Comes	 On successful completion of the course the students shall be able to: CO1 : Understanding the issues of online platforms and Competitive Programming (CP) and developing brute force coding for commonly asked CP problems. CO2 : Analyzing the space and time complexity of brute force solutions and designing efficient solutions. CO3 : Evaluating the applicability of suitable algorithmic approaches to solve relevant CP problems. CO4: Creating efficient solutions of CP problems using the learnt algorithmic approaches. 						
Course Objective	The objective of the course is to familiarize of Competitive Programming and Prok Development through Experiential Learning te	the learne blem Solv chniques.	rs w /ing	ith t and	he c attai	oncepts n Skill	

Module 1: Introduction to Competitive Programming

Overview of Efficient Coding for Problem Solving and CP: Introduction to competitive programming (CP); revisit of complexity analysis; introduction to online platforms such as codechef, codeforces etc and online submission; constraints during CP, online testing process and common errors such as TLE; use of STL

Module 2: Number Theory for Problem-Solving

Use of Number Theory for problem-solving: reducing time/space complexity of brute force coding solution of Sieve Method, Inverse Module, Euclidian Method of factorization; efficient coding

for Permutation Combination; XORing based and pattern-based solutions.

Module 3: Optimizing Time & Space Using Sequential Storage

Coding for Optimizing time and Space using Sequential Storage: two pointer approach; problem-solving using arrays and strings such as rotation on sorted arrays, duplicate removal, string

matching algorithms; Kadane's algo, stacks, priority-queues and hashing based efficient coding; median based problems and alternate solutions.

Module 4: Non-Linear Data Structures

Applying Non-Linear Data Structures for real-life problems: design of efficient solutions for problems such as finding loops in a linked list, memory efficient DLL, block reversal in LL; problem

solving using trees and binary trees, Catalan numbers, applications of graphs, spanning tree and path

algos for CP problems with reduced time/space complexity.

Module 5: Problem Solving using Advanced Topics

CP Problem Solving using Advanced Topics: concept of disjoint sets and their efficient representation, algorithmic approaches such as Greedy, Backtracking, Dynamic Programming and

applying them for CP problems using bottom-up dynamic programming.

List of Laboratory Tasks:

- 1. You are given the finishing times of 'N' runners in a marathon. Write a program to find the runner who finished in the third position. **Focus:** Basic data structures (arrays), sorting algorithms (e.g., insertion sort, selection sort), and basic input/output.
- 2. In the same marathon, you are given the finishing times of 'N' runners and their bib numbers. Write a program to efficiently find the top 10 runners and their corresponding bib numbers. **Focus:** Efficient sorting algorithms (e.g., merge sort, quick sort), data structures like priority queues, and optimizing for large datasets.
- 3. A library maintains a list of books with their unique IDs. Write a program to check if a given book ID is present in the library. Focus: Searching algorithms (linear search), basic data structures (arrays or lists).
- 4. The library wants to implement a system to quickly find books by their titles. Suggest an efficient data structure (e.g., a hash table or a trie) and explain how to implement it to achieve fast book lookups. Focus: Understanding the trade-offs between different data structures, choosing the most appropriate data structure for a specific problem, and implementing efficient search operations.
- 5. An online store sells products with different prices. Write a program to calculate the total cost of a given list of products. **Focus:** Basic arithmetic operations, working with arrays or lists to store product prices.
- 6. The online store offers discounts based on the total purchase amount. Design an algorithm to efficiently calculate the final cost of an order, considering different discount rules (e.g., percentage discounts, fixed amount discounts, tiered discounts). Focus: Algorithmic design, conditional statements, handling complex scenarios with multiple rules, and potentially using dynamic programming techniques for optimization.
- 7. You are given two integers, 'a' and 'm'. Calculate 'a' raised to the power 'm' modulo a large prime number 'p'. **Focus:** Basic modular arithmetic operations (modular exponentiation), understanding the modulo operator.
- 8. In a secure communication system, you need to efficiently compute the modular exponentiation for very large values of 'm'. Implement and analyze the efficiency of the binary exponentiation algorithm for this task. **Focus:** Efficient algorithms for modular exponentiation (binary exponentiation), time complexity analysis, and understanding the importance of efficient algorithms in cryptography.
- 9. You have a deck of 'N' cards. Calculate the total number of possible hands of size 'K' that can be drawn from the deck. **Focus:** Basic combinatorics (combinations), factorial calculations.
- 10. In a card game, you need to calculate the probability of drawing certain combinations of cards (e.g., a pair, a three-of-a-kind) from a shuffled deck. Design an efficient algorithm to calculate these probabilities. **Focus:** Advanced combinatorics

(permutations and combinations with repetitions), probability calculations, and optimizing calculations to avoid overflows.

