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 8thsem 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 using Java	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	2	0	2	04	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	2	0	2	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

3rdYear 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	Software Project 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	22AECCS56	Research Methodology and Intellectual Property Rights	CSE	2	0	0	02	2	100	100	200
7	MC	22CS58A	Environmental Studies		2	0	0	02	2	100	100	200
8	AEC	22AECCS58A	Employability Skills -1	Bizotic	1	0	0	01	1	100	-	100
9	MC	22CS58B1	National Service Scheme (NSS)	NSS coordinator	0	0	2		0	100	-	100
		22CS58B2	Physical Education (PE) (Sports and Athletics) and Yoga	Physical Education dept & Yoga instructor								
		22CS58B3	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	Object Oriented Modelling and Design	22CS544	Robotic Process Automation (Industry Supported Elective) (2-0-2)
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 report, 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 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.

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	**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	Computer Networks Lab	CSE	0	0	2	02	1	50	50	100
Total									**18**	**750**	**450**	**1200**

Professional Elective Course			
22CS631	Agile Software Development	22CS634	Compiler Design
22CS632	Digital Twin Technology	22CS635	Introduction to Salesforce (2- 0 - 2)(Industry Supported Elective)
22CS633	Internet of Things (2 – 0 – 2)	22INT61	PwC Launchpad Program (Project based)
Open Elective Course for Non CSE Students			
22CS641	Data Structures	22CS643	Python Programming
22CS642	Robotic Process Automation	22CS644	Web Programming
Open Electives offered for all branches			
22MAT641	Applied Statistics	22CH641	Nanoscience and Nanotechnology
22MAT642	Linear Algebra	22INT61	Marketing Management

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

4thYear 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	Big Data and Analytics	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	Distributed and 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	10	10	5	100	100	200
7	AEC	22AECCS77	Indian Knowledge System		1	0	0	01	1	100	-	100
Total									**24**	**700**	**600**	**1300**

Professional Elective Course			
22CS741	Cryptography and Network Security	22CS744	Cyber Security
22CS742	Blockchain Management	22CS745	Salesforce Lightning (2- 0 - 2)(Industry Supported Elective)
22CS743	Business Intelligence and Data Analytics		
Open Elective Course for Non CSE students			
22CS751	Disaster Management	22CS754	Machine Learning
22CS752	Database Management System	22CS755	Introduction to Cyber Security
22CS753	Object-Oriented Programming using JAVA		
Open Electives offered for all branches			
22MAT751	Optimization Techniques	22PH751	Introduction to Astronomy
22MAT752	Complex Analysis and Special Functions	22INT71	Human Resource Management for Engineers

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.

IKS (Indian Knowledge system) - VTU in compliance with UGC directive has introduced IKS (Indian Knowledge system) in the 6thsem as AEC (1 credit) for 2022 scheme. Hence after discussion it has been decided to introduce the IKS course (as 1 credit) in the 7thsem as an AEC.

Online courses in 8th sem (OEC & PEC)- OEC & PEC courses present in the 8th sem should be completed by the end of 7th semester & valid Certificates by Competent authority to be submitted to the Department. These are ONLINE courses suggested by the respective Board of Studies. The online courses can be NPTEL/SWAYAM/NASSCOM/Industry certified and for a minimum duration of 12 weeks. Details of these courses shall be made available for students on the college web portal

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	Practical Cyber Security for Cyber Security Practitioners by Prof. Sandeep K. Shukla	22CS814	Cloud Computing by Prof. Soumya Kanti Ghosh
22CS812	Data Structure and Algorithms using Java by Prof. Debasis Samanta	22CS815	Operating System Fundamentals by Prof. Santanu Chattopadhyay
22CS813	Introduction to Machine Learning by Prof. Balaraman Ravindran	22CS816	Advanced Web Technology by Prof. Kannan Moudgalya(swayam)
Open Elective Courses (Online Courses)			
22CS821	Advanced Distributed Systems by Prof. Smruti Ranjan Sarangi	22CS823	Introduction to Internet of Things by Prof. Sudip Misra
22CS822	Software Testing by Prof. Meenakshi D'souza	22CS824	Ethical Hacking by Prof. Indranil Sengupta

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: Professional Elective Course (Online courses): List of Courses will be displayed by BOS.

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.

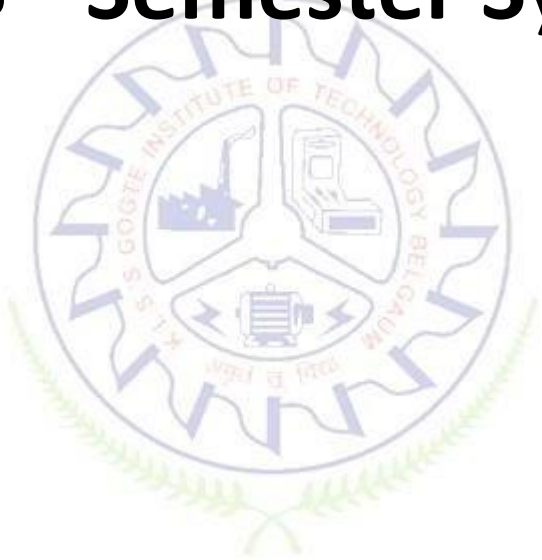
Rural Internship: Rural development internship is an initiative of Unnat Bharat Abhiyan Cell, RGIT in association with AICTE to involve students of all departments studying in different academic years for exploring various opportunities in techno-social fields, to connect and work with Rural India for 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.


KLS GOGTE INSTITUTE OF TECHNOLOGY BELGAUM

Detailed 3rd Semester Syllabus



FUNDAMENTALS OF STATISTICS AND PROBABILITY FOR DATA SCIENCE

Course Code:	**22MATCS31**	**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 – V	Contact Hours = 8 Hours
Sampling distribution: Sampling distribution, Sampling distribution of means, Test of significance for small and large samples. 't' and 'chi square' distributions, F- distribution. Practical examples.	

Unit No.	Self-Study Topics
I	Regression models, Regression strategies.
II	Discrete and Continuous Random vectors in different areas such as Mutual funds, lottery draw, decision making, decision trees etc…
III	Restate the research question as research hypothesis and a null hypothesis about the populations and determine the characteristics of the comparison distribution.
IV	Eliminating variability during gathering statistical data.
V	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. Rajnish Verma**:** Higher Engineering Mathematics" S. Chand Publication, 3rd Ed., 2014.
	E-resources (NPTEL/SWAYAM. Any Other)- mention links
1.	https://nptel.ac.in/courses/111106111
2.	https://nptel.ac.in/courses/111104025
3.	https://nptel.ac.in/courses/117105085
4.	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	Two Assignments – (Open /Industry/Certification etc)	Course project (CP)/ Case study etc	Total Marks
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

-Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.

-Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests.

-Lack of minimum score in IA test will make the student Not Eligible for SEE

-Minimum score in CIE 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 ≥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 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (planned)													CO-PSO Mapping(planned)		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
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**	**Conduction**	**Lab test**	
30 marks	30 marks	10 marks	30 marks	100 marks

IA Test:

1. No objective part in IA question paper
2. All questions descriptive

-Certification earned by passing the standard Online MOOCs course (of at least 8 hours defined by BOS) can be considered as a Course activity/Assignment and awarded maximum of 10 marks.

Conduct of Lab:

1. Conducting the experiment and journal: 5 marks
2. Calculations, results, graph, conclusion and Outcome: 5 marks

Lab test: (Batch wise with 15 students/batch)

1. Test will be conducted at the end of the semester
2. Time table, 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: 15 marks
5. Viva voce: 10 marks

Eligibility for SEE:

1. 40% and above (24 marks and above) in theory component (No change)
2. Student should score minimum 40% of 30 marks (i.e. 12 marks) in Lab test & should score 40% of 40 marks (i.e. 16 marks) in Total.
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 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (planned)													CO-PSO Mapping (planned)		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**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 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
I	2	2-dimensional array.
		String handling.
II	2	Class and its member methods.
		Parameterized Methods and Constructors
III	2	**Inheritance and interfaces.**
		Method Overloading and overriding
IV	2	Packages.
		Customized exception handling.
V	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**	**Conduction**	**Lab test**	
30 marks	30 marks	10 marks	30 marks	100 marks
IA Test:				

1. No objective part in IA question paper 2. All questions descriptive
-Certification earned by passing the standard Online MOOCs course (of at least 8 hours defined by BOS) can be considered as a Course activity/Assignment and awarded maximum of 10 marks.
Conduct of Lab: 1. Conducting the experiment and journal: 5 marks 2. Calculations, results, graph, conclusion and Outcome: 5 marks
Lab test: (Batch wise with 15 students/batch) 1. Test will be conducted at the end of the semester 2. Time table, 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: 15 marks 5. Viva voce: 10 marks
Eligibility for SEE: 1. 40% and above (24 marks and above) in theory component (No change) 2. Student should score minimum 40% of 30 marks (i.e. 12 marks) in Lab test & should score 40% of 40 marks (i.e. 16 marks) in Total. 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 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

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		

CO-PO Mapping (planned)													CO-PSO Mapping(planned)		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
1	✓	✓	✓		✓								✓	✓	
2	✓	✓	✓		✓								✓	✓	
3	✓		✓										✓		
4	✓		✓										✓		
5		✓	✓		✓				✓	✓	✓	✓	✓	✓	✓
Tick mark the CO, PO and PSO mapping															

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**	**Two Assignments – (Open /Industry/Certification etc)**	**Course project (CP)/ Case study etc**	**Total Marks**
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

-Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.
-Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests.
-Lack of minimum score in IA test will make the student Not Eligible for SEE
-Minimum score in CIE 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 three parts **A, B and C**. Students have to answer 1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

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

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
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
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
II	5	1. Class and object
		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.

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. c. 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	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**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 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
I	2	Figma, HTML5, and AWS
II	2	CSS transformations, UI and multi column features
III	2	Tailwind and JavaScript
IV	2	Twitter Bootstrap, Jumbotron
V	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.

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.
-Submission of 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. c. 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	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
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
I	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.
II	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.
III	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.
IV	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.
V	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.

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. c. 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	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**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 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
II	1	Functions and lists
	2	Functions and dictionaries
III	3	File I/O and exception handling mechanisms
	4	Implement a Python program to work with a database
IV	5	Object composition and encapsulation
	6	Inheritance and polymorphism
V	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.

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. c. 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	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
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.	100 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
4. 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%.		
3.	One or Two experiments to be conducted.		
4.	Minimum marks required in SEE to pass: 20 out of 50		
	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
5.	Viva-voce shall be conducted for individual student and not in a group.		

CO-PO Mapping (planned)													CO-PSO Mapping (planned)		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**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 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:

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: 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%.		
3.	One or Two experiments to be conducted.		
4.	Minimum marks required in SEE to pass: 20 out of 50		
	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
5.	Viva-voce shall be conducted for individual student and not in a group.		

CO-PO Mapping (planned)													**CO-PSO Mapping (planned)**		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
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	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

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
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:

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:

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%.		
3.	One or Two experiments to be conducted.		
4.	Minimum marks required in SEE to pass: 20 out of 50		
	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
5.	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:

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:

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%.		
3.	One or Two experiments to be conducted.		
4.	Minimum marks required in SEE to pass: 20 out of 50		
	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
5.	Viva-voce shall be conducted for individual student and not in a group.		

CO-PO Mapping (planned)													**CO-PSO Mapping (planned)**		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
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 I

Course Code	22AECCS375	Course type	AEC	Credits L-T-P	1-0-0
Hours/week: L-T-P	1-0-0			Total credits	1
Total Contact Hours	L = 20 Hrs; T = 0 Hrs; P = 0 Hrs Total = 20 Hrs			CIE Marks	50
Flipped Classes content	5 Hours			SEE Marks	50

Course learning objectives	
1.	Review basic differentiation and Integration
1.	Get acquainted with different applications of Calculus.
2.	Understand modular arithmetic.
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:	**Contact Hours =5 Hours**
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.
	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.	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)		

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	✓														

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.	**Review** basics of Differentiation and Integration	L1	1	1
2.	**Review** basic concepts of Calculus.	L1	1	1
3.	**Understand** modular arithmetic	L2	1	1
4.	**Understand** basic Linear Algebra**.**	L1	1	1

Scheme of Continuous Internal Evaluation (CIE): Theory course (Non-Integrated)		
Components	**Addition of CIE components**	**Total Marks**
Written Test	30	50
Two Open Book Assignments	20	
Scheme of Semester End Examination (SEE): Theory course (Non-Integrated)		
Components	**Total Marks**	
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
I	1	Structures
II	2	Stack, Queue
III	2	Linked list, DLL
IV	1	Trees
V	1	Hashing

s

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.		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.	**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:

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

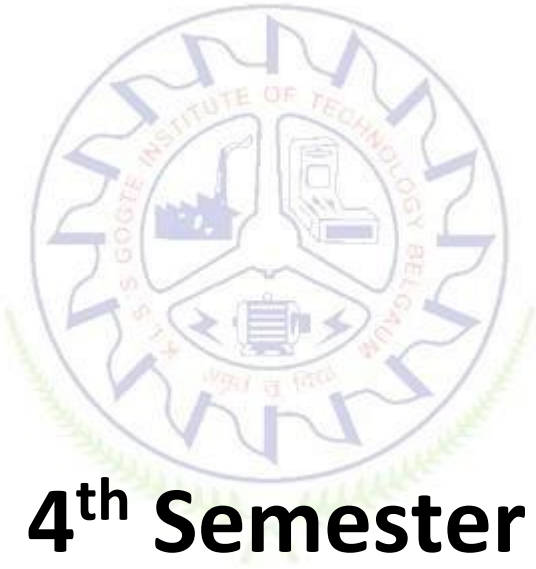
Eligibility for SEE:

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%.		
3.	One or Two experiments to be conducted.		
4.	Minimum marks required in SEE to pass: 20 out of 50		
	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
5.	Viva-voce shall be conducted for individual student and not in a group.		

CO-PO Mapping (planned)													CO-PSO Mapping (planned)		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
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**	**Two Assignments – (Open /Industry/Certification etc)**	**Course project (CP)/ Case study etc**	**Total Marks**
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

-Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.
-Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests.
-Lack of minimum score in IA test will make the student Not Eligible for SEE
-Minimum score in CIE 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	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**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 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 appropriate for a solution	**An**	1,2,3,4	1,2
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**	**Conduction**	**Lab test**	
30 marks	30 marks	10 marks	30 marks	100 marks
IA Test: 1. No objective part in IA question paper 2. All questions descriptive				
-Certification earned by passing the standard Online MOOCs course (of at least 8 hours defined by BOS) can be considered as a Course activity/Assignment and awarded maximum of 10 marks.				
Conduct of Lab: 1. Conducting the experiment and journal: 5 marks 2. Calculations, results, graph, conclusion and Outcome: 5 marks				

Lab test: (Batch wise with 15 students/batch) 1. Test will be conducted at the end of the semester 2. Time table, 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: 15 marks 5. Viva voce: 10 marks
Eligibility for SEE: 1. 40% and above (24 marks and above) in theory component (No change) 2. Student should score minimum 40% of 30 marks (i.e. 12 marks) in Lab test & should score 40% of 40 marks (i.e. 16 marks) in Total. 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	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**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 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
I	**2**	Entity-Relationship Model, ER-Relational Mapping Rules
II	**1**	Relational Operations
III	**1**	Normalization
IV	**2**	DDL,DML, Web Programming
V	**2**	PL/SQL Programs, Cursors, Triggers

Unit No.	Self-Study Topics
I	Various users of DBMS, Classification od DBMS
II	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**	**Conduction**	**Lab test**	
30 marks	30 marks	10 marks	30 marks	100 marks
IA Test: 1. No objective part in IA question paper 2. All questions descriptive				
-Certification earned by passing the standard Online MOOCs course (of at least 8 hours defined by BOS) can be considered as a Course activity/Assignment and awarded maximum of 10 marks.				
Conduct of Lab: 1. Conducting the experiment and journal: 5 marks 2. Calculations, results, graph, conclusion and Outcome: 5 marks				
Lab test: (Batch wise with 15 students/batch) 1. Test will be conducted at the end of the semester 2. Time table, 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: 15 marks 5. Viva voce: 10 marks
Eligibility for SEE: 1. 40% and above (24 marks and above) in theory component (No change) 2. Student should score minimum 40% of 30 marks (i.e. 12 marks) in Lab test & should score 40% of 40 marks (i.e. 16 marks) in Total. 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	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
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	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 =0 Hrs; 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

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

Books	
	Text Books:
1.	Kolman, Busby, Ross "Discrete Mathematical Structures", 6th Edition Prentice Hall of India, 2010 onwards
2.	Ralph Grimaldi, "Discrete and Combinatorial Mathematics 4th Edition 2003 onwards
	Reference Books:
1.	Kenneth Rosen "Discrete Mathematics and Its Applications with Combinatorics and Graph Theory (SIE) | 7th Edition onwards
2.	Narsingh Deo ,"Graph theory and its Applications"
	E-resource's (NPTEL/SWAYAM. Any Other)- mention links
1.	https://archive.nptel.ac.in/courses/111/106/111106086/(DMS)
2.	https://www.digimat.in/nptel/courses/video/111106102/L19.html(GT)
3	https://www.javatpoint.com/graph-theory-tree-and-forest (GTTrees)

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	Two Assignments – (Open /Industry/Certification etc)	Course project (CP)/ Case study etc	Total Marks
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100
-Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks. -Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests. -Lack of minimum score in IA test will make the student Not Eligible for SEE -Minimum score in CIE 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. 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	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
1	✓												✓		
2	✓												✓		
3	✓												✓		
4	✓												✓		
Tick mark the CO, PO and PSO mapping															

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.

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. c. 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	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
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	**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
I	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.
II	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.
III	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.
IV	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.
V	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.

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. c. 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	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**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 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	**22CS444 / 22IS444**	**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
II	1	Functions and lists
	2	Functions and dictionaries
III	3	File I/O and exception handling mechanisms
	4	Implement a Python program to work with a database
IV	5	Object composition and encapsulation
	6	Inheritance and polymorphism
V	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.

THEORY (40 marks)		**PROJECT (60 marks)**			**Total**
IA test (Theory)	**IA test (Lab)**	**Project Phase 1**	**Project Phase 2**	**Project report**	
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Submitting Project report is compulsory.

Eligibility for SEE:

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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. c. 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	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
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		

Design Thinking

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 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
4. 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%.		
3.	One or Two experiments to be conducted.		
4.	Minimum marks required in SEE to pass: 20 out of 50		
	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
5.	Viva-voce shall be conducted for individual student and not in a group.		

CO-PO Mapping (planned)													**CO-PSO Mapping (planned)**		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**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 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.		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.	**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:

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:

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%.		
3.	One or Two experiments to be conducted.		
4.	Minimum marks required in SEE to pass: 20 out of 50		
	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
5.	Viva-voce shall be conducted for individual student and not in a group.		

