KARNATAK LAW SOCIETY'S
GOGTE INSTITUTE OF TECHNOLOGY
UDYAMBAG, BELAGAVI-590008
(An Autonomous Institution under Visvesvaraya Technological University, Belagavi)
(APPROVED BY AICTE, NEW DELHI)

Third to Eighth semester B.E.
(2022 Scheme)
COMPUTER SCIENCE AND ENGINEERING

INSTITUTION VISION

Gogte Institute of Technology shall stand out as an institution of excellence in technical education and in training individuals for outstanding caliber, character coupled with creativity and entrepreneurial skills.

MISSION

To train the students to become Quality Engineers with High Standards of Professionalism and Ethics who have Positive Attitude, a Perfect blend of Techno-Managerial Skills and Problem solving ability with an analytical and innovative mindset.

QUALITY POLICY

- Imparting value added technical education with state-of-the-art technology in a congenial, disciplined and a research oriented environment.
- Fostering cultural, ethical, moral and social values in the human resources of the institution.
- Reinforcing our bonds with the Parents, Industry, Alumni, and to seek their suggestions for innovating and excelling in every sphere of quality education.

DEPARTMENT VISION

To be a center of Excellence for Education, Research and Entrepreneurship in Computer Science and Engineering in creating professionals who are competent to meet emerging challenges to benefit society

MISSION

To impart and strengthen fundamental knowledge of students, enabling them to cultivate professional skills, entrepreneurial and research mindset with right attitude and aptitude.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)	
1.	The graduates will acquire core competence in basic-science and engineering fundamentals necessary to formulate, analyze, and solve engineering problems and to pursue advanced study.
2.	The graduates will acquire capabilities to succeed as computer engineering professionals with an aptitude for higher education and entrepreneurship.
3.	The graduates will have the curiosity and desire of learning for life and self-confidence to adapt to changes.
4.	The graduates will maintain high professionalism and ethical standards, effective oral and written communication skills, work as part of teams on multidisciplinary projects under diverse professional environments, and relate engineering issues to the society, global economy and to emerging technologies.

PROGRAM OUTCOMES (POs)	
1.	**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
2.	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and Engineering sciences.
3.	**Design/Development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4.	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5.	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6.	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7.	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8.	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9.	**Individual and team work:** Function effectively as an individual and as a member or leader in diverse teams, and in multidisciplinary settings.
10.	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive

	clear instructions.
11.	**Project management and finance:** Demonstrate knowledge and understanding of the engineering 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.
12.	**Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)	
1.	**Problem solving skills:** Ability to identify and analyze problems of varying complexity and propose solutions by applying fundamental knowledge acquired in the field of Computer Science and Engineering.
2.	**Project development skills:** Ability to apply design principles and demonstrate best practices of software development processes to solve real life problems.
3.	**Career advancement:** Ability to demonstrate professional and leadership qualities required to pursue opportunities in Information Technology/self-employment/ higher studies.

KLS Gogte Institute of Technology
3rd to 8th sem B.E.
Scheme of Teaching and Examination- 2022
Outcome-Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2023-24)

Total credits for B.E. Program: 160

Credit definition:

Offline Courses	Online Courses
• 1-hour Lecture **(L)** per week = 1 Credit • 2 hours Tutorial **(T)** per week = 1 Credit, • 2 hours Practical /Drawing **(P)** per week = 1 Credit	04 weeks =1 Credit 08 weeks = 2 Credit 12 weeks = 3 Credit

Semester wise distribution of credits for B.E program

Year	Semester	Credits	Total/Year	Cumulative Credits
1st	I	20	40	40
	II	20		
2nd	III	20	40	80
	IV	20		
3rd	V	22	40	120
	VI	18		
4th	VII	24	40	160
	VIII	16		
Total			160	

Curriculum frame work:

Structure of Undergraduate Engineering program

S.No.	Category of courses	VTU Breakup of credits	KLSGIT Breakup of credits
1	Humanities and Social Sciences including Management courses (English, Kannada, Indian Constitution, Environmental Sciences, Health and Management)	9	10
2	Basic Science courses	22	22
3	Engineering Science courses including ETC, PLC & Drawing	24	24
4	Professional Core Courses	54	54
5	Professional Elective courses relevant to chosen specialization/branch	12	12
6	Open subjects – Electives from other technical, emerging, arts, commerce	9	9
7	Mini, Project, Major Project work and Seminar	10	10
8	Summer Internship and Research /Industrial Internship	10	10
9	Ability Enhancement Courses, including Research Methodology, NCC/NSS/ Sports/Ex- Curricular, Online Certification Course	8	7
10	Universal Human Values	2	2
	TOTAL	**160**	**160**

L-T-P Model for Courses

	Contact Hours				Credits	
S.No.	**L-T-P**	**Lecture**	**Tutorial**	**Practical**	**L-T-P**	**Total**
1	3 - 0 - 0	3	0	0	3 - 0 - 0	3
2	3 - 2 - 0	3	2	0	3 - 1 - 0	4
3	3 - 0 - 2	3	0	2	3 - 0 - 1	4
4	2 - 0 - 2	2	0	2	2 - 0 - 1	3
	1 - 0 - 4	1	0	4	1 - 0 - 2	3

Theory courses having the corresponding lab are converted to integrated type course. Also, the electives (if possible) can also be made integrated type.

Integrated courses (Professional Core/Electives): Integrated courses will have **Theory Syllabus with Practical Syllabus of the same course**. In such a course there could be **no Semester End Examination (SEE) for the practical syllabus**of the course, however, Continuous Internal Evaluation (CIE) will be conducted for the practical topics. SEE can include questions from practical topics.

SDA-Skill Development Activities, TD/PSB- Teaching Department / Paper Setting Board, ASC-Applied Science Course, ESC- Engineering Science Courses, ETC- Emerging Technology Course, AEC- Ability Enhancement Course, HSMS-Humanity and Social Science and Management Course, SDC- Skill Development Course,

KLS Gogte Institute of Technology

2nd Year B.E. Scheme of Teaching and Examination 2022

3rd Semester					**Hours/week**			**Total contact hours/week**	**Credits**	**Examination**		
S.No.	**Course Type**	**Course Code**	**Course Title**	**Teaching Dept.**	**L**	**T**	**P**			**CIE**	**SEE**	**Total**
1	BSC	22MATCS31/ 22MATIS31	Fundamentals of Statistics and Probability for Data Science	Maths	3	0	0	03	3	100	100	200
2	IPCC	22CS32/ 22IS32	Software Engineering and Design	CSE	3	0	2	05	4	100	100	200
3	IPCC	22CS33/ 22IS33	Object Oriented Programming usingJava	CSE	3	0	2	05	4	100	100	200
4	PCC	22CS34/ 22IS34	Data Structures and Applications	CSE	3	0	0	03	3	100	100	200
5	ESC	22CS35X/ 22IS35X	ESC/ETC/PLC	CSE	3	0	0	03	3	100	100	200
6	UHV	22CS36/ 22IS36	**Social Connect and Responsibility**	CSE	0	0	2	02	1	100	--	100
7	AEC/ SEC	22AECCS37x/ 22AECIS37X	Ability Enhancement Course/Skill Enhancement Course - III	CSE	If the course is a Theory 1	0	0	01	1	50	50	100
					If a course is a laboratory 0	0	2	02				
8	MC	22CS38A/ 22IS38A	National Service Scheme (NSS)	NSS coordinator	0	0	2		0	100	--	100
		22CS38B/ 22IS38B	Physical Education (PE) (Sports and Athletics) and Yoga	Physical Education dept & Yoga instructor								
		22CS38C/ 22IS38C	Clubs- Social, Cultural & Academic	Coordinators								
9	PCCL	22CSL39/ 22ISL39	Data Structures Laboratory using C	CSE	0	0	2	02	1	50	50	100
Total									**20**	**800**	**600**	**1400**

Engineering Science Course (PLC)			
22CS351/ 22IS351	Object Oriented Programming using C++ (2-0-2)	22CS353/ 22IS353	Digital Electronics (2-0-2)
22CS352/ 22IS352	Web Programming - A Practical Approach (2-0-2)	22CS354/ 22IS354	Python Programming - A Practical Approach(2-0-2)
Ability Enhancement Course – III			
22AECCS371	Design Thinking	22AECCS373	Software Tools and Technologies
22AECCS372	Introduction to Embedded Systems and IoT - A Hands-on Approach	22AECCS374	Data V*i*sualization Tools and Techniques
22AECCS375	Mathematics - I		

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23 may please be referred.

National Service Scheme /Physical Education/Yoga/Clubs: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), Yoga(YOG) and Clubs with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, Yoga and Club activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

4th Semester					Hours/week			Total contact hours/week	Credits	Examination		
S.No.	**Course Type**	**Course Code**	**Course Title**	**Teaching Dept.**	**L**	**T**	**P**			**CIE**	**SEE**	**Total**
1	PCC	22CS41/22IS41	Operating Systems	CSE	3	0	0	03	3	100	100	200
2	IPCC	22CS42/22IS42	Design and Analysis of Algorithms	CSE	3	0	2	05	4	100	100	200
3	IPCC	22CS43/22IS43	Database Management Systems	CSE	3	0	2	05	4	100	100	200
4	ESC	22CS44x/22IS44x	ESC/ETC/PLC	CSE	3	0	0	03	3	100	100	200
5	AEC/ SEC	22AECCS45x	Ability Enhancement Course/Skill Enhancement Course- IV	CSE	If the course is Theory 1	0	0	01	1	50	50	100
					If the course is a lab 0	0	2	02				
6	BSC	22CS46/22IS46	Biology For Engineers	CSE	3	0	0	03	3	100	100	200
7	UHV	22CS47/22IS47	Universal Human Values	CSE	1	0	0	01	1	50	50	100
8	MC	22CS481/ 22IS481	National Service Scheme (NSS)	NSS coordinator	0	0	2		**0**	100	--	100
		22CS482/ 22IS482	Physical Education (PE) (Sports and Athletics) and Yoga	Physical Education dept & Yoga instructor								
		22CS483/22IS483	Clubs- Social, Cultural & Academic	Coordinators								
9	PCCL	22CSL49/22ISL49	Operating Systems Lab	CSE	0	0	2	02	1	50	50	100
Total									**20**	**750**	**650**	**1400**

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation.

Engineering Science Course (ESC/ETC/PLC)			
22CS441	Discrete Mathematical Structures and Graph Theory	22CS443/ 22IS443	Digital Electronics(2-0-2)
22CS442/ 22IS442	Web Programming- A Practical Approach (2-0-2)	22CS444/ 22IS444	Python Programming- A Practical Approach (2-0-2)
Ability Enhancement Course / Skill Enhancement Course - IV			
22AECCS451	Design Thinking	22AECCS453	Software Tools and Technologies
22AECCS452	Introduction to Embedded Systems and IoT - A Hands-on Approach	22AECCS454	Data Visualization Tools and Techniques
22AECCS455	Mathematics - II		

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23.

National Service Scheme /Physical Education/Yoga/Clubs: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), Yoga(YOG) and Clubs with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, Yoga and Club activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

KLS Gogte Institute of Technology

3rd Year B.E. Scheme of Teaching and Examination 2022

5th Semester					Hours/week			Total contact hours/week	Credits	Examination		
S.No.	Course Type	Course Code	Course Title	Teaching Dept.	L	T	P			CIE	SEE	Total
1	HSMS	22CS51	Entrepreneurship and Management	CSE	3	0	0	03	3	100	100	200
2	IPCC	22CS52	Formal Languages and Automata Theory	CSE	3	0	2	05	4	100	100	200
3	PCC	22CS53	Micro-Controllers and Embedded Systems	CSE	4	0	0	04	4	100	100	200
4	PEC	22CS54x	Professional Elective Course	CSE	3	0	0	03	3	100	100	200
5	PROJ	22CS55	Research Based Mini Project	CSE	0	0	4	04	2	100	-	100
6	AEC	22CS56A	Research Methodology and Intellectual Property Rights	CSE	2	0	0	02	2	100	100	200
7	AEC	22AECCS56B	Employability Skills -1	Bizotic	1	0	0	01	1	100	-	100
8	MC	22CS57	Environmental Studies		2	0	0	02	2	100	100	200
9	MC	22CS581	National Service Scheme (NSS)	NSS coordinator	0	0	2		0	100	-	100
		22CS582	Physical Education (PE) (Sports and Athletics) and Yoga	Physical Education dept & Yoga instructor								
		22CS583	Clubs- Social, Cultural & Academic	Coordinators								
10	PCCL	22CSL59	Micro-Controllers and Embedded Systems Laboratory	CSE	0	0	2	02	1	50	50	100
Total									**22**	**950**	**650**	**1600**

Professional Elective Course			
22CS541	Data Visualization	22CS543	Advanced Java
22CS542	Big Data Management	22CS544	Agile Software Development
22CS545	Data Warehousing and Data Mining		

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**:

Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation.**PROJ**: Project /Mini Project. **PEC**: Professional Elective course

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23

National Service Scheme /Physical Education/Yoga/Clubs: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), Yoga(YOG) and Clubs with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, Yoga and Club activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Mini-project work: Mini Project is a laboratory-oriented/hands-on course that will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications etc. Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students.

CIE procedure for Mini-project:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of the project publication/technical paper, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batches mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project.

The CIE marks awarded for the Mini-project, shall be based on the evaluation of the project publication/technical paper, project presentation skills, and question-answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

No SEE component for Mini-Project.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering a professional elective is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

6th Semester					Hours/week			Total contact hours/week	Credits	Examination		
S.No.	Course Type	Course Code	Course Title	Teaching Dept.	L	T	P			CIE	SEE	Total
1	IPCC	22CS61	Artificial Intelligence and Machine Learning	CSE	3	0	2	05	4	100	100	200
2	PCC	22CS62	Computer Networks	CSE	4	0	0	04	4	100	100	200
3	PEC	22CS63x	Professional Elective Course	CSE	3	0	0	03	3	100	100	200
4	OEC	22CS64x	Open Elective Course	CSE	3	0	0	03	3	100	100	200
5	PROJ	22CS65	Major Project Phase I	CSE	0	0	4	04	2	100	--	100
6	AEC/SDC	22AECCS66	Ability Enhancement Course/Skill Development Course V- **Employability Skills -2**	Bizotic	1	0	0	01	1	100	-	100
7	MC	22CS671	National Service Scheme (NSS)	NSS coordinator	0	0	2		0	100	--	100
		22CS672	Physical Education (PE) (Sports and Athletics) and Yoga	Physical Education dept & Yoga instructor								
		22CS673	Clubs- Social, Cultural & Academic	Coordinators								
8	PCCL	22CSL68	*Programming Lab	CSE	0	0	2	02	1	50	50	100
Total									**18**	**750**	**450**	**1200**

Professional Elective Course			
22CS631	Robotic Process Automation (Industry Supported Elective)	22CS634	Compiler Design
22CS632	Distributed and Cloud Computing	22CS635	Introduction to Salesforce (Industry Supported Elective)
22CS633	Internet of Things (2 – 0 – 2)		

Open Elective Course			
22CS641	Indian Knowledge System	22CS644	Robotic Process Automation
22CS642	Data Structures	22CS645	Web Programming
22CS643	Object-Oriented Programming using JAVA	22CS646	Stream-specific Mathematics course

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal

Evaluation, **SEE**: Semester End Evaluation.**PROJ**: Project /Mini Project. **PEC**: Professional Elective Course. **PROJ**: Project Phase -I, **OEC**: Open Elective Course
Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practicals of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23 **National Service Scheme /Physical Education/Yoga/Clubs:** All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), Yoga(YOG) and Clubs with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, Yoga and Club activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.
Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.
Open Elective Courses: Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.
Project Phase-I : Students have to discuss with the mentor /guide and with their help he/she has to complete the literature survey and prepare the report and finally define the problem statement for the project work.

KLS Gogte Institute of Technology

4th Year B.E. Scheme of Teaching and Examination 2022

7th Semester					Hours/week			Total contact hours/week	Credits	Examination		
S.No.	Course Type	Course Code	Course Title	Teaching Dept.	L	T	P			CIE	SEE	Total
1	IPCC	22CS71	Object Oriented Modelling and Design	CSE	3	0	2	05	4	100	100	200
2	IPCC	22CS72	Unix System and Network Programming	CSE	3	0	2	05	4	100	100	200
3	PCC	22CS73	Cloud computing	CSE	4	0	0	04	4	100	100	200
4	PEC	22CS74x	**Professional Elective Course**	CSE	3	0	0	03	3	100	100	200
5	OEC	22CS75x	**Open Elective Course**	CSE	3	0	0	03	3	100	100	200
6	PROJ	22CS76	**Major Project Phase-II**	CSE	0	0	12	12	6	100	100	200
Total									**24**	**600**	**600**	**1200**

Professional Elective Course			
22CS741	Information and Network Security	22CS744	Cyber Security
22CS742	Block Chain Management	22CS745	Salesforce Lightning (Industry Supported Elective)
22CS743	Mobile Computing		

Open Elective Course			
22CS751	Disaster Management	22CS754	Machine Learning
22CS752	Database Management System	22CS755	Principles of Cyber Security
22CS753	Python Programming	22CS756	Stream specific Mathematics course

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **PEC**: Professional Elective Course, **OEC**: Open Elective Course PR: Project Work, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **TD-** Teaching Department, **PSB**: Paper Setting department, **OEC**: Open Elective Course, **PEC**: Professional Elective Course. **PROJ**: Project work

Note: VII and VIII semesters of IV years of the program

(1) Institutions can swap the VII and VIII Semester Schemes of Teaching and Examinations to accommodate research internships/ industry internships after the VI semester**.**

(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether the VII or VIII semesters is completed during the beginning of the IV year or the later part of IV years of the program.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the

Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses:

Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.

PROJECT WORK: The objective of the Project work is

(i) To encourage independent learning and the innovative attitude of the students.

(ii) To develop interactive attitude, communication skills, organization, time management, and presentation skills.

(iii) To impart flexibility and adaptability.

(iv) To inspire team working.

(v) To expand intellectual capacity, credibility, judgment and intuition.

(vi) To adhere to punctuality, setting and meeting deadlines.

(vii) To install responsibilities to oneself and others.

(viii) To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

CIE procedure for Project Work:

(1) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work, shall be based on the evaluation of the project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(2) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

SEE procedure for Project Work: SEE for project work will be conducted by the two examiners appointed by the COE. The SEE marks awarded for the project work shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25.

8th Semester					Hours/week			Total contact hours/week	Credits	Examination		
S.No.	Course Type	Course Code	Course Title	Teaching Dept.	L	T	P			CIE	SEE	Total
1	PEC	22CS81x	Professional Elective (Online Courses)	TD-PSB	3	0	0	03	3	100	-	100
2	OEC	22CS82x	Open Elective (Online Courses)	TD: PSB	3	0	0	03	3	100	-	100
3	INT	22CS83	Internship (Industry/Research) (14 - 20 weeks)	TD: PSB	0	0	20	20	10	100	100	200
Total									**16**	**300**	**100**	**400**

Professional Elective Course (Online courses)			
22CS811		22CS813	
22CS812		22CS814	
Open Elective Courses (Online Courses			
22CS821		22CS823	
22CS822		22CS824	

L: Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **TD-** Teaching Department, **PSB**: Paper Setting department, **OEC**: Open Elective Course, **PEC**: Professional Elective Course. **PROJ**: Project work, **INT**: Industry Internship / Research Internship / Rural Internship

Note: VII and VIII semesters of IV years of the program

Swapping Facility

- Institution can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate **research internships/ industry internships/Rural Internship** after the VI semester**.**
- Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the program.

Elucidation:

At the beginning of IV years of the program i.e., after VI semester, VII semester classwork and VIII semester **Research Internship /Industrial Internship / Rural Internship** shall be permitted to be operated simultaneously so that students have ample opportunity for an internship. In other words, a good percentage of the class shall attend VII semester classwork and a similar percentage of others shall attend to Research Internship or Industrial Internship or Rural Internship.

Research/Industrial /Rural Internship shall be carried out at an Industry, NGO, MSME, Innovation center, Incubation center, Start-up, center of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations/institutes.

The mandatory Research internship /Industry internship / Rural Internship is for 14 to 20 weeks. The internship shall be considered as a head of passing and shall be considered for the award of a degree. Those, who do not take up/complete the internship shall be declared to fail and shall have to complete it during the subsequent University examination after satisfying the internship requirements.

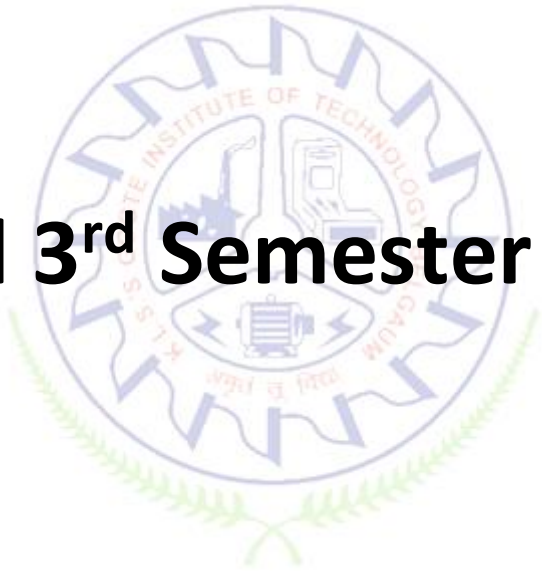
Research internship: A research internship is intended to offer the flavor of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research.

Industry internship: Is an extended period of work experience undertaken by students to supplement their degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints.

Rural Internship: Rural development internship is an initiative of Unnat Bharat Abhiyan Cell, RGIT in association with AICTE to involve students of all departments studying in different academic years for exploring various opportunities in techno-social fields, to connect and work with Rural India for their upliftment. The faculty coordinator or mentor has to monitor the student's internship progress and interact with them to guide for the successful completion of the internship. The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of the internship.

With the consent of the internal guide and Principal of the Institution, students shall be allowed to carry out the internship at their hometown (**within or outside the state or abroad**), provided favorable facilities are available for the internship and the student remains regularly in contact with the internal guide. **College shall not bear any cost involved in carrying out the internship by students.** However, students can receive any financial assistance extended by the organization.

Professional Elective /Open Elective Course: These are ONLINE courses suggested by the respective Board of Studies. The online courses can be NPTEL/SWAYAM/NASSCOM/Industry certified and for a duration of 12 weeks. Details of these courses shall be made available for students on the college web portal.



Detailed 3rd Semester Syllabus

FUNDAMENTALS OF STATISTICS AND PROBABILITY FOR DATA SCIENCE

Course Code:	**22MATS31**	**Course type**	Theory	**Credits L-T-P**	3 – 0– 0
Hours/week: L-T-P	3 – 0 – 0			**Total credits**	3
Total Contact Hours	L = 40 Hrs; T = 0Hrs;P = 0 Hrs Total = 40 Hrs			**CIE Marks**	100
Flipped Classes content	10 Hours			**SEE Marks**	100

Course learning objectives	
At the end of the course students should be able to	
1.	Fit a suitable curve for the data using regression.
2.	Get knowledge about various probability distributions involving discrete /continuous random variable.
3.	Get familiar with various sampling distributions and estimation of various parameters.
4.	Get acquainted with various hypothesis testing techniques.
5.	Understand Joint discrete PDF and various stochastic processes.

Pre-requisites : Basic statistics, Basic probability.