- 11. You are given a network of devices represented as a graph. Determine if there is a path between two given devices in the network. **Focus:** Graph traversal algorithms (depth-first search or breadth-first search).
- 12. In a secure network, you need to detect and isolate compromised devices. Design an algorithm that efficiently identifies devices that exhibit anomalous behavior (e.g., unusual traffic patterns) using XOR-based techniques for data comparison and pattern matching. **Focus:** Applying XOR operations for data comparison and pattern recognition, understanding the properties of XOR (e.g., commutative, associative), and designing algorithms for network anomaly detection.
- 13. You are given an array representing the speeds of cars on a highway. Find the minimum time required for all cars to pass a certain point. **Focus:** Basic array traversal, finding the minimum element in an array.
- 14. In a more realistic scenario, cars have different lengths. Implement a two-pointer approach to simulate the movement of cars and determine the minimum time for all cars to pass a given point. **Focus:** Two-pointer technique, simulating real-world scenarios with arrays, optimizing time complexity.
- 15. Given a string, find the number of occurrences of a specific substring within the string. **Focus:** Basic string manipulation, string matching (brute-force approach).
- 16. Implement the KMP (Knuth-Morris-Pratt) string matching algorithm to efficiently find all occurrences of a given pattern within a large text document. **Focus:** Advanced string matching algorithms, understanding the concept of the "next" array in KMP, optimizing for large input sizes.
- 17. An online auction platform receives bids for different items. Implement a data structure (e.g., a priority queue) to efficiently track the highest bid for each item. **Focus:** Priority queues, insertion and extraction operations on priority queues, basic implementation of a priority queue using an array or a suitable library.
- 18. The auction platform needs to handle a large number of bids concurrently. Design and implement a system that efficiently processes bids, updates the highest bid for each item, and handles potential race conditions. **Focus:** Concurrent data structures and algorithms, thread safety, handling race conditions, optimizing for high-throughput scenarios.
- 19. A social network can be represented as a graph where users are nodes, and connections between users are edges. Write an algorithm to find if two given users are connected in the network. **Focus:** Graph traversal algorithms (depth-first search or breadth-first search), basic graph representation (adjacency list or adjacency matrix).
- 20. In a large social network, efficiently finding the shortest path between two users is crucial. Implement Dijkstra's algorithm to find the shortest paths between users in the network, considering edge weights (e.g., representing the strength of connections). Focus: Shortest path algorithms (Dijkstra's algorithm), graph algorithms with weighted edges, optimizing for large graphs.
- 21. A file system can be modeled as a tree structure. Implement a function to traverse the file system and print the names of all files and directories. **Focus:** Tree traversal algorithms (depth-first search or breadth-first search), basic tree representation (using nodes and pointers).
- 22. Design and implement a file system that supports efficient operations like creating directories, deleting files, and finding files based on their names or paths. Consider using a combination of tree structures and hash tables for efficient indexing and searching. Focus: Designing and implementing file system structures, using multiple data structures together, optimizing for common file system operations.

- 23. An online shopping cart can be represented as a tree, where each node represents an item or a category of items. Write an algorithm to calculate the total price of all items in the shopping cart. **Focus:** Tree traversal, calculating sums within a tree structure.
- 24. Implement a system that allows customers to apply discounts and coupons to their shopping carts. Consider using a combination of trees and other data structures (e.g., hash tables) to efficiently apply discounts and calculate the final price. **Focus:** Applying discounts and promotions to tree-like structures, efficient implementation of discount rules, optimizing for complex pricing scenarios.
- In a social network, users can form groups. Given a list of friendships, determine if all users in a specific group are connected (directly or indirectly) through friendships.
 Focus: Disjoint set union (DSU) data structure, basic connectivity checks.
- 26. Design an efficient algorithm to find the minimum number of new friendships needed to connect all users in the social network into a single, connected component. **Focus:** Applying DSU for finding connected components, greedy algorithms, optimization for minimizing connections.
- 27. A treasure hunt involves a series of clues leading to the final treasure. Given a list of possible paths and their associated costs, find the cheapest path to reach the treasure. Focus: Greedy algorithms (e.g., Dijkstra's algorithm for shortest paths), basic graph representation.
- 28. In a more complex treasure hunt, there are time constraints associated with each path. Design an algorithm to find the fastest path to the treasure while considering both path costs and time constraints.