CO-PO Mapping (planned)													**CO-PSO Mapping (planned)**		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
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	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

Software Tools and Technologies

Course Code	**22AECCS453**	**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
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:

1. Conduction of the experiment: 15 marks + Viva voce: 5 marks = 20 marks
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4. 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%.		
3.	One or Two experiments to be conducted.		
4.	Minimum marks required in SEE to pass: 20 out of 50		
	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
5.	Viva-voce shall be conducted for individual student and not in a group.		

CO-PO Mapping (planned)													CO-PSO Mapping (planned)		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
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:

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:

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%.		
3.	One or Two experiments to be conducted.		
4.	Minimum marks required in SEE to pass: 20 out of 50		
	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
5.	Viva-voce shall be conducted for individual student and not in a group.		

CO-PO Mapping (planned)													CO-PSO Mapping (planned)		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
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

Course Code	22AECCS455	**Course type**	AEC	**Credits L-T-P**	1-0-0
Hours/week: L-T-P	1-0-0			**Total credits**	1
Total Contact Hours	L = 20 Hrs; T = 0 Hrs; P = 0 Hrs Total = 20 Hrs			**CIE Marks**	50
Flipped Classes content	5 Hours			**SEE Marks**	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 probability.

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 = 5 Hours**
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 Class room Sessions	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.	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)

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 probability**.**	L2	1	

CO-PO Mapping(planned)													CO-PSO Mapping(planned)		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
1	✓														
2	✓														
3	✓														
4	✓														

Scheme of Continuous Internal Evaluation (CIE): Theory course (Non-Integrated)		
Components	**Addition of CIE components**	**Total Marks**
Written Test	30	50
Two Open Book Assignments	20	
Scheme of Semester End Examination (SEE): Theory course (Non-Integrated)		
Components	**Total Marks**	
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**	**Two Assignments – (Open /Industry/Certification etc)**	**Course project (CP)/ Case study etc**	**Total Marks**
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100
-Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks. **-Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests.** **-Lack of minimum score in IA test will make the student Not Eligible for SEE** **-Minimum score in CIE 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 > 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	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
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 > 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**	**PO10**	**PO11**	**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.		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.	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:

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%.		
3.	One or Two experiments to be conducted.		
4.	Minimum marks required in SEE to pass: 20 out of 50		
	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
5.	Viva-voce shall be conducted for individual student and not in a group.		

CO-PO Mapping (planned)													CO-PSO Mapping (planned)		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
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

5th Semester Syllabi

Software Project Management

Course Code	22CS51	**Course type**	HSMS	**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 provide **understanding** of basic project management principles, including project planning, risk management, and team collaboration.
2.	To **apply** comprehensive project plans, incorporating project scheduling, resource allocation, and risk management techniques to guide students in meeting specified learning objectives.
3.	To **analyze s**ecurity risk assessments and propose mitigation strategies based on security engineering principles to ensure students understand software system survivability
4.	To **evaluate** various software testing methodologies such as boundary value analysis and equivalence class testing, and design effective test cases to ensure students understand software quality and reliability.

Pre-requisites: Software Engineering, Engineering mathematics

Unit – I	**Contact Hours = 8 Hours**
Project management: Introduction, Risk management, Risk management process, Risk analysis, Risk planning, Risk monitoring**,** Risk indicators**,** managing people, motivating people, Teamwork: selecting group members.	

Unit – II	**Contact Hours = 8 Hours**
Project Planning: Software pricing, Plan-driven Development: Project Plans, Planning process, Project scheduling: Schedule Representation, Agile Planning, Estimation techniques: Algorithmic Cost Modeling, Introduction to The COCOMO II Model. Tools used: Atlassian Jira	

Unit – III	**Contact Hours = 8 Hours**
Security engineering: Introduction, Security risk management, Life cycle risk analysis, Operational risk assessment, Design of security, System survivability, stages in System survivability**.**	

Unit – IV	**Contact Hours = 8 Hours**
Software Testing: A perspective on Testing, Basic definitions, Test cases, Insights from Venn diagram, Identifying Test Cases, Error and fault taxonomy, Levels of Testing. Examples: Generalized pseudocode, The Triangle problem, The Next Date function, The Commission Problem, The SATM (Simple Automatic Teller Machine) system, Saturn Windshield Wiper Controller.	

Unit – V	Contact Hours = 8 Hours
Boundary Value Testing: Boundary Value Analysis, Robustness Testing, Worst Case Testing, Special Value Testing, Examples Equivalence Class Testing: Equivalence classes, Weak Normal Equivalence Class Test, Strong Normal Equivalence Class Test, Weak Robust testing, strong robust testing, Equivalence Class Test Cases examples: Triangle Problem, Next Date Function, Guidelines and Observations.	

Flipped Classroom Details

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

Unit No.	Self-Study Topics
I	Personality types
II	Atlasian Jira tool
III	Stages in System survivability
IV	The currency convertor
V	Guidelines and Observations.

Books	
	Text Books:
1.	Ian Sommerville: Software Engineering, Pearson Education, 9th Edition onwards.
2.	Paul C. Jorgensen: Software Testing, ACraftsman's approach, 3rd Edition, Auerbach Publications, 2008.
	Reference Books:
1.	Aditya P. Mathur: Foundations of Software Testing, Pearson Education, 2008.
2.	Srinivasan Desikan, Gopalaswamy Ramesh, : Software Testing Principles and Practices, 2nd Edition, Pearson Education, 2007.
	E-resources (NPTEL/SWAYAM.. Any Other)-
1.	https://onlinecourses.nptel.ac.in/noc22_cs61/preview
2.	https://onlinecourses.nptel.ac.in/noc24_mg01/preview

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Assignment (OA)/ Certification
3.	Flipped Classes	3.	Course Project
4.	Online classes	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.	Demonstrate **understanding** of project management, including project planning, risk management, and teamwork.	Un	1,6,8,9,11	2
2.	**Apply** project planning techniques to create effective project plans with clear objectives, schedules, and resource allocation.	Ap	2, 3, 4, 5,6, 8,9	1,2
3.	**Analyze** security risks and propose mitigation strategies to ensure system survivability.	An	2,4, 6, 8,12	1,2
4.	**Evaluate** software testing methodologies, such as boundary value analysis and equivalence class testing, to design effective test cases for quality assurance.	Ev	2,3,4	2
5	**Demonstrate** effective team collaboration and communication skills to complete project-related tasks.	Ap	8, 9,10,11,12	3

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Two Assignments – (Open /Industry/Certification etc)**	**Course project (CP)/ Case study etc**	**Total Marks**
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

-Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.
-Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests.
-Lack of minimum score in IA test will make the student Not Eligible for SEE
-Minimum score in CIE 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 three parts **A,B and C**. Students have to answer 1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**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 Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Software Design	IT Sector, Banking, Finance, Health Care	Software Engineers
2	Software Project Management Tools		Project Manager
3	Software Testing Tools		Quality Assurance Engineer

Formal Languages Automata Theory

Course Code	**22CS52**	**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 study abstract computing machines, Language representation techniques and finite state machines to realize formal language.
2.	To Employ regular expressions and properties to solve problems in computing.
3.	To Design Grammars and Recognizers for different formal languages
4.	To Understand Push Down Automata and Turing theory and its significance.
5.	To Demonstrate Lex and YACC tools.

Prerequisite: Basic knowledge of problem solving and Discrete mathematics

Unit – I	**Contact Hours = 8 Hours**
Introduction to Finite Automata: Introduction to Finite Automata, Structural Representation. The central concepts of Automata theory – Alphabet, Strings & Languages. Deterministic Finite Automata (DFA), Non -Deterministic and Equivalence of NFA and DFA, FA with Epsilon (ε) transitions.	

Unit – II	**Contact Hours = 8 Hours**
Regular Expressions and languages: Regular Expressions, Finite Automata and Regular Expressions, Properties of Regular Languages (RL): Proving Languages not to be Regular. Equivalence and Minimization of Automata. Applications of Regular Expressions.	

Unit – III	**Contact Hours = 8 Hours**
Context -Free Grammars (CFG) and Languages (CFL): Context - Free Grammars, Parse Trees, Applications of Context - Free Grammars, Ambiguity in Grammars and Languages. Normal forms for Context Free Grammar.	

Unit – IV	**Contact Hours = 8 Hours**
Pushdown Automata (PDA): Definition of Pushdown Automata, The languages of a PDA: Acceptance by Final state & Empty stack. Introduction to Turing Machines (TM): Turing Machine model: Definition of Turing Machine, Transition Function, Instantaneous Description & Moves, Programming a Turing Machine, Language recognition by Turing Machine.	

Unit – V	Contact Hours = 8 Hours
LEX and YACC Tools: The Simplest Lex Program, Recognizing Words with Lex. Grammars: Parser-Lexer communication, A Yacc Parser, Rules section. Running Lex and Yacc and examples. Using Lex: Regular Expressions and examples. Using Yacc: Shift reduce parsing, Arithmetic Expressions Validity and Evaluation.	

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
I.	-	
II.	3	Programs on regular expressions using Lex tool
III.	3	Programs on Context Free Grammars using YACC tool
V.	2	Programs to check validity and evaluation of arithmetic expression using YACC tool

Unit No.	Self-Study Topics
I.	Applications of Automata Theory.
II.	Properties of Regular Languages
III.	Normal form of Context Free Grammars (GNF)
IV.	Lexical and Syntax Analysis phases of Compiler Design

Books

	Text Books:
1.	John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson Education, 3/E, 2013
2.	John R. Levine and Tony Mason and Doug Brown, Lex and Yacc, "UNIX programming tools", 2/E, 1992.
3.	S. P. Euguene Xavier "Theory of Automata, Formal Languages and Computation ", 5/ E 2008.
	Reference Books:
1.	Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, "Compilers Principles, Techniques and Tools", Pearson Education, 2 / E,2008.
2.	Peter Linz, "An Introduction to Formal Languages and Automata",Narosa Publishing House, 5/E, 2011.
	E-resources (NPTEL/SWAYAM/ Any Other)
1.	https://nptel.ac.in/courses/106105196

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Assignment (OA)/ Lab Project/ Industry assignment/Certification/ Course 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.	Acquire fundamental understanding of the core concepts in automata theory , regular expressions, CFG, PDA, Turing machines .	Un	1,2	1,3
2.	Design Finite state machines and Regular Expressions for the given pattern.	Ap	1,2,3,12	1,3
3.	Design Grammars for different language classes and become knowledgeable about restricted models of Computation (Regular, Context Free)	Ap	1,2,3,12	1,3
4.	Design and Analysis of PDA, Turing Machine for the given problem description.	An	1,2,3,12	1,3
5.	Design programs to implement lexical analyzer & parsers using LEX and YACC tools.	Ap	1,2,3,5,12	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**	**Conduction**	**Lab test**	
30 marks	30 marks	10 marks	30 marks	100 marks

IA Test:
1. No objective part in IA question paper
2. All questions descriptive

-Certification earned by passing the standard Online MOOCs course (of at least 8 hours defined by BOS) can be considered as a Course activity/Assignment and awarded maximum of 10 marks.

Conduct of Lab:
1. Conducting the experiment and journal: 5 marks
2. Calculations, results, graph, conclusion and Outcome: 5 marks

Lab test: (Batch wise with 15 students/batch)
1. Test will be conducted at the end of the semester
2. Time table, 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: 15 marks
5. Viva voce: 10 marks

Eligibility for SEE:
1. 40% and above (24 marks and above) in theory component (No change)
2. Student should score minimum 40% of 30 marks (i.e. 12 marks) in Lab test & should score 40% of 40 marks (i.e. 16 marks) in Total.
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 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (planned)													CO-PSO Mapping (planned)		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**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 Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Compiler Design phases	Core Companies, Networking companies	Software Designer

Microcontrollers and Embedded Systems

Course Code	22CS53	**Course type**	PCC	**Credits L-T-P**	**4 – 0 - 0**
Hours/week: L - T- P	**4 – 0 – 0**			**Total credits**	**4**
Total Contact Hours	**L = 50 Hrs; T = 0 Hrs; P = 0 Hrs** **Total = 50 Hrs**			**CIE Marks**	**100**
Flipped Classes content	**10 Hours**			**SEE Marks**	**100**

Course learning objectives	
1.	To equip students with a thorough understanding of microcontrollers, including their architecture, functionalities, and various applications in embedded systems.
2.	To guide students in mastering programming microcontrollers using Embedded 'C', ensuring they can write efficient and effective code for various applications.
3.	To teach students how to connect microcontrollers with a wide range of peripheral devices such as sensors, actuators, displays, and communication modules, enhancing their practical skills in system integration.
4.	To enable students to design and deploy embedded systems by instructing them on selecting appropriate hardware components and integrating them into functional and optimized systems.

Pre-requisites : Digital Electronics, 'C' Programming.

Unit – I	Contact Hours = 10 Hours
The 8051 Microcontrollers: Microcontrollers and Embedded Processors, A brief history of the 8051, Block Diagram of 8051 Microcontroller. 8051 Programming in 'C': Data Types and Time Delay in 8051 'C', I/O Programming in 'C', Logic operations in 8051 'C'.	

Unit – II	Contact Hours = 10 Hours
8051 Programming in 'C': Data conversion programs in 8051 'C', Accessing code ROM space in 8051 'C', Data Serialization using 8051 'C'. 8051 Timer Programming in 'C': Programming Timers in Mode1 and Mode 2.	

Unit – III	Contact Hours = 10 Hours
8051 Counter Programming in 'C': Programming Counters in Mode1 and Mode 2. Serial Communication: Basics of Serial Communication, Serial Port Programming in 'C'.	

Unit – IV	Contact Hours = 10 Hours
Interrupts Programming in 'C': 8051 interrupts, Interrupt Programming in 'C'. Peripheral interfacing: Sensor, Actuator, LCD, ADC and DAC interfacing with 8051 Microcontroller.	

Unit – V	Contact Hours = 10 Hours
Embedded Computing: Introduction, Complex systems and microprocessors, embedding computers, Characteristics of embedded computing applications, why use microprocessors, Challenges in embedded computing system design, Performance of embedded computing systems. The Embedded System Design Process: Requirements, Specification, Architecture design, Designing hardware and software components, System integration.	

Flipped Classroom Details

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

Unit No.	**Self-Study Topics**
I	A brief history of the 8051
II	Data Serialization using 8051 'C'
III	Basics of Serial Communication
IV	8051 interrupts
V	Performance of embedded computing systems

Books	
	Text Books:
1.	Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, The 8051 Microcontroller and Embedded Systems: Using Assembly and C, Pearson, Second Edition onwards.
2.	Marilyn Wolf, Computers as Components Principles of Embedded Computing System Design, Morghan Kaufmann Elsevier, Third Edition onwards.
	Reference Books:
1.	David Calcutt, Frederick Cowan, and Hassan Parchizadeh, 8051 Microcontroller: An Applications Based Introduction
2.	Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education, Private Limited, 2nd Edition.
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://onlinecourses.nptel.ac.in/noc20_ee42/preview
2.	https://onlinecourses.nptel.ac.in/noc20_ee98/preview

Course delivery methods		**Assessment methods**	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Assignment (OA)/ Certification
3.	Flipped Classes	3.	Course Project
4.	Online classes	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.	Explain the essential concepts governing microcontrollers and the architectural framework of embedded systems.	Un	1,2	1
2.	Apply programming concepts to effectively program microcontrollers using Embedded 'C'.	Ap	1,2,3,5	1,2
3.	Analyze various peripheral devices and determine suitable interfacing methods with microcontrollers.	An	1,2,3,5	1,2
4.	Develop embedded systems solutions by selecting appropriate hardware components and designing circuits.	Ap	1,2,3,5	1,2
5.	Analyze the requirements for a real world problem or a specification and develop a course project as the solution.	An	1,2,3,5, 9,10,11,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Open Assignments (OA)**	**Course project (CP)**	**Total Marks**
Marks	30 + 30 = 60 marks	10 + 10 = 20 marks	20 marks (with report & presentation)	100

-Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.
-Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests.
-Lack of minimum score in IA test will make the student Not Eligible for SEE
-Minimum score in CIE 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 three parts A,B and C. Students have to answer 1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**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 Industry Sectors & domains**	**Job roles students can take up after undergoing the course**
1	Programming Proficiency	Embedded System and IoT Application.	Embedded Engineers
2	Peripheral Interfacing		Embedded- IoT- Firmware Design Engineer
3	Hardware Design and Selection		

Data Visualization

Course Code	**22CS541**	**Course type**	**PLC**	**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 gain a deeper understanding of how to effectively communicate data insights using visualizations.
2.	To create interactive visualizations which can be used to create dashboards and reports, which can be shared with stakeholders.
3.	To have hands-on experience working with real-world data sets and to practice creating visualizations and improve their skills.
4.	To gain the basic understanding of julia language for data visualization

Pre-requisites : Basics of Python programming and Data Structure

Unit – I:	Contact Hours = 8 Hours
Introduction to Python: Python Programming Language, History of Python, Python Enhancement, Proposals, Applications of Python, Installing Python on Various Platforms, installing on a Windows Computer, Installing on Ubuntu and Debian Derivatives, Python Modes, Interactive Mode Script Mode **Exploring Jupyter Notebook** : Overview of Jupyter Notebook, Setting up Jupyter Notebook , Running Code in Jupyter Notebook	

Unit – II:	Contact Hours = 8 Hours
Data Visualization with Leather Running OS Commands in Jupyter Notebook, Introduction to Leather, More Types of Visualizations, Scales, Styling. Scientific Python Ecosystem and NumPy: Scientific Python Ecosystem, NumPy and Ndarrays, More Than One Dimension, Ndarray Properties, NumPy Constants	

Unit – III:	**Contact Hours = 8 Hours**
Data Visualization with NumPy and Matplotlib: Matplotlib, Visualization with NumPy and Matplotlib, Single Line Plots, Multiline Plots, Grid, Axes, and Labels, Colors, Styles, and Markers Visualizing Images and 3D Shapes: Visualizing the Images, Operations on Images, 3D Visualizations Getting Started with Pandas: Introduction to Pandas, Series in Pandas, Basic Operations on Series, Dataframes in Pandas, Reading Data Stored in CSV Format, Visualizing with Pandas	

Unit – IV: Visualizing Graphs and Networks & Story Telling	**Contact Hours = 8 Hours**
Visualizing Graphs and Networks: Graphs and Networks, Graphs in Python 3, Visualizing Graphs in Python, More Types of Graphs, Assigning Custom Labels to Nodes **Introduction to Storytelling:** The importance of context, choosing an effective visual, clutter is your enemy!, focus your audience's attention, think like a designer	

Unit – V: Introduction to Julia and Data visualization	Contact Hours = 8 Hours
Data manipulation: Creating new dataframes, Indexing and summarizing data, Basic mathematical operations, General operations, Grouping data, Dealing with missing data. Importing and exporting data as CSV and excel files. Data visualization: Line plot, Attributes of a plot, Scatter plot, Heatmap, Histogram, Pie chart, Plotting mathematical functions, Saving plots, Animated plots, Various packages for plotting in Julia.	