Unit – I	**Contact Hours = 8 Hours**
Correlation and Regression: Curve fitting by least square method. Fitting the curve , $y = a+bx$, , $y = ax^b$, $y =a+bx+cx^2$.Karl Pearson coefficient of correlation, Linear Regression: Problems. Multiple correlation and regression. Partial correlation and regression.	

Unit – II	**Contact Hours = 8 Hours**
Random Variable: Revision of basic probability, conditional probability upto Bayes theorem. Discrete and Continuous Random Variable, (DRV,CRV) Probability Distribution Functions (PDF) and Cumulative Distribution Functions(CDF), Expectations, Mean, Variance. Binomial, Poisson, Exponential and Normal Distributions. Practical examples.	

Unit –III	**Contact Hours = 8 Hours**
Joint PDF and Stochastic Process: Discrete Multivariable Joint PDF, Multivariable Conditional Joint PDF, Expectations (Mean, Variance and Covariance). Definition and classification of stochastic processes. Discrete state and discrete parameter stochastic process, Unique fixed probability vector, Regular Stochastic Matrix, Transition probability, Markov chain.	

Unit – IV	**Contact Hours = 8 Hours**
Hypothesis Testing : Null and alternate hypothesis, Critical region, Sampling, Sampling errors, Level of significance and confidence limits ,Testing hypothesis of mean, Testing hypothesis of variance, Testing hypothesis of proportion.	

Unit –	**Contact Ho**

V
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Unit No.	Self-Study Topics
1	Regression models, Regression strategies.
2	Discrete and Continuous Random vectors in different areas such as Mutual funds, lottery draw, decision making, decision trees etc…
3	Restate the research question as research hypothesis and a null hypothesis about the populations and determine the characteristics of the comparison distribution.
4	Eliminating variability during gathering statistical data.
5	Monte Carlo Simulation.

Books	
	Text Books:
1.	B. S. Grewal: "Higher Engineering Mathematics", Khanna publishers, 42thEd., 2021 onwards.
2.	Erwin Kreyszig: "Advanced Engineering Mathematics, John Wiley & Sons Inc., 9th Edition, 2006 and onwards.
	Reference Books:
1.	B.V. Ramana**: "**Higher Engineering Mathematics"McGraw-Hill Education, 11thEd., 2004 onwards.
2.	Srimanta Pal &Subodh C. Bhunia: "Engineering Mathematics"Oxford University Press, 3rd Ed., 2016 onwards
3	N.P Bali and Manish Goyal:"A textbook of Engineering Mathematics Laxmi Publications, 10th Ed., 2022 onwards
4	C. Ray Wylie, Louis C. Barrett: **"**Advanced Engineering Mathematics"McGraw –Hill Book Co., New york, 6thEd., 2017 onwards
5	H. K. Dass and Er. RajnishVerma**:** Higher Engineering Mathematics"S. Chand Publication, 3rd Ed., 2014.
	E-resourses (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://nptel.ac.in/courses/111106111
3	https://nptel.ac.in/courses/111104025
4	https://nptel.ac.in/courses/117105085
5	https://nptel.ac.in/courses/111105042

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Book Assignments (OBA)
3.	Flipped Classes	3.	Course Seminar
4.	Practice session/Demonstrations in Labs	4.	Quizzes
5.	Virtual Labs (if present)	5.	Semester End Examination

Course Outcome (COs) **Learning Levels:** **Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create**				
At the end of the course, the student will be able to		**Learning Level**	**PO(s)**	**PSO(s)**
1.	**Understand** regression analysis for data analysis.	Ap	1	1
2.	**Apply** the knowledge of Discrete and Continuous Random vectors in different areas such as Mutual funds, lottery draw, decision making, decision trees etc…	Ap	1	1
3.	**Apply** knowledge of Sampling distribution and Hypothesis Testing to conduct basic statistical analysis of data.	Ap	1	1

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Online Quiz	Addition of two OBAs/Python	Course Seminar	Total Marks
Marks	25+25= 50	4* 5 marks = 20	10+10 =20	10	100

OBA- Open Book Assignment
Minimum score to be eligible for CIE: 40 OUT OF 100

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains three parts **A(30 marks),B(50 marks) and C (20 marks).**Student has to answer 1. From Part A answer any 5 questions each Question Carries 6 Marks. 2. From Part B answer any one full question from each unit and each question Carries 10 Marks. 3. From Part C answer any one full question and each Question Carries20 Marks.

CO-PO Mapping (planned)													**CO-PSO Mapping(planned)**		
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
1	✓												✓		
2	✓												✓		
3	✓												✓		
Tick mark the CO, PO and PSO mapping															

SOFTWARE ENGINEERING AND DESIGN

Course Code	22CS32 / 22IS32	Course type	IPCC	Credits L-T-P	3 - 0 - 1
Hours/week: L - T- P	3 - 0 - 2			Total credits	4
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 20 Hrs Total = 60 Hrs			CIE Marks	100
Flipped Classes content	10 Hours			SEE Marks	100

Course learning objectives	
1.	Contrast use of Software Engineering and associated processes using standard models.
2.	Identify the software functions and associated component to design architectural framework.
3.	Decide the separation of concern and design relevant processes for the required operations.
4.	Prepare test cards to measure project performance accomplishing specified requirements.

Required Knowledge of : Basics of any programming language, software types, functions and steps of software development

Unit – I	Contact Hours = 8 Hours
Introduction: Professional software development, Software engineering ethics, Case studies. **Software Processes:** Software Process models: The Waterfall model – A Case study, Incremental development, Reuse-oriented software engineering, Process activities: Software specification, Software design and implementation, Software validation, Coping with Change: Prototyping, Incremental Delivery, Boehm's Spiral Model.	

Unit – II	Contact Hours = 8 Hours
Requirements Engineering: Functional and non-functional requirements: Functional requirements. Non-functional requirements, Introduction to Requirements specification. **Agile Software Development:** Agile methods- Plan driven and Agile Development, Introduction to Extreme Programming.	

Unit – III	Contact Hours = 8 Hours
Design and Implementation: Object-oriented design using UML: System Context and Interaction, Architectural design, Object Class identification, design Models, Interface Specification, Design Patterns, Implementation issues, Open Source development.	

Unit – IV	Contact Hours = 8 Hours
Software Testing: Development Testing: Unit Testing, Choosing Unit Test Cases, Component Testing, System Testing, Test Driven Development, Release Testing: Requirements Based Testing, Scenario Testing, Performance Testing, User Testing. A Demo of Selenium.	

Unit – V	Contact Hours = 8 Hours
Quality Management: Introduction, Software quality, Software standards: The ISO 9001 standard framework, Reviews and inspection. **Configuration management:** Introduction to Change management, Version management, System building, Release management.	

Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	2	2	2	2	2

List of Experiments

Unit No.	No. of Experiments	Topic(s) related to Experiment
1	1	Software Process Model
2	2	Requirements Engineering: Plan-driven and Agile approaches
3	3	Software Design & Development using UML diagrams.
4	3	Software Testing

Unit No.	Self-Study Topics
I	Identification of requirements for any common software in use by business domain and the advantages.
II	Classification of functional and non-functional requirements of any software used in business domain. Software Architectural patterns, implementation and uses.
III	Object oriented software and UML: Business use-case Design and Activity diagrams
IV	Software testing ISO 9001 series – Guidelines applicable to software industry
V	Software Quality & Performance: Git-Hub based topics with ref. link: https://github.com/ICTU/quality-time

Books

	Text Books:
1.	Ian Summerville: Software Engineering, Pearson Education, 9th Edition onwards
	Reference Books:
1.	Roger .S. Pressman: Software Engineering-A Practitioners approach, 8th Edition and above, Tata McGraw Hill
2.	Paul C. Jorgensen: Software Testing Craftsman's Approach, 4th Edition CRC Press, Taylor Francis Group
3.	Rajib Mall, Fundamentals of Software Engineering , 4thEdition onwards PHI Learning Pvt. Ltd.
4.	Pankaj Jalote: An Integrated Approach to Software Engineering, Wiley India, 2009 onwards Resources

	E-resourses (NPTEL/SWAYAM.. Any Other)- mention links
1.	**NPTEL:** https://nptel.ac.in/courses/106105182
2.	**SWAYAM:** https://onlinecourses.swayam2.ac.in/cec20_cs07/preview
3.	**IIT Chennai:** https://onlinedegree.iitm.ac.in/course_pages/BSCCS3001.html

Course delivery methods		**Assessment methods**	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Book Assignments (OBA)/ Lab Project
3.	Flipped Classes	3.	Lab Test
4.	Practice session/Demonstrations in Labs	4.	Semester End Examination
5.	Virtual Labs (if present)		

Course Outcome (COs)

Learning Levels:

Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create

At the end of the course, the student will be able to		**Learning Level**	**PO(s)**	**PSO(s)**
1.	**Explain** professional practice for software development; requirements for associated processes, feasibility and decide the suitable model of software.	**Un**	1, 2	1
2.	**Choose** software design accumulating information and the functional components for the development.	**Ap**	2, 3, 5	1, 2
3.	**Apply** the software testing methods.to check the accuracy based on the analysis of contextual requirement.	**Ap**	3, 4, 5	1, 2
4.	**Analyze** software that matches with industry needs and adapt the changes based on demand for the continuous quality improvement.	**An**	4	2
5.	**Design** a course project by applying the learnings inculcated throughout the course.	**Ap**	2, 3, 5, 9, 10, 11, 12	1, 2, 3

Scheme of Continuous Internal Evaluation (CIE):

For integrated courses, a lab test also will be conducted at the end of the semester. The lab test **(COMPULSORY)** will be part of the CIE. **No SEE for Lab**.

THEORY (60 marks)			**LAB (40 marks)**		Total
IA test 1	IA test 2	Assignment (OBA/Lab Project/ Industry assignment)/ Course project	Conduction	Lab test	
25 marks	25 marks	10 marks	15 marks	25 marks	100 marks
IA Test: 1. No objective part in IA question paper					

2. All questions descriptive
Conduct of Lab: 1. Conducting the experiment and journal: 5 marks 2. Calculations, results, graph, conclusion and Outcome: 5 marks 3. Viva voce: 5 marks
Lab test: (Batchwise with 15 students/batch) 1. Test will be conducted at the end of the semester 2. Timetable, Batch details and examiners will be declared by Exam section 3. Conducting the experiment and writing report: 5 marks 4. Calculations, results, graph and conclusion: 10 marks 5. Viva voce: 10 marks
Eligibility for SEE: 1. 40% and above (24 marks and above) in theory component 2. 40% and above (16 marks and above) in lab component 3. **Lab test is COMPULSORY** 4. Not eligible in any one of the two components will make the student **Not Eligible** for SEE

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration.
2.	**Minimum marks required in SEE to pass:** Score should be ≥35 &, however overall score of CIE+SEE should be ≥40%.
3.	Question paper contains three parts **A,B and C**. Students have to answer 1. From Part A answer any 5 questions each Question Carries 6 Marks. 2. From Part B answer any one full question from each unit and each Question Carries 10 Marks. 3. From Part C answer any one full question and each Question Carries 20 Marks.

CO-PO Mapping (planned)													**CO-PSO Mapping (planned)**		
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
1	√	√											√		
2		√	√		√								√	√	
3			√	√	√								√	√	
4				√										√	
5		√	√		√				√	√	√	√	√	√	√
Tick mark the CO, PO and PSO mapping															

Sl No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Project development	IT Sector	Software Engineer
2	Software Design and development		Software Developer

Object Oriented Programming using JAVA

Course Code	22CS33 / 22IS33	Course type	IPCC	Credits L-T-P	3 - 0- 1
Hours/week: L-T-P	3 - 0 - 2			Total credits	4
Total Contact Hours	L = 40Hrs; T = 0Hrs; P = 20Hrs Total = 60Hrs			CIE Marks	100
Flipped Classes content	10 Hours			SEE Marks	100

Course Learning Objectives

1.	To understand the fundamentals of object-oriented programming and String class in Java.
2.	To demonstrate the object-oriented features such as encapsulation, inheritance and polymorphism to design and develop programs in Java.
3.	To understand exception handling mechanism supported in Java.
4.	To learn to use the data structures to organize data in the program using the collections framework in Java.
5.	To understand the concept of Packages, Interfaces and Lambda expressions in Java.

Required Knowledge of: Procedure Oriented Programming Languages

Unit – I	**Contact Hours = 8 Hours**
OOP Paradigm: The key attributes of object-oriented programming. **Java basics:** The Java language, JDK, arrays, multidimensional arrays, alternative array declaration, assigning array references, using the length member, the for-each loop. **Introducing classes and objects:** Class fundamentals, how objects are created, reference variables and assignment, String class	

Unit – II	**Contact Hours = 8 Hours**
Methods and classes: methods, returning from a method, returning a value, using parameters, constructors, parameterized constructors, the new operator revisited, garbage collection and finalizers, this keyword, controlling access to class members, pass objects to methods, argument passing, returning objects, method overloading.	

Unit – III	**Contact Hours = 8 Hours**
Inheritance: Inheritance basics, member access and inheritance, constructors, and inheritance, using super, multilevel hierarchy, when are constructors executed, superclass reference and subclass objects, method overriding, polymorphism, using abstract classes. **Interfaces:** interface fundamentals, creating, implementing, and using interfaces, implementing multiple interfaces.	

Unit – IV	**Contact Hours = 8 Hours**
Packages: Package fundamentals, packages and member access, importing packages, static import. **Exception handling:** the exception hierarchy, exception handling fundamentals, exception types, uncaught exceptions, using try and catch, multiple catch clauses, catching subclass exceptions, nested try, throw, throws, finally, Java's built-in exceptions, creating your own exception subclasses.	

Unit –V	**Contact Hours = 8 Hours**

The Java Collections Framework: overview, the collections interfaces, the collections classes, accessing a collection via an Iterator. **Java Lambda Expressions:** Syntax (0 parameter, 1 parameter, multiple parameters), Using Lambda expressions, examples

Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	2	2	2	2	2

List of Experiments

Unit No.	No. of Experiments	Topic(s) related to Experiment
1	2	2-dimensional array.
		String handling.
2	2	Class and its member methods.
		Parameterized Methods and Constructors
3	2	**Inheritance and interfaces.**
		Method Overloading and overriding
4	2	Packages.
		Customized exception handling.
5	2	**Collection classes and interfaces.**
		Lambda expressions.

Unit No.	Self-Study Topics
1	String class

Books	
	Text Books:
1.	Herbert Schildt& Dale Skrien, "Java Fundamentals A Comprehensive Introduction", 7th Edition onwards, Tata McGraw Hill, 2007.
2.	E Balagurusamy, Programming with Java A primer, Tata McGraw Hill companies.
	Reference Books:
1.	Kathy Sierra & Bert Bates, "Head First Java", O'Reilly, 2nd Edition and onwards.
2.	Y. Daniel Liang: Introduction to JAVA Programming, 7th Edition, Pearson Education, 2007.
	E-resources:
1.	https://www.w3schools.com/java
2.	https://freecodecamp.org
3.	https://www.tutorialspoint.com/java8
4.	https://www.javatpoint.com

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Book Assignments (OBA)/ Lab Project
3.	Flipped Classes	3.	Lab Test
4.	Practice session/Demonstrations in Labs	4.	Semester End Examination
5.	Virtual Labs (if present)		

Course Outcome (COs) **Learning Levels:** **Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create**				
At the end of the course, the student will be able to		**Learning Level**	**PO(s)**	**PSO(s)**
1.	**Develop** programs using OOP paradigm	Ap	1,2,3,5	1,2
2.	**Apply** skills in writing programs using exception-handling techniques.	Ap	1,2,3,5	1,2
3.	**Make use of** the type hierarchy in the Collections Framework and Lambda expressions.	Ap	1,3	1
4.	**Experiment with** the concept of packages and interfaces.	Ap	1, 3	1
5.	**Develop** a course project or present a course seminar by applying the learnings inculcated throughout the course.	Cr	2, 3, 5, 9, 10, 11, 12	1, 2, 3

Scheme of Continuous Internal Evaluation (CIE):

For integrated courses, a lab test also will be conducted at the end of the semester. The lab test **COMPULSORY)** will be part of the CIE. **No SEE for Lab**.

THEORY (60 marks)			**LAB (40 marks)**		Total
IA test 1	IA test 2	Assignment (OBA/Lab Project/ Industry assignment)	Conduction	Lab test	
25 marks	25 marks	10 marks	15 marks	25 marks	100 marks
IA Test: 1. No objective part in IA question paper 2. All questions descriptive					
Conduct of Lab: 1. Conducting the experiment and journal: 5 marks 2. Calculations, results, graph, conclusion and Outcome: 5 marks 3. Viva voce: 5 marks					
Lab test: (Batchwise with 15 students/batch) 1. Test will be conducted at the end of the semester					

2. Timetable, Batch details and examiners will be declared by Exam section 3. Conducting the experiment and writing report: 5 marks 4. Calculations, results, graph and conclusion: 10 marks 5. Viva voce: 10 marks
Eligibility for SEE: 1. 40% and above (24 marks and above) in theory component 2. 40% and above (16 marks and above) in lab component 3. **Lab test is COMPULSORY** 4. Not eligible in any one of the two components will make the student **Not Eligible** for SEE

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

CO-PO Mapping (planned)													**CO-PSO Mapping(planned)**		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
1	√	√	√		√								√	√	
2	√	√	√		√								√	√	
3	√		√										√		
4	√		√										√		
5		√	√		√				√	√	√	√	√	√	√
Tick mark the CO, PO and PSO mapping															

Sl No	Skill & competence enhanced after undergoing the course	Applicable try Sectors & domains	Job roles students can take up after undergoing the course
1	Good knowledge of OOP concepts	IT Sector	Java Developer / Java Programmer
2	Familiarity with development tools like Eclipse		
3	Familiarity with popular Java EE frameworks		

Data Structures and Applications

Course Code	22CS34 / 22IS34	Course type	PCC	Credits L-T-P	3 – 0 - 0
Hours/week: L - T- P	3 – 0 – 0			Total credits	3
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 0 Hrs Total = 40 Hrs			CIE Marks	100
Flipped Classes content	10 Hours			SEE Marks	100

Course learning objectives	
1.	To learn the fundamentals of data structure and realize their importance in designing variety of applications.
2.	To illustrate the implementation of data structures such as stack, queue and linked list and to apply them for the given problem.
3.	To introduce non linear data structures like Binary Tree, Heap and their applications and also to provide insight of advanced searching techniques like Hashing.
4.	To create and use appropriate data structures for solving real life problems.

Pre-requisites : Basic computer concepts & C programming.

Unit – I	**Contact Hours = 8 Hours**
Pointers, Structures: Introduction to Pointers, Pointers and Arrays, Pointers to Pointers, Pointers to functions. **Introduction to Structures**: Declaration, Initialization, Accessing Structures, Internal implementation of Structures. **Files in C:** Text input output with respect to files in C, Basic file handling functions in C.	

Unit – II	**Contact Hours = 8 Hours**
Stacks & Queues: **Stacks:** Basic Stack operations, Stack applications: Conversion of Expression (Infix to Postfix), Evaluation of Expressions. **Queues:** Queues, Circular Queues , Queue applications	

Unit – III	**Contact Hours = 8 Hours**
Linked lists: **General linear lists:** Basic operations, Implementation: circular linked lists, doubly linked lists, implementation of Stack and Queue using linked list.	

Unit – IV	**Contact Hours = 8 Hours**
Trees and Heaps : Basic tree concepts, Binary trees, Binary search tree (BST) concept, BST operations. **Heap:** Basic concepts, Heap implementation, Heap applications	

Unit – V	**Contact Hours = 8 Hours**

Hashing
Hashing: Basic concept, Hashing methods: Division Method, Mid Square Method, Folding Method, Multiplication Method. Collision Resolution Techniques: Separate chaining (open hashing), Open addressing (closed hashing): Linear Probing, Quadratic Probing.

Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	2	2	2	2	2

Books	
	Text Books:
1.	Richard.F.Gilberg, Behrouz.A. Forouzan, Data Structures: A Pseudocode Approach with C, Cengage Learning, 2nd edition 2007 and onwards
2.	Horowitz, Sahni, Anderson-Freed, Fundamentals of Data Structures in C, Universities Press, 2nd Edition, 2007 and onwards.
	Reference Books:
1.	Yedidyah, Augenstein, Tannenbaum: Data Structures Using C and C++, Pearson Education, 2nd Edition and onwards.
2.	ReemaThareja, Data structures using C, Oxford Higher Education, 1st edition, 2011 onwards
	E-resourses (NPTEL/SWAYAM.. Any Other)- mention links
1.	NPTELcourse link : https://nptel.ac.in/courses/106102064/
2.	SWAYAM course link: https://swayam.gov.in/course/1407-programming-and-data-structures
3.	edx course link: https://www.edx.org/course/data-structures-fundamentals

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Online Quizzes (Surprise and Scheduled)
3.	Flipped Classes	3.	Open Book Tests (OBT)
4.	Online classes	4.	Course Seminar
		5.	Semester End Examination

Course Outcome (COs)

At the end of the course, the student will be able to (Highlight the **action verb** representing the learning level.)

Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create		**Learning Level**	**PO(s)**	**PSO(s)**
1.	**Apply** C constructs for implementing Data Structures	Ap	1	1

2.	**Explain** the fundamental concepts of various data structure	Un	2,3	1
3.	**Develop** solutions using different data structures like Stack, Queue, linked List and Tree.	Ap	2,3	1
4.	**Develop** programming skills to solve real life problems using appropriate data structures and build projects.	Cr	2, 3, 5, 9, 10, 11, 12	1, 2, 3

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Online Quiz	Addition of two OAs/ Course project	Course Seminar	Total Marks
Marks	25+25 = 50	4* 5 marks = 20	10+10 =20	10	100
OBA - Open Book Assignment **Minimum score to be eligible for SEE: 40 OUT OF 100**					

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration.
2.	**Minimum marks required in SEE to pass:** Score should be $\geq$ 35%, however overall score of CIE + SEE should be $\geq$ 40%.
3.	Question paper contains 3 parts - A,B & C, wherein students have to answer any 5 out of 7 questions in part A, 5 out of 10 questions choosing 1 question from each unit in part B & 1 out of 2 questions in part C.

CO-PO Mapping (Planned)													**CO-PSO Mapping (Planned)**		
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
1	√												√		
2		√	√										√		
3		√	√										√		
4		√	√		√				√	√	√	√	√	√	√
Tick mark the CO, PO and PSO mapping															

Object Oriented Programming using C++ (Project-based)

Course Code	**22CS351/ 22IS351**	**Course type**	**Integrated Project based**	**Credits L-T-P**	2-0-1

Sl No	**Skill & competence enhanced after undergoing the course**	**Applicable Industry Sectors & domains**	**Job roles students can take up after undergoing the course**
1	**Programming and Problem solving skills**	**IT Sector**	**Software Developer, Freelancer**
2		**IT Sector, Academics**	**Researcher**

Hours/week: L - T- P	2 - 0 – 2	**Total credits**	3

Total Contact Hours	L = 20 Hrs; T = Hrs; P = 20 Hrs Total = 40 Hrs	**CIE Marks**	100
Flipped Classes content	5 Hours	**SEE Marks**	100

Course learning objectives	
1.	To introduce the basic concepts of Object Oriented Programming.
2.	To Analyze the problem statement and build object oriented system model.
3.	To Explain function overloading, operator overloading and virtual functions.
4.	To Solve the problem with object oriented approach.

Required Knowledge of : C Programming Concepts

Unit – I	**Contact Hours = 8 Hours**
Beginning with C++ and its features: What is C++?, Applications and structure of C++ program, Different Data types, Variables, Different Operators, expressions, operator overloading.	