Focus: Combining greedy approaches with other techniques (e.g., priority queues), handling multiple constraints, optimizing for time-critical scenarios.

- 29. In a simplified chess game with only rooks, determine the minimum number of moves required for a rook to reach a specific target square on an empty board. **Focus:** Breadth-first search (BFS) on a graph (the chessboard), basic graph traversal.
- 30. In a more realistic chess game with multiple pieces and obstacles, implement a minimax algorithm with alpha-beta pruning to determine the best move for a player. Focus: Game tree search, minimax algorithm, optimization techniques like alpha-beta pruning, handling complex game states.

Targeted Application & Tools that can be used:

- 1. C or C++ Compiler (g++): The standard compiler for CP. Familiarize students with compilation flags (e.g., -O2 for optimization).
- 2. IDE (Integrated Development Environment): Code:: Blocks, Visual Studio, CLion, or similar IDEs. These provide debugging capabilities, code completion, and other helpful features.
- 3. Online Judges (CodeChef, Codeforces, LeetCode, HackerRank): Essential for practicing and submitting solutions.
- 4. Debugger (gdb): Crucial for understanding code execution and finding bugs. Origin, excel and Mat lab soft wares for programming and data analysis.
- 5. Number Theory Libraries: Some libraries provide pre-built functions for number theory operations (though often it's better to implement them yourself for learning).
- 6. Wolfram Alpha: A useful tool for verifying number theory calculations and exploring concepts.
- 7. **String Libraries:** Familiarize students with the string manipulation functions available in C++.
- 8. **Graph Visualization Tools:** Tools like Graphviz can be helpful for visualizing graphs and understanding graph algorithms.
| DP Debugging Techniques: Practice debugging DP solutions, as they can be complex.
Visualizing the DP table can be helpful. | | | | |
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| Text Books: | | | | |
| 1 Guide to Competitive Programming: Learning and Improving Algorithms Through
Contests" (3rd Edition), <i>Antti Laaksonen, springer, 2024</i> | | | | |
| 2 "Data Structures and Algorithms in Java: A Project-Based Approach" – Dan S. Myers,
Cambridge University Press | | | | |
| Reference Books: | | | | |
| 1. Data Structures and Algorithmic Thinking with Python/C++/Java", Narasimha
Karumanchi, 5 th Edition, Career Monk, 2017. | | | | |
| 2. Introduction to Algorithms, Thomas H. Cormen (Author), Charles E. | | | | |
| <u>Leiserson</u> (Author), <u>Ronald L. Rivest</u> , fourth edition April 2022 | | | | |
| Web Resources | | | | |
| 1. https://nptel.ac.in/courses/106106231 | | | | |
| 2. | | | | |
| Project work/Assignment: Mention the Type of Project /Assignment proposed for this course | | | | |
| Assessment Type | | | | |
| Midterm exam | | | | |
| Assignment (review of digital/ e-resource from PU link given in references | | | | |
| section - mandatory to submit screen shot accessing digital resource.) | | | | |
| • Quiz | | | | |
| End Term Exam | | | | |
| Self-Learning | | | | |