Flipped Classroom Details

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

Books	
	Text Books:
1.	Ashwin Pajankar, Practical Python Data Visualization: A Fast Track Approach To Learning Data Visualization With Python, Apress.
2.	Cole Nussbaumer Knaflic, Storytelling with data, Wiley, John Wiley & Sons, Inc., Hoboken, New Jersey.
	Reference Books:
1.	Igor Milovanović), Python Data Visualization Cookbook, Packt Publishing, November 2013
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://www.udemy.com/course/complete-data-visualization-in-python/w
2.	https://blog.quantinsti.com/data-manipulation-visualization-using-julia/

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Book Tests (OBT)
3.	Flipped Classes	3.	Course Seminar
4.	Online classes	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.	**Describe** effectively the data insights using visualizations.	Un	1,2,3,5	1,2
2.	**Demonstrate** interactive visualizations using dashboards and reports	Ap	1,2,3,4,5,12	1,2,3
3.	**Use** real-world data sets to practice creating visualizations and improve the skills.	Ap	1,2,3,5,6,9	1,2,3
4.	**Discuss** the methodologies of storytelling with data	AP	1,2,4,5,10	1,2,3

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Addition of two OAs	Course project	Total Marks
Marks	30 + 30 = 60 marks	10 + 10 = 20 marks	20 marks (with report & presentation)	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 ≥ 35%, however overall score of CIE + SEE should be > 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	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**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 Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Data visualization techniques using Python and Julia	Finance, Health care, banking etc	Data Scientist, Data science Engineer, Visualization Specialist

Object Oriented Modeling and Design

Course Code	22CS542	Course type	PEC	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 Bring out the importance of object oriented software development
2.	To study and understand the UML notations as applicable to different stages of software development.
3.	To model given real world problem using object oriented concepts and notations.

Pre-requisites : Basics of object oriented programming and Software Engineering

Unit – I	Contact Hours = 8 Hours

Introduction, Modeling Concepts, Class Modeling: Introduction to Object Orientated (OO) development. OO themes; OO modeling history. Modeling as Design Technique: Modeling; abstraction; The three models.

Class Modeling: Object and class concepts; Link and associations concepts; Generalization and Inheritance.

Unit – II	Contact Hours = 8 Hours

State Modeling, Advanced State Modeling: State Modeling: Events, States, Transitions and Conditions; State diagrams; State diagram behavior; Advanced State Modeling: Nested state diagrams; Nested states.

Unit – III	Contact Hours = 8 Hours

Interaction Modeling, Advanced interaction Modeling Interaction Modeling Use case models; Sequence models; Activity models. Use case relationships; Procedural sequence models; Special constructs for activity models.

Unit – IV	Contact Hours = 8 Hours

Domain Analysis: Overview of domain analysis; Domain class model; Domain state model; Domain interaction model; Iterating the analysis.

Unit – V	Contact Hours = 8 Hours

Application Analysis: Application interaction model; Application class model; Overview of class design

Flipped Classroom Details

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

Unit No.	Self-Study Topics
1	Application of Object Oriented Design and Modeling
2	Build a model based on a case study.
5	Introduction to Design Patterns

Books	
	Text Books:
1.	Michael Blaha, James Rumbaugh: Object-Oriented Modeling and Design with UML, Pearson Education, 2nd Edition and onwards.
2.	Grady Booch, James Rumbaugh, Ivar Jacobson, "Unified Modeling Language User Guide", Publisher: Addison Wesley.
	Reference Books:
1.	Grady Booch et al: Object-Oriented Analysis and Design with Applications, 3rd Edition, Pearson Education, 2007 and onwards.
2.	Brahma Dathan, Sarnath Ramnath: Object-Oriented Analysis, Design, and Implementation, Universities Press, 2009 and onwards.
3.	Grady Booch, James Rumbaugh, Ivar Jacobson, "Unified Modeling Language Reference Manual", Publisher: Addison Wesley.
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	Object-Oriented Design Course by University of Alberta | Coursera

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Book Tests (OBT)
3.	Flipped Classes	3.	Course Seminar
4.	Online classes	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.	**Identify** and **explain** different UML notations for a given problem statement	**Un**	1,2	1
2.	**Apply** UML notations to model real world problems at different stages of software development.	**Ap**	2,3,5	1,2
3.	**Perform** domain and application Analysis for a given real world problems.	**Ap**	2,3,11	1,2,3
4.	**Analyze** the requirements for a real world problem or a specification and develop a course project as the solution using OOP language	**An**	1,2,3,5,9,10,11,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Open Assignments (OA)	Course project (CP)	Total Marks
Marks	30 + 30 = 60 marks	10 + 10 = 20 marks	20 marks (with report & presentation)	100

-Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.
-Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests.
-Lack of minimum score in IA test will make the student Not Eligible for SEE
-Minimum score in CIE 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 three parts **A, B and C**. Students have to answer 1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (Planned)													**CO-PSO Mapping (Planned)**		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
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	After undergoing an object-oriented modeling course, individuals can enhance their skills and competencies applicable across various industries, sectors, and domains.	Object-oriented modeling is foundational to software engineering, making it applicable in industries such as: Information Technology, Services, Software Development Companies .	Software Engineer/Developer Systems Analyst Database Administrator Product Designer/Engineer Designing and Systems Engineer Business Analyst Project Manager Quality Assurance Engineer Data Scientist Healthcare IT Specialist
2	Students have a basic idea to develop the Software		

Advanced Java

Course Code	**22CS543**	Course type	**PEC**	**Credits L-T-P**	2-0-1
Hours/week: L - T- P	2 - 0 –2			**Total credits**	3
Total Contact Hours	L = 30 Hrs; T = 0 Hrs; P = 10 Hrs Total = 40 Hrs			**CIE Marks**	100
Flipped Classes content	10 Hours			**SEE Marks**	100

Course learning objectives	
1.	To introduce the fundamental concept of Java Collections for efficient data organization and manipulation.
2.	To implement advanced Java concepts such as multithreading.
3.	**To design the Graphical User Interface (GUI) through Java Swing.**
4.	To Develop web applications using Java EE technologies like Servlets

Required Knowledge of : Basics of Java Programming

Unit – I	**Contact Hours = 8 Hours**
Collections: Overview, Collection Interfaces, Collection classes, storing user defined classes in collections, working with Maps, Comparators, the collections algorithms.	

Unit – II	**Contact Hours = 8 Hours**
Multithreading: The Java thread model, the main thread, creating a thread, multiple threads, isAlive() and join(), thread priorities, synchronization, inter thread communication, suspending, resuming and stopping threads. The Stream API: Stream Basics, Stream Interfaces, Methods, How to Obtain a Stream, A Simple Stream Example, Reduction Operations.	

Unit – III	**Contact Hours = 8 Hours**
Introducing Lambda Expressions: Block Lambda Expressions, Generic Functional Interfaces, Passing Lambda Expressions as Arguments, Lambda Expressions and Exceptions, Lambda Expressions and Variable Capture, Method References.	

Unit – IV	**Contact Hours = 8 Hours**
Introducing Swing: The Origins of Swing, Key Swing Features, Components and Containers, The Swing Packages, A Simple Swing Application, Event Handling, Create a Swing Applet, JLabel and ImageIcon, JTextField.	

Unit – V	**Contact Hours = 8 Hours**
Servlets: Background; The Life Cycle of a Servlet; Using Tomcat for Servlet Development; A simple Servlet; The Servlet API; The Javax.servlet Package; Reading Servlet Parameter; The Javax.servlet. http package	

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	Collections and collection class
2	2	Multithreading
3	1	lambda expression
4	3	Simple Swing GUI
5	1	Servlets Program

Books	
	Text Books:
1.	Herbert Schildt, Java The Complete Reference, TataMcGraw Hill, Ninth edition onwards
2.	H.M.Deitel, P. J. Deitel , Advanced Java 2 Platform HOW TO PROGRAM", Prentice Hall, Ninth edition onwards.
	Reference Books:
1.	Rod Johnson, J2EE Design and Development" , Wrox publishers, July 2004 and onwards.
	E-resources (NPTEL/SWAYAM. Any Other)- mention links
1.	https://www.shiksha.com/online-courses/programming-in-java-by-nptel-course-nptel22
2.	https://onlinecourses.nptel.ac.in/noc22_cs47

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.	Make use of the collection framework to store and manipulate data efficiently	Ap	1,2	1,2
2.	Explore and understand use of Java Server Programming	Ap	1	1
3.	Create and Design GUIs using Java Swing.	An	1,2,3	1
4.	Develop advanced skills for programming in Java	Ap	1,2,12,5,3,9,10,11	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. -Submission of 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. c. 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	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
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	Developed and enhanced dynamic applications using SWINGS.	Healthcare Sector	Front-End Developer
2	Developed high-quality, scalable code for various modules in the complex software development	e-commerce, Logistics	Junior Developer. Java Web Developer.
3	Developer is responsible for designing, developing, and maintaining Java-based programs.	Banking and finance	Architect. Java EE developer.

Robotic Process Automation

Course Code	22CS544	Course type	PEC	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 = 0 Hrs; P = 20 Hrs Total = 40 Hrs			CIE Marks	100
Flipped Classes content	10 Hours			SEE Marks	100

Course learning objectives	
1.	To Describe Robotic Process Automation (RPA) and its benefits
2.	To understand and use sequences / flowcharts to build automation
3.	To Explain and apply data manipulation
4.	To utilize the concept of selectors, descriptors to build ui automation
5.	To Describe version control system and orchestrator functionalities.

Required Knowledge of : Basics of logical reasoning and programming

Unit – I	Contact Hours = 8 Hours
Introduction to Robotic Process Automation (RPA) concepts, tools and fundamentals of implementation: Robotic Process Automation (RPA) and its benefits, UiPath Business Automation Platform, the UiPath core RPA components (Studio, Orchestrator and Robot with Assistant), two types of UiPath robots—attended and unattended, the key components of the UiPath Studio user interface, modern vs classic design, variables in an automation project , common data types used in UiPath Studio and conversion methods, arguments in an automation project, Invoke Workflow File Activity to chain workflow execution and pass data through arguments, Automation best practices, global constants and global variables in your automation projects	

Unit – II	Contact Hours = 8 Hours
Control flow, common RPA implementations, Exception handling and Debugging : Sequences and Flowcharts, control flow statements for decisions and iterations, Excel and Workbook activities, different types of exceptions, best practices for error and exception handling , file and folder activities - selecting, creating, deleting, moving and renaming files and folders, UiPath Studio integration capabilities - Gmail account, retrieve, work with emails, Microsoft Office 365 activities, working with PDF files, debugging actions	

Unit – III	Contact Hours = 8 Hours
Data Manipulation: Explain and apply data manipulation: VB.NET methods to manipulate string variables, RegEx builder in UiPath Studio, string activities in Studio, Lists and data manipulation on Lists, Invoke and String Conversion methods, Arrays and Lists, dictionary variables and data manipulation, Working with Datatable variable in Studio, comparison of worksheet and a data table	

Unit – IV	Contact Hours = 8 Hours
UI Automation, Descriptors and Selectors Synchronizing activities in automation workflows, Check App State activity and Verify Execution feature, Pick Branch activity, Targeting methods used in UI automation and characteristics ,Validate target	

elements, Fine-tune descriptors using the 'Dynamic Text Target' option, wildcards, variables, and making adjustments to enhance image accuracy, the structure and type of selectors in the context of web development, the functionality and purpose of the Property Explorer tool during editing selectors

Unit – V	**Contact Hours = 8 Hours**
Version Control System, Orchestrator resources and Project organization: Orchestrator capabilities and entities, tenant context and the folder context, Orchestrators resources, Benefits and challenges of using version control systems, basic GIT features for version control, project layout for an automation process, split complex automation project into functional workflows that can be developed separately, benefits of utilizing best practices for project organization	

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**
I	4	Basic automation Example
II	3	Web automation and Conditional Statements
III	2	Data Table and Data manipulation
IV	2	Screen Scraping , Data Scraping and PDF automation
V	1	Email Automation & Exception Handling

Unit No.	**Self-Study Topics**
I	Programming fundamentals
III	Practical exercises on conditional statements and loops
V	Exercises on exception handling

Books	
	Text Books:
1.	Alok Mani Tripathi, Learning Robotic Process Automation, Publisher: Packt Publishing Release Date: March 2018ISBN: 9781788470940
	Reference Books:
1.	Frank Casale (Author), Rebecca Dilla (Author), Heidi Jaynes (Author), Lauren Livingston (Author), Introduction to Robotic Process Automation: a Primer, Institute of Robotic Process Automation.
2.	Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant
3	Srikanth Merianda, Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation
	E-resources (NPTEL/SWAYAM. Any Other)- mention links
1.	https://www.uipath.com/rpa/robotic-process-automation

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 and utilize the fundamentals of Robotic Process Automation	Un	1	1
2.	Develop familiarity and deep understanding of UiPath tools	Ap	3	1
3.	Develop the ability to independently design and create robots for business processes	Ap	3	1
4	Prepare for UiPath Certified Professional Automation Developer Associate exam by further learning	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.

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Eligibility for SEE:

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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	10 marks	

	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. c. Viva-voce	30 marks 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	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
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	Robotic Process Automation with UiPath	HealthCare, Finance, Banking, Education etc	RPA solution architect, RPA developer, RPA Evangelist, RPA Subject Matter Expert etc

Data Warehousing and Data Mining

Course Code	**22CS545**	**Course type**	PEC	**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 basic concepts and techniques of data mining and data warehousing.
2.	To understand the different architectures and mining techniques.
3.	To inculcate the skills using recent data mining software for solving practical problems.
4.	To assess the strengths and weaknesses of various data mining methods and algorithms.

Pre-requisites: Database Management System, Design and Analysis of Algorithms.

Unit – I	Contact Hours = 8 Hours
Introduction and Data Pre-processing: Why data mining, what is data mining, What kinds of data can be mined, what kinds of patterns can be mined, Which Technologies Are used, which kinds of Applications are targeted, Major issues in data mining. Data Pre-processing: An overview, Data cleaning, Data integration, Data reduction, Data transformation and data discretization.	

Unit – II	Contact Hours = 8 Hours
What is a Data Warehouse? Differences between Operational Database Systems and Data Warehouses, Data Warehouse Architecture, Data Warehouse Modelling: Data Cube and OLAP, Data Warehouse Design and Usage, Data Warehouse Implementation, From Data warehousing to Data Mining.	

Unit – III	Contact Hours = 8 Hours
Classification and Prediction: Issues regarding Classification and Prediction, classification by Decision tree induction, Bayesian classification, Rule Based classification, Classification Based on the concepts from association rule mining. Other classification methods, prediction.	

Unit – IV	Contact Hours = 8 Hours
Cluster Analysis: What is Cluster Analysis? Types of data in cluster Analysis: a Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical methods, Density Based Methods, Model Based Clustering Methods: Statistical Approach, Neural Network Approach Outliner Analysis.	

Unit – V	Contact Hours = 8 Hours
Application and Trends in Data Mining: Data mining application, Data mining system Products and research Prototypes, Additional Themes on Data Mining, Data Mining and Intelligent Query Answering, Trends in Data Mining.	

Flipped Classroom Details

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

Unit No.	Self-Study Topics
I	Introduction to Data Lakes
II.	Efficient Processing of OLAP Queries
III.	Metrics for Evaluating Classifier Performance
IV.	Evaluation of Clustering
V.	Privacy, Security, and Social Impacts of Data Mining

Books	
	Text Books:
1.	Jiawei Han, Micheline Kamber , Jian Pei: Data Mining - Concepts and Techniques , 3rd Edition, Morgan Kaufmann Publishers, 2011 and above.
	Reference Books:
1.	Pang Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Addison Wesley, 2007.
2.	G. K. Gupta: Introduction to Data Mining with Case Studies, 3rd Edition, PHI, New Delhi, 2014.
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://nptel.ac.in/courses/106105174
2.	https://onlinecourses.swayam2.ac.in/cec20_cs12/preview

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Assignment (OA)/ Certification
3.	Flipped Classes	3.	Course Project
4.	Online classes	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 - **Remembe**r; Un - **Understand**; Ap - **Apply**; An - **Analysis**; Ev - **Evaluate**; Cr – **Create**		**Learning Level**	**PO(s)**	**PSO(s)**
1.	**Apply** KDD process for finding interesting patterns from warehouse.	Ap	1,2,3	1
2.	**Understand** warehousing architectures and tools for systematically organizing large database and use their data to make strategic decisions.	Un	2,3,4	1,2
3.	**Design and apply** appropriate classification techniques.	An	2,3,4,5	1,2,3
4.	**Apply** clustering the high dimensional data for better organization of the data.	Ap	2,3,4,5	1,2,3

5.	Apply the learnings inculcated throughout the course and develop a course project or present a course seminar.	Ap	1,2,3,4,5,9,10 ,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Open Assignments (OA)	Course project (CP)	Total Marks
Marks	30+30 = 60 marks	10 + 10 = 20 marks	20 marks (with report & presentation)	100

-Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.
-Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests.
-Lack of minimum score in IA test will make the student Not Eligible for SEE
-Minimum score in CIE 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 three parts **A,B and C**. Students have to answer 1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (Planned)													**CO-PSO Mapping (Planned)**		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**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 Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Students can apply appropriate techniques/methods to store and extract the useful information from large data sets.	IT Industry	Software Developer Data Mining Engineer Database Administrator

Research Methodology and IPR

Course Code	22AECCS56	Course type	AEC	Credits L-T-P	2-0-0
Hours/week: L-T-P	2-0-0			Total credits	2
Total Contact Hours	L = 30 Hrs; Total = 30 Hrs			CIE Marks	100
Flipped Classes content	05 Hours			SEE Marks	100

Course learning objectives	
1.	Understand the basic concepts of research and its methodologies
2.	Identify and select the appropriate research.
3.	Understand the basic concepts & types of hypothesis.
4.	Create the awareness about Intellectual Property Rights for the protection of inventions.

Required Knowledge of : --

Unit – I	Contact Hours = 5 Hours
Research Methodology: Introduction Meaning, Objectives, types, Research Approaches. Significance of Research, Research Methods versus Methodology, Research and scientific method, research Process, Criteria of good research, Problems encountered by researchers.	

Unit – II	Contact Hours = 6 Hours
Research Problem: Defining a research problem, selecting a research problem, necessity and techniques involved in defining the research problem. **Data Collection Methods:** Collection of Primary Data, Observation Method, Interview Method, Questionnaires, Schedules, Collection of Secondary Data, Case study method.	

Unit – III	Contact Hours = 9 Hours
Processing and Analysis of Data: Processing operations, Elements/ types of analysis, Statistics in research-measures of central tendency or statistical averages, measures of dispersion, measures of asymmetry (skewness), measures of relationship. **Testing of hypothesis 1:** Definition, basic concepts, procedure, flow diagram, measuring the power of hypothesis tests, tests of hypothesis. **Chi-square test:** Chi-square as a test for comparing variance, steps involved in applying chi-square test.	

Unit – IV	Contact Hours = 5 Hours
Intellectual Property Rights – IPR- Invention and Creativity- Intellectual Property-Importance and Protection of Intellectual Property Rights (IPRs)- A brief summary of: Patents, Copyrights, Trademarks, Industrial Designs-Integrated Circuits-Geographical Indications-Establishment of WIPO-Application and Procedures. Research ethics, Plagiarism, Prior art search.	