Unit – II	**Contact Hours = 8 Hours**
Functions, classes and Objects: Functions, Inline function, function overloading, friend and virtual functions, Specifying a class, C++ program with a class, memory allocation to objects.	

Unit – III	**Contact Hours = 8 Hours**
Constructors, Destructors and Operator overloading: Constructors, Multiple constructors in a class, Copy constructor, Dynamic constructor, Destructors.	

Unit – IV	**Contact Hours = 8 Hours**
Inheritance, Pointers, Virtual Functions, Polymorphism: Derived Classes, Single, multilevel, multiple inheritance, Pointers to objects and derived classes, this pointer, Virtual functions, and polymorphism.	

Unit – V	**Contact Hours = 8 Hours**
Streams and Working with files: C++ streams and stream classes, Unformatted I/O operations, Managing output with manipulators, Classes for file stream operations, opening and closing a file.	

Flipped Classroom Details

Unit No.	**I**	**II**	**III**	**IV**	**V**
No. for Flipped Classroom Sessions	**1**	**1**	**1**	**1**	**1**

List of Experiments

Unit No.	**No. of Experiments**	**Topic(s) related to Experiment**
	5	1. Class and object

II		2. Reference type in C++
		3. Function overloading
		4. Dynamic memory management in C++
		5. Array of objects
III	**2**	6. Constructors and destructors
		7. Operator overloading
IV	**2**	8. Inheritance
		9. Virtual functions and pure virtual functions
V	**1**	10. File streams

Unit No.	**Self-Study Topics**
1	**Control structures in C++**
2	**Array of objects**
3	**Overloading Unary and binary operators**
4	**Pure virtual functions**
5	**Detecting EOF**

Books	
	Text Books:
1.	E. Balagurusamy, " Object Oriented Programming with C++", Tata McGraw Hill, 6th edition onwards.
	Reference Books:
1.	Robert Lafore, “Object Oriented Programming using C++”, Programming in C, Galgotia publication 2010 onwards
	E-resourses (NPTEL/SWAYAM.. Any Other)- mention links
1.	NPTEL Link: https://nptel.ac.in/noc/individual_course.php?id=noc18-cs32
2.	edx Link: https://www.edx.org/course/object-oriented-programming-2

Course delivery methods		**Assessment methods**	
1.	Chalk and Talk	1.	IA tests- Theory & Lab based
2.	PPT and Videos	2.	Project phase 1 & 2
3.	Flipped Classes	3.	SEE- Project evaluation
4.	Practice session/Demonstrations in Labs	4.	SEE- Solving an Open ended problem
5.	Virtual Labs (if present)		

Course Outcome (COs)

Learning Levels:

Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create

At the end of the course, the student will be able to		Learning Level	PO(s)	PSO(s)
1.	**Explain** the salient features of C++ Programming Language.	**Un**	**1**	**1**
2.	**Develop** programs using the concept of encapsulation to implement data hiding.	**Ap**	**1,2,3**	**1**
3.	**Apply** the concept of object instantiation and operator overloading.	**Ap**	**1,2,3**	**1**
4.	**Apply** the concept of static and dynamic polymorphism and streams for file handling. to solve real world problems.	**Ap**	**1,2,3**	**1**
5.	**Develop** a course project by applying the learnings inculcated throughout the course.	**Cr**	2, 3, 5, 9, 10, 11, 12	1, 2, 3

Scheme of Continuous Internal Evaluation (CIE):

For integrated courses, a lab test also will be conducted at the end of the semester. The lab test **(COMPULSORY)** will be part of the CIE. **No SEE for Lab**.

THEORY (40 marks)		**PROJECT (60 marks)**			Total
IA test (Theory)	IA test (Lab)	Project Phase 1	Project Phase 2	Project report	
25 marks	15 marks	25 marks	25 marks	10 marks	100 marks
Theory IA test should be of one-hour duration. Lab IA test should be of two/three-hour duration. Project batch will ideally consist of 2 students (maximum of 3). Project Phase 1 presentation will be conducted after 6 weeks and Project Phase 2 presentation will be conducted after 13 weeks from the start of the semester. Submitting Project report is compulsory.					
Eligibility for SEE: 1. 40% and above (16 marks and above) in theory component 2. 40% and above (24 marks and above) in project component 3. Not eligible in any one of the two components will make the student **Not Eligible** for SEE					

Semester End Examination (SEE):

1.	It will be conducted for 100 marks having 3 hours duration.		
2.	**Lab Open ended program/problem/experiment** Write-up & execution (1 open ended expt)- (20 marks write-up + 20 marks algorithm/flowchart + 10 marks execution)	50 marks	100 marks
	Project evaluation a. Initial write up stating the objectives, methodology and the outcome b. Hardware project: Exhibiting and demonstration of working of project. Software project: Demonstration of the programming capabilities by writing flowchart, algorithm and codes related to a section of the project.	10 marks 30 marks	

	c. Viva-voce	10 marks	
3.	**Minimum marks required in SEE to pass:** Score should be ≥ 35%, however overall score of CIE + SEE should be ≥ 40%.		
4.	SEE will be conducted in project batches by **Internal & External examiners** together.		

CO-PO Mapping (planned)													**CO-PSO Mapping (planned)**		
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
1	√												√		
2	√	√	√										√		
3	√	√	√										√		
4	√	√	√										√		
5		√	√		√				√	√	√	√	√	√	√
Tick mark the CO, PO and PSO mapping															

Sl No	**Skill & competence enhanced after undergoing the course**	**Applicable Industry Sectors & domains**	**Job roles students can take up after undergoing the course**
1	**Well verse with Object Oriented Programming and Concepts**	**IT Sector Application Domain**	**Software Engineer**

Web Programming- A Practical Approach (Project based)

Course Code	**22CS352/ 22IS352**	**Course type**	**Integrated Project based**	**Credits L-T-P**	2-0-1
Hours/week: L - T- P	2 - 0 – 2			**Total credits**	3
Total Contact Hours	L = 20 Hrs; T = Hrs; P = 20 Hrs Total = 40 Hrs			**CIE Marks**	100
Flipped Classes content	5 Hours			**SEE Marks**	100

Course learning objectives	
1.	To learn the basics of web development and develop basic web applications using HTML5, CSS3 and JavaScript
2.	To develop advanced web applications using Tailwind and JavaScript frameworks

3.	To understand and implement the concepts of responsive design and retina ready websites
4.	To deploy applications on AWS and generate static websites
5.	To understand the working of web APIs and use them in building web applications

Required Knowledge of : Basic Programming knowledge and basics of computer science

Unit – I	**Contact Hours = 8 Hours**

HTML and AWS

Writing HTML code using Header Tags, Paragraphs, Ordered and Unordered lists, Forms, Links and Tables, Iframes and Images, Text Formatting, Image Maps, Creating an Amazon Web Services ,AWS) account and how to deploy a static website to AWS Simple Storage Service ,S3

Working Encoding URL, Introduction to XHTML, Using HTML5 introduced features, Handling of multiple file upload using multiple attribute, HTML5 Local Storage, HTML5 form validate /novalidate, HTML5 canvas, embedding audio and video in a webpage, Drag and drop, HTML5 web workers and server sent events

Introduction to Figma, Working with UI- Design , Components , Mobile App design

Unit – II	**Contact Hours = 8 Hours**

CSS3

Styling of HTML elements-text; Links, lists and tables; Different ways to write CSS e.g. external, internal, inline; Creating Navigation Bars; Writing Media Rules; Hide visibility of an element; CSS Image Sprites and Gradients; CSS Pseudo Classes and Pseudo Elements

CSS3 Text Effects using different text fonts; Creating 2D and 3D transformations; Applying animations and transitions to HTML elements; CSS3 resize UI and multiple columns feature

Unit – III	**Contact Hours = 8 Hours**

Tailwind CSS and JavaScript

What is Tailwind CSS? advantages of tailwind CSS, comparison of tailwind CSS and bootstrap, getting started with tailwind, colors, element sizing, flexbox and grid, padding and margins, styling text, typography, borders and shadows.

Java Script datatypes; Variables and arrays; Creating loops and writing if-else decision-making statements; Defining and calling JavaScript functions on events; Manipulating DOM elements.

Unit – IV	**Contact Hours = 8 Hours**

Twitter Bootstrap

Getting started with Twitter Bootstrap 3; Bootstrap features like fixed drop-down menu; Carousel, text and image grids; Custom Thumbnails; Bootstrap modal; Using Font Awesome Icons

Building a real-world website using Twitter; Bootstrap 3 features like bootstrap fixed dropdown menu; Carousel; Bootstrap modal; Font awesome icons; custom Thumbnails; Text and Image grids; Accordions; Signin/Signup form and Jumbotron

Unit – V	**Contact Hours = 8 Hours**

Web APIs, Ajax

Bootstrap ScrollSpy AJAX XML; Http Request object; Making an AJAX call and retrieving the response; Working with Google APIs Adding social plugins on your web page provided by LinkedIn, Facebook, Quora and Twitter, Web APIs, Introduction to CI/CD, Using git- commands and

concepts, hosting a static website on GitHub Pages.

Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	1	1	1	1	1

List of Experiments

Unit No.	No. of Experiments	Topic(s) related to Experiment
1	2	Figma, HTML5, and AWS
2	2	CSS transformations, UI and multi column features
3	2	Tailwind and JavaScript
4	2	Twitter Bootstrap, Jumbotron
5	2	Git and AJAX

Books	
	Text Books:
1.	Robert Sebesta, Programming the World wide web, 6th Edition
2.	Jennifer Robbins, Learning Web Design, 5th Edtion, 2018
3.	Noel Rappin, Modern CSS with Tailwind: flexible styling without the fuss, programmatic bookshelf, 2021
	Reference Books:
1.	DarioCalonaci, Designing user interfaces, BB publications, 2021
2.	David Cochran, Twitter Bootstrap Web development-How to, packt publishing, 2012
	E-resourses (NPTEL/SWAYAM.. Any Other)- mention links
1.	Responsive Web Design https://www.freecodecamp.org/learn/2022/responsive-web-design/
2.	Front End Development Libraries https://www.freecodecamp.org/learn/front-end-development-libraries

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests- Theory & Lab based
2.	PPT and Videos	2.	Project phase 1 & 2
3.	Flipped Classes	3.	SEE- Project evaluation
4.	Practice session/Demonstrations in Labs	4.	SEE- Solving an Open ended problem
5.	Virtual Labs (if present)		

Course Outcome (COs) **Learning Levels:** **Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create**				
At the end of the course, the student will be able to		**Learning Level**	**PO(s)**	**PSO(s)**
1.	**Explain** the basic concepts of frontend web development using HTML5, CSS3 and other libraries	Un	1	1
2.	**Analyse** the real world problem and **Create** a wireframe model of the application	Cr	1, 3, 5, 9 , 10, 12	1,2,3
3.	**Demonstrate** the use of concepts learnt and integrate them to build real world applications	Ap	1, 3, 5, 9 , 10, 12	1,2,3
4.	**Make use of** hosting services to deploy the application.	Ap	5	2

Scheme of Continuous Internal Evaluation (CIE):

For integrated courses, a lab test also will be conducted at the end of the semester. The lab test **(COMPULSORY)** will be part of the CIE. **No SEE for Lab**.

THEORY (40 marks)		**PROJECT (60 marks)**			Total
IA test (Theory)	IA test (Lab)	Project Phase 1	Project Phase 2	Project report	
25 marks	15 marks	25 marks	25 marks	10 marks	100 marks

Theory IA test should be of one-hour duration.
Lab IA test should be of two/three-hour duration.
Project batch will ideally consist of 2 students (maximum of 3).
Project Phase 1 presentation will be conducted after 6 weeks and Project Phase 2 presentation will be conducted after 13 weeks from the start of the semester.
Submitting Project report is compulsory.

Eligibility for SEE:

1. 40% and above (16 marks and above) in theory component
2. 40% and above (24 marks and above) in project component
3. Not eligible in any one of the two components will make the student **Not Eligible** for SEE

Semester End Examination (SEE):

1.	It will be conducted for 100 marks having 3 hours duration.		
2.	**Lab Open ended program/problem/experiment** Write-up & execution (1 open ended expt)- (20 marks write-up + 20 marks algorithm/flowchart + 10 marks execution)	50 marks	100 marks
	Project evaluation d. Initial write up stating the objectives, methodology and the outcome	10 marks	
	e. Hardware project: Exhibiting and demonstration of working of project. Software project: Demonstration of the programming capabilities by writing flowchart, algorithm and codes related to a section of the project.	30 marks	
	f. Viva-voce	10 marks	

3.	**Minimum marks required in SEE to pass:** Score should be ≥ 35%, however overall score of CIE + SEE should be ≥ 40%.
4.	SEE will be conducted in project batches by **Internal & External examiners** together.

CO-PO Mapping (planned)													CO-PSO Mapping (planned)		
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
1	√												√		
2	√		√		√				√	√		√	√	√	√
3	√		√		√				√	√		√	√	√	√
4					√									√	
Tick mark the CO, PO and PSO mapping															

Sl No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	**Website Development**	**IT Sector**	**Web Developer**
2	**Ajax programmer**		**Developer**

Digital Electronics (Project based)

Course Code	**22CS353/ 22IS353**	**Course type**	**Integrated Project based**	**Credits L-T-P**	2-0-1
Hours/week: L - T- P	2 - 0 – 2			**Total credits**	3
Total Contact Hours	L = 20 Hrs; T = Hrs; P = 20 Hrs Total = 40 Hrs			**CIE Marks**	100
Flipped Classes content	5 Hours			**SEE Marks**	100

Course learning objectives	
1.	Understand the basics of Digital Electronics.

2.	Comprehend the knowledge of digital circuits to construct combinational and sequential sub-systems useful for digital system designs.
3.	Implement digital circuits for a particular application using simulation and Virtual Lab platform.
4.	Analyse digital circuits and systems to model using Verilog HDL.

Required Knowledge of : Basic Electronics

Unit – I	**Contact Hours = 8 Hours**
Introduction: Revision of Logic gates and Boolean algebra, Simplification of Boolean functions using Basic Logic gates, Universal Gates, SOP, POS form, K-Map Simplification (up to 4 variables), Don't-care Condition.	

Unit – II	**Contact Hours = 8 Hours**
Data Processing Circuits: Multiplexers, De-multiplexers, Decoder, Encoders and implementation of Boolean functions using multiplexer and Decoders, Magnitude Comparators (1 bit and 2 bit).	

Unit – III	**Contact Hours = 8 Hours**
Clocks and Flip Flops: Clock waveforms, TTL clock, RS Flip Flops, Gated flip-flops, Edge triggered RS Flip-Flops, Edge triggered D Flip-Flops, and Edge triggered JK Flip-Flops, JK master slave Flip Flops, various representations of Flip Flops	

Unit – IV	**Contact Hours = 8 Hours**
Analysis of Sequential Circuits: Conversion of flip flops: A synthesis example, Types of Shift Register, SISO, SIPO, PISO and PIPO, Applications of Shift Registers as Ring Counter, Johnson Counter, Serial Adder. **Counters:** Asynchronous counters (4 bit), Synchronous Counters (4 bit), changing the counter Modulus.	

Unit – V	**Contact Hours = 8 Hours**
Content of the Unit **Introduction to HDL:** Types of Model, Syntax for Data Flow model.	

Flipped Classroom Details

Unit No.	**I**	**II**	**III**	**IV**	**V**
No. for Flipped Classroom Sessions	**1**	**1**	**1**	**1**	**1**

List of Experiments

Unit No.	**No. of Experiments**	**Topic(s) related to Experiment**
1	1	**Verification and interpretation of truth table for AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates.**

	2	**Construction of half and full adder using XOR and NAND gates and verification of its operation.**
	3	**Realization of logic functions with the help of Universal Gates (NAND, NOR).**
	4	**Verify Binary to Gray and Gray to Binary conversion using NAND gates only.**
2	5	**To Study and Verify Half and Full Subtractor.**
	6	**Implementation and verification of decoder or de-multiplexer and encoder using logic gates.**
	7	**Implementation of 4x1 multiplexer and 1x4 demultiplexer using logic gates.**
	8	**Verify the truth table of one bit and two bit comparator using logic gates.**
3	9	**Construction of a NOR gate latch and verification of its operation.**
	10	**Verify the truth table of RS, JK, T and D flip-flops using NAND and NOR gates.**
4	11	**Design and Verify the 4-Bit Serial In - Parallel Out Shift Registers.**
	12	**Design and verify the 4- Bit Synchronous or Asynchronous Counter using JK Flip Flop.**
5	13	**Develop HDL (Verilog) code to implement simple SOP equation.**
	14	**Develop HDL (Verilog) code to implement Multiplexer.**
	15	**Develop HDL (Verilog) code to implement Adder.**

Books	
	Text Books:
1.	Donald P Leach, Albert Paul Malvino and GoutamSaha: Digital Principles and Applications, 7th Edition and onwards, Tata McGraw Hill, 2011.
	Reference Books:
1.	Donald Givone: Digital Principles and Design, Palgrave Macmillan, 2003 and onwards.
2.	R D Sudhaker Samuel: Illustrative Approach to Logic Design, Sanguine-Pearson, 2012 and onwards.
3.	Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss: Digital Systems Principles and Applications, 10th Edition, Pearson Education, 2007 and onwards.
	E-resourses (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://nptel.ac.in/courses/117106086/

Course delivery methods		**Assessment methods**	
1.	Chalk and Talk	1.	IA tests- Theory & Lab based
2.	PPT and Videos	2.	Project phase 1 & 2
3.	Flipped Classes	3.	SEE- Project evaluation
4.	Practice session/Demonstrations in Labs	4.	SEE- Solving an Open ended problem
5.	Virtual Labs (if present)		

Course Outcome (COs) **Learning Levels:** **Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create**				
At the end of the course, the student will be able to		**Learning Level**	**PO(s)**	**PSO(s)**
1.	**Apply** the knowledge of Digital Electronics to design digital systems.	**Ap**	**1,2,3,5**	**1,2**
2.	**Design** Combinational and Sequential Circuits for digital systems.	**Ap**	**1,2,3,5**	**1,2**
3.	**Utilize** the simulation tool/ Virtual Lab platform to implement the digital circuits.	**Ap**	**1,2,3,5**	**1,2**
4.	**Analyse** the digital circuits developed using HDL Verilog.	**An**	**1,2,3,5**	**1,2**
5.	**Apply** the learnings inculcated throughout the course and develop a course project.	**Ap**	**1,2,3,5, 9,10,11,12**	**1,2,3**

Scheme of Continuous Internal Evaluation (CIE):

For integrated courses, a lab test also will be conducted at the end of the semester. The lab test **(COMPULSORY)** will be part of the CIE. **No SEE for Lab**.

THEORY (40 marks)		**PROJECT (60 marks)**			Total
IA test (Theory)	IA test (Lab)	Project Phase 1	Project Phase 2	Project report	
25 marks	15 marks	25 marks	25 marks	10 marks	100 marks
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Eligibility for SEE: 1. 40% and above (16 marks and above) in theory component 2. 40% and above (24 marks and above) in project component 3. Not eligible in any one of the two components will make the student **Not Eligible** for SEE					

Semester End Examination (SEE):

1.	It will be conducted for 100 marks having 3 hours duration.		
2.	**Lab Open ended program/problem/experiment** Write-up & execution (1 open ended expt)- (20 marks write-up + 20 marks algorithm/flowchart + 10 marks execution)	50 marks	100 marks
	Project evaluation g. Initial write up stating the objectives, methodology and the outcome	10 marks	
	h. Hardware project: Exhibiting and demonstration of working of project. Software project: Demonstration of the programming capabilities by writing flowchart, algorithm and codes related to a section of the project.	30 marks	

	i. Viva-voce	10 marks	
3.	**Minimum marks required in SEE to pass:** Score should be ≥ 35%, however overall score of CIE + SEE should be ≥ 40%.		
4.	SEE will be conducted in project batches by **Internal & External examiners** together.		

CO-PO Mapping (planned)													**CO-PSO Mapping (planned)**		
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
1	✓	✓	✓		✓								✓	✓	
2	✓	✓	✓		✓								✓	✓	
3	✓	✓	✓		✓								✓	✓	
4	✓	✓	✓		✓								✓	✓	
5	✓	✓	✓		✓				✓	✓	✓	✓	✓	✓	✓
Tick mark the CO, PO and PSO mapping															

Sl No	**Skill & competence enhanced after undergoing the course**	**Applicable Industry Sectors & domains**	**Job roles students can take up after undergoing the course**
1	**Digital Circuit Design, Logic Design and Analysis**	**Electronics Industry**	**Digital Circuit Designer**
2	**Digital System Simulation**	**Semiconductor Industry**	**FPGA Engineer**
3	**Microcontrollers and Embedded Systems**	**Embedded Systems**	**Embedded Systems Engineer**

Python Programming- A Practical Approach (Project based)

Course Code	**22CS354/ 22IS354**	**Course type**	**Integrated Project based**	**Credits L-T-P**	2-0-1

Hours/week: L - T- P	2 - 0 – 2	**Total credits**	3
Total Contact Hours	L = 20 Hrs; T = Hrs; P = 20 Hrs Total = 40 Hrs	**CIE Marks**	100
Flipped Classes content	5 Hours	**SEE Marks**	100

Course learning objectives	
1.	Gain knowledge about basic Python language syntax and semantics to write Python programs using the procedure oriented programming paradigm.
2.	Appreciate the usage of high level data constructs provided by Python and work with file and exception handling mechanisms.
3.	Write Python applications using the object-oriented programming paradigm.
4.	Become acquainted with the development of database and GUI applications and usage of various packages.