Course Code: CSE7000	Course Title: Internship Type of Course:	L- T-P- C	-	-	-	2
Version No.	1.0					
Course Pre- requisites	Knowledge and Skills related to all the courses studied in previous semesters.					
Anti-requisites	NIL					
Course Description	NIL Students observe science and technology in action, develop an awareness of the method of scientific experimentation, and often get an opportunity to see, study and operate sophisticated and costly equipment. They also learn about the implementation of the principles of management they have learnt in class, when they observe multidisciplinary teams of experts from engineering, science, economics, operations research, and management deal with techno-economic problems at the micro and macro levels. Finally, it enables them to develop and refine their language, communication and inter-personal skills, both by its very nature, and by the various evaluation components, such as seminar, group discussion, project report preparation, etc. The broad-based core education, strong in mathematics and science and rich in analytical tools, provides the					

	foundation necessary for the student to understand properly the nature of real-life problems.
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Professional Practice and attain Employability Skills through Experiential Learning techniques.
Course Outcomes	 On successful completion of this course the students shall be able to: Identify the engineering problems related to local, regional, national or global needs. (Understand) Apply appropriate techniques or modern tools for solving the intended problem. (Apply) Design the experiments as per the standards and specifications. (Analyze) Interpret the events and results for meaningful conclusions. (Evaluate)

Course Code:CSE 7100	Course Title: Mini Project Type of Course:	L- T-P- C	0	0	0	4
Version No.	1.0					
Course Pre- requisites	Knowledge and Skills related to all the courses studied in previous semesters.					
Anti-requisites	NIL					
Course Description	NILStudents observe science and technology in action, develop an awareness of the method of scientific experimentation, and often get an opportunity to see, study and operate sophisticated and costly equipment. They also learn about the implementation of the principles of management they have learnt in class, when they observe multidisciplinary teams of experts from engineering, science, economics, operations research, and management deal with techno-economic problems at the micro and macro levels. Finally, it enables them to develop and refine their language, communication and inter-personal skills, both by its very nature, and by the various evaluation components, such as seminar, group discussion, project report preparation, etc. The broad-based core education, strong in mathematics and science and rich in analytical tools, provides the foundation necessary for the student to understand properly the nature of real-life problems. The students have options to pursue this course as		ess ity lso ave om ent els. ge, by on, g in the e of as c in			

	an Industry/ Company/ Research Laboratory, or Internship Program in an			
	Industry/Company.			
	The objective of the course is to familiarize the learners with the concepts of			
Course Objectives	Professional Practice and attain Employability Skills through Experiential			
	Learning techniques.			
On successful completion of this course the students shall be able to:				
	1. Identify the engineering problems related to local, regional, national			
	or global needs. (Understand)			
	2. Apply appropriate techniques or modern tools for solving the			
Course Outcomes	intended problem. (Apply)			
	3. Design the experiments as per the standards and specifications.			
	(Analyze)			
	4. Interpret the events and results for meaningful conclusions.			
	(Evaluate)			
	5. Appraise project findings and communicate effectively through			
	scholarly publications. (Create)			

Course Code:CSE 7300	Course Title: Capstone Project Type of Course:	L- T-P- C	0	0	0	10
Version No.	1.0					
Course Pre- requisites	Knowledge and Skills related to all the courses studied in previous semesters.					
Anti-requisites	NIL					
Course Description	NIL Students observe science and technology in action, develop an awareness of the method of scientific experimentation, and often get an opportunity to see, study and operate sophisticated and costly equipment. They also learn about the implementation of the principles of management they have learnt in class, when they observe multidisciplinary teams of experts from engineering, science, economics, operations research, and management deal with techno-economic problems at the micro and macro levels. Finally, it enables them to develop and refine their language, communication and inter-personal skills, both by its very nature, and by the various evaluation components, such as seminar, group discussion, project report preparation, etc. The broad-based core education, strong in mathematics and science and rich in analytical tools, provides the foundation necessary for the student to understand properly the nature of real-life problems. The students have options to pursue this course as		ess iity lso ave om ent els. ge, by on, g in the e of as c in			

	an Industry/ Company/ Research Laboratory, or Internship Program in an Industry/Company.
Course Objectives	The objective of the course is to familiarize the learners with the concepts of Professional Practice and attain Employability Skills through Experiential Learning techniques.
Course Outcomes	 On successful completion of this course the students shall be able to: Identify problems based on societal /research needs. (Understand) Apply Knowledge and skill to solve societal problems in a group. (Apply) Develop interpersonal skills to work as member of a group or leader. (Apply) Analyze the inferences from available results through theoretical / Experimental / Simulations. (Analyze) Analyze the impact of solutions in societal and environmental context for sustainable development. (Analyze) Improve in written and oral communication. (Create) Demonstrate capabilities of self-learning in a group, which leads to lifelong learning. (Understand)

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