Unit – V	Contact Hours = 5 Hours
Interpretation and Report Writing: Meaning of interpretation, Why interpretation, Technique of interpretation, Precaution in interpretation, Significance of report writing, Different steps in writing report, Layout of the research report, Types of reports, Mechanics of writing research report.	

Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	01	01	01	01	01

Unit No.	Self-Study Topics [Mention if applicable else NIL]
I	Significance of Research Methodology.
II	Limitations of test of hypothesis.
III	Other measures-Index numbers, Time series analysis.

Books	
	Text Books:
1.	C R. Kothari, **"Research Methodology"**, New Age International Publishers, 2nd edition, 2007.
2.	Dr. B.L. Wadhera, **"Intellectual Property Rights"**, Universal Law Publishing Co. Ltd. 2002
	Reference Books:
1.	Panneer Selvam, **"Research Methodology"**, PHI Learning Pvt. Ltd., 2007.
	E-resources (NPTEL/SWAYAM. Any Other)-
1.	https://onlinecourses.swayam2.ac.in/cec20_ge37

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Assignments (OA)
3.	Flipped Classes	3.	Case studies
4.		4.	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.	Identify and select an appropriate methodology for research.	Un	1,2,9,10	1
2.	Analyze and interpret data collected	Ap	1,2,9,10	1
3.	Analyze the significance of hypothesis testing	An	1,2,9,10	1
4.	Discuss the significance of Intellectual Property Rights & report writing	Ap	1,2,3,9,10,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Two Assignments – (Open /Industry/Certification	Course project (CP)/ Case study etc	Total Marks
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

-Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.
-Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests.
-Lack of minimum score in IA test will make the student Not Eligible for SEE
-Minimum score in CIE 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 three parts **A,B and C**. Students have to answer 1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (Planned)													**CO-PSO Mapping (Planned)**		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
1	✓	✓							✓	✓			✓		
2	✓	✓							✓	✓			✓		
3	✓	✓							✓	✓			✓		
4	✓	✓	✓						✓	✓		✓	✓	✓	✓
Tick mark the CO, PO and PSO mapping															

Environmental Studies

Course Code	22CS58A	Course type	HSMS	Credits L-T-P	2-0-0
Hours/week: L-T-P	2-0-0			Total credits	2
Total Contact Hours	L = 30 Hrs; Total = 30 Hrs			CIE Marks	100
Flipped Classes content	5 Hours			SEE Marks	100

Course learning objectives	
1.	To understand the scope of Environmental Engineering.
2.	Identify the Environmental impact due to Human activities.
3.	Identify the renewable and non-renewable sources of energy.
4.	To understand the concept of Disaster Management.
5.	Identify the various Legal aspects in Environmental Protection.

Required Knowledge of : Nil

Unit – I	Contact Hours = 6 Hours
Definition of Environment, Ecology and Ecosystem, Structure and functions of ecosystem, balanced ecosystem, Introduction to Environmental Impact Assessment Natural Resources: Material Cycles – Oxygen, Carbon, Nitrogen and Hydrological cycle. Importance of water quality, Water borne diseases, Water induced diseases, Significance of Fluoride in drinking water.	

Unit – II	Contact Hours = 6 Hours
Energy – Different types of energy, Conventional and Non – Conventional sources – Advantages and Limitations of Wind Mills, Hydro Electric, Fossil fuel, Nuclear, Solar, Biomass and Biogas, Geothermal energy.	

Unit – III	Contact Hours = 6 Hours
Disasters – Natural Disasters: Meaning and nature of natural disasters, their types and effects (Floods, drought, cyclone, earthquakes, Tsunami). Man Made Disasters: Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution and marine pollution.	

Unit – IV	Contact Hours = 6 Hours
Disaster Management: International strategy for disaster reduction. Concept of disaster management and national disaster management framework.	

Unit – V	Contact Hours = 6 Hours
Environmental Protection: Role of Government, Legal aspects, Initiatives by Non – Governmental Organizations (NGO), Environmental Education, Women Education. E-waste and solid waste management rules.	

Flipped Classroom Details

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

Unit No.	Self-Study Topics [Mention if applicable else NIL]

Books	
	Text Books:
1.	Benny Joseph, **"Environmental Studies"**, Tata McGraw – Hill Publishing Company Limited (2005).
2.	Sanjay K. Sharma, **"Environment Engineering and Disaster Management"**, USP (2011).
3.	Harsh K. Gupta, **"Disaster Management"**, Universities Press (India) Pvt. Ltd (2003).
4.	Ranjit Daniels R.J. and Jagdish Krishnaswamy, **"Environmental Studies"**, Wiley India Private Ltd., New Delhi (2009).
	Reference Books:
1.	Meenakshi P., **"Elements of Environmental Science and Engineering"**, Prentice Hall of India Private Limited, New Delhi (2006).
2.	Tyler Miller Jr. G., **"Environmental Science – Working with the Earth"**, Tenth Edition, Thomson Brooks/Cole (2004).
	E-resources (NPTEL/SWAYAM. Any Other)-

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Assignment- Open/Industry/Certification
3.	Flipped Classes	3.	Course Project
4.	Online classes	4.	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 the importance of the Environment and different sources of energy and energy crises.	Un	6,7	1
2.	Understand various environmental disasters and its management.	Ap	6,7	1
3.	Understand the various Legislations related to Environment.	Un	6,7	1

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Two Assignments – (Open /Industry/Certification etc)	Course project (CP)/ Case study etc	Total Marks
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

-Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.
-Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests.
-Lack of minimum score in IA test will make the student Not Eligible for SEE
-Minimum score in CIE 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 three parts **A, B and C**. Students have to answer 1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (Planned)													**CO-PSO Mapping (Planned)**		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
1						✓	✓						✓		
2						✓	✓						✓		
3						✓	✓						✓		
Tick mark the CO, PO and PSO mapping															

Employability Skills I

Course Code	22AECCS58A	Course type	AEC	Credits L-T-P	1– 0 - 0
Hours/week: L - T- P	1 – 0 – 0			Total credits	1
Total Contact Hours	L = 30 Hrs; T = 0 Hrs; P = 0 Hrs Total = 30 Hrs			CIE Marks	100

Course learning objectives	
1.	Skill development is/are personal attributes that influence how well an individual works or interacts with others.
2.	Skill development is/are personal attributes that influence how well an individual works or interacts with others.
3.	In essence, they are essential for individual success in the workplace, their company's success, and their personal life also

Pre-requisites :----

Unit – I	Contact Hours = 6 Hours
Quantitative Aptitude**:** Number System (2 Hours), HCF, LCM and Decimal Fractions (1 Hour), Simplification (1 Hour) ***Logical Reasoning*****:** Blood Relations (1 Hour), Direction Sense Test (1 Hour)	

Unit – II	Contact Hours = 6 Hours
Quantitative Aptitude**:** Percentages (2 Hours), Profit, Loss and Discounts (2 Hours) ***Verbal Ability:*** Change of Speech and Voice (2 Hours)	

Unit – III	Contact Hours = 6 Hours
Quantitative Aptitude**:** Simple and Compound Interest (2 Hours) ***Logical Reasoning*****:** Number and Letter Series (2 Hours) ***Verbal Ability:*** Sentence Correction (2 Hours)	

Unit – IV	Contact Hours = 6 Hours
Quantitative Aptitude**:** Averages (2 Hours) ***Logical Reasoning*****:** Coding and Decoding (1 Hour), Analogy (1 Hour) ***Soft Skills*****:** Body Language (1 Hour), Grooming and Etiquette (1 Hour)	

Unit – V	Contact Hours = 6 Hours
Quantitative Aptitude: Alligations and Mixtures (2 Hours) ***Verbal Ability*****:** Sentence Completion (2 Hours) ***Soft Skills*****:** Group Discussion and Mock GDs (2 Hours)	

Books	
	Text Books:
1.	The Aptitude Triad , BIZOTIC
2.	How to prepare for Quantitative Aptitude for CAT & other Management Examinations, Arun Sharma, McGraw Hill Education(India) Private Limited, 4th Edition, 2018.
3.	How to prepare for Logical Reasoning for CAT & other Management Examinations, Arun Sharma, McGraw Hill Education(India) Private Limited, 8th Edition, 2018.
4.	How to prepare for Verbal Ability and Reading Comprehension for CAT & other Management Examinations, Arun Sharma, McGraw Hill Education(India) Private Limited, 8th Edition, 2018.
5.	How to prepare for Data Interpretation for CAT & other Management Examinations, Arun Sharma, McGraw Hill Education(India) Private Limited, 5th Edition, 2018.

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Online Quizzes
		3.	Assignments
		4.	Seminar

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.	Clear the Aptitude round of recruiters during placements	L2	10, 12	
2.	Perform confidently during the GD and Interview process	L2	10, 12	
3.	Develop behaviors that are appropriate for a professional	L2	10, 12	

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Online Quiz**	**Addition of two Assignments**	**Total Marks**
Marks	30+30 = 60	20	10+10 =20	100

- Writing 2 IA tests are compulsory

-Student should score minimum 40% of 100 marks to pass the course.

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
1										✓		✓			
2										✓		✓			
3										✓		✓			
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	Logical Thinking	IT Industry	Software Engineer
2	Problem Solving	Automotive	Developer
3	Communication Skills	Education Sector	Project Manager

Micro-Controllers and Embedded Systems Laboratory

Course Code	22CSL59	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.	To guide students in mastering the programming of microcontrollers using Embedded 'C', ensuring they can develop robust and efficient code for embedded applications.
2.	To instruct students on how to interface microcontrollers with a variety of peripheral devices, including sensors, actuators, displays, and communication modules, enhancing their practical skills and system integration capabilities.
3.	To facilitate students' understanding of hardware components by designing and conducting experiments that explore the functionalities of embedded systems, fostering hands-on learning and practical problem-solving skills.

Required Knowledge of : Digital Electronics, 'C' Programming.

List of Experiments

Lab Experiment – I	**Contact Hours = 2 Hours**
8051 I/O Programming.	
Lab Experiment – 2	**Contact Hours = 2 Hours**
Led Interfacing.	
Lab Experiment – 3	**Contact Hours = 2 Hours**
Timer Programming.	
Lab Experiment – 4	**Contact Hours = 2 Hours**
Counter Programming.	
Lab Experiment – 5	**Contact Hours = 2 Hours**
Liquid Crystal Display Interfacing.	
Lab Experiment – 6	**Contact Hours = 2 Hours**
Digital to Analog Converter (DAC) Interfacing.	
Lab Experiment – 7	**Contact Hours = 2 Hours**
Stepper Motor Interfacing.	
Lab Experiment – 8	**Contact Hours = 2 Hours**
Serial Port Programming.	
Lab Experiment – 9	**Contact Hours = 2 Hours**

Interrupt Programming.	
Lab Experiment – 10	**Contact Hours = 2 Hours**
Sensor and Actuator 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, Second Edition onwards.
2.	Marilyn Wolf, Computers as Components Principles of Embedded Computing System Design, Morghan Kaufmann Elsevier, Third Edition onwards.
	Reference Books:
1.	David Calcutt, Frederick Cowan, and Hassan Parchizadeh, 8051 Microcontroller: An Applications Based Introduction
2.	Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education, Private Limited, 2nd Edition.
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	**https://onlinecourses.nptel.ac.in/noc20_ee42/preview**
2.	https://onlinecourses.nptel.ac.in/noc20_ee98/preview

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.	**Apply** programming concepts to effectively code microcontrollers using Embedded 'C'.	**Ap**	1,2	1
2.	**Analyze** the specifications of various peripheral devices and determine suitable interfacing methods with microcontrollers based on their functionalities.	**An**	1,2,3,5	1,2
3.	**Apply** knowledge of embedded systems hardware to design circuits and select appropriate components for specific applications.	**Ap**	1,2,3,5	1,2
4.	**Analyze** the requirements for a real world problem or a specification and develop a course project as the solution	**An**	1,2,3,5, 9,10,11,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE):

Conduction of experiments & viva-voce	Journal	Lab project/ Open ended expt	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
2. Calculations, results, graph, conclusion and Outcome recorded in Journal: 5 marks
3. Lab project/ Open ended expt: 10 marks
4. 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.	Minimum marks required in SEE to pass: 20 out of 50		
4.	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
5.	Viva-voce shall be conducted for individual student and not in a group.		

CO-PO Mapping (planned)													**CO-PSO Mapping (planned)**		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
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	Programming Proficiency	Embedded System and IoT Application.	Embedded Engineers
2	Peripheral Interfacing	Embedded System and IoT Application.	Embedded- IoT- Firmware Design Engineer
3	Hardware Design and Selection	Embedded System and IoT Application.	Embedded- IoT- Firmware Design Engineer

6th Semester Syllabi

Artificial Intelligence and Machine Learning (Integrated)

Course Code	22CS61	**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 understand various artificial intelligence techniques
2.	To understand different logical systems for inference over formal domain representations
3.	To understand basic concepts of machine learning
4.	To apply artificial intelligence and machine learning techniques to real world problems

Required Knowledge of: Algorithm, Probability, Discrete Mathematical Structures	
Unit – I	**Contact Hours = 8 Hours**
Introduction to Artificial Intelligence: Introduction, A brief history of AI, what is AI, Strong Methods, and Weak Methods, Uses and Limitations **Knowledge Representation:** Need for good representation, Semantic nets, Frames, Search Spaces, Semantics Tress, Search Trees, Combinatorial Explosion, Problem reduction, Goal Trees	

Unit – II	**Contact Hours = 8 Hours**
Search Methodologies: Introduction, Problem solving as search, Data driven or goal driven search, Generate and test, Properties of search methods, Depth First Iterative Deepening, Using Heuristics for Search, Hill Climbing, Best-First Search, Identifying Optimal Paths, Constraint Satisfaction Problem **Aspects of No Code AI**	

Unit – III	**Contact Hours = 8 Hours**
Game Playing: Game trees, Minimax, Alpha beta pruning **Introduction to Machine Learning-I**: Introduction, Training Rote Learning, Learning Concepts, General-to-Specific Ordering, Version Spaces, Candidate Elimination, Decision-Tree Induction, The Problem of Overfitting, Reinforcement Learning, The Nearest Neighbor-K nearest neighbor algorithm	

Unit – IV	**Contact Hours = 8 Hours**
Introduction to Machine Learning-II: Linear regression, Support vector machine, Clustering-K means clustering, Principal Component Analysis (PCA) **Neural Networks:** Introduction, Neurons, Perceptrons, Multilayer Neural Networks- Backpropagation algorithms, Recurrent Networks, Unsupervised Learning Networks	
Unit – V	**Contact Hours = 8 Hours**
Bootstrapping & Cross Validation, Ensemble Methods – Bagging, Gradient Boosting, Random Forests, Boosting **Probabilistic Reasoning and Bayesian Belief Networks:** Introduction, Probabilistic Reasoning, Joint Probability Distributions, Bayes' Theorem, Simple Bayesian Concept Learning, Bayesian Belief Networks, The Noisy-V Function, Bayes' Optimal Classifier, The Naïve Bayes Classifier	

Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	1	2	3	3	1

List of Experiments

Unit No.	No. of Experiments	Topic(s) related to Experiment
II	3	DFID algorithm
		Heuristic search algorithm
		A* algorithm
III	2	Game trees
		Find-S algorithm
IV	4	Single Layer Perceptrons
		Backpropagation
		Unsupervised learning networks
		Clustering algorithm
V	1	Naïve Bayes Algorithm

Unit No.	Self-Study Topics
I	Inheritance, Object-oriented programming
II	Depth First Search, Breadth First Search, Implementation of Depth-First and Breadth-First Search, Beam Search
III	Supervised Learning, Unsupervised Learning, Underfitting
IV	Preprocessing, Class Evaluation Measures
V	Collaborative Filtering

Books	
	Text Books:
1.	Ben Coppin, Artificial Intelligence Illuminated, Jones and Bartlett, 2004
2.	Tom M. Mitchell, "Machine Learning", Mcgraw-Hill Education (Indian Edition),2013
	Reference Books:
1.	Elaine Rich Kevin Knight, Shivashankar B Nair: Artificial Intelligence, Tata McGraw Hill 3rd edition 2013.
2.	Stuart Russel, Peter Norvig: Artificial Intelligence A Modern Approach, Pearson 3rd edition 2013.
3.	Ethem Alpaydin, "Introduction to Machine Learning", 2nd Edition, PHI Learning Pvt. Ltd. 2013
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://nptel.ac.in/courses/106105077
2.	https://nptel.ac.in/courses/106106139

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Assignment (OA)/ Lab Project/ Industry assignment/Certification/ Course project
3.	Flipped Classes	3.	Lab Test
4.	Practice session/Demonstrations in Labs	4.	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.	**Apply** difficult real-world problems in a state space representation to solve them using AI techniques	Ap	1,2,3,5,12	1,2,3
2.	**Understand** the informed and uninformed problem types and **apply** search strategies to solve them.	Ap	1,2,3,5,12	1,2,3
3.	**Understand** the basics of machine learning and neural networks to solve real world problems	An	1,2,3,5,12	1,2,3
4.	**Understand** the concepts in Bayesian analysis from probability models and methods	Re	1,2,3,5,12	1,2,3
5.	**Apply** the learnings inculcated throughout the course and **develop** a course project / present a seminar on that	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**	**Conduction**	**Lab test**	
30 marks	30 marks	10 marks	30 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

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: 15 marks
5. Viva voce: 10 marks

Eligibility for SEE:

1. **Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests. Lack of minimum score in IA test will make the student Not Eligible for SEE**

2. **Student should score minimum 40% of 30 marks (i.e. 12 marks) in Lab test & should score 40% of 40 marks (i.e. 16 marks) in Lab component.**
3. Lab test is COMPULSORY
4. **Minimum score in CIE to be eligible for SEE: 40 OUT OF 100.**
5. 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 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (planned)													**CO-PSO Mapping (planned)**		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**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 Industry Sectors & domains**	**Job roles students can take up after undergoing the course**
1	Data modeling and evaluation	Healthcare Sector	Data Scientist
2	Proficiency in conceptual knowledge of neural networks	e-commerce	Machine Learning Engineer
3	Build classifiers	Banking and finance	Business Intelligence Developer

Computer Networks

Course Code	22CS62	**Course type**	PCC	**Credits L-T-P**	4 – 0 - 0
Hours/week: L - T- P	4 – 0 – 0			**Total credits**	4
Total Contact Hours	L = 50 Hrs; T = 0 Hrs; P = 0 Hrs Total = 50 Hrs			**CIE Marks**	100
Flipped Classes content	10 Hours			**SEE Marks**	100

Course learning objectives	
1.	To provide an understanding of the basics of computer networking.
2.	To inculcate the knowledge of various protocols including Application layer, Transport layer and Network layers used in computer Networks.
3.	To familiarize the connection-oriented and connection-less services including their applications in computer networks.
4.	To inculcate programming skills on Routing Algorithms and the error detection and correction techniques.

Pre-requisites : Fundamentals of basic mathematics, Data Structures and algorithms, Operating systems.