Required Knowledge of : Procedure Oriented and Object Oriented Programming Languages

Unit – I	**Contact Hours = 8 Hours**
Python Fundamentals: **An Introduction to Python programming:** Introduction to Python, IDLE to develop programs **How to write your first programs:** Basic coding skills, data types and variables, numeric data, string data, five of the Python functions **Control statements:** Boolean expressions, selection structure, iteration structure	

Unit – II	**Contact Hours = 8 Hours**
Define and use Functions and Modules: define and use functions, more skills for defining and using functions and modules, create and use modules, standard modules **Higher Data Constructs:** **Lists and tuples:** Basic skills for working with lists, list of lists, more skills for working with lists, tuples **Dictionaries:** get started with dictionaries, more skills for working with dictionaries	

Unit – III	**Contact Hours = 8 Hours**
Files, Exception Handling, Database Programming **File I/O:** An introduction to file I/O, text files, CSV files, binary files **Exception Handling:** handle a single exception, handle multiple exceptions **Work with a database:** An introduction to relational databases, SQL statements for data manipulation, SQLite Manager to work with a database, use Python to work with a database	

Unit – IV	**Contact Hours = 8 Hours**
Object Oriented Programming: **Define and use your own classes:** An introduction to classes and objects, define a class, object composition, encapsulation **Inheritance:** Inheritance, override object methods	

Unit – V	**Contact Hours = 8 Hours**

Packages: **How to build a GUI Program:** Create a GUI that handles an event **Numpy Basics:** Arrays and Vectorized Computation: Creating ndarrays, Data Types for ndarrays, Operations between Arrays and Scalars, Basic Indexing and Slicing, Indexing with slices, Boolean Indexing, Transposing Arrays and Swapping Axes **Getting started with Pandas:** Introduction to Pandas Data Structures, Summarizing and Computing Descriptive Statistics, Handling missing data

Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	1	1	1	1	1

List of Experiments

Unit No.	No. of Experiments	Topic(s) related to Experiment
2	1	Functions and lists
	2	Functions and dictionaries
3	3	File I/O and exception handling mechanisms
	4	Implement a Python program to work with a database
4	5	Object composition and encapsulation
	6	Inheritance and polymorphism
5	7	GUI application
	8	NumPy and Pandas packages

Books	
	Text Books:
1.	Michael Urban and Joel Murach, Python Programming, Shroff/Murach, 2016
2.	Wes McKinney, Python for Data Analysis, OReilly, 1st Edition, 2012
	Reference Books:
1.	SciPy and NumPy, O`Reilly, 1st Edition, 2012
2.	Mark Lutz, Programming Python, O`Reilly, 4th Edition, 2010
	E-resourses (NPTEL/SWAYAM.. Any Other)- mention links
1.	The joy of computing using python - https://onlinecourses.nptel.ac.in/noc21_cs32/preview
2.	Programming in python- https://onlinecourses.swayam2.ac.in/cec22_cs20/preview

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests- Theory & Lab based
2.	PPT and Videos	2.	Project phase 1 & 2
3.	Flipped Classes	3.	SEE- Project evaluation
4.	Practice session/Demonstrations in Labs	4.	SEE- Solving an Open ended problem
5.	Virtual Labs (if present)		

Course Outcome (COs) **Learning Levels:** **Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create**				
At the end of the course, the student will be able to		**Learning Level**	**PO(s)**	**PSO(s)**
1.	**Illustrate** basic principles of Python programming and **Develop** programs using the procedure-oriented programming paradigm.	Ap	1,3,5	1,2
2.	**Develop** Python programs for file operations, exception handling, GUI, database operations and **Make use of** different packages for computing and manipulation.	Ap	1,3,5	1,2
3.	**Explain** the concepts of object-oriented programming paradigm and **Apply** the same to develop programs.	Ap	1,3,5	1,2
4.	**Apply** the learnings inculcated throughout the course by developing a course project.	Ap	1,2,3,5, 9,10,11,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE):

For integrated courses, a lab test also will be conducted at the end of the semester. The lab test **(COMPULSORY)** will be part of the CIE. **No SEE for Lab**.

THEORY (40 marks)		**PROJECT (60 marks)**			Total
IA test (Theory)	IA test (Lab)	Project Phase 1	Project Phase 2	Project report	
25 marks	15 marks	25 marks	25 marks	10 marks	100 marks

Theory IA test should be of one-hour duration.
Lab IA test should be of two/three-hour duration.
Project batch will ideally consist of 2 students (maximum of 3).
Project Phase 1 presentation will be conducted after 6 weeks and Project Phase 2 presentation will be conducted after 13 weeks from the start of the semester.
Submitting Project report is compulsory.

Eligibility for SEE:

1. 40% and above (16 marks and above) in theory component
2. 40% and above (24 marks and above) in project component
3. Not eligible in any one of the two components will make the student **Not Eligible** for SEE

Semester End Examination (SEE):

1.	It will be conducted for 100 marks having 3 hours duration.		
2.	**Lab Open ended program/problem/experiment** Write-up & execution (1 open ended expt)- (20 marks write-up + 20 marks algorithm/flowchart + 10 marks execution)	50 marks	100 marks
	Project evaluation j. Initial write up stating the objectives, methodology and the outcome k. Hardware project: Exhibiting and demonstration of working of project. Software project: Demonstration of the programming	10 marks 30 marks	

	capabilities by writing flowchart, algorithm and codes related to a section of the project. l. Viva-voce	10 marks	
3.	**Minimum marks required in SEE to pass:** Score should be ≥ 35%, however overall score of CIE + SEE should be ≥ 40%.		
4.	SEE will be conducted in project batches by **Internal & External examiners** together.		

CO-PO Mapping (planned)													CO-PSO Mapping (planned)		
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
1	√		√		√								√	√	
2	√		√		√								√	√	
3	√		√		√								√	√	
4	√	√	√		√				√	√	√	√	√	√	√
Tick mark the CO, PO and PSO mapping															

Sl No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	**Procedure Oriented Programming using Python**	**Healthcare, Finance, Retail, Agriculture, Manufacturing, Networks, Security, Big Data, etc,**	**Python Developer Software Developer Data and Research Analyst Senior Backend / Software Developer Python Big Data Developer Python Framework Developer - AI Developer, etc.**
2	**Object Oriented Programming using Python**		
3	**Use of various packages**		

SOCIAL CONNECT AND RESPONSIBILITY

Course Code	22CS36 / 22IS36	Course type	UHV	Credits L-T-P	0-0-1

Hours/week: L - T- P	0-0-2	**Total credits**	1
Total Contact Hours	16 Hours of engagement	**CIE Marks**	100
Flipped Classes content	--	**SEE Marks**	--

Course learning objectives	
1.	Bridging the gap between theory and practice through community engagement
2.	Interaction with the community for identification and solution to real life problems faced by the community
3.	Catalyzing acquisition of values and responsibilities for public service to make better citizens

Required Knowledge of: Interpersonal skills, Communication skills

Activities to be planned and conducted by the Department Associations are:

1. **Linking learning with the community through Knowledge Sharing**: In this the students can apply their knowledge and skills to improve the lives of the people. The knowledge available with the students can be shared to the school students of the local community. It can be in the form of engaging the classes, developing projects which can used by the students and teachers, training sessions on MS word, Excel, PPT for students and teachers etc.
2. **Creating Awareness about health and hygiene:** The students can arrange talks on Importance of cleanliness, health, and hygiene by taking help of Doctors, Public Health Organizations, NGOs etc.
3. **Including the Practitioners as teachers:** Arrange the invited talks by experts in agriculture for the farmers in the local community to create awareness about Organic farming, new methods of agriculture such as hydroponics, vertical farming etc.
4. **Environmental Sustainability:** Students can take initiatives to educate the local community regarding protecting our environment through tree plantations, preserving water bodies etc.
5. **Social Innovations for Rural development**

Course Outcome (COs)

Learning Levels:

Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create

At the end of the course, the student will be able to		**Learning Level**	**PO(s)**
1.	Gain knowledge about the culture and societal realities	Un	6,9
2.	Develop sense of responsibility and bond with the local community	Un	6,9
3.	Make significant contributions to the local community and the Society at large	Ap	6,9
4	Identify opportunities for contribution to the Socio-economic development	Ev	6,9

Scheme of Continuous Internal Evaluation (CIE):

• Students must maintain the diary of the activities conducted. • The activities can be conducted in groups/batches. • Faculty members can design the evaluation system wherein weightage can be given to presentation of activities conducted & report writing.	50 marks

CO-PO Mapping (Planned)												
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
1						✓			✓			
2						✓			✓			
3						✓			✓			
4						✓			✓			
5												
Tick mark the CO, PO and PSO mapping												

Design Thinking

Course Code	22AECCS371	**Course type**	**AEC**	**Credits L-T-P**	0 - 0 - 1

Hours/week: L - T- P	0 - 0 - 2	**Total credits**	1
Total Contact Hours	L = 0 Hrs; T = 0 Hrs; P = 20 Hrs Total = 20 Hrs	**CIE Marks**	50
Flipped Classes content		**SEE Marks**	50

Course learning objectives	
1.	Describe and explain what Design Thinking is and how to incorporate it in problem solving.
2.	Manage the requirements gathering process to determine customer needs.
3.	Ideate and adopt MVP's and prototypes to quickly get feedback and iterate on designs.

Required Knowledge of : Digital Electronics, Computer Organization

Lab Experiment – I	**Contact Hours = 4 Hours**
Break the Ice and Introduction to Design Thinking.	
Lab Experiment – 2	**Contact Hours = 4 Hours**
Empathize (search for rich stories)	
Lab Experiment – 3	**Contact Hours = 4 Hours**
Define (user need and insights – their POV)	
Lab Experiment – 4	**Contact Hours = 4 Hours**
Ideate (ideas, ideas, ideas)	
Lab Experiment – 5	**Contact Hours = 4 Hours**
Prototype (build to learn); Test the prototype.	

Books	
	Text Books:
1.	Michael Lewrick, Patrick Link, Larry Leifer 2018, *The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems*, First Ed., John Wiley & Sons [ISBN: 9781119467472]
2.	Michael Lewrick, Patrick Link, Larry Leifer 2020, *The Design Thinking Toolbox: A Guide to Mastering the Most Popular and Valuable Innovation Methods*, First Ed., John Wiley & Sons New York, United States [ISBN: 9781119629191]
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	http://www.dschool.stanford.edu/resource s/

Course delivery methods		**Assessment methods**	
1.	Chalk and Talk	1.	PPT & demos

2.	PPT and Videos	2.	Semester End Examination
3.	Hands on DIY group activities		

Course Outcome (COs)

Learning Levels:

Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create

At the end of the course, the student will be able to		Learning Level	PO(s)	PSO(s)
1.	**Explain** the various stages involved in the process of design thinking.	Un	1	1
2.	**Identify** the problem statement and formulate objectives	Ap	2	1
3.	**Experiment** and brainstorm to generate ideas/ alternatives to address the problem identified.	Ap	2,3	1
4.	**Assess** the alternatives to the problem at hand in order to arrive at the optimal alternative for various test cases.	Ev	3,4,5	1,2
5.	**Develop** a course project by applying the learnings inculcated throughout the course.	**Cr**	2, 3, 5, 9, 10, 11, 12	1, 2, 3

Scheme of Continuous Internal Evaluation (CIE):

Conduction of experiments & viva-voce	Journal	Lab project/ Open ended experiment	Lab Test	Total
20 marks	5 marks	10 marks	15	50 marks

Conduct of Lab:

1. Conduction of the experiment: 15 marks + Viva voce: 5 marks = 20 marks
2. Calculations, results, graph, conclusion and Outcome recorded in Journal: 5 marks
3. Lab project/ Open ended experiment: 10 marks
3. Lab Test: 15 marks

Eligibility for SEE:

1. 40% and above (20 marks and above)
2. **Lab test is COMPULSORY**

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 2/3 hours duration.		
2.	**Minimum marks required in SEE to pass:** Score should be ≥35% , however overall score of CIE+SEE should be ≥40%.		
2.	One or Two experiments to be conducted.		
3.	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	

4.	Viva-voce shall be conducted for individual student and not in a group.

CO-PO Mapping (planned)													CO-PSO Mapping (planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	√												√		
2		√											√		
3		√	√										√		
4			√	√	√								√	√	
5		√	√		√				√	√	√	√	√	√	√
Tick mark the CO, PO and PSO mapping															

Sl No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Problem solving, critical thinking, creativity, leadership, collaboration and communication	Health Care and Medicine, Public sector, Space exploration, Education, The world of retail Food and beverage industry, Entertainment, The banking industry	Strategist, Brand Experience Design. Lead, Innovation. Design Researcher. User Experience (UX) Designer. Head of Product Design. Service Designer.

Introduction to Embedded Systems and IoT- A Hands-on Approach

Course Code	22AECCS372	Course type	AEC	Credits L-T-P	0 - 0 - 1
Hours/week: L - T- P	0 - 0 - 2			Total credits	1
Total Contact Hours	L = 0 Hrs; T = 0 Hrs; P = 20 Hrs Total = 20 Hrs			CIE Marks	50
Flipped Classes content				SEE Marks	50

Course learning objectives	
1.	Understand the architecture of Microcontroller.
2.	Programming Microcontroller for simple applications.
3.	Programming 8051 Microcontroller timer/counter and serial port.
4.	Interfacing sensors and peripherals with the Microcontroller.

Required Knowledge of : Digital Electronics, Computer Organization

Lab Experiment – I	**Contact Hours = 2 Hours**
The 8051 Microcontrollers: Microcontrollers and embedded processors**. 8051 Programming in 'C':** Data types and time delay in 8051 'C', I/O programming in 8051 'C'.	
Lab Experiment – 2	**Contact Hours = 2 Hours**
8051 Programming in 'C': Logic operations in 8051 'C', Data conversion programs in 8051 'C'.	
Lab Experiment – 3	**Contact Hours = 2 Hours**
8051 Programming in 'C': Accessing code ROM space in 8051 'C', Data serialization using 8051 'C'.	
Lab Experiment – 4	**Contact Hours = 2 Hours**
8051 Timer Programming in 'C': Programming 8051 timers in mode 1.	
Lab Experiment – 5	**Contact Hours = 2 Hours**
8051 Timer Programming in 'C': Programming 8051 timers in mode 2.	
Lab Experiment – 6	**Contact Hours = 2 Hours**
8051 Counter Programming in 'C': Programming 8051 counters in mode 1.	
Lab Experiment – 7	**Contact Hours = 2 Hours**
8051 Counter Programming in 'C': Programming 8051 counters in mode 2.	
Lab Experiment – 8	**Contact Hours = 2 Hours**
8051 Serial Port Programming in 'C': Basics of serial communication, serial port programming in 'C'.	
Lab Experiment – 9	**Contact Hours = 2 Hours**
8051 Peripheral Interfacing: Interfacing ADC, DAC, sensors, LCD with 8051 Microcontroller.	
Lab Experiment – 10	**Contact Hours = 2 Hours**
Programming Arduino UNO: LED blinking, push button and led interfacing, sensors interfacing.	

Books	
	Text Books:
1.	Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay: The 8051 Microcontroller and Embedded Systems Using Assembly and C, Pearson Prentice Hall, 1st edition and above.
2.	James Fiore, Embedded Controllers Using C and Arduino, Mohawk Valley Community College; eBook (Creative Commons Licensed)
3.	Kenneth Ayala, The 8051Microcontroller, Cengage Learning, 2nd edition and above.
4.	Julien Bayle, C Programming for Arduino, Packt Publishing (May 17, 2013).
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links

1.	https://www.udemy.com/course/embedded-c-for-8051-microcontroller/
2.	https://www.udemy.com/course/arduino-programming-and-interfacing/

Course delivery methods		Assessment methods	
1.	Practice session/Demonstrations in Labs	1.	Conduction of Experiments
2.	Virtual Labs (if present)	2.	Journal writing
3.	Chalk and Talk	3.	Lab project/ Open ended experiment
4.		4.	Lab Test
5.		5.	Semester End Examination

Course Outcome (COs)

Learning Levels:

Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create

At the end of the course, the student will be able to		Learning Level	PO(s)	PSO(s)
1.	**Develo**p programs for microcontrollers for simple I/O applications.	Ap	2,3,5	1,2
2.	**Experiment with** microcontroller's timer/ counter and serial port.	Ap	2,3,5	1,2
3.	**Make use of** interfacing for sensors and peripherals with the Microcontroller.	Ap	2,3,5	1,2
4.	**Develop** a course project by applying the learnings inculcated throughout the course.	**Cr**	2, 3, 5, 9, 10, 11, 12	1, 2, 3

Scheme of Continuous Internal Evaluation (CIE):

Conduction of experiments & viva-voce	Journal	Lab project/ Open ended experiment	Lab Test	Total
20 marks	5 marks	10 marks	15	50 marks

Conduct of Lab:

4. Conduction of the experiment: 15 marks + Viva voce: 5 marks = 20 marks
5. Calculations, results, graph, conclusion and Outcome recorded in Journal: 5 marks
6. Lab project/ Open ended experiment: 10 marks
3. Lab Test: 15 marks

Eligibility for SEE:

2. 40% and above (20 marks and above)
2. **Lab test is COMPULSORY**

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 50 marks of 2/3 hours duration.
2.	**Minimum marks required in SEE to pass:** Score should be ≥35% , however overall score of CIE+SEE should be ≥40%.
2.	One or Two experiments to be conducted.

3.	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
4.	Viva-voce shall be conducted for individual student and not in a group.		

CO-PO Mapping (planned)													CO-PSO Mapping (planned)		
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
1		√	√		√								√	√	
2		√	√		√								√	√	
3		√	√		√								√	√	
4		√	√		√				√	√	√	√	√	√	√
Tick mark the CO, PO and PSO mapping															

Software Tools and Technologies

Course Code	**22AECCS373**	**Course type**	**AEC**	**Credits L-T-P**	0 - 0 - 1
Hours/week: L - T- P	0 - 0 - 2			**Total credits**	1
Total Contact Hours	L = 0 Hrs; T = 0 Hrs; P = 20 Hrs Total = 20 Hrs			**CIE Marks**	50
Flipped Classes content				**SEE Marks**	50

Course learning objectives	
1.	To make familiar with the modern tool usage
2.	To improve the verbal and written communication skills
3.	Explain the importance of problem solving and usage of various program design tools

Sl No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	**Embedded 'C' Programming.**	**Embedded Systems and IoT Application**	**Embedded Engineers**
2	**Programming Microcontroller 8051 for simple I/O operations.**	**Embedded Systems and IoT Application**	**Embedded-IoT-Firmware Design Engineer**
3	**Programming Arduino UNO for simple I/O, sensor interfacing and actuator interfacing.**	**Embedded Systems and IoT Application**	**Embedded-IoT-Firmware Design Engineer**
4.	To get familiar with creation of professional accounts and usage of google drives		

Required Knowledge of : MS Office, programming knowledge

Lab Experiment – I	Contact Hours = 6 Hours
MS Word - Quick styles, Template usage, Graphics use, Auto correction, Auto formatting, Translate documents, Compare documents, Document security, Set watermark, Report writing **MS PowerPoint** - Presentation skills	
Lab Experiment – 2	**Contact Hours = 6 Hours**
MS Excel - Filling, Logical functions, Functions and formulae, Sort and filters, Charts, Shortcuts **MS Access** - Orientation to access, Working with table data, Querying a database	
Lab Experiment – 3	**Contact Hours = 8 Hours**
Building logic to improve programming skills - Decision making and branching constructs, Looping statements Introduction to LinkedIn, GitHub, Kaggle, Google form, Google classroom, Google sheet, usage of google drive	

Books	
	Text Books:
1.	The Art of Computer Programming by Donald E. Knuth.
2.	How to Solve it by Computer by R. G. Dromey

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Book Assignments (OBA)/ Lab Project
3.	Flipped Classes	3.	Lab Test
4.	Practice session/Demonstrations in Labs	4.	Semester End Examination
5.	Virtual Labs (if present)		

Course Outcome (COs)

Learning Levels:

Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create

At the end of the course, the student will be able to		Learning Level	PO(s)	PSO(s)
1.	Get acquainted with the modern tool usage	**Un**	**1, 5**	**1**
2.	Improve the verbal and written communication skills	**Un**	**1, 12**	**2**
3.	Familiar with the importance of problem solving and usage of various program design tools	**Ev**	**2, 3**	**1**
4.	**Develop** a course project by applying the learnings inculcated throughout the course.	**Cr**	2, 3, 5, 9, 10, 11, 12	1, 2, 3

Scheme of Continuous Internal Evaluation (CIE):

Conduction of experiments & viva-voce	Journal	Lab project/ Open ended experiment	Lab Test	Total
20 marks	5 marks	10 marks	15	50 marks

Conduct of Lab:

7. Conduction of the experiment: 15 marks + Viva voce: 5 marks = 20 marks
8. Calculations, results, graph, conclusion and Outcome recorded in Journal: 5 marks
9. Lab project/ Open ended experiment: 10 marks
3. Lab Test: 15 marks

Eligibility for SEE:

3. 40% and above (20 marks and above)
2. **Lab test is COMPULSORY**

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 2/3 hours duration.		
2.	**Minimum marks required in SEE to pass:** Score should be ≥35% , however overall score of CIE+SEE should be ≥40%.		
2.	One or Two experiments to be conducted.		
3.	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
4.	Viva-voce shall be conducted for individual student and not in a group.		

CO-PO Mapping (planned)													**CO-PSO Mapping (planned)**		
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
1	✓				✓								✓		
2	✓									✓		✓		✓	✓
3		✓	✓										✓		
4		✓	✓		✓				✓	✓	✓	✓	✓	✓	✓
Tick mark the CO, PO and PSO mapping															

Sl No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Help in proper Arrangement, formatting and analyses Data into various tools	Any Domain	Skill Enhancement

Data Visualization Tools and Techniques

Course Code	22AECCS374	Course type	AEC	Credits L-T-P	0 - 0 - 1
Hours/week: L - T- P	0 - 0 - 2			Total credits	1
Total Contact Hours	L = 0 Hrs; T = 0 Hrs; P = 20 Hrs Total = 20 Hrs			CIE Marks	50
Flipped Classes content				SEE Marks	50

Course learning objectives	
1.	Understand the fundamental concepts of data visualization
2.	Understand different types of data visualization tools
3.	Apply the knowledge of tableau to solve real time problems
4.	Understand the concepts of Power Bi

Required Knowledge of : Basics of Programming language

Lab Experiment – I	**Contact Hours = 4 Hours**
Introduction to Data Visualization: What makes Data Visualization Effective? History of Data Visualization, Importance of Data Visualization Why Use Data Visualization? Tables, Pro and Cons of Data Visualization, Acquiring and Visualizing Data, Applications of Data Visualization, Keys factors of Data Visualization.	
Lab Experiment – 2	**Contact Hours = 4 Hours**
EXCEL Introduction, Interface, Tabs and Ribbons, Document Windows, Navigation Tips, Office Button and Save. Entering, Editing and Formatting Data: Entering Data, Fonts, Fills, and Alignment, Cut, Copy, and Paste, Paste Special, Undo and Redo, Moving, Finding, and Replacing a Value. Finding out mean, median and mode in Excel. Bar charts, pie charts, combination charts, Band charts Gantt chart, Waterfall chart	
Lab Experiment – 3	**Contact Hours = 4 Hours**
POWER BI Introduction, Installation Steps, Architecture, Supported Data Sources, Comparison with Other BI Tools, Data Modelling, Dashboard Options, Visualization Options, Excel Integration	
Lab Experiment – 4	**Contact Hours = 4 Hours**
Tableau: Introduction to tableau, Getting started with tableau, Exploring basic Tableau, deep drive into tableau ,visualization.	
Lab Experiment – 5	**Contact Hours = 4 Hours**
WEKA and R: Introduction to WEKA, Installation, loading data, Exploring file formats, visualization. Introduction to R programming tool, Installation, programming with R, Visualizing charts and graphs using R.	

Books	
	Text Books:
1.	Tillman Davias, The Book of R first course in programming and statistics, William Pollock, 2016.
2.	Joshua Milligan, Learning Tableau 2019 , Packt Publishing, 3rd Edition 2019
3.	Alberto Ferari, Introducing Microsoft Power BI, Microsoft Press, 2016
4.	Curtis D. Frye , Microsoft Step by Step Excel 2010, Microsoft Press,

Course delivery methods		**Assessment methods**	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Book Assignments (OBA)/ Lab Project
3.	Flipped Classes	3.	Lab Test
4.	Practice session/Demonstrations in Labs	4.	Semester End Examination
5.	Virtual Labs (if present)		

Course Outcome (COs)
Learning Levels:

Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create				
At the end of the course, the student will be able to		**Learning Level**	**PO(s)**	**PSO(s)**
1.	**Illustrate** the basics of data visualization tools and techniques	Un	1, 5	1, 2
2.	Experiment with data visualization tools for various data sets in order to perform exploratory data analysis	An	2, 3, 4, 5	1,2
3.	Analyze the results to draw inferences.	An	2, 3, 4, 5	1,2
4.	**Develop** a course project by applying the learnings inculcated throughout the course.	**Cr**	2, 3, 4, 5, 9, 10, 11, 12	1, 2, 3

Scheme of Continuous Internal Evaluation (CIE):

Conduction of experiments & viva-voce	Journal	Lab project/ Open ended experiment	Lab Test	Total
20 marks	5 marks	10 marks	15	50 marks

Conduct of Lab:

10. Conduction of the experiment: 15 marks + Viva voce: 5 marks = 20 marks
11. Calculations, results, graph, conclusion and Outcome recorded in Journal: 5 marks
12. Lab project/ Open ended experiment: 10 marks
3. Lab Test: 15 marks

Eligibility for SEE:

4. 40% and above (20 marks and above)
2. **Lab test is COMPULSORY**

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 2/3 hours duration.		
2.	**Minimum marks required in SEE to pass:** Score should be ≥35% , however overall score of CIE+SEE should be ≥40%.		
2.	One or Two experiments to be conducted.		
3.	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
4.	Viva-voce shall be conducted for individual student and not in a group.		

CO-PO Mapping (planned)													**CO-PSO Mapping (planned)**		
CO	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PO**	**PSO**	**PSO**	**PSO**

	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	✓				✓								✓		
2		✓	✓	✓	✓								✓	✓	
3		✓	✓	✓	✓								✓	✓	
4	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓
Tick mark the CO, PO and PSO mapping															

Mathematics I

CourseCode	22AECCS375	**Coursetype**	**AEC**	**CreditsL-T-P**	1-0-0
Hours/week:L-T-P	1-0-0			**Totalcredits**	1
TotalContactHours	L = 20 Hrs; T = 0 Hrs; P = 0 Hrs Total = 20 Hrs			**CIEMarks**	50
FlippedClassescontent	5 Hours			**SEEMarks**	50

Course learning objectives
1. Review basic differentiation and Integration
2. Get acquainted with different applications of Calculus.
3. Understand modular arithmetic.

Sl No	**Skill & competence enhanced after undergoing the course**	**Applicable Industry Sectors & domains**	**Job roles students can take up after undergoing the course**
1	**Source, gather, arrange, process, and model data. Analyze large volumes of structured or unstructured data. Prepare and present data in the best forms for decision-making and problem-solving.**	**Data Mining, Cloud and Computing, Data visualization, Data Analytics**	**Data Scientist, Data Analyst**

5.	Get familiar with various topics in Linear Algebra.

Required Knowledge of: Basic Trigonometry, Calculus,Algebra

Unit– I: Basic Differentiation, Integration	**Contact Hours =5 Hours**
Rate of change, increasing/decreasing functions, tangents and normals, maxima and minima (first derivative test motivated geometrically and second derivative test given as a provable tool). Simple problems (that illustrate basic principles and understanding of the subject as well as real-life situations).Integration of a variety of functions by substitution, by partial fractions and by parts, Basic properties of definite integrals and evaluation of definite integrals.	

Unit–II: Calculus	**Contact Hours =5 Hours**
Series expansion of functions (Taylor's and Maclaurin's series) Polar Curves, angle between radius vector and tangent, angle between polar curves,.	

Unit – III: Modular Arithmetic:
Introduction to congruences, Linear Congruences, The Chinese Remainder theorem, Solving Polynomials, Linear Diophantine Equation, System of Linear Congruences, Euler's Theorem, Wilson Theorem and Fermat's little theorem (only statements) .

Unit– IV: Linear Algebra I	**Contact Hours =5 Hours**
Rank of a matrix by elementary transformation, consistency of system of linear equations-Gauss Jordan method and Gauss-Seidal method. Eigen value and Eigen vectors – Rayleigh's Power method.	

Flipped Classroom Details

Unit No.	**I**	**II**	**III**	**IV**
No. for Flipped Classroom Sessions	**1**	**1**	**1**	**2**

Books																
Text Books:																
1.	B.S. Grewal – Higher Engineering Mathematics, Khanna Publishers, 42nd Edition, 2012.															
2.	Erwin Kreyszig – Advanced Engineering Mathematics, John Wiley & Sons Inc., 9th Edition, 2006.															
3.	B. V.Ramana- Higher Engineering Mathematics, Tata McGraw-Hill Education Private Limited, Tenth reprint 2010 and onwards.															
4.	Peter V. O' Neil – Advanced Engineering Mathematics, Thomson Brooks/Cole, 7th Edition, 2011.															
5.	Glyn James – Advanced Modern Engineering Mathematics, Pearson Education, 4th Edition, 2010.															
Reference Books:																
1.	Peter V. O' Neil – Advanced Engineering Mathematics, Thomson Brooks/Cole, 7th Edition, 2011.															
2.																
3.																
4.																

Course delivery methods

Assessment methods

Course Outcome (COs)

At the end of the course, the student will be able to (Highlight the **action verb** representing the learning Level)

CO-PO Mapping (planned)

CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
1											L1		1		1
2											L1		1		1
3											L2		1		1
4											L1		1		1

Learning Levels: Remember: L1 - Understand: L2 - Apply: L3 - Analysis: L4 - Evaluate: L5 - Create L6

CO-PSO Mapping(planned)

PO(s)	**PSO(s)**
1	**2**
1	1
1	1
1	1
1	1

Review basics of Differentiation and Integration.

Review basic concepts of Calculus.

Understand modular arithmetic.

Understand basic Linear Algebra.

SchemeofContinuousInternalEvaluation(CIE):Theorycourse(Non-Integrated)

Components	AdditionofCIEcomponents	Total Marks
WrittenTest	30	50
Two quizzes	20	

SchemeofSemesterEndExamination(SEE):Theorycourse(Non-Integrated)

Components	TotalMarks
Written exams	50

Data Structures Laboratory using C

Course Code	22CSL39/22ISL39	Course type	PCCL	Credits L-T-P	0 - 0 - 1

Hours/week: L - T- P	0 - 0 - 2	**Total credits**	1
Total Contact Hours	L = 0 Hrs; T = 0 Hrs; P = 20 Hrs Total = 20 Hrs	**CIE Marks**	50
Flipped Classes content		**SEE Marks**	50

Course learning objectives	
1.	Demonstrate the abstract properties of various data structures such as stacks, queues, lists, and trees.
2.	Compare different implementations of data structures and recognize the advantages and disadvantages of the different implementations
3.	Able to demonstrate features of different data structures such as Linked List, Hash Table, Queues to solve real world problems.

Required Knowledge of : C programming Skills

Unit No.	**No. of Experiments**	**Topic(s) related to Experiment**
1	**1**	**Structures**
2	**2**	**Stack, Queue**
3	**2**	**Linked list, DLL**
4	**1**	**Trees**
5	**1**	**Hashing**

Books	
	Text Books:
1.	Richard.F.Gilberg, Behrouz.A. Forouzan, Data Structures: A Pseudocode Approach with C, Cengage Learning, 2nd edition 2007 and onwards
2.	Horowitz, Sahni, Anderson-Freed, Fundamentals of Data Structures in C, Universities Press, 2nd Edition, 2007 and onwards.
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	NPTELcourse link : https://nptel.ac.in/courses/106102064/
2.	SWAYAM course link: https://swayam.gov.in/course/1407-programming-and-data-structures
3.	edx course link: https://www.edx.org/course/data-structures-fundamentals

Course delivery methods		**Assessment methods**	
1.	Practice session/Demonstrations in Labs	1.	Conduction of Experiments
2.	Virtual Labs (if present)	2.	Journal writing
3.	Chalk and Talk	3.	Lab project/ Open ended experiment
4.		4.	Lab Test
5.		6.	Semester End Examination

Course Outcome (COs) **Learning Levels:** **Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create**				
At the end of the course, the student will be able to		**Learning Level**	**PO(s)**	**PSO(s)**
1.	**Demonstrate** the understanding of structured programming.	Ap	1, 2	1
2.	**Analyze** the problem statement and able to choose right data structure for implementation.	An	3, 4	1
3.	**Develop** an ability to construct robust, maintainable programs which satisfy the requirements of user.	Ap	3, 4, 5	1, 2
4.	**Develop** a course project or present a course seminar by applying the learnings inculcated throughout the course.	**Cr**	2, 3, 5, 9, 10, 11, 12	1, 2, 3

Scheme of Continuous Internal Evaluation (CIE):

Conduction of experiments & viva-voce	Journal	Lab project/ Open ended experiment	Lab Test	Total
20 marks	5 marks	10 marks	15	50 marks

Conduct of Lab:

13. Conduction of the experiment: 15 marks + Viva voce: 5 marks = 20 marks
14. Calculations, results, graph, conclusion and Outcome recorded in Journal: 5 marks
15. Lab project/ Open ended experiment: 10 marks
3. Lab Test: 15 marks

Eligibility for SEE:

5. 40% and above (20 marks and above)
2. **Lab test is COMPULSORY**

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 2/3 hours duration.		
2.	**Minimum marks required in SEE to pass:** Score should be ≥35% , however overall score of CIE+SEE should be ≥40%.		
2.	One or Two experiments to be conducted.		
3.	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
4.	Viva-voce shall be conducted for individual student and not in a group.		

CO-PO Mapping (planned)													CO-PSO Mapping (planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	√	√											√		
2			√	√									√		
3			√	√	√								√	√	
4									√	√	√	√			√
Tick mark the CO, PO and PSO mapping															

Sl No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	To design and analyze simple linear and non-linear data structures.	IT Sector	Software Developer
2	Ability for the students to identify and apply the suitable data structure		

Data Structures Laboratory using C

Course Code	22CSL39/22ISL39	Course type	PCCL	Credits L-T-P	0 - 0 - 1
Hours/week: L - T- P	0 - 0 - 2			Total credits	1
Total Contact Hours	L = 0 Hrs; T = 0 Hrs; P = 20 Hrs Total = 20 Hrs			CIE Marks	50
Flipped Classes content				SEE Marks	50

Course learning objectives	
1.	Demonstrate the abstract properties of various data structures such as stacks, queues, lists, and trees.
2.	Compare different implementations of data structures and recognize the advantages and

	disadvantages of the different implementations
3.	Able to demonstrate features of different data structures such as Linked List, Hash Table, Queues to solve real world problems.

Required Knowledge of : C programming Skills

Unit No.	No. of Experiments	Topic(s) related to Experiment
1	**1**	**Structures**
2	**2**	**Stack, Queue**
3	**2**	**Linked list, DLL**
4	**1**	**Trees**
5	**1**	**Hashing**

Books	
	Text Books:
1.	Richard.F.Gilberg, Behrouz.A. Forouzan, Data Structures: A Pseudocode Approach with C, Cengage Learning, 2nd edition 2007 and onwards
2.	Horowitz, Sahni, Anderson-Freed, Fundamentals of Data Structures in C, Universities Press, 2nd Edition, 2007 and onwards.
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	NPTELcourse link : https://nptel.ac.in/courses/106102064/
2.	SWAYAM course link: https://swayam.gov.in/course/1407-programming-and-data-structures
3.	edx course link: https://www.edx.org/course/data-structures-fundamentals

Course delivery methods		**Assessment methods**	
1.	Practice session/Demonstrations in Labs	1.	Conduction of Experiments
2.	Virtual Labs (if present)	2.	Journal writing
3.	Chalk and Talk	3.	Lab project/ Open ended experiment
4.		4.	Lab Test
5.		7.	Semester End Examination

Course Outcome (COs)

Learning Levels:

Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create

At the end of the course, the student will be able to		Learning Level	PO(s)	PSO(s)
1.	**Demonstrate** the understanding of structured programming.	Ap	1, 2	1
2.	**Analyze** the problem statement and able to choose right data structure for implementation.	An	3, 4	1

3.	**Develop** an ability to construct robust, maintainable programs which satisfy the requirements of user.	Ap	3, 4, 5	1, 2
4.	**Develop** a course project or present a course seminar by applying the learnings inculcated throughout the course.	**Cr**	2, 3, 5, 9, 10, 11, 12	1, 2, 3

Scheme of Continuous Internal Evaluation (CIE):

Conduction of experiments & viva-voce	Journal	Lab project/ Open ended experiment	Lab Test	Total
20 marks	5 marks	10 marks	15	50 marks

Conduct of Lab:

16. Conduction of the experiment: 15 marks + Viva voce: 5 marks = 20 marks
17. Calculations, results, graph, conclusion and Outcome recorded in Journal: 5 marks
18. Lab project/ Open ended experiment: 10 marks
3. Lab Test: 15 marks

Eligibility for SEE:

6. 40% and above (20 marks and above)
2. **Lab test is COMPULSORY**

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 2/3 hours duration.		
2.	**Minimum marks required in SEE to pass:** Score should be ≥35% , however overall score of CIE+SEE should be ≥40%.		
2.	One or Two experiments to be conducted.		
3.	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
4.	Viva-voce shall be conducted for individual student and not in a group.		

CO-PO Mapping (planned)													**CO-PSO Mapping (planned)**		
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
1	√	√											√		
2			√	√									√		
3			√	√	√								√	√	
4									√	√	√	√			√

Tick mark the CO, PO and PSO mapping			

Sl No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	To design and analyze simple linear and non-linear data structures.	IT Sector	Software Developer
2	Ability for the students to identify and apply the suitable data structure		

Detailed 4th Semester Syllabus

Operating Systems

Course Code	**22CS41 / 22IS41**	**Course type**	PCC	**Credits L-T-P**	**3 – 0 - 0**
Hours/week: L - T- P	3 – 0 – 0			**Total credits**	3
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 0 Hrs Total = 40 Hrs			**CIE Marks**	100
Flipped Classes content	10 Hours			**SEE Marks**	100

Course learning objectives	
1.	To introduce the functions of an operating system, design, structure, and associated system calls
2.	To study and analyze various scheduling algorithms and process synchronization techniques
3.	To develop an understanding of deadlocks and deadlock recovery techniques.
4.	To discuss and realize the importance of memory management techniques.
5.	To gain knowledge of file systems and secondary storage structures.

Pre-requisites: Basic knowledge of computer concepts & programming, Computer Organization.

Unit – I	**Contact Hours = 8 Hours**

Introduction to Operating System: System structures: What operating systems do; Operating System operations; Process management; Memory management; Storage management; Protection and security; Distributed system; Operating System Services; System calls; Operating System structure; System boot. **Introduction to UNIX File System:** Inside UNIX, Internal and External Commands, Command structure. **Case Study:** Android Operating System / iOS

Unit – II	**Contact Hours = 8 Hours**
Process Management: Process concept; Process scheduling; Process Scheduling: Basic concepts; Scheduling criteria; Scheduling algorithms. **The Process:** Understanding the process, How a process is created, the login shell, init, internal and external commands, ps. **Case Study: OSSim Simulation Tool**	

Unit – III	**Contact Hours = 8 Hours**
Process Synchronization: Synchronization: The Critical section problem; Peterson's solution; Semaphores, Classical problems of synchronization: The Dining-Philosophers Problem. **Deadlocks:** System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.	

Unit – IV	**Contact Hours = 8 Hours**
Memory Management: Memory Management Strategies: Background; Swapping; Contiguous memory allocation; Paging; Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement;	

Unit – V	**Contact Hours = 8 Hours**
File System: File System: File concept; Access methods; Directory and Disk structure; File system mounting; File sharing; Protection. **The File System:** The parent child relationship, The UNIX file system, Absolute Pathnames, Relative Pathnames, pwd, cd, mkdir, rmdir, cp, rm, mv, cat. File Attributes: ls, ls-l, ls-d, file permissions, chmod.	

Flipped Classroom Details

Unit No.	**I**	**II**	**III**	**IV**	**V**
No. for Flipped Classroom Sessions	**2**	**2**	**2**	**2**	**2**

Books	
	Text Books:
1.	Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Principles", Wiley India, 6th edition and onwards.
2.	Sumitabha Das: "YOUR UNIX – The Ultimate Guide" , Tata McGraw Hill, 23rd reprint , 2012 and onwards.
	Reference Books:

1.	Gary Nutt, “Operating System”, Pearson Education, 2nd edition and above.
2.	Harvey M Deital, “Operating system”, Addison Wesley, 2nd edition and above.
3.	D.M Dhamdhere, “Operating System”, “A concept based Approach”, Tata McGraw- Hill, 2nd edition and onwards
4.	Behrouz A. Forouzan and Richard F. Gilberg: “UNIX and Shell Programming “, Cengage Learning, 2005 and onwards.
	E-resourses (NPTEL/SWAYAM.)/COURSERA
1.	https://onlinecourses.nptel.ac.in/ Tentative Course List (July - Dec 2023) - Google Drive
2.	https://www.coursera.org/specializations/codio-introduction-operating-systems
3.	Lectures on Operating Systems (iitb.ac.in)

Course delivery methods		**Assessment methods**	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Online Quizzes (Surprise and Scheduled)
3.	Flipped Classes	3.	Open Book Tests (OBT)
4.	Online classes	4.	Course Seminar
		5.	Semester End Examination

Course Outcome (COs)

At the end of the course, the student will be able to (Highlight the **action verb** representing the learning level.)

Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create		**Learning Level**	**PO(s)**	**PSO(s)**
1.	**Explain** the computer system resources and the role of an operating system in managing those resources	**Un**	1	1
2.	**Develop** applications keeping concurrency and synchronization, semaphores, Monitors shared memory, mutual exclusion, and process scheduling services of general operating systems and do the case study on OSSim Simulation Tool.	**Ap**	1,2,5	1,2
3.	**Describe** and **analyze** memory management, file management, and secondary Memory Management techniques.	**Ap**	2,5	1,2
4.	**Discuss** UNIX shell commands for file handling, process control and do the case study on Android Operating System / iOS.	**Un**	1,2	1,2
5.	**Understand** the learnings inculcated throughout the course and present a course seminar or **develop** a course project.	**Re,Un,Ap**	1,2,3, 5,9,10,11,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Online Quiz	Addition of two OBAs/ Course project	Course Seminar	Total Marks
Marks	25+25 = 50	4* 5 marks = 20	10+10 =20	10	100
OBA - Open Book Assignment **Minimum score to be eligible for SEE: 40 OUT OF 100**					

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration.
2.	**Minimum marks required in SEE to pass:** Score should be $\geq$ 35%, however overall score of CIE + SEE should be $\geq$ 40%.
3.	Question paper contains 3 parts - A,B & C, wherein students have to answer any 5 out of 7 questions in part A, 5 out of 10 questions choosing 1 question from each unit in part B & 1 out of 2 questions in part C.

CO-PO Mapping (Planned)													**CO-PSO Mapping (Planned)**		
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
1	✓												✓		
2	✓	✓			✓								✓	✓	
3		✓			✓								✓	✓	
4	✓	✓											✓	✓	
5	✓	✓	✓		✓				✓	✓	✓	✓	✓	✓	✓
Tick mark the CO, PO and PSO mapping															

Sl No	**Skill & competence enhanced after undergoing the course**	**Applicable Industry Sectors & domains**	**Job roles students can take up after undergoing the course**
1	Continuous Improvement: Continuous improvement is an ongoing process of improvement of products, services, and processes with the help of innovative ideas.	Product based companies	Software engineer Software Analyst Operations Systems Specialist

2.	Once they understand the basics of OS, they can start building, managing, and repairing hardware devices	Product based companies	Software Developer System Engineer
3.	Programming skills will be enhanced as whatever code they develop, will eventually run on an OS. Good understanding of OS is essential to become a programmer.	Software Industry	Computer System Engineer

Design and Analysis of Algorithms

Course Code	**22CS42 / 22IS42**	**Course type**	**IPCC**	**Credits L-T-P**	**3 – 0 - 1**
Hours/week: L - T- P	3 – 0 – 2			**Total credits**	4
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 20 Hrs Total = 60 Hrs			**CIE Marks**	100
Flipped Classes content	10 Hours			**SEE Marks**	100

Course learning objectives	
1.	To bring out the importance of the study of algorithms.
2.	To study and analyze time complexity of various algorithms.
3.	To discuss various algorithm design techniques.
4.	To develop a technique of analyzing and computing the performance of algorithms.

Pre-requisites : Basic Computer Programming

Unit – I	**Contact Hours = 8 Hours**
Introduction: Fundamentals of Algorithmic Problem Solving, Analysis Framework, Asymptotic Notations and basic efficiency classes, Mathematical Analysis of Non-Recursive and Recursive Algorithms,	

Unit – II	Contact Hours = 8 Hours
Divide and Conquer: Merge sort, Quicksort, Multiplication of Long Integers, Strassen's Matrix Multiplication. Decrease and Conquer: Insertion Sort, Depth First Search, Breadth First Search, Topological Sorting,	

Unit – III	Contact Hours = 8 Hours
The General Greedy Technique, Illustration with examples. Applications of Greedy method: Kruskal's Algorithm – Minimum-Cost Spanning Trees: Prim's Algorithm, Single Source Shortest Path - Dijkstra's Algorithm, Huffman Trees – Encoding of Data	

Unit – IV	Contact Hours = 8 Hours
Dynamic Programming Definition and Concept Illustration. The General Method, Applications of Dynamic programming: Warshall's Algorithm – Transitive Closure, Floyd's Algorithm for the All-Pairs Shortest Paths, Knapsack using General Weights and 0/1 Knapsack.	

Unit – V	Contact Hours = 8 Hours
Backtracking: N-Queen's Problem, Sum of Subset Problem. Branch-and-Bound: Travelling Salesperson Problem, Assignment Problem Decision Trees: Decision Trees for Sorting NP and NP-Complete Problems: Basic Concepts, Non- Deterministic Algorithms, P, NP, NP Complete, and NP-Hard classes	

Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	2	2	2	2	2

List of Experiments

Unit No.	No. of Experiments	Topic(s) related to Experiment
1	2	Fundamentals of Algorithmic
2	2	Divide and Conquer Decrease and Conquer
3	1	Applications of Greedy method
4	2	Applications of Dynamic programming

		All-Pairs Shortest Paths
5	**3**	Backtracking Branch-and-Bound Decision Trees

Unit No.	Self-Study Topics
1	Brute Force Approaches: Introduction, Selection Sort, linear search.
2	Application of DFS and BFS.

Books	
	Text Books:
1.	Introduction to the Design and Analysis of Algorithms, Anany Levitin, University, 3rd Edition, 2012, Pearson, ISBN 13: 978-0-13-231681-1.
2.	Computer Algorithms, Horowitz E., Sahani S., Rajasekharan S., 2nd Edition, 2006, Galgotia Publications,ISBN:9780716783169
	Reference Books:
1.	Kenneth Berman, Jerome Paul, Algorithms, Cengage Learning.
2.	Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, introduction to Algorithms PHI, 2nd edition and above.
3	R.C.T. Lee, S.S. Tseng, R.C. Chang & Y.T.Tsai: Introduction to the Design and analysis of Algorithms A Strategic Approach, TataMcGraw Hill.
	E-resourses (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://onlinecourses.nptel.ac.in

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Online Quizzes (Surprise and Scheduled)
3.	Flipped Classes	3.	Open Book Tests (OBT)
4.	Online classes	4.	Course Seminar
		5.	Semester End Examination

Course Outcome (COs)

At the end of the course, the student will be able to (Highlight the **action verb** representing the learning level.)

Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr – Create		**Learning Level**	**PO(s)**	**PSO(s)**
1.	**Apply** knowledge of computing and mathematics to algorithm analysis and design	**Ap**	1,2	1
2.	**Analyze** a problem and identify the computing requirements	**An**	1,2,3,4	1,2

	appropriate for a solution			
3.	**Apply** algorithmic principles and computer science theory to the modeling for evaluation of computer-based solutions in a way that demonstrates comprehension of the trade-offs involved in design choices.	**Ap**	1,2,3,4	1,2
4.	**Investigate** and use optimal design techniques, development principles, skills and tools in the construction of software solutions of varying complexity.	**An**	1,,2,3,4	1,2
5.	**Understand** the learnings inculcated throughout the course and present a course seminar or **develop** a course project or assignments.	**An**	1,2,3, 5,9,10,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE):
For integrated courses, a lab test also will be conducted at the end of the semester. The lab test **(COMPULSORY)** will be part of the CIE. **No SEE for Lab**.