Unit – I	**Contact Hours = 10 Hours**
Introduction to Computer Networks and the Internet: What Is the Internet? The Network Edge, Network Devices, Network Architecture, Network Topologies, The Network Core, Delay, Loss, and Throughput in Packet-Switched Networks, Protocol Layers and Their Service Models, Introduction to various Networking devices like like routers/gateway/firewall.	

Unit – II	**Contact Hours = 10 Hours**
Application Layer: Principles of Network Applications, The Web and HTTP, File Transfer: FTP Commands and Replies, Electronic Mail in the Internet, SMTP, POP3, DNS, P2P, Video Streaming, Content Distribution Networking, The Internet's Directory Service, Peer-to-Peer Applications-Bit Torrent File distribution protocol. Domain Name System (DNS)	

Unit – III	**Contact Hours = 10 Hours**
Transport Layer: Introduction and Transport-Layer Services, Multiplexing and De-multiplexing, Connectionless Transport: UDP, Principles of Reliable Data Transfer: Go-Back-N and Selective Repeat, Connection-Oriented Transport: TCP. TLS 1.3 and QUIC protocol. Demonstration of Network Analysis Tool.	

Unit – IV	**Contact Hours = 10 Hours**
The Network layer: Introduction, Virtual Circuit and Datagram Networks, inside a Router, The Internet Protocol (IP): Forwarding and Addressing in the Internet. Configuring IPv4, IPv6, IPSec, Subnetting and Supernetting Configuring Network devices such as router, gateway, firewall.	

Unit – V	Contact Hours = 10 Hours
The Link Layer: Links, Access Networks, and LANs: Introduction to the Link Layer, Error Detection and Correction Techniques, Multiple Access Links and Protocols, Introduction to Link Virtualization and Data Center Networking.	

Flipped Classroom Details

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

Unit No.	Self-Study Topics
I	Network Security.
II	Cookies & web caching.
III	Link virtualization, Data Centre Networking.

Books	
	Text Books:
1.	James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth edition, Pearson, 2013.
	Reference Books:
2.	Behrouz A Forouzan, Data and Communications and Networking, Fifth Edition, McGraw Hill, Indian Edition
3.	Larry L Peterson and Brusce S Davie, Computer Networks, fifth edition, ELSEVIER
4.	Andrew S Tanenbaum, Computer Networks, fifth edition, Pearson
5.	Mayank Dave, Computer Networks, Second edition, Cengage Learning
	E-resources (NPTEL/SWAYAM.. Any Other)
1.	https://nptel.ac.in/courses/106105081/
2.	https://onlinecourses.swayam2.ac.in/cec19_cs07/

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 Assignment (OA)/ Certification
		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.	**Explain** the basics of computer networking and its real world applications	Un	1	1

2.	**Demonstrate** the connection oriented and connection-less services and analyze the packet transfer using Network simulator tool like Wireshark.	Un, An	1,4,5	1,2
3.	**Analyze** the concept of Routing and forwarding using IPV6 and IPV4.	An	1,2,3,4	1,2
4.	**Develop** the programs to implement the error detection and correction techniques.	Ap	1,2,3	1,2,3

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Two Assignments – (Open /Industry/Certification etc)	Course project (CP)/ Case study etc	Total Marks
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

-Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.
-Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests.
-Lack of minimum score in IA test will make the student Not Eligible for SEE
-Minimum score in CIE to be eligible for SEE: 40 OUT OF 100.
2

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 three parts **A, B and C**. Students have to answer 1. From Part A answer any 5 out of 7questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2questions, each Question Carries 20 Marks.

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
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	Analytical skills	Cisco Systems., IBM, Infosys Technologies, TCS, Bharti Airtel, HCL.	Network Analyst, Network administrator.
2	Programming skills	TCS, Bharti Airtel, HCL.	Network Analyst , Network administrator.

Agile Software Development

Course Code	22CS631	**Course type**	PEC	**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.	**Understand** the Agile methodology, its underlying principles (like the Agile Manifesto), and the reasons for adopting Agile in software development.
2.	**Apply** Agile practices, such as Extreme Programming (XP), pair programming, and stand-up meetings, and use Agile tools like user stories and Agile testing methods.
3.	**Analyze** Agile project results, assessing factors like iteration planning, release frequency, and code quality to evaluate project success.
4.	**Create** Agile-based solutions for software projects, utilizing Agile concepts, values, and best practices to deliver value and promote continuous improvement.

Pre-requisites: Software Engineering

Unit – I	**Contact Hours = 8 Hours**
Agile Fundamentals. Understanding Success, Beyond Deadlines, The Importance of Organizational Success, Enter Agility, How to Be Agile? Agile Methods, Don't Make Your Own Method, The Road to Mastery, Find a Mentor. The Genesis of Agile, Introduction and background, Agile Manifesto, and Principles, Simple Design, User Stories, Agile Testing, Agile Tools.	

Unit – II	**Contact Hours = 8 Hours**
Understanding XP: The XP Lifecycle, The XP Team, XP Concepts, Adopting XP: Is XP Right for Us?, Go!, Assess Your Agility ,Overview of Extreme Programming, The Practices of Extreme Programming, Conclusion, Bibliography, Planning Initial Exploration, Release Planning, Iteration Planning, Defining "Done", Task Planning Iterating, Tracking.	

Unit – III	**Contact Hours = 8 Hours**
Practicing XP: Thinking: Pair Programming, Energized Work, Informative Workspace, Root Cause Analysis, Retrospectives Collaborating: Trust, Sit Together, Real Customer Involvement, Ubiquitous Language, Stand-Up Meetings, Coding Standards, Iteration Demo, Reporting	

Unit – IV	**Contact Hours = 8 Hours**
Mastering Agility: Values and Principles: Commonalities, About Values, Principles, and Practices, Further Reading, Improve the Process: Understand Your Project, Tune and Adapt, Break the Rules, Rely on People: Build Effective Relationships, Let the Right People Do the Right Things, Build the Process for the People, Eliminate Waste: Work in Small, Reversible Steps, Fail Fast, Maximize Work Not Done, Pursue Throughput	

Unit – V	Contact Hours = 8 Hours
Deliver Value: Exploit Your Agility, Only Releasable Code Has Value, Deliver Business Results, Deliver Frequently, Seek Technical Excellence: Software Doesn't Exist, Design Is for Understanding, Design Trade-offs, Quality with a Name, Great Design, Universal Design Principles, Principles in Practice, Pursue Mastery	

Flipped Classroom Details

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

Unit No.	Self-Study Topics
I	Agile Tools.
II	Tracking.
III	Reporting
IV	Pursue Throughput
V	Pursue Throughput

Books	
	Text Books:
1.	James shore, Chromatic, O'Reilly, The Art of Agile Development, 2007
2.	Ian Sommerville: Software Engineering, Pearson Education, 9th Edition onwards.
	Reference Books:
1.	Ken Schawber, Mike Beedle, "Agile Software Development with Scrum",Pearson, 2008
2.	2. Agile-Principles-Patterns-and-Practices-in-C by Robert C Martin & Mic Martin
	E-resources (NPTEL/SWAYAM. Any Other)
1.	https://nptel.ac.in/courses/110104073
2.	https://onlinecourses.nptel.ac.in/noc24_mg01/preview

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 Assignment (OA)/ Certification
4.	Online classes	4.	Course Project
		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.	**Describe** Agile principles and explain the Agile mindset, including the Agile Manifesto and key Agile practices.	Un	1,2	1

2.	**Apply** Agile practices like Extreme Programming (XP), pair programming, and stand-up meetings to real-world projects.	Ap	4,5,9,12	2,3
3.	**Analyze** Agile project outcomes, focusing on iteration planning, release frequency, and code quality to assess project success.	An	1,2,5	3
4.	**Develop** Agile-based solutions for software projects, emphasizing continuous improvement and delivering value.	Cr	2,3,11,12	2,3

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Two Assignments – (Open /Industry/Certification etc)**	**Course project (CP)/ Case study etc**	**Total Marks**
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

-Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.
-Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests.
-Lack of minimum score in IA test will make the student Not Eligible for SEE
-Minimum score in CIE 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 three parts **A,B and C**. Students have to answer 1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (Planned)													**CO-PSO Mapping (Planned)**		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
1	✓	✓											✓		
2				✓	✓				✓			✓		✓	✓
3	✓	✓			✓										✓
4		✓	✓								✓	✓		✓	✓
5															

Sl No	**Skill & competence enhanced after undergoing the course**	**Applicable Industry Sectors & domains**	**Job roles students can take up after undergoing the course**
1	Software Design	IT Sector, Banking, Finance, Health Care	Software Engineers
2	Software Project Management Tools		Project Manager
3	Software Testing Tools		Quality Assurance Engineer

Digital Twin Technology

Course Code	22CS632	Course type	PEC	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 and explain the concepts of Digital Twin.
2.	To understand the basic building blocks of Digital Twin.
3.	To inculcate about the Solution Architecture and Models of Digital Twin.
4.	To understand the real-time applications of Digital Twin.

Pre-requisites: Engineering Maths

Unit – I	Contact Hours = 8 Hours
Overview of Digital Twin: A Simplistic Introduction to Digital Twin, Basic Definition Digital Twin Concepts, Working Principle, Characteristics of Digital Twin, Features, Advantages of Digital Twin, Challenges.	

Unit – II	Contact Hours = 8 Hours
An Insight to Digital Twin: Understanding Digital Twin, Essential Aspects From Working Perspectives of Digital Twin, Insights to Digital Twin Technology Concept, Types of Digital Twin, Traits of Digital Twin, Value of Digital Twin	

Unit – III	Contact Hours = 8 Hours
Digital Twin Solution Architecture: Architecture Considerations, Understanding the Physical Object, Digital Twin and IoT, Digital Twin Solution Architecture, Database Considerations, Messaging, Interfaces, Digital Twin: Pros and Cons.	

Unit – IV	Contact Hours = 8 Hours
Digital Twin Models and Networks: Digital Twin Models, DT Networks (DTNs) **DTT Applications Use Cases 1:** Role of Digital Twin Technology in Medical Sector, Digital Twin as a Revamping Tool for Construction Industry, Digital Twin Applications and Challenges in Healthcare.	

Unit – V	Contact Hours = 8 Hours
DTT Applications Use Cases 2 : Blockchain for Digital Twin, Monitoring Structural Health Using Digital Twin, Role and Advantages of Digital Twin in Oil and Gas Industry, Digital Twin in Smart Cities: Application and Benefits, Digital Twin in Pharmaceutical Industry	

Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	0	1	1	2	3

Unit No.	Self-Study Topics
I	Digital Twin History and Essential Aspects
II	Introduction and Use Cases
III	Digital Twin for 6G Networks
IV	Possibilities with Digital Twin

Books	
	Text Books:
1.	Manisha Vohra, "Digital Twin Technology Fundamentals and Applications", Scrivener Publishing, First Edition, 2023 onwards.
2.	Yan Zhang, "Digital Twin Architectures, Networks, and Applications", Simula SpringerBriefs on Computing, 2024 onwards.
3.	Fei Tao, Qinglin Qi and A.Y.C. Nee, "Digital Twin Driven Service", Academic Press is an imprint of Elsevier, 2022 onwards
	Reference Books:
1.	Fei Tao, Qinglin Qi and A.Y.C. Nee, "Digital Twin Driven Service", Academic Press is an imprint of Elsevier 125 London Wall, London EC2Y 5AS, United Kingdom, 2022.
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://www.csccm.in/courses/introduction-to-digital-twins

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Assignment (OA)/ Certification
3.	Flipped Classes	3.	Course Project
4.	Online classes	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.	**Classify** and I**llustrate** the behavior of Digital Twins	Un	1	1
2.	**Demonstrate** the working and the working, concepts and architectural solution of Digital Twin	Un	1,2,3	1, 2
3.	**Apply** the various real worls use case application of Digital Twin	Ap	2,3,4,12	1, 2
4.	**Analyze** the requirements for a real world problem or a specification and develop a course seminar as the solution.	An	2, 3, 4, 9, 10, 12	1, 2

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Two Assignments – (Open /Industry/Certification etc)	Course project (CP)/ Case study etc	Total
Marks	30 + 30 = 60 marks	10 + 10 = 20 marks	20 marks (with report & presentation)	100

-Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.
-Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests.
-Lack of minimum score in IA test will make the student Not Eligible for SEE
-Minimum score in CIE 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 three parts **A, B and C**. Students have to answer 1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
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	Collect and analyze data to optimize performance.	Automotive, Manufacturing, Aerospace, Healthcare, Energy, Logistics and Supply Chain	Digital Twin Engineer, Data Scientist/Analyst, Simulation Engineer, Systems Engineer, Product Lifecycle Manager, Research Scientist, IT Specialist
2	Develop and implement digital twin models for products, processes, or systems.		

Internet of Things

Course Code	22CS633	Course type	PEC	Credits L-T-P	2-0-1
Hours/week: L - T- P	2 - 0 – 2			Total credits	3
Total Contact Hours	L = 30 Hrs; T = Hrs; P = 20 Hrs Total = 50 Hrs			CIE Marks	100
Flipped Classes content	10 Hours			SEE Marks	100

Course learning objectives	
1.	To equip students with a thorough understanding of IoT, its components, architecture, and protocols, laying a strong foundation for further learning and application.
2.	To develop students' ability to comprehend and implement IoT sensing and actuation, enabling them to design and build effective IoT systems.
3.	To Instruct students on how to effectively program Arduino UNO and Raspberry Pi boards, interface sensors, and develop basic projects that involve reading sensor data and controlling external devices based on sensor inputs.
4.	To provide students with a comprehensive understanding of IoT applications in various domains such as agriculture, transportation, and healthcare by analyzing relevant case studies.

Required Knowledge of : Micro-Controllers and Embedded Systems.

Unit – I	Contact Hours = 10 Hours
Introduction to Internet of Things: Introduction, Definition and Characteristics of IoT, Physical design of IoT, Things in IoT, IoT Protocols, Logical Design of IoT, IoT functional blocks, IoT Communication Models, IoT Communication APIs, IoT Enabling Technologies, IoT levels and Deployment Templates. **Domain Specific IoTs:** Introduction, Home Automation, Environment.	

Unit – II	Contact Hours = 10 Hours
IoT Sensing and Actuation: Introduction, sensors, sensor characteristics, sensorial deviations, sensing types, sensing considerations, actuators, actuator types, actuator characteristics.	

Unit – III	Contact Hours = 10 Hours
Arduino UNO: What is Arduino, Boards, IDE, Arduino Programming: Basic structure of Arduino program, Functions, Variables, Arrays, Arithmetic operators, constants: True/False, High/ Low, Input/Output, if…else, pinMode, digitalRead, digitalWrite, analogRead(pin). Interfacing sensors with Arduino UNO.	

Unit – IV	Contact Hours = 10 Hours
Introduction to Raspberry Pi: Arduino vs Raspberry Pi, installation, remotely accessing the Raspberry Pi, introduction to python basics, accessing GPIO pins, Configuring WiFi on Raspberry Pi. Interfacing sensors with Raspberry Pi.	

Unit – V	Contact Hours = 10 Hours
IoT case studies and Future trends: Agricultural IoT, Introduction, case study: smart irrigation management system, Vehicular IoT, case study: Crime assistance in a smart IoT transportation system, Healthcare IoT, case study: AmbuSens system.	

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
I	**2**	Simple I/O Applications using Arduino UNO
II	**2**	Interfacing various sensors with Arduino UNO.
III	**2**	Interfacing various peripheral devices like 7-segment display, LCD, DC motor with Arduino UNO.
IV	**2**	Interfacing various sensors with Raspberry Pi, sending/receiving data to/ from cloud.
V	**2**	Implementing case studies using Arduino UNO and Raspberry Pi.

Unit No.	Self-Study Topics
I	Domain Specific IoTs: Introduction, Home Automation, Environment.
II	Actuator characteristics.
III	Boards.
IV	Installation.
V	Case study: AmbuSens system.

Books	
	Text Books:
1.	Arshdeep Bagha, Vijay Madishetti, Internet of Things A Hands- on Approach, Universities Press, 2014.
2.	Sudip Misra, Anandarup Mukherjee, Arijit Roy, Introduction to IoT, Cambridge University Press, 2021.
3.	Mayur Ramgir, Internet of Things- Architecture, Implementation, and Security, Pearson Education India, 2019.
	Reference Books:
1.	David Hanes, Gonzalo S, Patrick G, Rob Barton, Jermone Henry, Rowan T, IoT Fundamentals Networking Technologies, Protocols, and Use Cases for the Internet of Things, Pearson (Cisco press) 2018.
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://onlinecourses.nptel.ac.in/noc22_cs53/preview.
2.	https://www.udemy.com/course/arduino-programming-and-interfacing/.
3.	https://nptel.ac.in/courses/106105166

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 the overview of Internet of Things, its associated components, IoT Architecture and Protocols.	Un	1,2	1
2.	Design and implement effective IoT systems with sensors and actuators while considering their characteristics, limitations, and practical considerations.	Ap	1,2,3,5	1,2
3.	Program Arduino UNO/ Raspberry Pi boards, interface sensors with the board, and develop basic projects involving reading sensor data and controlling external devices based on sensor inputs.	Ap	1,2,3,5	1,2
4.	Analyze and evaluate real-world IoT implementations and gain insights into the future trends and possibilities of IoT technology.	An	2,3,5,6,7	1,2
5.	Analyse the requirements for a real world problem or a specification and develop a course project as the solution	An	1,2,3,5,6,7, 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.

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. -Submission of 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 $\geq$ 35%, however overall score of CIE + SEE should be $\geq$ 40%.		
4.	SEE will be conducted in project batches by **Internal & External examiners** together.		

Sl. No.	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Build IoT solutions for various applications.	Embedded System and IoT Application.	Embedded Engineers
2	Program Arduino UNO/ Raspberry Pi boards for various applications.	Embedded System and IoT Application.	Embedded- IoT- Firmware Design Engineer
3	Develop the IoT systems in the given domain.	Embedded System and IoT Application.	Embedded- IoT- Firmware Design Engineer

CO-PO Mapping (planned)													**CO-PSO Mapping (planned)**		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
1	✓	✓											✓		
2	✓	✓	✓		✓								✓	✓	
3	✓	✓	✓		✓								✓	✓	
4		✓	✓		✓	✓	✓						✓	✓	
5	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
Tick mark the CO, PO and PSO mapping															

Compiler Design

Course Code	22CS634	Course type	PEC	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 familiarize the structure of a compiler and activities of different phases of the compilation process
2.	To provide an insight into the design strategy for front end of a compiler
3.	To get acquainted with the techniques to optimize and to build efficient target code
4.	To demonstrate projects on regular expressions , grammars and parsers.