THEORY (60 marks)			**LAB (40 marks)**		Total
IA test 1	IA test 2	Assignment (OBA/Lab Project/ Industry assignment)/ Course project	Conduction	Lab test	
25 marks	25 marks	10 marks	15 marks	25 marks	100 marks
IA Test: 1. No objective part in IA question paper 2. All questions descriptive					
Conduct of Lab: 1. Conducting the experiment and journal: 5 marks 2. Calculations, results, graph, conclusion and Outcome: 5 marks 3. Viva voce: 5 marks					
Lab test: (Batchwise with 15 students/batch) 1. Test will be conducted at the end of the semester 2. Timetable, Batch details and examiners will be declared by Exam section					

3. Conducting the experiment and writing report: 5 marks 4. Calculations, results, graph and conclusion: 10 marks 5. Viva voce: 10 marks
Eligibility for SEE: 1. 40% and above (24 marks and above) in theory component 2. 40% and above (16 marks and above) in lab component 3. **Lab test is COMPULSORY** 4. Not eligible in any one of the two components will make the student **Not Eligible** for SEE

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours' duration.
2.	**Minimum marks required in SEE to pass:** Score should be $\geq$ 35%, however overall score of CIE + SEE should be $\geq$ 40%.
3.	Question paper contains 3 parts - A,B & C, wherein students have to answer any 5 out of 7 questions in part A, 5 out of 10 questions choosing 1 question from each unit in part B & 1 out of 2 questions in part C.

CO-PO Mapping (Planned)													**CO-PSO Mapping (Planned)**		
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
1	✓	✓											✓		
2	✓	✓	✓	✓									✓	✓	
3	✓	✓	✓	✓									✓	✓	
4	✓	✓	✓	✓									✓	✓	
5	✓	✓	✓		✓				✓	✓		✓	✓	✓	✓
Tick mark the CO, PO and PSO mapping															

Sl No	**Skill & competence enhanced after undergoing the course**	**Applicable Industry Sectors & domains**	**Job roles students can take up after undergoing the course**
1	Designing, Analyzing and writing algorithms	Software Industry	Software engineer Software Analyst

			Operations Systems Specialist

Database Management Systems

Course Code	**22CS43 / 22IS43**	**Course type**	**IPCC**	**Credits L-T-P**	**3 – 0 – 1**
Hours/week: L - T- P	3 – 0 – 2			**Total credits**	4
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 20 Hrs Total = 60 Hrs			**CIE Marks**	100
Flipped Classes content	10 Hours			**SEE Marks**	100

Course learning objectives	
1.	To discuss the concept of databases, ER Modeling and Schema mapping
2.	To gain the knowledge Relational model concepts and constraints and explore the various relational operations.
3.	To introduce a formal database design approach through various normal forms and study the importance of concurrent transactions and control algorithms.
4.	To understand the application of different query languages and query optimizations.

Pre-requisites : - Basics of Programming Knowledge.

Unit – I	Contact Hours = 8 Hours
Introduction: Introduction to database, Characteristics of Database approach, Advantages of using DBMS approach, Three-schema architecture and data independence, **Entity-Relationship Model:** Using High-Level Conceptual Data Models for Database Design; An Example Database Application; Entity Types, Entity Sets, Attributes and Keys; Relationships, Relationship types, Roles and Structural Constraints; Weak Entity Types. ER-Relational Mapping Rules.	

Unit – II	Contact Hours = 8 Hours
Relational Model : Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update Operations, Dealing with constraint violations; Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations: JOIN and DIVISION.	

Unit – III	Contact Hours = 8 Hours
Database Design: Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms; Boyce-Codd Normal Form. **Transaction Processing Concepts:** Introduction to Transaction processing, Transaction and System concepts, Desirable properties of Transactions and issues with concurrent transactions. 2PL and TSO algorithms	

Unit – IV	Contact Hours = 8 Hours
SQL: SQL Data Definition and Data Types; Specifying basic constraints in SQL; Schema change statements in SQL; Basic queries in SQL; More complex SQL Queries; Nested and Correlated Queries, IN, ALL, EXIST operators. Insert, Delete and Update statements in SQL. Introduction to Query Optimization techniques; SQL Web Programming using PHP	

Unit – V	Contact Hours = 8 Hours
PL/SQL: PL/SQL Block Structure, PL/SQL Variables, PL/SQL Function, PL/SQL Procedure, PL/SQL IF Statement, PL/SQL Loop Statement: PL/SQL WHILE Loop Statement, PL/SQL FOR Loop Statement. Introduction to Cursors and Triggers.; Overview of NoSQL**,** Apache Hive as an HDFS, HBase	

Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	2	2	2	2	2

List of Experiments

Unit No.	No. of Experiments	Topic(s) related to Experiment
1	**2**	Entity-Relationship Model, ER-Relational Mapping Rules
2	**1**	Relational Operations
3	**1**	Normalization
4	**2**	DDL,DML, Web Programming
5	**2**	PL/SQL Programs, Cursors, Triggers

Unit No.	Self-Study Topics
1	Various users of DBMS, Classification od DBMS
2	Database and Java, Python connectivity

Books	
	Text Books:
1.	Elmasri and Navathe: Fundamentals of Database Systems, Addison-Wesley, 6th edition and above.
	Reference Books:
1.	Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, McGraw-Hill, 2nd edition and above.
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	Database Management Systems – NPTEL - https://onlinecourses.nptel.ac.in/noc22_cs51/preview
2.	Database Management Courses- https://www.udemy.com/topic/database-management/

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Online Quizzes (Surprise and Scheduled)
3.	Flipped Classes	3.	Open Book Tests (OBT)
4.	Online classes	4.	Course Seminar
5.	Enquiry Based Learning	5.	Semester End Examination

Course Outcome (COs) At the end of the course, the student will be able to (Highlight the **action verb** representing the learning level.)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr – Create		**Learning Level**	**PO(s)**	**PSO(s)**
1.	**Analyze** the given database applications using E-R diagrams and apply the normalization to produce schema diagrams and relations.	An	1,2,3,4	1,2
2.	**Explain** the relational operators , SQL concepts and transaction processing.	Re	1,2,3	1,
3.	**Apply** SQL , PL/SQL and NoSQL languages to design different Database applications.	Ap	1,2,3,4,	1,2
4.	**Understand** the learnings inculcated throughout the course and present a course seminar or **develop** a course project or assignments.	An	1,2,3, 5,9,10,11,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE):					
For integrated courses, a lab test also will be conducted at the end of the semester. The lab test **(COMPULSORY)** will be part of the CIE. **No SEE for Lab**.					
THEORY (60 marks)			**LAB (40 marks)**		Total
IA test 1	IA test 2	Assignment (OBA/Lab Project/ Industry assignment)/ Course project/Open ended Problems	Conduction and Journal	Lab test	
25 marks	25 marks	10 marks	15 marks	25 marks	100 marks
IA Test: 1. No objective part in IA question paper 2. All questions descriptive					
Conduct of Lab: 1. Conducting the experiment and journal: 5 marks 2. Calculations, results, graph, conclusion and Outcome: 5 marks 3. Viva voce: 5 marks					
Lab test: (Batchwise with 15 students/batch) 1. Test will be conducted at the end of the semester 2. Timetable, Batch details and examiners will be declared by Exam section 3. Conducting the experiment and writing report: 5 marks					

4. Calculations, results, graph and conclusion: 10 marks 5. Viva voce: 10 marks
Eligibility for SEE: 1. 40% and above (24 marks and above) in theory component 2. 40% and above (16 marks and above) in lab component 3. **Lab test is COMPULSORY** 4. Not eligible in any one of the two components will make the student **Not Eligible** for SEE

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hour duration.
2.	**Minimum marks required in SEE to pass:** Score should be ≥35 &, however overall score of CIE+SEE should be ≥40%.
3.	Question paper contains three parts **A,B and C**. Students have to answer 1. From Part A answer any 5 questions each Question Carries 6 Marks. 2. From Part B answer any one full question from each unit and each Question Carries 10 Marks. 3. From Part C answer any one full question and each Question Carries 20 Marks.

CO-PO Mapping (planned)													**CO-PSO Mapping (planned)**		
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
1	√	√	√	√	√				√	√		√	√	√	√
2	√	√	√							√			√	√	√
3		√	√	√						√		√	√	√	√
4	√	√	√		√				√	√		√	√	√	√

Sl No	**Skill & competence enhanced after undergoing the course**	**Applicable Industry Sectors & domains**	**Job roles students can take up after undergoing the course**
1	Analyzing and Designing Databases	Software Industry	Database Developers
2	Administration of Databases	Software Industry	Database Administrators

Discrete Mathematical Structures and Graph Theory

Course Code:	**22CS441 / 22IS441**	**Course type**	Theory	**Credits L-T-P**	3 –0– 0
Hours/week: L-T-P	3 – 0 – 0			**Total credits**	3
Total Contact Hours	L = 40 Hrs; T =0Hrs;P = 0 Hrs Total = 40 Hrs			**CIE Marks**	100
Flipped Classes content	10 Hours			**SEE Marks**	100

Course learning objectives	
At the end of the course students should be able to	
1.	Get acquainted with fundamentals and all laws of logic and quantifiers.
2.	Get familiar with relations and their closures, Posets and Lattices.
3.	Understand the theory of recurrence relations and generating functions.
4.	Get acquainted with basic concepts of graphs, trees and their applications..

Pre-requisites : Relations, Functions ,Permutations and combinations, Algebra.

Unit – I	Contact Hours = 8 Hours
Fundamentals of Logic: Basic connectives and Truth tables, Logical equivalence- Laws of Logic, Logical Implication-Rules of Inference. Quantifiers- Universal and Existential Quantifiers.	

Unit – II	Contact Hours = 8 Hours
Relations: Types and Properties of Relations (revision), n-ary Relations and Their Applications. Computer recognition-Zero One Matrices and Directed graphs, Transitive, closure, Warshall's algorithm, Equivalence relation and Partitions, Posets and Hasse Diagrams, Lattices.	

Unit – III	Contact Hours = 8 Hours
Recurrence relations: Definition, Homogeneous recurrence relations, Non Homogeneous recurrence relations. Solution of homogeneous and non homogeneous recurrence relations. Generating functions. Solution of recurrence relation by generating function.	

Unit – IV	Contact Hours = 8 Hours
Graph Theory I: Definitions and Examples, Subgraphs, Matrix Representation of graphs. Complements and Graph Isomorphism, Connectivity, Euler Trails and Circuits, Shortest path: Dijkartas algorithm. Planar Graphs, Hamiltonian Paths and Cycles.	

Unit –V	Contact Hours = 8 Hours
Graph Theory II: Coloring covering and matching: Chromatic number, chromatic polynomial, uniquely colorable graphs , coloring planar graphs :Five color theorem ,Four color theorem. Covering minimal covering, Matching Halls theorem.	

Flipped

Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	2	2	2	2	2

Books	
	Text Books:
1.	Kolman, Busby, Ross " Discrete Mathematic

	al Struc
2.	Ralph G
	Referen
1.	Kennet Graph
2.	Narsing
	E-resou
1.	https://
2.	https://
3	https://

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Online Quizzes (Surprise and Scheduled)
3.	Flipped Classes	3.	Open Book Tests (OBT)/Matlab
4.	Online classes	4.	Course Seminar
		5.	Semester End Examination

Course Outcome (COs) At the end of the course, the student will be able to				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create		**Learning Level**	**PO(s)**	**PSO(s)**
1.	**Understand** and **Apply** the Logic of mathematics in the field of Computer science.	**Un, Ap**	1	1
2.	**Explain** and **Analyze** different Relations and their closures. Posets and lattices.	**Un, Ap**	1	1
3.	**Apply** theory of solution of recurrence relations to solve them.	**Un, Ap**	1	1
4.	**Apply** the concepts related to graphs their relevant applications..	**Un,Ap**	1	1

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Online Quiz	Addition of two OBAs/Math tools	Course Seminar	Total Marks

Marks	25+25= 50	4* 5 marks = 20	10+10 =20	10	100
OBA- Open Book Assignment **Minimum score to be eligible for CIE: 40 OUT OF 100**					

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains three parts **A(30 marks),B(50 marks) and C (20 marks).**Student has to answer 1. From Part A answer any 5 questions each Question Carries 6 Marks. 2. From Part B answer any one full question from each unit and each Question Carries 10 Marks. 3. From Part C answer any one full question and each Question Carries 20 Marks.

CO-PO Mapping (Planned)													**CO-PSO Mapping(Planned)**		
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
1	√												√		
2	√												√		
3	√												√		
4	√												√		

Web Programming- A Practical Approach (Project based)

Course Code	**22CS442/ 22IS442**	**Course type**	**Integrated Project based**	**Credits L-T-P**	2-0-1
Hours/week: L - T- P	2 - 0 – 2			**Total credits**	3
Total Contact Hours	L = 20 Hrs; T = Hrs; P = 20 Hrs Total = 40 Hrs			**CIE Marks**	100
Flipped Classes content	5 Hours			**SEE Marks**	100

Course learning objectives	
1.	To learn the basics of web development and develop basic web applications using HTML5, CSS3 and JavaScript
2.	To develop advanced web applications using Tailwind and JavaScript frameworks
3.	To understand and implement the concepts of responsive design and retina ready websites
4.	To deploy applications on AWS and generate static websites

5.	To understand the working of web APIs and use them in building web applications

Required Knowledge of : Basic Programming knowledge and basics of computer science

Unit – I	**Contact Hours = 8 Hours**

HTML and AWS

Writing HTML code using Header Tags, Paragraphs, Ordered and Unordered lists, Forms, Links and Tables, Iframes and Images, Text Formatting, Image Maps, Creating an Amazon Web Services ,AWS) account and how to deploy a static website to AWS Simple Storage Service ,S3

Working Encoding URL, Introduction to XHTML, Using HTML5 introduced features, Handling of multiple file upload using multiple attribute, HTML5 Local Storage, HTML5 form validate /novalidate, HTML5 canvas, embedding audio and video in a webpage, Drag and drop, HTML5 web workers and server sent events

Introduction to Figma, Working with UI- Design , Components , Mobile App design

Unit – II	**Contact Hours = 8 Hours**

CSS3

Styling of HTML elements-text; Links, lists and tables; Different ways to write CSS e.g. external, internal, inline; Creating Navigation Bars; Writing Media Rules; Hide visibility of an element; CSS Image Sprites and Gradients; CSS Pseudo Classes and Pseudo Elements

CSS3 Text Effects using different text fonts; Creating 2D and 3D transformations; Applying animations and transitions to HTML elements; CSS3 resize UI and multiple columns feature

Unit – III	**Contact Hours = 8 Hours**

Tailwind CSS and JavaScript

What is Tailwind CSS? advantages of tailwind CSS, comparison of tailwind CSS and bootstrap, getting started with tailwind, colors, element sizing, flexbox and grid, padding and margins, styling text, typography, borders and shadows.

Java Script datatypes; Variables and arrays; Creating loops and writing if-else decision-making statements; Defining and calling JavaScript functions on events; Manipulating DOM elements.

Unit – IV	**Contact Hours = 8 Hours**

Twitter Bootstrap

Getting started with Twitter Bootstrap 3; Bootstrap features like fixed drop-down menu; Carousel, text and image grids; Custom Thumbnails; Bootstrap modal; Using Font Awesome Icons

Building a real-world website using Twitter; Bootstrap 3 features like bootstrap fixed dropdown menu; Carousel; Bootstrap modal; Font awesome icons; custom Thumbnails; Text and Image grids; Accordions; Signin/Signup form and Jumbotron

Unit – V	**Contact Hours = 8 Hours**

Web APIs, Ajax

Bootstrap ScrollSpy AJAX XML; Http Request object; Making an AJAX call and retrieving the response; Working with Google APIs Adding social plugins on your web page provided by LinkedIn, Facebook, Quora and Twitter, Web APIs, Introduction to CI/CD, Using git- commands and concepts, hosting a static website on GitHub Pages.

Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	1	1	1	1	1

List of Experiments

Unit No.	No. of Experiments	Topic(s) related to Experiment
1	2	Figma, HTML5, and AWS
2	2	CSS transformations, UI and multi column features
3	2	Tailwind and JavaScript
4	2	Twitter Bootstrap, Jumbotron
5	2	Git and AJAX

Books	
	Text Books:
1.	Robert Sebesta, Programming the World wide web, 6th Edition
2.	Jennifer Robbins, Learning Web Design, 5th Edtion, 2018
3.	Noel Rappin, Modern CSS with Tailwind: flexible styling without the fuss, programmatic bookshelf, 2021
	Reference Books:
1.	DarioCalonaci, Designing user interfaces, BB publications, 2021
2.	David Cochran, Twitter Bootstrap Web development-How to, packt publishing, 2012
	E-resourses (NPTEL/SWAYAM.. Any Other)- mention links
1.	Responsive Web Design https://www.freecodecamp.org/learn/2022/responsive-web-design/
2.	Front End Development Libraries https://www.freecodecamp.org/learn/front-end-development-libraries

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests- Theory & Lab based
2.	PPT and Videos	2.	Project phase 1 & 2
3.	Flipped Classes	3.	SEE- Project evaluation
4.	Practice session/Demonstrations in Labs	4.	SEE- Solving an Open ended problem
5.	Virtual Labs (if present)		

Course Outcome (COs)

Learning Levels:

Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create

At the end of the course, the student will be able to	Learning Level	PO(s)	PSO(s)

1.	**Explain** the basic concepts of frontend web development using HTML5, CSS3 and other libraries	Un	1	1
2.	**Analyse** the real world problem and **Create** a wireframe model of the application	Cr	1, 3, 5, 9 , 10, 12	1,2,3
3.	**Demonstrate** the use of concepts learnt and integrate them to build real world applications	Ap	1, 3, 5, 9 , 10, 12	1,2,3
4.	**Make use of** hosting services to deploy the application.	Ap	5	2

Scheme of Continuous Internal Evaluation (CIE):

For integrated courses, a lab test also will be conducted at the end of the semester. The lab test **(COMPULSORY)** will be part of the CIE. **No SEE for Lab**.

THEORY (40 marks)		**PROJECT (60 marks)**			Total
IA test (Theory)	IA test (Lab)	Project Phase 1	Project Phase 2	Project report	
25 marks	15 marks	25 marks	25 marks	10 marks	100 marks
Theory IA test should be of one-hour duration. Lab IA test should be of two/three-hour duration. Project batch will ideally consist of 2 students (maximum of 3). Project Phase 1 presentation will be conducted after 6 weeks and Project Phase 2 presentation will be conducted after 13 weeks from the start of the semester. Submitting Project report is compulsory.					
Eligibility for SEE: 1. 40% and above (16 marks and above) in theory component 2. 40% and above (24 marks and above) in project component 3. Not eligible in any one of the two components will make the student **Not Eligible** for SEE					

Semester End Examination (SEE):

1.	It will be conducted for 100 marks having 3 hours duration.		
2.	**Lab Open ended program/problem/experiment** Write-up & execution (1 open ended expt)- (20 marks write-up + 20 marks algorithm/flowchart + 10 marks execution)	50 marks	100 marks
	Project evaluation m. Initial write up stating the objectives, methodology and the outcome n. Hardware project: Exhibiting and demonstration of working of project. Software project: Demonstration of the programming capabilities by writing flowchart, algorithm and codes related to a section of the project. o. Viva-voce	10 marks 30 marks 10 marks	
3.	**Minimum marks required in SEE to pass:** Score should be $\geq$ 35%, however overall score of CIE + SEE should be $\geq$ 40%.		
4.	SEE will be conducted in project batches by **Internal & External examiners** together.		

CO-PO Mapping (planned)													CO-PSO Mapping (planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	√												√		
2	√		√		√				√	√		√	√	√	√
3	√		√		√				√	√		√	√	√	√
4					√									√	
Tick mark the CO, PO and PSO mapping															

Digital Electronics (Project based)

Sl No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Website Development	IT Sector	Web Developer
2	Ajax programmer		Developer

Course Code	**22CS443/ 22IS443**	**Course type**	**Integrated Project based**	**Credits L-T-P**	2-0-1
Hours/week: L - T- P	2 - 0 – 2			**Total credits**	3
Total Contact Hours	L = 20 Hrs; T = Hrs; P = 20 Hrs Total = 40 Hrs			**CIE Marks**	100
Flipped Classes content	5 Hours			**SEE Marks**	100

Course learning objectives	
1.	Understand the basics of Digital Electronics.
2.	Comprehend the knowledge of digital circuits to construct combinational and sequential sub-systems useful for digital system designs.
3.	Implement digital circuits for a particular application using simulation and Virtual Lab platform.

4.	Analyse digital circuits and systems to model using Verilog HDL.

Required Knowledge of : Basic Electronics

Unit – I	**Contact Hours = 8 Hours**
Introduction: Revision of Logic gates and Boolean algebra, Simplification of Boolean functions using Basic Logic gates, Universal Gates, SOP, POS form, K-Map Simplification (up to 4 variables), Don't-care Condition.	

Unit – II	**Contact Hours = 8 Hours**
Data Processing Circuits: Multiplexers, De-multiplexers, Decoder, Encoders and implementation of Boolean functions using multiplexer and Decoders, Magnitude Comparators (1 bit and 2 bit).	

Unit – III	**Contact Hours = 8 Hours**
Clocks and Flip Flops: Clock waveforms, TTL clock, RS Flip Flops, Gated flip-flops, Edge triggered RS Flip-Flops, Edge triggered D Flip-Flops, and Edge triggered JK Flip-Flops, JK master slave Flip Flops, various representations of Flip Flops	

Unit – IV	**Contact Hours = 8 Hours**
Analysis of Sequential Circuits: Conversion of flip flops: A synthesis example, Types of Shift Register, SISO, SIPO, PISO and PIPO, Applications of Shift Registers as Ring Counter, Johnson Counter, Serial Adder. **Counters:** Asynchronous counters (4 bit), Synchronous Counters (4 bit), changing the counter Modulus.	

Unit – V	**Contact Hours = 8 Hours**
Content of the Unit **Introduction to HDL:** Types of Model, Syntax for Data Flow model.	