Pre-requisites : Knowledge of programming, Finite Automata and Formal languages

Unit – I	Contact Hours = 8 Hours
Introduction and Lexical Analysis: **Introduction**: **Language Processor, Structure of Compiler:** Lexical Analysis, Syntax Analysis, Semantic Analysis, Intermediate Code Generation, Code Optimization, Code Generation, Symbol Table Management, The Grouping of Phases into Passes, Compiler-Construction Tools **Lexical Analysis: The Role of Lexical Analyzer:** Lexical Analysis Versus Parsing, Tokens, Patterns, and Lexemes, Attributes for Tokens, Lexical Errors; **Input Buffering:** Buffer pairs, Sentinels; **Specification of Tokens:** Strings and Languages, Operations on Languages, Regular Expressions, Regular Definitions, Extensions of Regular Expressions; **Recognition of Tokens:** Transition Diagrams, Recognition of Reserved Words and Identifiers, Completion of the Running Example, Architecture of a Transition-Diagram-Based Lexical Analyzer	

Unit – II	Contact Hours = 8 Hours
Syntax Analysis-1: **Introduction:** The Role of the Parser, Representative Grammars, Syntax Error Handling, Error Recovery Strategies; **Context-Free Grammars:** The Formal Definition of a Context-Free Grammar, Notational Conventions, Derivations, Parse Trees and Derivations, Ambiguity, Verifying the Language Generated by a Grammar, Context-Free Grammars Versus Regular Expressions; **Writing a Grammar:** Lexical Versus Syntactic Analysis, Eliminating Ambiguity, Elimination of Left Recursion, Left Factoring; **Top-Down Parsing:** Recursive-Descent Parsing, FIRST and FOLLOW, LL(l) Grammars, Non-recursive Predictive Parsing, Error Recovery in Predictive Parsing	

Unit – III	Contact Hours = 8 Hours
Syntax Analysis-2: **Bottom-up Parsing:** Reductions, Handle Pruning, Shift-Reduce Parsing, Conflicts During Shift-Reduce Parsing; **Introduction to LR Parsing: Simple LR:** Items and the LR(O) Automaton, The LR-Parsing Algorithm, Constructing SLR-Parsing Tables, Viable Prefixes; **More Powerful LR Parsers:** Canonical LR(l) Items, Constructing LR(l) Sets of Items, Canonical LR(l) Parsing Tables, Constructing LALR Parsing	

Unit – IV	Contact Hours = 8 Hours
Syntax-Directed Definitions and Syntax-Directed Translation Schemes: Inherited and Synthesized Attributes, Evaluating an SDD at the Nodes of a Parse Tree; **Evaluation Orders for SDD's:** Dependency Graphs, Ordering the Evaluation of Attributes, S-Attributed Definitions, L-Attributed Definitions; **Applications of Syntax-Directed Translation:** Construction of Syntax Trees (Only S-Attributed) **Syntax-Directed Translation Schemes:** Postfix Translation Schemes, Parser-Stack Implementation of Postfix SDT's	

Unit – V	Contact Hours = 8 Hours
Intermediate Code Generation and Code Generation: **Variants of Syntax Trees:** Directed Acyclic Graphs for Expressions, The Value-Number Method for Constructing DAG's; **Three-Address Code:** Addresses and Instructions, Quadruples, Triples, Static Single-Assignment Form; **Translation of Expressions:** Operations Within Expressions **Control Flow statements** **Code Generation:** Issues in the design of Code Generator, The Target language, Basic blocks and Flow graphs; Optimization of basic blocks; A Simple Code Generator	

Flipped Classroom Details

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

Books	
	Text Books:
1.	Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D Ullman- Compilers- “Principles, Techniques and Tools”, 2/E, Addison-Wesley, 2007
	Reference Books:
1.	D. M. Dhamdhere, “System Programming and Operating Systems”, 2nd revised edition, Tata McGraw - Hill, 2009 reprint
	E-resources (NPTEL/SWAYAM. Any Other)- mention links
1.	https://nptel.ac.in/courses/128106009
2.	https://ocw.mit.edu/courses/6-004-computation-structures-spring-2017/pages/c11/c11s2/

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 Assignment (OA)/ Certification
4.	Online classes	4.	Course Project
		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.	**Explainthe fundamental concepts in the design of a compiler**	Un	1	1
2.	**Analyze** the requirements for front end design of a compilerand apply the techniques for a given specification.	An	1,2,3,4	1,2,3
3.	**Apply** the concept of syntax directed translation to aid intermediate code generation.	Ap	1,2,3,4	1,2,3
4.	**Apply** the learnings inculcated throughout the course and **develop** a course project / present a course seminar.	An	1,2,3,4,5,9,10, 11,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Two Assignments – (Open /Industry/Certification etc)**	**Course project (CP)/ Case study etc**	**Total Marks**
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

-Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.
-Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests.
-Lack of minimum score in IA test will make the student Not Eligible for SEE
-Minimum score in CIE 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 three parts **A, B and C**. Students have to answer 1. From Part A answer any 5 out of 7questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosingany one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2questions, each Question Carries 20 Marks.

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
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	Understand phases of a Compiler	IT Services	Programmer
2	Design and Develop the front end of a compiler	Private Sector	Compiler Engineer
3	Comprehend the concepts for back end design of a compiler	IT or Academia	Software Engineer

Introduction to Salesforce (Industry Supported Elective)

Course Code	22CS635	**Course type**	PEC	**Credits L-T-P**	**2-0-1**
Hours/week: L - T- P	2 - 0 – 2			**Total credits**	3
Total Contact Hours	L = 30 Hrs; T = 0 Hrs; P = 20 Hrs Total = 50Hrs			**CIE Marks**	100
Flipped Classes Content	10 Hours			**SEE Marks**	100

Course learning objectives	
1.	To introduce fundamentals of Salesforce and its components used for multiple domains.
2.	To provide an understanding o f the Salesforce terminologies and the different operations involved in constructing an informative system
3.	To develop ability to access or populate tables as an object in Salesforce database to create new processes based on the demands by users.
4.	To provide a solution to real world problems with the help of lightning tools and extensions using reusable components.

Required Knowledge of: Database Management Systems and Enterprise Management.

Unit – I	**Contact Hours = 10 Hours**
Introduction: Getting Around the App, Salesforce Platform Basics: Get started with salesforce platform. Discover Use Cases for the Platform, Understand the Salesforce Architecture, Navigate Setup, Power Up with AppExchange, Data Model: Understand Custom & Standard Objects, Create Object Relationships, Work with Schema Builder, Lightning Experience: Get Your Bearings, Navigate Around, Work with List Views, Work with Your Data, Company-Wide Org Settings: Learn About Regional Settings, Discover Multiple Currency Settings.	

Unit – II	**Contact Hours = 10 Hours**
Getting Your Organization Ready for Users: Lightning Experience Productivity: Elevate Your Daily Productivity, Work with Notes and Files, Manage Your Tasks, Events, and Email, Find Your Stuff with Search, Collaborate with Feeds and Groups, Analyze Your Data with Reports and Dashboards, Configuring Search Settings: Choose the Right Search Solution, Optimize Search Results, Setting Up Chatter (Classic): Get Started with Chatter, Enable Feed Tracking, Create Publisher Actions, Approve Records from the Feed, Develop a Rollout Strategy, Support a New Business Unit: Manage User Access, Manage Chatter, Modify Your Data Model, Configure an Email Letterhead and Template, Automate Your Business Process, Mobile Access with Salesforce1.	

Unit – III	**Contact Hours = 10 Hours**
Elementary SCTP Sockets: Interface Models, shutdown function, Notifications. **Setting Up and Managing Users:** Managing Users and Introduction to Data Security, Activity Management: Activities: Tasks, Events, and Calendars Documentation. **Security and Data Access:** Data Security, Who Sees What.	

Unit – IV	Contact Hours = 10 Hours
Lightning Experience Customization: Customize the Lightning Experience user interface without writing any code, Reports and Dashboards: Introduction to Reports and Dashboards, Creating New Reports with the Report Builder, Running and Modifying Reports, Format Reports with Summary, Tabular, Matrix and Joined, Building Dashboards, Email Templates and Letterheads: Email Templates and LetterHeads, Automation: Difference Between Workflow Rules and Process Builder, Process Builder, Lead Automation.	

Unit – V	Contact Hours = 10 Hours
Managing the Support Process: Managing and Resolving Cases, Customizing a Support Process, Automating Support, Understanding the Salesforce Console for Service, Collaborating in the Service Cloud, Analyzing Support Data, Lightning App Builder: Build custom pages for Lightning Experience and the Salesforce mobile app quickly with point-and-click tools.	

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
I	**1**	Salesforce Trailhead account/ profile creating and customizing the interface
II	**2**	Create users & rights, Lightning Experience, Elevate Daily Productivity using tools, Notes and Files, Manage Your Tasks, Events, and Email
III	**3**	Introduction to Business Process: Who Sees What, Object Customizations: Creating Picklist and Picklist Administration, Creating Formula Fields and Validation Rule, Working with Page Layouts, Working with Record Types
IV	**2**	Lightning Experience Customization: Customize the Lightning Experience user interface without writing any code, Reports and Dashboards: Introduction to Reports and Dashboards, Creating New Reports with the Report Builder
V	**2**	Customizing a Support Process, Automating Support, Understanding the Salesforce Console for Service, Collaborating in the Service Cloud, Analyzing Support Data, Lightning App Builder

Unit No.	Self-Study Topics
I	Salesforce platform features and facilities available for business application development. A brief historical background towards customer relationship management (CRM).
II	Getting Profile Organization Ready for Users & Lightning Experience in salesforce
III	Salesforce business use-cases, modular approach to Project design and development
IV	Salesforce clouds and interfaces for business development
V	Business support and customer relationship management for business continuity

Books	
	Text Books:
1.	Paul Goodey ,Salesforce CRM - The Definitive Admin Handbook, Packt Publishing ,4th Edition Copyright ©,2016
	Reference Books:
1.	Basics of salesforce- Salesforce Docs @salesforcedocs 19 Dec 2019
2.	Best Practices for Implementing Salesforce CRM- SalesforceDocs @ salesforcedocs Dec 2019
	E-resourses (NPTEL/SWAYAM. Any Other)- mention links
1.	https://trailhead.salesforce.com

Course delivery methods	Assessment methods	
Chalk and Talk	1.	IA tests- Theory & Lab based
PPT and Videos	2.	Project phase 1 & 2
Flipped Classes	3.	SEE- Project evaluation
Practice session/Demonstrations in Labs	4.	SEE- Solving an Open ended problem
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.	**Identify** the Salesforce terminologies to make use for products of different commodity	Un	1,2	1
2.	**Describe** the uses of Salesforce in the business world as a good promotional means for marketing the products.	Un	2,3,5	1,2
3.	**Apply** the techniques to retrieve the customer needs by means of Salesforce designs and options	Ap	1,2,3,4,5	1,2,3
4.	**Categorize** and **build** the solutions with suitable mode of representation for the domain requirements using the lightning trends.	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.

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. c. 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 > 40%.		
4.	SEE will be conducted in project batches by **Internal & External examiners** together.		

CO-PO Mapping (planned)													CO-PSO Mapping (planned)		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
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	Students can apply appropriate Components of salesforce to provide service to the customers.	Service based Industry	Salesforce Administrator Salesforce Business Analyst Salesforce Developer Salesforce Functional Consultant Salesforce Platform Manager Salesforce Solution Architect Salesforce Technical Architect
2	Have a knowledge about Interactive applications and salesforce terminologies.		
3	Students can solve real world problems.		

PwC Launchpad Program (Project based)
MOU-Credit based

Course Code	**22INT61**	**Course type**	**Integrated Project based**	**Credits L-T-P**	3-0-0
Hours/week: L - T- P	2 - 0 – 2			**Total credits**	3
Total Contact Hours	L = Hrs; T = Hrs; P = Hrs Total = 40 Hrs			**CIE Marks**	100
Flipped Classes content	5 Hours			**SEE Marks**	100

Course learning objectives	
1.	To introduce basic programing principles, fundamentals of Object Oriented approach and benefits of Agile features in the IT domain.
2.	To gain an understanding of RDBMS concepts using MySQL database to perform various functions and develop informative reports.
3.	Use design aspects of Java programming and implement its features through the integrated development environment to deploy end user applications.
4.	To learn the key concepts of Customer Relationship Management on the Salesforce platform and its terminologies through the cloud services.

Required Knowledge of: Programming language basics, uses of commercial software applications and related data manipulations.

Unit – I IT Fundamentals	**Contact Hours = 7 Hours**
Content of the Unit: **Conditions, iterations and Arrays in a Pseudocode, features of Agile and its benefits, various tiers of an application, the difference between layered and tiered architecture and Object-Oriented Principles (OOP) - Abstraction, Encapsulation, Hierarchy, Polymorphism, Modularity, Typing and Persistence.**	

Unit – II RDBMS Using MySQL	**Contact Hours = 7 Hours**
Content of the Unit: **Data is creation, organization, storage, to retrieve from a database and working with the MySQL database to perform various computations, and functions. RDBMS concepts Data definition, Data manipulation, select statements, Scalar & Aggregate functions, Joins and Subqueries, Views.**	

Unit – III Programming Fundamentals Java	**Contact Hours = 10 Hours**
Content of the Unit: **Various object-oriented features and design and program stand-alone Java applications, and you will learn the basics of Java, Eclipse IDE, Classes and Objects, Array and Strings, Regular expression**	

Unit – IV Salesforce - Intro	**Contact Hours = 6 Hours**
Content of the Unit **Basic CRM, Fundamentals of the Salesforce Platform, terminologies of use, Explore Various Salesforce Clouds**	

Unit – V	Contact Hours = 10 Hours
Content of the Unit: **Salesforce Lightning, Components used in Lightning, Salesforce flows, Dashboard and Reports.**	

Flipped Classroom Details

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

Unit No.	Self-Study Topics
1	Salesforce Basics: Understanding Salesforce ecosystem, Navigation and UI familiarity.
2	Salesforce Administration: User management and security settings, Customizing objects, fields, and page layouts.
3	Workflow rules and process automation, Reports and dashboards creation.
4	Salesforce Connect External objects and data sources Middleware tools.

Books	
	Text Books:
1.	Salesforce Lightning Platform Enterprise Architecture" Author: Andrew Fawcett Copyright © 2018 Packt Publishing
2.	Salesforce CRM - The Definitive Admin Handbook,4th Edition, Paul Goodey, Copyright © 2016 Packt Publishing
3.	Salesforce Essentials for Administrators" 2nd Edition Mohith Shrivastava Copyright © 2018 Packt Publishing
	Reference Books:
1.	Best Practices for Implementing Salesforce CRM- SalesforceDocs @ salesforcedocs Dec 2019
2.	Salesforce Lightning Platform Enterprise Architecture" by Andrew Fawcett Copyright © 2018 Packt Publishing.
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://www.salesforce.com/learning//customer-relationships/
2.	https://trailhead.salesforce.com/content/learn/modules/trailhead_playground_management

PwC Course delivery methods		PwC Assessment methods	
1.	Masterclass and Discussions (once or twice as decided by company)	1.	CIE - IA tests and Assignment - Unit wise
2.	Question and Answer sessions	2.	Project progress assessment - phases wise maintained at company.
3.	Demonstrations / Hands-on sessions	3.	▪ SEE- Project Demonstration, Viva and Project report submission. ▪ Student has to submit a copy of project report has to respective department for the purpose of documentation.
4.	▪ Course Document and Videos sharing. ▪ Virtual Labs (as decided by company)		

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** the significance of information technology deployed through common programing methods and business automation techniques.	Un	1,6	1
2.	**Articulate** the necessary information utilizing a relational database system that integrates data from multiple sources in the context.	Ap	4,7,10	1,3
3.	**Analyse** customer needs, trends and preferences with Salesforce's tools that help to improve customer relationships management opportunities.	An	2,5,12	2
4.	**Categorize** and develop a solutions with salesforce lightning mode of representation that fulfils domain requirements	Cr	3,7,11	1,3

Scheme of Continuous Internal Evaluation (CIE):

- The demonstration of **Industry project (COMPULSORY)** will be part of **SEE.**
- As stated in aforesaid point, **No Theory Examination** of (3) Hrs. as part of **SEE** for this course.

CIE- Theory & Lab				**TOTAL**
IA Test1	**IA Test2**	**Asgmt-1**	**Asgmt-2**	
25 marks	25 marks	25 marks	25 marks	100 marks

- 2 IA tests content and time decided by PwC.
- 2 Assignments given during distinct phases of course progress.
- Assessment results of both IA-Tests and Assignments of PwC post evaluation will be shared with individual departments/ faculty in-charge

Eligibility for SEE:

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

Scheme of Semester End Examination (SEE): Evaluation of Project through demonstration.

Project / Demo / Viva					
Project Devp.	**Project Demo**	**Project Viva**	**Project Report**	**TOTAL**	
50 marks	30 marks	10 marks	10 marks	100 Marks	
1.	Project development and demonstration are part of SEE consisting of (100) marks. In the college campus demonstration conducted by **Internal & External examiners.**				
2.	a. Project batch size varies from min 2 students to max 4 students decided by company based on proposed project objectives and volume of work planned / involved. b. Project once approved, the work progress and development assessments done by the company. c. Evaluation results of a project shared with college / department / faculty in-charge for further processing.			50 marks	100 marks
	Project evaluation			30 marks	

	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. c. Viva-voce. d. Submission of Project report to the college / respective department is compulsory.	10 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%.		

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															

Name & Signature of Faculty members involved in designing the syllabus
Prof. S.K Madi(ISE)
Dr. Arundhati V.Nelli(CSE)

Name & Signature of Faculty members verifying/approving the syllabus

Sl No	**Skill & competence enhanced after undergoing the course**	**Applicable Industry Sectors & domains**	**Job roles students can take up after undergoing the course**
1	Students can apply appropriate Components of salesforce to provide service to the customers.	Service based Industry	Salesforce Administrator Salesforce Business Analyst Salesforce Developer Salesforce Functional Consultant Salesforce Platform Manager Salesforce Solution Architect Salesforce Technical Architect
2	Have a knowledge about Interactive applications and salesforce terminologies.		
3	Students can solve real world problems.		

HOD (ISE) HOD (CSE) DEAN Academics

Data Structures

Course Code	22CS641	**Course type**	**OEC**	**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 bring out the importance of data structures in a variety of applications.
2.	To introduce linear (arrays, linked list, doubly linked list) and nonlinear data structures (Binary Tree).
3.	To present the advantages and applications of hashing.

Pre-requisites: Basic computer concepts & C programming

Unit – I	**Contact Hours = 8 Hours**
Basic Concepts: Data Structures: Introduction to Data Structures, Pointers and Dynamic Memory Allocation; Malloc (), Realloc(), Calloc(), free(), Structures : Initialization, Declaration, Accessing Structures, Internal implementation of structures. Program examples	

Unit – II	**Contact Hours = 8 Hours**
Stacks and Queues: Stacks, Implementation of basic stack operations: Push, Pop, Display. Queues, Queues operations: Insert, Delete, Display. Converting infix to postfix expressions, Evaluation of an Expressions. Applications of stack and Queues.	

Unit – III	**Contact Hours = 8 Hours**
Linked Lists: **Singly Linked list:** Insert a node from the front end, insert a node from the rear end, delete a node from the front end, delete a node from the rear end, Representing Chains in C, Additional List operations: Traversing the List, Display the number of nodes in the list, Search a node from the list. **Circular LinkedList**: Insert a node from the front end, insert a node from the rear end, delete a node from the front end, delete a node from the rear end.	

Unit – IV	Contact Hours = 8 Hours
Trees: Introduction, Representation of Trees: List Representation, Left-Child Right-child sibling Representation, Binary tree Representation, Binary Tree Traversal: Preorder Traversal, In order Traversal, Post order Traversal. Binary Search Tree: Insertion, Searching. Applications of Trees.	

Unit – V	Contact Hours = 8 Hours
Hashing: Introduction, Hashing methods, Collision Resolution Techniques.	

Flipped Classroom Details

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

Books	
	Text Books:
1.	Horowitz, Sahni, Anderson-Freed: Fundamentals of Data Structures in C, 2nd Edition, Universities Press, 2007 and onwards.
2.	Richard.F.Gilberg, Behrouz.A.Forouzan Data Structures: A Pseudocode Approach with C by, 2nd edition 2007 and onwards.
	Reference Books:
1.	Yedidyah, Augenstein, Tannenbaum: Data Structures Using C and C++, 2nd Edition, Pearson Education, 2003 and onwards.
2.	Debasis Samanta: Classic Data Structures, 2nd Edition, PHI, 2009 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.	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.		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.	**Identify** the appropriate and optimal data structure for a specified application.	UN	1, 2	1
2.	**Choose** dynamic and static data structures Implementations	AP	1,2,3	1
3.	**Make use of** different non-linear data structures and their applications.	AP	1,2,3	1
4.	**Apply** techniques like hashing, trees in a variety of Applications	AP	1,2,3	1
5.	**Develop** programming skills to solve real life problems using appropriate data structures and build projects	AP	1,2,3,5,9,10,11,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Two Assignments – (Open /Industry/Certification etc)**	**Course project (CP)/ Case study etc**	**Total Marks**
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

-Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.
-Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests.
-Lack of minimum score in IA test will make the student Not Eligible for SEE
-Minimum score in CIE 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 > 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	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**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 Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Programming and Problem solving skills	IT Sector	Software Developer
2		IT Sector, Academics	Researcher
3		IT Sector, Academics	Freelancer

Robotic Process Automation

Course Code	22CS642	**Course type**	OEC	**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 = 0 Hrs; P = 20 Hrs Total = 40 Hrs			**CIE Marks**	100
Flipped Classes content	10 Hours			**SEE Marks**	100

Course learning objectives	
1.	To understand Basic Programming concepts and the underlying logic/structure
2.	To Describe RPA , where it can be applied and how its implemented
3.	To Describe the concept of basic Ui Automation and mail automation
4.	To use excel automation techniques to automate tabular data.
5.	To describe csv automation, file/folder automation and presentation automation.

Required Knowledge of : basic logical reasoning , programming basics

Unit – I	**Contact Hours = 8 Hours**
PROGRAMMING BASICS & RECAP Programming Concepts Basics Understanding the application, Basic Web Concepts, protocols Email Clients. Data Structures - Data Tables - Algorithms, Software Processes - Software Design -Scripting Net Framework .Net Fundamentals - XML - Control structures and functions - XML -HTML - CSS - Variables & Arguments	

Unit – II	**Contact Hours = 8 Hours**
Robotic Process Automation: Return on Investment (ROI), Automation Types, UiPath StudioX UiPath StudioX: System Requirements, Hardware Requirements, Software Requirements, Installation and Setup, Register, Download, Install. Interface Overview, Home, Design View, Project Workspace. Building Blocks: Common Concepts, Learning Objectives, Notebook Default Notebook, Custom Notebook. Activity Inputs, Activity Outputs, Common Properties, Common Activities: Write Line, Message Box, Input Dialog, Modify Text, Text to Left/Right, Delay, If, Switch, Repeat Number of Times, Skip Current, Exit Loop, Get Username/Password, Get Orchestrator Asset, Save For Later, Wait for Download, Group.	

Unit – III	**Contact Hours = 8 Hours**
UI Automation: Sample Overview, Activities Reference, Use Application/Browser, Go to URL, Navigate Browser, Highlight, Take Screenshot, Check App State, Click, Type Into, Select Item, Check/Uncheck, Get Text, Get Attribute, Extract Table Data, Hover, Keyboard Shortcuts, Get Active Window, Maximize Window, Minimize Window, Hide Window, Restore Window, Move Window, App/Web Recorder. Mail Automation: Sample Overview, Desktop Outlook Setup, File System Structure.	

Activities Reference. Use Desktop Outlook App, Use Outlook 365, Use Gmail, For Each Email, Mark Email as Read/Unread, Forward Email, Save Email Attachments, Save Email, Send Calendar Invite, Move Email, Reply to Email, Archive Email, Delete Email Word Automation: Sample Overview, Word Setup, File System Structure, Activities Reference Use Word File, Save Document as, Read Text, Set Bookmark Content, Replace Text in Document, Append Text, Insert DataTable in Document, Replace Picture, Add Picture, Save Document as PDF.

Unit – IV	**Contact Hours = Hours**
Excel Automation: Sample Overview, Activities Reference, Use Excel File, Insert Sheet, Rename Sheet, Duplicate Sheet, Delete Sheet, For Each Excel Sheet, Insert Column, Text To Columns, Delete Column, Insert Rows, Delete Rows, Find First/Last Data Row, For Each Excel Row, Write Cell, Create Pivot Table, Format as Table, Change Pivot Data Source, Refresh Pivot Table, Append Range, Copy Range, Clear Sheet/Range/Table, Sort Range, Auto Fill, Fill Range, Write Range, Read Cell Formula, Read Cell Value, Format Cells, Export to CSV, Save Excel File, Save Excel File As, Save Excel File As PDF, VLookup, Filter,	

Unit – V	**Contact Hours = Hours**
CSV Automation: Sample Overview, Activities Reference, Write CSV, Append to CSV, Read CSV. File Automation: Learning Objectives, Sample Overview, Activities Reference, Get Folder Info, Folder Exists, Create Folder, Delete Folder, Copy Folder, Move Folder, For Each File In Folder, Compress/Zip Files, Extract/Unzip Files, Get File Info, File Exists, Create File, Delete File, Copy File, Move File, Write Text File, Append Line, Read Text File, Presentation Automation: Sample Overview, File System Structure, Activities Reference: Use PowerPoint Presentation, Copy Paste Slide, Delete Slide, Add New Slide, Replace Text in Presentation, Add Text to Slide, Add Data Table to Slide, Add Image/Video to Slide, Add File to Slide, Run Presentation Macro, Save PowerPoint File As, Save Presentation as PDF	

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**
I	2	Basic Automation exercises
II	2	UI Automation and Recording
III	2	Mail Automation and Word Automation
IV	2	Excel automation and CSV automation
V	2	Files and folder automation

Books	
	Text Books:
1.	Adeel Javed, Anum Sundrani, Nadia Malik, Sidney Madison Prescott, Robotic Process Automation using UiPath StudioX, Apress, 2021
	Reference Books:
1.	Frank Casale (Author), Rebecca Dilla (Author), Heidi Jaynes (Author), Lauren Livingston (Author), Introduction to Robotic Process Automation: a Primer, Institute of Robotic Process Automation.
2.	Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant
3	Srikanth Merianda, Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links

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 - **Remembe**r; 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 basics of Automation.	Un	1	1
2.	Apply and Implement RPA with uipath.	Ap	1,3	1
3.	Implement UI automation and word automation	Ap	1,3	1
4.	Solve Excel and CSV automation examples	Ap	1,3	1
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.

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. -Submission of 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. c. 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	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**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 Industry Sectors & domains**	**Job roles students can take up after undergoing the course**
1	Robotic Process Automation with UiPath	HealthCare, Finance, Banking, Education etc	RPA solution architect, RPA developer, RPA Evangelist, RPA Subject Matter Expert etc

Python Programming

Course Code	22CS643	**Course type**	OEC	**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 **familiarize** the concepts of Python language syntax and semantics to write Python programs using the procedure oriented programming paradigm.
2.	To provide an **understanding** of high level data constructs provided by Python and work with file and exception handling mechanisms.
3.	To **inculcate** Python programming skills using the object-oriented programming paradigm.
4.	To provide an **understanding** of GUI applications and usage of various packages.

Pre-requisites : Basics of 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, GUI 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 GUI:** An introduction, creating a GUI that handles event, working with components, illustrative programs and exercises.	

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: **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

Unit No.	Self-Study Topics
I	Installation of Python.
II	Working with Date and Times.
III	Abstract Classes

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-resources (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
2.	PPT and Videos	2.	Assignment- Open/Industry/Certification
3.	Flipped Classes	3.	Course Project
4.	Online classes	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.	**Illustrate** basic principles of Python programming and Demonstrate programs using the procedure-oriented programming paradigm.	**Ap**	**1,3,5**	**1**
2.	**Develop** Python programs for file operations, exception handling, GUI and Make use of different packages for computing and manipulation.	**Ap**	**1,2,3,5**	**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.	**An**	**1,2,3,5, 9,10,11,12**	**1,2,3**

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Two Assignments – (Open /Industry/Certification etc)**	**Course project (CP)/ Case study etc**	**Total Marks**
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100
-Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks. **-Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests.** **-Lack of minimum score in IA test will make the student Not Eligible for SEE** **-Minimum score in CIE 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 three parts **A, B and C**. Students have to answer 1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**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 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		

Web Programming

Course Code	22CS644	**Course type**	OEC	**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 understand basic concepts involved in web programming.
2.	To differentiate XHTML, Old HTML and HTML5 concepts.
3.	To design web pages using HTML and CSS.
4.	To utilize JavaScript for interactive pages on the client side

Pre-requisites : Any Basic Programming language.

Unit – I	**Contact Hours = 8 Hours**
Fundamentals of Web, XHTML, HTML 5 – URLs, MIME, HTTP, Security. XHTML: Basic syntax, Standard structure, Basic text markup tags, Introduction, creating a Website, Web Page Example, HTML Tags, Structural Elements, title Element, meta Element, HTML Attributes, body Elements: hr, p, br, pre Element, q and cite Elements, sup, sub, s, mark, strong, em, b, u, and i Elements.	

Unit – II	**Contact Hours = 8 Hours**
HTML 5-Introduction to web programming (continued):, History of HTML, Differences Between Old HTML and HTML5, How to Check Your HTML Code, HTML Coding Conventions, Comments, Block Elements, block quote Element, Whitespace Collapsing, ,img and link elements, ,lists, tables, forms. Case study: Flutter Flow.	

Unit – III	**Contact Hours = 8 Hours**
Introduction to CSS: CSS Overview, CSS Rules, Example with Type Selectors and the Universal Selector, CSS Syntax and Style, element selectors, Class Selectors, ID Selectors, span and div Elements Cascading, style Attribute, style Container, External CSS Files, CSS Properties, Color Properties, RGB Values for Color, Opacity Values for Color, HSL and HSLA Values for Color, Font Properties, Text Properties, Border Properties, Element Box, padding Property, margin Property, background properties.	

Unit – IV	**Contact Hours = 8 Hours**
Introduction to JavaScript: Functions, DOM, Forms, and Event with JavaScript: Introduction, History of JavaScript, Hello World Web Page, Buttons, Functions, Variables, Identifiers, Assignment Statements and Objects, Document Object Model, Forms and How They're Processed: Client-Side Versus Server-Side, form Element, Controls, Text Control, reset and focus Methods, Comments and Coding Conventions.	

Unit – V	Contact Hours = 8 Hours
Additional JavaScript Basics: window Object, alert and confirm Methods, if Statement: if by itself, prompt Method, if Statement: else and else if Clauses, Strings, Arithmetic Operators, Comparison Operators and Logical Operators looping constructs.JS Arrays and Loops, Event-Handler Attributes, onmouseover, onmouseout, Handling events from text box and password elements.	

Flipped Classroom Details

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

Unit No.	Self-Study Topics
I	Internet and its inception
II	WWW, Web Browsers and Web Servers
III	XHTML Tags
IV	Differences between XHTML and HTML

Books	
	Text Books:
1.	Robert W. Sebesta: Programming the World Wide Web, Pearson education,4th Edition, 2008.
2.	John Dean, WEB PROGRAMMING, Copyright © 2019 by Jones & Bartlett Learning, LLC, an Ascend Learning Company
	Reference Books:
1.	M. Deitel, P.J. Deitel, A. B. Goldberg: Internet & World Wide Web How to Program, Pearson education,3rd Edition
2.	Xue Bai et al: The web Warrior Guide to Web Programming, Thomson, 2003
	E-resources (MOOC-Coursera)- mention links
1.	https://www.coursera.org/learn/codio-angular-for-front-end-engineers/home/week/1

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Assignment (OA)/ Certification
3.	Flipped Classes	3.	Course Project
4.	Online classes	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)**
Explain and acknowledge basic concepts of Web programming, XHTML and HTML5.	Un	1	1
Describe and liberate usage of HTML 5 and CSS, for real time representation.	Un	1,2	1
Implement simple applications with HTML, CSS and Javascript for various real time applications.	Ap	1,3,5,8,9	2
Apply the learnings inculcated throughout the course and develop a course project.	Ap	1,3,5,9,10,11,12	2

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Two Assignments – (Open /Industry/Certification etc)	Course project (CP)/ Case study etc	Total Marks
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

-Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.
-Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests.
-Lack of minimum score in IA test will make the student Not Eligible for SEE
-Minimum score in CIE 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 three parts **A, B and C**. Students have to answer 1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**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 Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Designing a website	Social Media	Front End Developer
2	Creating Dynamic Web pages	Product Based, Service based	Web Designer, Full stack developer

LINEAR ALGEBRA

Course Code	22MAT642	**Course type**	OEC	**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.	Basics in Abstract Algebra.
2.	Find the solution of the system of linear equations using matrix operations.
3.	Identify vector spaces and subspaces
4.	Transform a vector space of one dimension into another
5	Factorize a given matrix using different methods

Pre-requisites: Basic algebra. Matrix theory

Unit – I	**Contact Hours = 8 Hours**
Basic Abstract Algebra: Groups, Permutation Groups, Isomorphism, Fields, finite fields and examples.	

Unit – II	**Contact Hours = 8 Hours**
Vector Spaces: Vector spaces; subspaces; bases and dimension; coordinates; summary of row-equivalence; computations concerning subspaces.	

Unit – III	**Contact Hours = 8 Hours**
Linear Transformations: Linear transformations; algebra of linear transformations; isomorphism; representation of transformations by matrices;linear functional; Inverse of a linear transformation.	

Unit – IV	**Contact Hours = 8 Hours**
Inner Product Spaces: Inner products; inner product spaces; orthogonal sets and projections; Gram-Schmidt process; QR-factorization.	

Unit – V	**Contact Hours = 8 Hours**
Symmetric Matrices and Quadratic Forms: Diagonalization; quadratic forms;constrained optimization; Singular value decomposition.	

Flipped Classroom Details

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

Unit No.	Self-Study Topics
I	Fields and Rings with examples
II	Rank, nullity, Column space, Row space
III	Kernel of transformation, Inverse linear transformation
IV	Applications of orthogonal vectors.
V	Least square solution of linear system of equations.

Books	
	Text Books:
1.	John B. Fraleigh, “A First Course in Abstract Algebra,” Narosa Publication 3rd edition onwards.
2.	David C. Lay, “Linear Algebra and its Applications,” Pearson Education (Asia) Pte. Ltd, 2005 3rd edition onwards.
3.	Kenneth Hoffman and Ray Kunze, "Linear Algebra," Pearson Education (Asia) Pte. Ltd/2004 2nd edition onwards.
	Reference Books:
1.	Bernard Kolman and David R. Hill, "Introductory Linear Algebra with Applications”, Pearson Education(Asia) Pte. Ltd, 7th edition 2003 onwards.
2.	Gilbert Strang, "Linear Algebra and its Applications”, Thomson Learning Asia, 2003 3rd edition onwards.
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://onlinecourses.nptel.ac.in/noc24_ee138/preview
2.	https://onlinecourses.nptel.ac.in/noc24_ma69/preview

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Assignment- Open/Industry/Certification
3.	Flipped Classes	3.	Course Project
4.	Online classes	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.	Understand of algebraic structures.	Un	1	1
2.	Find bases and dimension of vector spaces.	Ap	1	1

3.	Understand the matrix theory in Linear transformation and applications	Un	1	1
4.	Apply techniques of constrained optimization and singular value decomposition for problems arising in power/control system analysis, signals and systems.	Ap	1	1

Scheme of Continuous Internal Evaluation (CIE)

Components	Addition of two IA tests	Two Assignments– (Open/Industry/Certification	Course project(CP)/ Case study etc	Total Marks
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

Certification earned by passing the standard Online MOOCs course (1 course of at least 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.
-Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests.
-Lack of minimum score in IA test will make the student Not Eligible for SEE
-Minimum score in CIE 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 three parts A, B and C. Students have to answer 1. From Part A answer any 5 out of 7questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2questions, each Question Carries 20 Marks.

CO-PO Mapping (Planned)													**CO-PSO Mapping (Planned)**		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
1	✓												✓		
2	✓												✓		
3	✓												✓		
4	✓												✓		
Tick mark the CO, PO and PSO mapping															

APPLIED STATISTICS

Course Code	22MAT641	**Course type**	OEC	**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.	Understand different terminology in statistics
2.	Get knowledge about various Dispersion parameters moments skewness
3.	Get familiar with Multiple Correlation and Regression
4.	Get acquainted with various Analysis of Variance (ANOVA) designs .One way and two way .
	Understand Non Parametric Tests processes.

Pre-requisites : Basic statistics, Basic probability

Unit – I	**Contact Hours = 8 Hours**
Descriptive Statistics: Discrete and continuous data, Simple descriptive statistics - Mean, Median, Quantiles, percentiles, and quartiles, Variance, and standard deviation, Standard errors of estimates, Inter quartile range. Graphical statistics - Histogram, frequency polygon, and ogives, Stem-and-leaf plot, Box plot, Scatter plots, and time plots.	