Flipped Classroom Details

Unit No.	**I**	**II**	**III**	**IV**	**V**
No. for Flipped Classroom Sessions	**1**	**1**	**1**	**1**	**1**

List of Experiments

Unit No.	**No. of Experiments**	**Topic(s) related to Experiment**
1	1	**Verification and interpretation of truth table for AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates.**
	2	**Construction of half and full adder using XOR and NAND gates and verification of its operation.**
	3	**Realization of logic functions with the help of Universal Gates (NAND, NOR).**

	4	**Verify Binary to Gray and Gray to Binary conversion using NAND gates only.**
2	5	**To Study and Verify Half and Full Subtractor.**
	6	**Implementation and verification of decoder or de-multiplexer and encoder using logic gates.**
	7	**Implementation of 4x1 multiplexer and 1x4 demultiplexer using logic gates.**
	8	**Verify the truth table of one bit and two bit comparator using logic gates.**
3	9	**Construction of a NOR gate latch and verification of its operation.**
	10	**Verify the truth table of RS, JK, T and D flip-flops using NAND and NOR gates.**
4	11	**Design and Verify the 4-Bit Serial In - Parallel Out Shift Registers.**
	12	**Design and verify the 4- Bit Synchronous or Asynchronous Counter using JK Flip Flop.**
5	13	**Develop HDL (Verilog) code to implement simple SOP equation.**
	14	**Develop HDL (Verilog) code to implement Multiplexer.**
	15	**Develop HDL (Verilog) code to implement Adder.**

Books	
	Text Books:
1.	Donald P Leach, Albert Paul Malvino and GoutamSaha: Digital Principles and Applications, 7th Edition and onwards, Tata McGraw Hill, 2011.
	Reference Books:
1.	Donald Givone: Digital Principles and Design, Palgrave Macmillan, 2003 and onwards.
2.	R D Sudhaker Samuel: Illustrative Approach to Logic Design, Sanguine-Pearson, 2012 and onwards.
3.	Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss: Digital Systems Principles and Applications, 10th Edition, Pearson Education, 2007 and onwards.
	E-resourses (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://nptel.ac.in/courses/117106086/

Course delivery methods		**Assessment methods**	
1.	Chalk and Talk	1.	IA tests- Theory & Lab based
2.	PPT and Videos	2.	Project phase 1 & 2
3.	Flipped Classes	3.	SEE- Project evaluation
4.	Practice session/Demonstrations in Labs	4.	SEE- Solving an Open ended problem
5.	Virtual Labs (if present)		

Course Outcome (COs)

Learning Levels:

Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create

At the end of the course, the student will be able to	**Learning Level**	**PO(s)**	**PSO(s)**

1.	**Apply** the knowledge of Digital Electronics to design digital systems.	**Ap**	**1,2,3,5**	**1,2**
2.	**Design** Combinational and Sequential Circuits for digital systems.	**Ap**	**1,2,3,5**	**1,2**
3.	**Utilize** the simulation tool/ Virtual Lab platform to implement the digital circuits.	**Ap**	**1,2,3,5**	**1,2**
4.	**Analyse** the digital circuits developed using HDL Verilog.	**An**	**1,2,3,5**	**1,2**
5.	**Apply** the learnings inculcated throughout the course and develop a course project.	**Ap**	**1,2,3,5, 9,10,11,12**	**1,2,3**

Scheme of Continuous Internal Evaluation (CIE):

For integrated courses, a lab test also will be conducted at the end of the semester. The lab test **(COMPULSORY)** will be part of the CIE. **No SEE for Lab**.

THEORY (40 marks)		**PROJECT (60 marks)**			Total
IA test (Theory)	IA test (Lab)	Project Phase 1	Project Phase 2	Project report	
25 marks	15 marks	25 marks	25 marks	10 marks	100 marks
Theory IA test should be of one-hour duration. Lab IA test should be of two/three-hour duration. Project batch will ideally consist of 2 students (maximum of 3). Project Phase 1 presentation will be conducted after 6 weeks and Project Phase 2 presentation will be conducted after 13 weeks from the start of the semester. Submitting Project report is compulsory.					
Eligibility for SEE: 1. 40% and above (16 marks and above) in theory component 2. 40% and above (24 marks and above) in project component 3. Not eligible in any one of the two components will make the student **Not Eligible** for SEE					

Semester End Examination (SEE):

1.	It will be conducted for 100 marks having 3 hours duration.		
2.	**Lab Open ended program/problem/experiment** Write-up & execution (1 open ended expt)- (20 marks write-up + 20 marks algorithm/flowchart + 10 marks execution)	50 marks	100 marks
	Project evaluation p. Initial write up stating the objectives, methodology and the outcome q. Hardware project: Exhibiting and demonstration of working of project. Software project: Demonstration of the programming capabilities by writing flowchart, algorithm and codes related to a section of the project. r. Viva-voce	10 marks 30 marks 10 marks	
3.	**Minimum marks required in SEE to pass:** Score should be $\geq$ 35%, however overall score of CIE + SEE should be $\geq$ 40%.		
4.	SEE will be conducted in project batches by **Internal & External examiners** together.		

CO-PO Mapping (planned)													CO-PSO Mapping (planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	✓	✓	✓		✓								✓	✓	
2	✓	✓	✓		✓								✓	✓	
3	✓	✓	✓		✓								✓	✓	
4	✓	✓	✓		✓								✓	✓	
5	✓	✓	✓		✓				✓	✓	✓	✓	✓	✓	✓
Tick mark the CO, PO and PSO mapping															

Python Programming- A Practical Approach (Project based)

Course Code	**22CS444 / 22IS444**	**Course type**	**Integrated Project based**	**Credits L-T-P**	2-0-1

Sl No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Digital Circuit Design, Logic Design and Analysis	Electronics Industry	Digital Circuit Designer
2	Digital System Simulation	Semiconductor Industry	FPGA Engineer
3	Microcontrollers and Embedded Systems	Embedded Systems	Embedded Systems Engineer

Hours/week: L - T- P	2 - 0 – 2	**Total credits**	3
Total Contact Hours	L = 20 Hrs; T = Hrs; P = 20 Hrs Total = 40 Hrs	**CIE Marks**	100
Flipped Classes content	5 Hours	**SEE Marks**	100

Course learning objectives	
1.	Gain knowledge about basic Python language syntax and semantics to write Python programs using the procedure oriented programming paradigm.
2.	Appreciate the usage of high level data constructs provided by Python and work with file and exception handling mechanisms.

3.	Write Python applications using the object-oriented programming paradigm.
4.	Become acquainted with the development of database and GUI applications and usage of various packages.

Required Knowledge of : Procedure Oriented and Object Oriented Programming Languages

Unit – I	**Contact Hours = 8 Hours**
Python Fundamentals: **An Introduction to Python programming:** Introduction to Python, IDLE to develop programs **How to write your first programs:** Basic coding skills, data types and variables, numeric data, string data, five of the Python functions **Control statements:** Boolean expressions, selection structure, iteration structure	

Unit – II	**Contact Hours = 8 Hours**
Define and use Functions and Modules: define and use functions, more skills for defining and using functions and modules, create and use modules, standard modules **Higher Data Constructs:** **Lists and tuples:** Basic skills for working with lists, list of lists, more skills for working with lists, tuples **Dictionaries:** get started with dictionaries, more skills for working with dictionaries	

Unit – III	**Contact Hours = 8 Hours**
Files, Exception Handling, Database Programming **File I/O:** An introduction to file I/O, text files, CSV files, binary files **Exception Handling:** handle a single exception, handle multiple exceptions **Work with a database:** An introduction to relational databases, SQL statements for data manipulation, SQLite Manager to work with a database, use Python to work with a database	

Unit – IV	**Contact Hours = 8 Hours**
Object Oriented Programming: **Define and use your own classes:** An introduction to classes and objects, define a class, object composition, encapsulation **Inheritance:** Inheritance, override object methods	

Unit – V	**Contact Hours = 8 Hours**
Packages: **How to build a GUI Program:** Create a GUI that handles an event **Numpy Basics:** Arrays and Vectorized Computation: Creating ndarrays, Data Types for ndarrays, Operations between Arrays and Scalars, Basic Indexing and Slicing, Indexing with slices, Boolean Indexing, Transposing Arrays and Swapping Axes **Getting started with Pandas:** Introduction to Pandas Data Structures, Summarizing and Computing Descriptive Statistics, Handling missing data	

Flipped Classroom Details

Unit No.	**I**	**II**	**III**	**IV**	**V**
No. for Flipped Classroom Sessions	**1**	**1**	**1**	**1**	**1**

List of Experiments

Unit No.	No. of Experiments	Topic(s) related to Experiment
2	1	Functions and lists
	2	Functions and dictionaries
3	3	File I/O and exception handling mechanisms
	4	Implement a Python program to work with a database
4	5	Object composition and encapsulation
	6	Inheritance and polymorphism
5	7	GUI application
	8	NumPy and Pandas packages

Books	
	Text Books:
1.	Michael Urban and Joel Murach, Python Programming, Shroff/Murach, 2016
2.	Wes McKinney, Python for Data Analysis, OReilly, 1st Edition, 2012
	Reference Books:
1.	SciPy and NumPy, O`Reilly, 1st Edition, 2012
2.	Mark Lutz, Programming Python, O`Reilly, 4th Edition, 2010
	E-resourses (NPTEL/SWAYAM.. Any Other)- mention links
1.	The joy of computing using python - https://onlinecourses.nptel.ac.in/noc21_cs32/preview
2.	Programming in python- https://onlinecourses.swayam2.ac.in/cec22_cs20/preview

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests- Theory & Lab based
2.	PPT and Videos	2.	Project phase 1 & 2
3.	Flipped Classes	3.	SEE- Project evaluation
4.	Practice session/Demonstrations in Labs	4.	SEE- Solving an Open ended problem
5.	Virtual Labs (if present)		

Course Outcome (COs)

Learning Levels:

Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create

At the end of the course, the student will be able to		Learning Level	PO(s)	PSO(s)
1.	**Illustrate** basic principles of Python programming and **Develop** programs using the procedure-oriented programming paradigm.	Ap	1,3,5	1,2
2.	**Develop** Python programs for file operations, exception handling, GUI, database operations and **Make use of** different packages for computing and manipulation.	Ap	1,3,5	1,2

3.	**Explain** the concepts of object-oriented programming paradigm and **Apply** the same to develop programs.	Ap	1,3,5	1,2
4.	**Apply** the learnings inculcated throughout the course by developing a course project.	Ap	1,2,3,5, 9,10,11,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE):

For integrated courses, a lab test also will be conducted at the end of the semester. The lab test **(COMPULSORY)** will be part of the CIE. **No SEE for Lab**.

THEORY (40 marks)		**PROJECT (60 marks)**			Total
IA test (Theory)	IA test (Lab)	Project Phase 1	Project Phase 2	Project report	
25 marks	15 marks	25 marks	25 marks	10 marks	100 marks
Theory IA test should be of one-hour duration. Lab IA test should be of two/three-hour duration. Project batch will ideally consist of 2 students (maximum of 3). Project Phase 1 presentation will be conducted after 6 weeks and Project Phase 2 presentation will be conducted after 13 weeks from the start of the semester. Submitting Project report is compulsory.					
Eligibility for SEE: 1. 40% and above (16 marks and above) in theory component 2. 40% and above (24 marks and above) in project component 3. Not eligible in any one of the two components will make the student **Not Eligible** for SEE					

Semester End Examination (SEE):

1.	It will be conducted for 100 marks having 3 hours duration.		
2.	**Lab Open ended program/problem/experiment** Write-up & execution (1 open ended expt)- (20 marks write-up + 20 marks algorithm/flowchart + 10 marks execution)	50 marks	100 marks
	Project evaluation s. Initial write up stating the objectives, methodology and the outcome	10 marks	
	t. Hardware project: Exhibiting and demonstration of working of project. Software project: Demonstration of the programming capabilities by writing flowchart, algorithm and codes related to a section of the project.	30 marks	
	u. Viva-voce	10 marks	
3.	**Minimum marks required in SEE to pass:** Score should be $\geq$ 35%, however overall score of CIE + SEE should be $\geq$ 40%.		
4.	SEE will be conducted in project batches by **Internal & External examiners** together.		

CO-PO Mapping (planned)													**CO-PSO Mapping (planned)**		
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**

1	√		√		√								√	√	
2	√		√		√								√	√	
3	√		√		√								√	√	
4	√	√	√		√				√	√	√	√	√	√	√
Tick mark the CO, PO and PSO mapping															

Sl No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Procedure Oriented Programming using Python	Healthcare, Finance, Retail, Agriculture, Manufacturing, Networks, Security, Big Data, etc,	Python Developer Software Developer Data and Research Analyst Senior Backend / Software Developer Python Big Data Developer Python Framework Developer - AI Developer, etc.
2	Object Oriented Programming using Python		
3	Use of various packages		

Desi gn Thin king

Course Code	**22AECCS451**	**Course type**	**AEC**	**Credits L-T-P**	0 - 0 - 1
Hours/week: L - T- P	0 - 0 - 2			**Total credits**	1
Total Contact Hours	L = 0 Hrs; T = 0 Hrs; P = 20 Hrs Total = 20 Hrs			**CIE Marks**	50
Flipped Classes content				**SEE Marks**	50

Course learning objectives	
1.	Describe and explain what Design Thinking is and how to incorporate it in problem solving.
2.	Manage the requirements gathering process to determine customer needs.
3.	Ideate and adopt MVP's and prototypes to quickly get feedback and iterate on designs.

Required Knowledge of : Digital Electronics, Computer Organization

Lab Experiment – I	**Contact Hours = 4 Hours**
Break the Ice and Introduction to Design Thinking.	
Lab Experiment – 2	**Contact Hours = 4 Hours**
Empathize (search for rich stories)	
Lab Experiment – 3	**Contact Hours = 4 Hours**
Define (user need and insights – their POV)	
Lab Experiment – 4	**Contact Hours = 4 Hours**
Ideate (ideas, ideas, ideas)	
Lab Experiment – 5	**Contact Hours = 4 Hours**
Prototype (build to learn); Test the prototype.	

Books	
	Text Books:
1.	Michael Lewrick, Patrick Link, Larry Leifer 2018, *The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems*, First Ed., John Wiley & Sons [ISBN: 9781119467472]
2.	Michael Lewrick, Patrick Link, Larry Leifer 2020, *The Design Thinking Toolbox: A Guide to Mastering the Most Popular and Valuable Innovation Methods*, First Ed., John Wiley & Sons New York, United States [ISBN: 9781119629191]
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	http://www.dschool.stanford.edu/resource s/

Course delivery methods		**Assessment methods**	
1.	Chalk and Talk	1.	PPT & demos
2.	PPT and Videos	2.	Semester End Examination
3.	Hands on DIY group activities		

Course Outcome (COs)

Learning Levels:

Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create

At the end of the course, the student will be able to		**Learning Level**	**PO(s)**	**PSO(s)**
1.	**Explain** the various stages involved in the process of design thinking.	Un	1	1
2.	**Identify** the problem statement and formulate objectives	Ap	2	1
3.	**Experiment** and brainstorm to generate ideas/ alternatives to address the problem identified.	Ap	2,3	1
4.	**Assess** the alternatives to the problem at hand in order to arrive at	Ev	3,4,5	1,2

	the optimal alternative for various test cases.			
5.	**Develop** a course project by applying the learnings inculcated throughout the course.	**Cr**	2, 3, 5, 9, 10, 11, 12	1, 2, 3

Scheme of Continuous Internal Evaluation (CIE):

Conduction of experiments & viva-voce	Journal	Lab project/ Open ended experiment	Lab Test	Total
20 marks	5 marks	10 marks	15	50 marks

Conduct of Lab:

1. Conduction of the experiment: 15 marks + Viva voce: 5 marks = 20 marks
2. Calculations, results, graph, conclusion and Outcome recorded in Journal: 5 marks
3. Lab project/ Open ended experiment: 10 marks
3. Lab Test: 15 marks

Eligibility for SEE:

1. 40% and above (20 marks and above)
2. **Lab test is COMPULSORY**

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 2/3 hours duration.		
2.	**Minimum marks required in SEE to pass:** Score should be ≥35% , however overall score of CIE+SEE should be ≥40%.		
2.	One or Two experiments to be conducted.		
3.	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
4.	Viva-voce shall be conducted for individual student and not in a group.		

CO-PO Mapping (planned)													**CO-PSO Mapping (planned)**		
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
1	√												√		
2		√											√		
3		√	√										√		
4			√	√	√								√	√	
5		√	√		√				√	√	√	√	√	√	√
Tick mark the CO, PO and PSO mapping															

Sl No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Problem solving, critical thinking, creativity, leadership, collaboration and communication	Health Care and Medicine, Public sector, Space exploration, Education, The world of retail Food and beverage industry, Entertainment, The banking industry	Strategist, Brand Experience Design. Lead, Innovation. Design Researcher. User Experience (UX) Designer. Head of Product Design. Service Designer.

Introduction to Embedded Systems and IoT- A Hands-on Approach

Course Code	22AECCS452	Course type	AEC	Credits L-T-P	0 - 0 - 1
Hours/week: L - T- P	0 - 0 - 2			Total credits	1
Total Contact Hours	L = 0 Hrs; T = 0 Hrs; P = 20 Hrs Total = 20 Hrs			CIE Marks	50
Flipped Classes content				SEE Marks	50

Course learning objectives	
1.	Understand the architecture of Microcontroller.
2.	Programming Microcontroller for simple applications.
3.	Programming 8051 Microcontroller timer/counter and serial port.
4.	Interfacing sensors and peripherals with the Microcontroller.

Required Knowledge of : Digital Electronics, Computer Organization

Lab Experiment – I	**Contact Hours = 2 Hours**
The 8051 Microcontrollers: Microcontrollers and embedded processors**. 8051 Programming in 'C':** Data types and time delay in 8051 'C', I/O programming in 8051 'C'.	
Lab Experiment – 2	**Contact Hours = 2 Hours**
8051 Programming in 'C': Logic operations in 8051 'C', Data conversion programs in 8051 'C'.	
Lab Experiment – 3	**Contact Hours = 2 Hours**
8051 Programming in 'C': Accessing code ROM space in 8051 'C', Data serialization using 8051 'C'.	
Lab Experiment – 4	**Contact Hours = 2 Hours**
8051 Timer Programming in 'C': Programming 8051 timers in mode 1.	
Lab Experiment – 5	**Contact Hours = 2 Hours**
8051 Timer Programming in 'C': Programming 8051 timers in mode 2.	
Lab Experiment – 6	**Contact Hours = 2 Hours**
8051 Counter Programming in 'C': Programming 8051 counters in mode 1.	
Lab Experiment – 7	**Contact Hours = 2 Hours**
8051 Counter Programming in 'C': Programming 8051 counters in mode 2.	
Lab Experiment – 8	**Contact Hours = 2 Hours**
8051 Serial Port Programming in 'C': Basics of serial communication, serial port programming in 'C'.	
Lab Experiment – 9	**Contact Hours = 2 Hours**
8051 Peripheral Interfacing: Interfacing ADC, DAC, sensors, LCD with 8051 Microcontroller.	
Lab Experiment – 10	**Contact Hours = 2 Hours**
Programming Arduino UNO: LED blinking, push button and led interfacing, sensors interfacing.	

Books	
	Text Books:
1.	Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay: The 8051 Microcontroller and Embedded Systems Using Assembly and C, Pearson Prentice Hall, 1st edition and above.

2.	James Fiore, Embedded Controllers Using C and Arduino, Mohawk Valley Community College; eBook (Creative Commons Licensed)
3.	Kenneth Ayala, The 8051Microcontroller, Cengage Learning, 2nd edition and above.
4.	Julien Bayle, C Programming for Arduino, Packt Publishing (May 17, 2013).
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://www.udemy.com/course/embedded-c-for-8051-microcontroller/
2.	https://www.udemy.com/course/arduino-programming-and-interfacing/

Course delivery methods		**Assessment methods**	
1.	Practice session/Demonstrations in Labs	1.	Conduction of Experiments
2.	Virtual Labs (if present)	2.	Journal writing
3.	Chalk and Talk	3.	Lab project/ Open ended experiment
4.		4.	Lab Test
5.		8.	Semester End Examination

Course Outcome (COs)

Learning Levels:

Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create

At the end of the course, the student will be able to		**Learning Level**	**PO(s)**	**PSO(s)**
1.	**Develo**p programs for microcontrollers for simple I/O applications.	Ap	2,3,5	1,2
2.	**Experiment with** microcontroller's timer/ counter and serial port.	Ap	2,3,5	1,2
3.	**Make use of** interfacing for sensors and peripherals with the Microcontroller.	Ap	2,3,5	1,2
4.	**Develop** a course project by applying the learnings inculcated throughout the course.	**Cr**	2, 3, 5, 9, 10, 11, 12	1, 2, 3

Scheme of Continuous Internal Evaluation (CIE):

Conduction of experiments & viva-voce	Journal	Lab project/ Open ended experiment	Lab Test	Total
20 marks	5 marks	10 marks	15	50 marks

Conduct of Lab:

4. Conduction of the experiment: 15 marks + Viva voce: 5 marks = 20 marks
5. Calculations, results, graph, conclusion and Outcome recorded in Journal: 5 marks
6. Lab project/ Open ended experiment: 10 marks
3. Lab Test: 15 marks

Eligibility for SEE:

2. 40% and above (20 marks and above)
2. **Lab test is COMPULSORY**

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 2/3 hours duration.		
2.	**Minimum marks required in SEE to pass:** Score should be ≥35% , however overall score of CIE+SEE should be ≥40%.		
2.	One or Two experiments to be conducted.		
3.	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
4.	Viva-voce shall be conducted for individual student and not in a group.		

CO-PO Mapping (planned)													CO-PSO Mapping (planned)		
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
1		√	√		√								√	√	
2		√	√		√								√	√	
3		√	√		√								√	√	
4		√	√		√				√	√	√	√	√	√	√
Tick mark the CO, PO and PSO mapping															

Software Tools and Technologies

Course Code	**22AECCS453**	**Course type**	**AEC**	**Credits L-T-P**	0 - 0 - 1

Sl No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	**Embedded 'C' Programming.**	**Embedded Systems and IoT Application**	**Embedded Engineers**
2	**Programming Microcontroller 8051 for simple I/O operations.**	**Embedded Systems and IoT Application**	**Embedded-IoT-Firmware Design Engineer**
3	**Programming Arduino UNO for simple I/O, sensor interfacing and actuator interfacing.**	**Embedded Systems and IoT Application**	**Embedded-IoT-Firmware Design Engineer**

Hours/week: L - T- P	0 - 0 - 2	**Total credits**	1
Total Contact Hours	L = 0 Hrs; T = 0 Hrs; P = 20 Hrs Total = 20 Hrs	**CIE Marks**	50

Flipped Classes content		SEE Marks	50

Course learning objectives	
1.	To make familiar with the modern tool usage
2.	To improve the verbal and written communication skills
3.	Explain the importance of problem solving and usage of various program design tools
4.	To get familiar with creation of professional accounts and usage of google drives

Required Knowledge of : MS Office, programming knowledge

Lab Experiment – I	Contact Hours = 6 Hours
MS Word - Quick styles, Template usage, Graphics use, Auto correction, Auto formatting, Translate documents, Compare documents, Document security, Set watermark, Report writing **MS PowerPoint** - Presentation skills	
Lab Experiment – 2	**Contact Hours = 6 Hours**
MS Excel - Filling, Logical functions, Functions and formulae, Sort and filters, Charts, Shortcuts **MS Access** - Orientation to access, Working with table data, Querying a database	
Lab Experiment – 3	**Contact Hours = 8 Hours**
Building logic to improve programming skills - Decision making and branching constructs, Looping statements Introduction to LinkedIn, GitHub, Kaggle, Google form, Google classroom, Google sheet, usage of google drive	

Books	
	Text Books:
1.	The Art of Computer Programming by Donald E. Knuth.
2.	How to Solve it by Computer by R. G. Dromey

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Book Assignments (OBA)/ Lab Project
3.	Flipped Classes	3.	Lab Test
4.	Practice session/Demonstrations in Labs	4.	Semester End Examination
5.	Virtual Labs (if present)		

Course Outcome (COs) **Learning Levels:** **Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create**			
At the end of the course, the student will be able to	**Learning Level**	**PO(s)**	**PSO(s)**

1.	Get acquainted with the modern tool usage	**Un**	**1, 5**	**1**
2.	Improve the verbal and written communication skills	**Un**	**1, 12**	**2**
3.	Familiar with the importance of problem solving and usage of various program design tools	**Ev**	**2, 3**	**1**
4.	**Develop** a course project by applying the learnings inculcated throughout the course.	**Cr**	2, 3, 5, 9, 10, 11, 12	1, 2, 3

Scheme of Continuous Internal Evaluation (CIE):

Conduction of experiments & viva-voce	Journal	Lab project/ Open ended experiment	Lab Test	Total
20 marks	5 marks	10 marks	15	50 marks

Conduct of Lab:

7. Conduction of the experiment: 15 marks + Viva voce: 5 marks = 20 marks
8. Calculations, results, graph, conclusion and Outcome recorded in Journal: 5 marks
9. Lab project/ Open ended experiment: 10 marks
3. Lab Test: 15 marks

Eligibility for SEE:

3. 40% and above (20 marks and above)
2. **Lab test is COMPULSORY**

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 2/3 hours duration.		
2.	**Minimum marks required in SEE to pass:** Score should be ≥35% , however overall score of CIE+SEE should be ≥40%.		
2.	One or Two experiments to be conducted.		
3.	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
4.	Viva-voce shall be conducted for individual student and not in a group.		

CO-PO Mapping (planned)													**CO-PSO Mapping (planned)**		
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
1	✓				✓								✓		

2	✓									✓		✓		✓	✓
3		✓	✓										✓		
4		✓	✓		✓				✓	✓	✓	✓	✓	✓	✓
Tick mark the CO, PO and PSO mapping															

Sl No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	**Help in proper Arrangement, formatting and analyses Data into various tools**	**Any Domain**	**Skill Enhancement**

Data Visualization Tools and Techniques

Course Code	**22AECCS454**	**Course type**	**AEC**	**Credits L-T-P**	0 - 0 - 1
Hours/week: L - T- P	0 - 0 - 2			**Total credits**	1
Total Contact Hours	L = 0 Hrs; T = 0 Hrs; P = 20 Hrs Total = 20 Hrs			**CIE Marks**	50
Flipped Classes content				**SEE Marks**	50

Course learning objectives	
1.	Understand the fundamental concepts of data visualization

2.	Understand different types of data visualization tools
3.	Apply the knowledge of tableau to solve real time problems
4.	Understand the concepts of Power Bi

Required Knowledge of : Basics of Programming language

Lab Experiment – I	**Contact Hours = 4 Hours**
Introduction to Data Visualization: What makes Data Visualization Effective? History of Data Visualization, Importance of Data Visualization Why Use Data Visualization? Tables, Pro and Cons of Data Visualization, Acquiring and Visualizing Data, Applications of Data Visualization, Keys factors of Data Visualization.	
Lab Experiment – 2	**Contact Hours = 4 Hours**
EXCEL Introduction, Interface, Tabs and Ribbons, Document Windows, Navigation Tips, Office Button and Save. Entering, Editing and Formatting Data: Entering Data, Fonts, Fills, and Alignment, Cut, Copy, and Paste, Paste Special, Undo and Redo, Moving, Finding, and Replacing a Value. Finding out mean, median and mode in Excel. Bar charts, pie charts, combination charts, Band charts Gantt chart, Waterfall chart	
Lab Experiment – 3	**Contact Hours = 4 Hours**
POWER BI Introduction, Installation Steps, Architecture, Supported Data Sources, Comparison with Other BI Tools, Data Modelling, Dashboard Options, Visualization Options, Excel Integration	
Lab Experiment – 4	**Contact Hours = 4 Hours**
Tableau: Introduction to tableau, Getting started with tableau, Exploring basic Tableau, deep drive into tableau ,visualization.	
Lab Experiment – 5	**Contact Hours = 4 Hours**
WEKA and R: Introduction to WEKA, Installation, loading data, Exploring file formats, visualization. Introduction to R programming tool, Installation, programming with R, Visualizing charts and graphs using R.	

Books	
	Text Books:
1.	Tillman Davias, The Book of R first course in programming and statistics, William Pollock, 2016.
2.	Joshua Milligan, Learning Tableau 2019 , Packt Publishing, 3rd Edition 2019
3.	Alberto Ferari, Introducing Microsoft Power BI, Microsoft Press, 2016
4.	Curtis D. Frye , Microsoft Step by Step Excel 2010, Microsoft Press,

Course delivery methods		**Assessment methods**	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Book Assignments (OBA)/ Lab Project

3.	Flipped Classes	3.	Lab Test
4.	Practice session/Demonstrations in Labs	4.	Semester End Examination
5.	Virtual Labs (if present)		

Course Outcome (COs)

Learning Levels:

Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create

At the end of the course, the student will be able to		Learning Level	PO(s)	PSO(s)
1.	**Illustrate** the basics of data visualization tools and techniques	Un	1, 5	1, 2
2.	Experiment with data visualization tools for various data sets in order to perform exploratory data analysis	An	2, 3, 4, 5	1,2
3.	Analyze the results to draw inferences.	An	2, 3, 4, 5	1,2
4.	**Develop** a course project by applying the learnings inculcated throughout the course.	**Cr**	2, 3, 4, 5, 9, 10, 11, 12	1, 2, 3

Scheme of Continuous Internal Evaluation (CIE):

Conduction of experiments & viva-voce	Journal	Lab project/ Open ended experiment	Lab Test	Total
20 marks	5 marks	10 marks	15	50 marks

Conduct of Lab:

10. Conduction of the experiment: 15 marks + Viva voce: 5 marks = 20 marks
11. Calculations, results, graph, conclusion and Outcome recorded in Journal: 5 marks
12. Lab project/ Open ended experiment: 10 marks
3. Lab Test: 15 marks

Eligibility for SEE:

4. 40% and above (20 marks and above)
2. **Lab test is COMPULSORY**

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 2/3 hours duration.		
2.	**Minimum marks required in SEE to pass:** Score should be ≥35% , however overall score of CIE+SEE should be ≥40%.		
2.	One or Two experiments to be conducted.		
3.	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	

4.	Viva-voce shall be conducted for individual student and not in a group.

CO-PO Mapping (planned)													CO-PSO Mapping (planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	✓				✓								✓		
2		✓	✓	✓	✓								✓	✓	
3		✓	✓	✓	✓								✓	✓	
4	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓
Tick mark the CO, PO and PSO mapping															

Sl No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Source, gather, arrange, process, and model data. Analyze large volumes of structured or unstructured data. Prepare and present data in the best forms for decision-making and problem-solving.	Data Mining, Cloud and Computing, Data visualization, Data Analytics	Data Scientist, Data Analyst

Mathematics II

CourseCode	22AECCS455	**Coursetype**	**AEC**	**CreditsL-T-P**	1-0-0
Hours/week:L-T-P	1-0-0			**Totalcredits**	1
TotalContactHours	L = 20 Hrs; T = 0 Hrs; P = 0 Hrs Total = 20 Hrs			**CIEMarks**	50
FlippedClassescontent	5 Hours			**SEEMarks**	50

Course learning objectives	
1.	Learn advanced concepts of Linear Algebra .
2.	Understand the abstract concepts of vector spaces.
3.	Learn various numerical techniques
4.	Learn basic concepts in statistics and probabilty.

Required Knowledge of : Basic Trigonometry, Calculus, Algebra

Unit– I: Linear algebra II	**Contact Hours = 5 Hours**
Diagonalization of a square matrix, Orthogonal matrix Quadratic form and reduction to Canonical forms by Orthogonal Transformation. Linear Transformation. Regular transformation. Special transformations	

Unit–II: Vector Spaces	**Contact Hours =5 Hours**
Vector spaces: Definition and examples, subspace, linear span, Linearly independent and dependent sets, Basis and dimension. Problems.	

Unit – III: Numerical Methods	**Contact Hours 5 Hours**
Solution of algebraic and transcendental equations - Regula-Falsi and Newton-Raphson methods (only formulae). Problems. Finite differences, Interpolation using Newton′s forward and backward difference formulae, Newton's divided difference formula and Lagrange′s interpolation formula	

Unit– IV: Basic Statistics and Probability	**Contact Hours = 5Hours**
Statistics: Introduction to data collection and classification, measures of central tendency(mean,median and mode) ,Standard deviation. Examples. Probability: Basic definitions, types of events, laws of probability ,conditional probability, Baye's theorem, Examples.	

Flipped Classroom Details

Unit No.	I	II	III	IV
No. for flipped ClassroomSessions	2	1	1	1

Books	
	Text Books:
1.	B.S. Grewal – Higher Engineering Mathematics, Khanna Publishers, 42nd Edition, 2012.
2.	Erwin Kreyszig –Advanced Engineering Mathematics, John Wiley & Sons Inc., 9th Edition, 2006.
3.	B. V.Ramana- Higher Engineering Mathematics, Tata McGraw-Hill Education Private Limited, Tenth reprint 2010 and onwards.
	Reference Books:
1.	Peter V. O' Neil – Advanced Engineering Mathematics, Thomson Brooks/Cole, 7th Edition, 2011.
2	Glyn James – Advanced Modern Engineering Mathematics, Pearson Education, 4th Edition, 2010.

Course delivery methods		Assessment methods	
1.	ChalkandTalk	1.	IAtests
2.	PPT andVideos	2.	OpenBookAssignments(OBA)/LabProject
3.	FlippedClasses	3.	LabTest
4.	Practicesession/DemonstrationsinLabs	4.	SemesterEndExamination
5.	VirtualLabs(ifpresent)		

Course Outcome (COs)

At the end of the course, the student will be able to (Highlight the **action verb** representing the learning level.)

Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create		**Learning Level**	**PO(s)**	**PSO(s)**
1.	**Understand** advanced concepts of Linear Algebra.	L1	1	
2.	**Understand** the abstract concept of vector space.	L1	1	
3.	**Understand** numerical techniques for various problem solving	L2	1	
4.	**Understand** basic terms in statistics and probabilty**.**	L2	1	

CO-POMapping(planned)													CO-PSO Mapping(planned)		
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
1	✓														
2	✓														
3	✓														
4	✓														

Scheme of Continuous Internal Evaluation (CIE): Theory course (Non-Integrated)

Components	AdditionofCIEcomponents	Total Marks
Written Test	**30**	**50**
Two quizzes	**20**	

Scheme of Semester End Examination (SEE):Theory course(Non-Integrated)

Components	TotalMarks
Written exams	**50**

BIOLOGY FOR ENGINEERS

Course Code	22CS46 / 22IS46	Course type	BSC	Credits L-T-P	3-0-0
Hours/week: L - T- P	3-0-0			Total credits	3
Total Contact Hours	L = 30 Hrs; T = 0 Hrs; P = 0 Hrs Total = 30 Hrs			CIE Marks	100
Flipped Classes content	-			SEE Marks	100

Course learning objectives	
1.	To familiarize the students with the basic biological concepts and their engineering applications.
2.	To enable the students with an understanding of biodesign principles to create novel devices and structures
3.	To provide the students an appreciation of how biological systems can be re-designed as substitute products for natural systems
4.	To motivate the students develop the interdisciplinary vision of biological engineering

Module-1	Contact Hours = 6 Hours
BIOMOLECULES AND THEIR APPLICATIONS (QUALITATIVE): Carbohydrates (cellulose-based water filters, PHA and PLA as bioplastics), Nucleic acids (DNA Vaccine for Rabies and RNA vaccines for Covid19, Forensics – DNA fingerprinting), Proteins (Proteins as food – whey protein and meat analogs, Plant based proteins), lipids (biodiesel, cleaning agents/detergents), Enzymes (glucose-oxidase in biosensors, lignolytic enzyme in bio-bleaching).	

Module-2	Contact Hours = 6 Hours
HUMAN ORGAN SYSTEMS AND BIO DESIGNS - 1 (QUALITATIVE): Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Robotic arms for prosthetics. Engineering solutions for Parkinson's disease).Eye as a Camera system (architecture of rod and cone cells, optical corrections, cataract, lens materials, bionic eye).Heart as a pump system (architecture, electrical signalling - ECG monitoring and heart related issues, reasons for blockages of blood vessels, design of stents, pace makers, defibrillators).	

Module-3	Contact Hours = 6 Hours
HUMAN ORGAN SYSTEMS AND BIO-DESIGNS - 2 (QUALITATIVE): Lungs as purification system (architecture, gas exchange mechanisms, spirometry, abnormal lung physiology - COPD, Ventilators, Heart-lung machine).Kidney as a filtration system (architecture, mechanism of filtration, CKD, dialysis systems). Muscular and Skeletal Systems as scaffolds (architecture, mechanisms, bioengineering solutions for muscular dystrophy and osteoporosis)	

Module-4	Contact Hours = 6 Hours
NATURE-BIOINSPIRED MATERIALS AND MECHANISMS (QUALITATIVE): Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf). Bird flying (GPS and aircrafts), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro), Shark skin (Friction reducing swim suits), Kingfisher beak (Bullet train). Human Blood substitutes - hemoglobin-based	

oxygen carriers (HBOCs) and perflourocarbons (PFCs)

Module-5	**Contact Hours = 6 Hours**
TRENDS IN BIOENGINEERING (QUALITATIVE): Bioprinting techniques and materials, 3D printing of ear, bone and skin. 3D printed foods. Electrical tongue and electrical nose in food science, DNA origami and Biocomputing, Bioimaging and Artificial Intelligence for disease diagnosis. Self healing Bioconcrete (based on bacillus spores, calcium lactate nutrients and biomineralization processes) and Bioremediation and Biomining via microbial surface adsorption (removal of heavy metals like Lead, Cadmium, Mercury, Arsenic)	

Books	
Text Books:	
1.	Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022 S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.
2.	Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi
3.	Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
4.	Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011.
5.	Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.
6.	Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press.
7.	Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MIT Press, 2008.
8.	Bioremediation of heavy metals: bacterial participation, by C R Sunilkumar, N Geetha A C Udayashankar Lambert Academic Publishing, 2019.
9.	3D Bioprinting: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016.
10.	Electronic Noses and Tongues in Food Science, Maria Rodriguez Mende, Academic Press, 2016
11.	Blood Substitutes, Robert Winslow, Elsevier, 2005
E-resources (NPTEL/SWAYAM.. Any Other)- mention links	
1	VTU EDUSAT / SWAYAM / NPTEL / MOOCS / Coursera / MIT-open learning resource
2	https://nptel.ac.in/courses/121106008
3	https://freevideolectures.com/course/4877/nptel-biology-engineers-other-non-biologists
4	https://ocw.mit.edu/courses/20-020-introduction-to-biological-engineering-design-spring 2009
5	https://ocw.mit.edu/courses/20-010j-introduction-to-bioengineering-be-010j-spring-2006
6	https://www.coursera.org/courses?query=biology
7	https://onlinecourses.nptel.ac.in/noc19_ge31/preview
8	https://www.classcentral.com/subject/biology
9	https://www.futurelearn.com/courses/biology-basic-concepts

Course delivery methods		**Assessment methods**	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Online Quizzes (Surprise and Scheduled)
3.		3.	Open Assignment/Seminar
4.		4.	Semester End Examination

Course Outcome (COs) At the end of the course, the student will be able to (Highlight the **action verb** representing the learning level.)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create		**Learning Level**	**PO(s)**	**PSO(s)**
1.	Elucidate the basic biological concepts via relevant industrial applications and case studies.	Un	1	
2.	Evaluate the principles of design and development, for exploring novel bioengineering projects.	Un	1	
3.	Corroborate the concepts of biomimetics for specific requirements.	Un	1	
4.	Think critically towards exploring innovative biobased solutions for socially relevant problems	Ap	1, 7	

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Online Quiz	Open Assignment	Seminar	Total Marks
Marks	25+25 = 50	4* 5 marks = 20	10+10 =20	10	100
OA - Open Assignment **Minimum score to be eligible for SEE: 40 OUT OF 100**					

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration.
2.	**Minimum marks required in SEE to pass:** Score should be $\geq$ 35%, however overall score of CIE + SEE should be $\geq$ 40%.
3.	Question paper contains 3 parts - A,B & C, wherein students have to answer any 5 out of 7 questions in part A, 5 out of 10 questions choosing 1 question from each unit in part B & 1 out of 2 questions in part C.

CO-PO Mapping (Planned)													**CO-PSO Mapping (Planned)**		
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
1	√														
2	√														
3	√														
4	√						√								
Tick mark the CO, PO and PSO mapping															

UNIVERSAL HUMAN VALUES

Course Code	22CS47 / 22IS47	Course type	UHV	Credits L-T-P	1 – 0 - 0
Hours/week: L - T- P	1– 0 – 0			Total credits	1
Total Contact Hours	L = 16 Hrs; T = 0 Hrs; P = 0 Hrs Total = 16 Hrs			CIE Marks	50
				SEE Marks	50

Course objectives	
1.	To provide understanding of basic human values
2.	To communicate the need of education for quality life

Knowledge required : English Language, Social Studies

Unit – I Human Values	8 Hours
Objectives, Morals , Values, Ethics, Integrity, Work ethics, Service learning, Virtues, Respect for others, Living peacefully, Caring, Sharing, Honesty, Courage ,Valuing time, Cooperation, Commitment, Empathy, Self-confidence, Challenges in the work place, Spirituality, Yoga for Professional Excellence and Stress Management.	

Unit – II Value Education	8 Hours
Introduction, Understanding Value Education, Basic Guidelines for Value Education, The content of Value Education, Education for Fulfilling Life, Skill Education, Priority of Values over Skills. The Process of Value Education.	

Activities include - Illustrative case studies and Surveys related to Human values.

	Books
1.	Nagarazan R.S., Professional Ethics and Human Values, New Age International Publishers Pvt.Ltd. 2006
2	P.R.Gaur, R.Sangal, G.P.Bagaria: A Foundation Course in Human Values and Professional ethics.

Course delivery methods		Assessment methods	
1.	Lecture	1.	IA. test
2.	Presentation	2.	Activity

3.	Expert talks	3.	Quiz
		4.	SEE

Course Outcome (COs) At the end of the course, the student will be able to (Highlight the **action verb** representing the learning level.)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create		**Learning Level**	**PO(s)**	**PSO(s)**
1.	Identify and practice the human values	Un	6	
2.	Understand the human values, work ethics, respect others and stress management.	Un, Ap	8	

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Quiz	Activities (Case study & Survey)	Total Marks
Marks	15+15 = 30	10	10	50
Minimum score to be eligible for SEE: 20 OUT OF 50				

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 50 marks of 1 hour duration.
2.	**Minimum marks required in SEE to pass:** Score should be $\geq$ 35%, however overall score of CIE + SEE should be $\geq$ 40%.
3.	The pattern of the **question paper is MCQ** (multiple choice questions).

CO-PO Mapping (Planned)													**CO-PSO Mapping (Planned)**		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
1						✓									
2								✓							
Tick mark the CO, PO and PSO mapping															

Operating System Lab

Course Code	22CSL49 / 22ISL49	Course type	PCCL	Credits L-T-P	0 - 0 - 1
Hours/week: L - T- P	0 - 0 - 2			Total credits	1
Total Contact Hours	L = 0 Hrs; T = 0 Hrs; P = 20 Hrs Total = 20 Hrs			CIE Marks	50
Flipped Classes content	OSSim Simulation Tool			SEE Marks	50

Course learning objectives	
1.	Understand data structures and algorithms used to implement OS concepts
2.	Discuss the process, memory, synchronization and other concepts to solve problems in operating system.
3.	Explore various UNIX shell commands and shell scripts

Required Knowledge of : Operating System, C programming

Lab Experiment – I	Contact Hours = 2 Hours
UNIX Internal and External Commands	
Lab Experiment – 2	**Contact Hours = 2 Hours**
Scheduling algorithms	
Lab Experiment – 3	**Contact Hours = 2 Hours**
Unix Process control system calls	
Lab Experiment – 4	**Contact Hours = 2 Hours**
Process Synchronization - The Dining-Philosophers Problem	
Lab Experiment – 5	**Contact Hours = 2 Hours**
Process Synchronization-Reader- writer and Producer –consumer Problem	
Lab Experiment – 6	**Contact Hours = 2 Hours**
Deadlock – Bankers algorithm	
Lab Experiment – 7	**Contact Hours = 2 Hours**
Memory Management - Page replacement	
Lab Experiment – 8	**Contact Hours = 2 Hours**
File allocation strategies	
Lab Experiment – 9	**Contact Hours = 2 Hours**
pwd, cd, mkdir, rmdir, cp, rm, mv, cat Unix shell scripts	
Lab Experiment – 10	**Contact Hours = 2 Hours**
File Attributes: ls, ls-l, ls-d, file permissions, chmod Unix shell scripts	

Books	
	Text Books:
1.	Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Principles", Wiley India, 6th edition and onwards.
2.	Sumitabha Das: "YOUR UNIX – The Ultimate Guide" , Tata McGraw Hill, 23rd reprint , 2012 and onwards.
	E-resources (NPTEL/SWAYAM. Any Other)- mention links
1.	https://www.coursera.org/specializations/codio-introduction-operating-systems
2.	Lectures on Operating Systems (iitb.ac.in)

Course delivery methods		Assessment methods	
1.	Practice session/Demonstrations in Labs	1.	Conduction of Experiments
2.	Virtual Labs (if present)	2.	Journal writing
3.	Chalk and Talk	3.	Lab project/ Open ended experiment
4.		4.	Lab Test
5.		9.	Semester End Examination

Course Outcome (COs)

Learning Levels:

Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create

At the end of the course, the student will be able to		Learning Level	PO(s)	PSO(s)
1.	Analyze data structures and algorithms used to implement OS concepts	An	1,2	1,2,3
2.	Apply process, memory, synchronization and other concepts to solve problems in operating system.	Ap	2,3	1,2,3
3.	Demonstrate various UNIX shell commands and shell scripts	Un,Ap	1,2	1,2,3
4.	**Understand** the learnings inculcated throughout the course and present it in a journal, viva-voce and project	**Re,Un,Ap**	1,2,3,8,9,10,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE):

Conduction of experiments & viva-voce	Journal	Lab project/ Open ended experiment	Lab Test	Total
20 marks	5 marks	10 marks	15	50 marks

Conduct of Lab:

1. Conduction of the experiment: 15 marks + Viva voce: 5 marks = 20 marks
2. Calculations, results, graph, conclusion and Outcome recorded in Journal: 5 marks
3. Lab project/ Open ended experiment: 10 marks
4. Lab Test: 15 marks

Eligibility for SEE:

5. 40% and above (20 marks and above)

2. **Lab test is COMPULSORY**

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 2/3 hours duration.		
2.	**Minimum marks required in SEE to pass:** Score should be ≥35% , however overall score of CIE+SEE should be ≥40%.		
2.	One or Two experiments to be conducted.		
3.	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
4.	Viva-voce shall be conducted for individual student and not in a group.		

CO-PO Mapping (planned)													**CO-PSO Mapping (planned)**		
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
1	✓	✓											✓	✓	✓
2		✓	✓										✓	✓	✓
3	✓	✓											✓	✓	✓
4										✓		✓	✓	✓	✓
Tick mark the CO, PO and PSO mapping															

Sl No	**Skill & competence enhanced after undergoing the course**	**Applicable Industry Sectors & domains**	**Job roles students can take up after undergoing the course**
1	Continuous Improvement: Continuous improvement is an ongoing process of improvement of products, services, and processes with the help of innovative ideas.	Product based companies	Software engineer Software Analyst Operations Systems Specialist
2.	Once they understand the basics of OS, they can start building, managing, and repairing hardware devices	Product based companies	Software Developer System Engineer
3.	Programming skills will be enhanced as whatever code they develop, will eventually run on an OS. Good understanding of OS is essential to become a programmer.	Software Industry	Computer System Engineer