Unit – II	**Contact Hours = 8 Hours**
Moments, Skewness and Kurtosis: Introduction to moments, Moments about the mean, Skewness , Negative Skewness , Positive Skewness, Kurtosis, Mesokurtic, Leptokurtic, Platykurtic -Practical, engineering related examples	

Unit – III	**Contact Hours = 8 Hours**
Multiple Correlation and Regression, Curve fitting: Multiple correlation and regression. Bivariate, Trivariate. Probable error of correlation coefficient. Spearman's rank correlation coefficient. Curvilinear regression. Standard error of estimate or residual variance. Least square Curve fitting and related error computation. Engineering related examples	

Unit – IV	**Contact Hours = 8 Hours**
Analysis of Variance (ANOVA): The Purpose of Analysis of Variance. One_ Way Classification. Variation within treatments. Variation between treatments. Total Variation. Expected values of the variation. Distribution of variations' ANOVA Tables. Two-way classification Variations for two-way classification. Experiments with replication. Experimental Design	

Unit – V	Contact Hours = 8 Hours
Non Parametric Tests: Introduction The Sign Test. The Mann-Whitney U Test. The Kruskal- Wallis H Test corrected for Ties. The run test for randomness. Further Applications of the Run test.Spear man's Rank Correlation	

Flipped Classroom Details

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

Unit No.	Self-Study Topics
I	Percentile ranks, quartile ranks.
II	Skewness and Kurtosis in Data Science.
III	Multiple regression in Machine Learning.
IV	Calculate ANOVA using MS excel.
V	Wilcoxon's signed rank test, Kolmorogov-Smirnov test, Jonckheer test

Books	
	Text Books:
1.	B. S. Grewal – Higher Engineering Mathematics, Khanna Publishers, 42nd Edition, 2012 and onwards.
2.	Fundamentals of Mathematical Statistics by S.C.Gupta and V.K.Kapoor., Sultan Chand and Sons, 2009 and onwards.
	Reference Books:
1.	Probability and statistics Schaum series second edition TAT Mc Graw Hill publication
2.	R Ganeshan -Research Mehtodology MJP Publishers
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://archive.nptel.ac.in/courses/111/102/111102111/ (Prob and Stochastic)
2.	https://archive.nptel.ac.in/courses/111/104/111104147/(Sampling and Linear regression)

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 Assignment (OA)/ Certification
4.	Online classes	4.	Course Project
		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.	To Understand different measures of Statistics	Un	1	1
2.	To Understand the concept Moments, Skewness and Kurtosis	Un	1	1
3.	To Apply methods of Multiple Correlation and Regression, Curve fitting and Analysis of Variance(ANOVA) for tabular data.	Ap	1	1
4.	To Understand the Non Parametric Tests	Un	1	1

Scheme of Continuous Internal Evaluation (CIE):

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 three parts A, B and C. Students have to answer 1. From Part A answer any 5 out of 7questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2questions, each Question Carries 20 Marks.

Components	**Addition of two IA tests**	**Two Assignments– (Open/Industry/Certification etc)**	**Course project(CP)/ Case study etc**	**Total Marks**
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

-Certification earned by passing the standard Online MOOCs course (1 course of at least 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.

-Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests.

-Lack of minimum score in IA test will make the student Not Eligible for SEE

-Minimum score in CIE to be eligible for SEE: 40 OUT OF 100.

CO-PO Mapping (Planned)													**CO-PSO Mapping (Planned)**		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
1	✓												✓		
2	✓												✓		
3	✓												✓		
4	✓												✓		
Tick mark the CO, PO and PSO mapping															

Nanoscience and Nanotechnology

Course Code	**22CH641**	**Course type**	OEC	**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 provide a comprehensive overview of synthesis and characterization of nanoparticles, nanocomposites and hierarchical materials with nanoscale features.
2.	To provide the engineering students with necessary background for understanding various nanomaterials characterization techniques
3.	To develop an understanding of the basis of the choice of material for device applications
4.	To give an insight into complete systems where nanotechnology can be used to improve our everyday life

Pre-requisites : NIL

Unit – I	**Contact Hours = 8 Hours**

Nanotechnology, Frontier of future-an overview, Length Scales, Variation of physical properties from bulk to thin films to nanomaterials, Confinement of electron in 0D, 1D, 2D and 3D systems

Synthesis of Nanomaterials: Bottom-Up approach: Chemical Routes for Synthesis of Nanomaterials-Sol-gel, Precipitation, Solution Combustion synthesis, SILAR Technique, Hydrothermal method.

LABORATORY ACTIVITIES PLANNED

1) Preparation of silver nanoparticles and characterization of particle size by optical spectroscopy
2) Preparation of ZnO nanoparticles by combustion technique
3) Preparation of Al_2O_3 nanoparticles by precipitation method
4) Preparation of Silica nanoparticles by sol-gel method
5) Hydrothermal synthesis of metal oxide nanoparticles

Unit – II	**Contact Hours = 8 Hours**

Basic principles and instrumentations of Electron Microscopy –Transmission Electron Microscope, Scanning Electron Microscope, Scanning Probes- Scanning Tunneling microscope, Atomic Force Microscope –different imaging modes, comparison of SEM and TEM, AFM and STM, AFM and SEM, Porosity (BET method), Zeta potential

Basic principles of working of X-ray diffraction, derivation of Debye-Scherrer equation, numerical on Debye Scherrer equation.

Unit – III	Contact Hours = 8 Hours
Electronic and optoelectronic properties: Explanation of Ballistic transport-comparison with superconductor, Coulomb blockade-property-in quantum dot circuit/single electron transistor, Diffusive transport Dielectric Properties: Polarization, Ferroelectric Behavior Optical Properties: Photoconductivity, Optical absorption and transmission, Plasmons and Excitons, Luminescence- Phosphorescence and Fluorescence.	

Unit – IV	Contact Hours = 8 Hours
Solar cells: First generation, second generation and third generation solar cells: Construction and working of Dye sensitized and Quantum dot sensitized solar cells. Batteries: Lithium ion battery- working, Requirements of anodic and cathodic materials, classification based on ion storage mechanisms, limitations of graphite anodes, Advances in Cathodic materials, Anodic materials, Separators Fuel Cells: Introduction, construction, working of fuel cells and nanotechnology in hydrogen storage and proton exchange membranes	

Unit – V	Contact Hours = 8 Hours
Switching glasses, Semiconductor devices including LEDs and Photonic crystals (1D, 2D and 3D) and their applications, Display devices TiO_2 and ZnO based photocatalysts, Photocatalysis Mechanism, Nanofiltration membranes-Dead end filtration method, Super hydrophobic materials-Lotus effect	

Flipped Classroom Details

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

Unit No.	Self-Study Topics
I	Top-Down approach- Ball milling technique, Sputtering, Laser Ablation.
II	Optical Spectroscopy- Instrumentation and application of IR, UV/VIS (Band gap measurement)
III	Magnetic properties: Nanomagnetism, Magnetoresistance, Super Para Magnetism-Neel Relaxation time, blocking temperature etc. Mechanical Properties of nanomaterials
IV	Super capacitors: Introduction, construction and working of supercapacitor
V	Nanosensors: Electrochemical sensors, Temperature Sensors, Chemical and gas Sensors, Light and radiation sensors.

Books	
	Text Books:
1.	Nano Materials – A.K. Bandyopadhyay/ New Age Publishers
2.	Nanocrystals: Synthesis, Properties and Applications – C.N.R. Rao, P. John Thomas and G. U. Kulkarni, Springer Series in Materials Science
3.	Nano Essentials- T. Pradeep/TMH
	Reference Books:
1.	Introduction to Nanotechnology, C. P. Poole and F. J. Owens, Wiley, 2003
2.	Understanding Nanotechnology, Scientific American 2002
3.	Nanotechnology, M. Ratner and D. Ratner, Prentice Hall 2003
4.	Nanotechnology, M. Wildon, K. Kannagara, G. Smith, M. Simmons and B. Raguse, CRC Press Boca Raton 2002
	E-resources (NPTEL/SWAYAM. Any Other)- mention links
1.	

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Assignment- Open/Industry/Certification
3.	Flipped Classes	3.	Course Project
4.	Online classes	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.	Demonstrate the synthesis of nanoparticles by various techniques.	[L2]	1	
2.	Explain working of basic instruments used in characterization of nanoparticles.	[L2]	1	
3.	Discuss the application of nanotechnology to mechanical and civil domains	[L2]	1,4	
4.	Classify the nanomaterials based on the dimensions.	[L3]	1	
5.	Assess the suitability of nanomaterials for various device applications.	[L4]	1,6,12	

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Two Assignments – (Open /Industry/Certification etc)	Course project (CP)/ Case study etc	Total Marks
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

-Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.
-Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests.
-Lack of minimum score in IA test will make the student Not Eligible for SEE
-Minimum score in CIE 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 three parts **A,B and C**. Students have to answer 1. From Part A answer any 5 out of 7questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosingany one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2questions, each Question Carries 20 Marks.

CO-PO Mapping (Planned)													**CO-PSO Mapping (Planned)**		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**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 Industry Sectors & domains**	**Job roles students can take up after undergoing the course**
1	Demonstrate the synthesis of nanoparticles by various techniques.	Energy sector	R&D Engineer in Nanotechnology industries
2	Explain working of basic instruments used in characterization of nanoparticles.	Sensor Industry	QC Engineer
3	Discuss the application of nanotechnology to mechanical and civil domains		

Marketing Management

Course Code	22INT61	**Course type**	OEC	**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 make students understand the fundamental concepts of marketing and environment in which marketing system operates.
2.	To gain knowledge on consumer buying behavior and influencing factors
3.	To describe major bases for segment marketing, target marketing, and market positioning.
4.	To develop a Conceptual framework, covering basic elements of the marketing mix.
5.	To understand fundamental premise underlying market driven strategies and hands on practical approach.

Pre-requisites: The student should have basic awareness of market, products, services, buying-selling transaction and promotional activities

Unit – I	**Contact Hours = 8 Hours**
Introduction to Marketing: Importance of marketing, Definitions of market and marketing, Types of Needs, Elements of Marketing Concept, Functions of Marketing, Marketing V/s Selling, 4P's of Marketing, 7P's of service marketing, Marketing Environment.	

Unit – II	**Contact Hours = 8 Hours**
Analyzing Consumer Behavior: Meaning and Characteristics, Importance of consumer behavior, Factors influencing Consumer Behavior, buying behavior, personal factors, psychological factors and cultural factors. Consumer Buying Decision Process, Buying Roles, Buying Motives, The black box model of consumer behavior. Characteristics of generation Z consumers	

Unit – III	**Contact Hours = 8 Hours**
Product Management, Pricing and Branding: product levels, product hierarchy, classification of products, Managing Product Life Cycle, New Product Development, packing as a marketing tool, Role of labeling in packaging. Types of Pricing Strategies Concept of Branding, Brand Equity, branding strategies	

Unit – IV	**Contact Hours = 8 Hours**
Distribution and Promotion: Roles and purpose of Marketing Channels, Factors Affecting Channel Choice, Integrated Marketing Communications (IMC)-Tools-Advantages, Disadvantages, Advertising Objectives, Advertising Budget, Advertising Copy, AIDA model,	

Unit – V	**Contact Hours = 8 Hours**
Market Segmentation, Targeting and Brand Positioning: Concept of Market Segmentation, Benefits, Requisites of Effective Segmentation, Bases for Segmenting Consumer Markets, Market Segmentation Strategies. Types of Segmentation. Targeting - Bases for identifying target Customer target Marketing strategies, Positioning - Meaning, Tasks involved in Positioning.	

Flipped Classroom Details

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

Unit No.	**Self-Study Topics**
I	Elements of Digital and social media Marketing, Green Marketing, Neuro Marketing, Sensory Marketing and societal marketing concept
II	Study the buying pattern based on demographics of consumers
III	Take any FMCG product and study the PLC, branding equity and pricing of that product.
IV	Draft advertising copy

Books	
	Text Books:
1.	Kotler, P., Keller, K. L., Ang, S. H., Tan, C. T., & Leong, S. M. Marketing management: an Asian Perspective. Pearson Publication, (2018).
2.	Kotler, P., Kartajaya, H., &Setiawan, I. Marketing 4.0: Moving from traditional to digital. John Wiley & Sons, (2016).
3.	Ramaswamy, Namakumari, Marketing Management: Global Perspective, McGraw-Hill, (2019
	Reference Books:
1.	Dhruv Grewal, Michael Levy, Marketing Management, McGraw-Hill, (2018)
2.	Baines, P., Fill, C, Page, K. and Sinha, P.K, Marketing, Asian edition, Oxford University Press, New Delhi (2013)
	E-resources (NPTEL/SWAYAM. Any Other)- mention links
1.	https://youtu.be/5fdx5Laavkc
2.	https://youtu.be/ob5KWs3I3aY?t=131

Course delivery methods		**Assessment methods**	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Assignment- Open/Industry/Certification
3.	Flipped Classes	3.	Course Project
4.	Online classes	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.	Understand the basics concepts for Marketing and business environment	2	1	1
2.	Demonstrate the application of the knowledge with respect to strategic and tactical use of the primary decision-making areas of marketing	2	2	1
3.	Demonstrate and Apply the critical thinking ability needed to ensure Product and Brand sustainability	3	1	2
4.	Evaluate the needed strategies for distribution and promotion of products and services	4	6	3

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Two Assignments – (Open /Industry/Certification etc)**	**Course project (CP)/ Case study etc**	**Total Marks**
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

-Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.
-Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests.
-Lack of minimum score in IA test will make the student Not Eligible for SEE
-Minimum score in CIE 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 three parts **A, B and C**. Students have to answer 1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
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	Strategic decision making	Retail, Service	Product Managers
2	Branding knowledge	Retail, Service	Brand Managers
3	Business Communication	Retail, Service, Branding	Advertising Consultants

EMPLOYABILITY SKILLS II

Course Code	**22AECCS66**	**Course type**	**AEC**	**Credits L-T-P**	1 – 0 - 0
Hours/week: L - T- P	1 – 0 – 0			**Total credits**	1
Total Contact Hours	L = 30 Hrs; T = 0 Hrs; P = 0 Hrs Total = 30 Hrs			**CIE Marks**	100

Course learning objectives	
1.	Skill development is/are personal attributes that influence how well an individual works or interacts with others.
2.	These skills make it easier to form relationships with people, create trust and dependability, and lead teams.
3.	In essence, they are essential for individual success in the workplace, their company's success, and their personal life also

Unit – I	**Contact Hours = 4 Hours**
Quantitative Aptitude: Ratios, Proportions and Variations (2 Hours), Partnership (1 Hour), Time and Work (2 Hours) **Logical Reasoning***:* Seating Arrangement (1 Hour)	

Unit – II	**Contact Hours = 4 Hours**
Quantitative Aptitude: Time, Speed and Distance (2 Hours), Trains, Boats and Streams (2 Hours) **Verbal Ability:** Reading Comprehension (2 Hours)	

Unit – III	**Contact Hours = 4 Hours**
Quantitative Aptitude: Permutation and Combination (2 Hours), Ages (1 Hour) **Logical Reasoning:** Data Arrangement (1 Hour) **Soft Skills:** Interview Skills (1 Hour), Resume Building (1 Hour).	

Unit – IV	**Contact Hours = 4 Hours**
Quantitative Aptitude: Probability (2 Hours) **Logical Reasoning:** Clocks and Calendars (2 Hours), Syllogisms (2 Hours)	

Unit – V	**Contact Hours = 4 Hours**
Quantitative Aptitude: Data Interpretation (2 Hours) **Logical Reasoning:** Data Sufficiency (2 Hours) **Verbal Ability:** Ordering of Sentences (1 Hour), Critical Reasoning (1 Hour)	

Books	
	Text Books:
1.	The Aptitude Triad , BIZOTIC
2.	How to prepare for Quantitative Aptitude for CAT & other Management Examinations, Arun Sharma, McGraw Hill Education(India) Private Limited, 4th Edition, 2018.
3.	How to prepare for Logical Reasoning for CAT & other Management Examinations, Arun Sharma, McGraw Hill Education(India) Private Limited, 8th Edition, 2018.
4.	How to prepare for Verbal Ability and Reading Comprehension for CAT & other Management Examinations, Arun Sharma, McGraw Hill Education(India) Private Limited, 8th Edition, 2018.
5.	How to prepare for Data Interpretation for CAT & other Management Examinations, Arun Sharma, McGraw Hill Education(India) Private Limited, 5th Edition, 2018.

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Online Quizzes
		3.	Assignments
		4.	Seminar

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.	Clear the Aptitude round of recruiters during placements	L2	10,12	3
2.	Perform confidently during the Interview process	L2	10,12	3
3.	Develop resumes that are grammatically correct and written in Business English	L2	10,12	3
4.	Develop behaviors that are appropriate for a professional	L2	10,12	3

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Online Quiz	Addition of two Assignments	Total Marks
Marks	30+30 = 60	20	10+10 =20	100

- Writing 2 IA tests are compulsory

-Student should score minimum 40% of 100 marks to pass the course.

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
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	Logical Thinking	IT Industry	Software Engineer
2	Problem Solving	Automotive	Developer
3	Communication Skills	Education Sector	Project Manager

Computer Networks Lab

Course Code	22CSL68	Course type	PCCL	Credits L-T-P	0 - 0 - 2
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	CN LAB			SEE Marks	50

Course learning objectives	
1.	Develop an Encryption Mechanism for networking applications
2.	Develop applications using Transport Layer Services
3.	Simulate Simple Network and analyze its performance

Required Knowledge of : Basic Knowledge of programming,

List of Experiments

Lab Experiment – I	Contact Hours = 2 Hours
Encryption & Description mechanism at Application Layer	
Lab Experiment – 2	Contact Hours = 2 Hours
Application using sockets and Transport layer Connectionless/ Connection oriented service.	
Lab Experiment – 3	Contact Hours = 2 Hours
Congestion controlling mechanism for network layer	
Lab Experiment – 4	Contact Hours = 2 Hours
Routing algorithm used in routers	
Lab Experiment – 5	Contact Hours = 2 Hours
Error detection & correction mechanism at link layer	

Lab Project:

The students have to implement a Computer Network Project (simulation/application) Applying the concepts learnt in the theory. The students have to use Modern Networking tools Like NS3, OPENET, QUALNET etc. along with any suitable programming language for the same.

Demonstration of configuration of any other networking devices like routers/gateway/firewall.

Books	
	Text Books:
1.	James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth edition, Pearson, 2013.
	Reference Books:
2.	Behrouz A Forouzan, Data and Communications and Networking, Fifth Edition, McGraw Hill, Indian Edition
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links

1.	https://www.nsnam.org/
2.	https://etdata.org/
3.	https://networksimulationtools.com/

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.	**Demonstrate the application development using socket programming at transport layer**	AP	2	1
2.	**Develop Application for Encryption and decryption mechanism**	AP	2,3	1
3.	**Implement and Analyze the performance of networks using network simulation tool**	AN	1,2,3,5,9 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
2. Calculations, results, graph, conclusion and Outcome recorded in Journal: 5 marks
3. Lab project/ Open ended expt: 10 marks
4. 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%.		
3.	One or Two experiments to be conducted.		
4.	Minimum marks required in SEE to pass: 20 out of 50		
5.	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
6.	Viva-voce shall be conducted for individual student and not in a group.		

CO-PO Mapping (planned)													CO-PSO Mapping (planned)		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
1		✓											✓		
2		✓											✓		
3	✓	✓	✓		✓				✓	✓	✓	✓	✓	✓	✓
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	Programming for basic Networking application, Network Simulation and analysis	Cisco Systems., IBM, Orange, Infosys Technologies, TATA Consultancy Services (TCS), Bharti Airtel. … HCL	Computer Network Analyst, Computer Network administrator, Computer Networking Professional

7th Semester Syllabi

BIG DATA AND ANALYTICS

Course Code	22CS71	**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 familiarize the concept of Big data, its dimensions, its applications and analyze business case studies in Big Data Analytics.
2.	To explore Hadoop framework and architecture.
3.	To understand the importance of MapReduce framework.
4.	To acquire knowledge about the importance of Hive and Pig.
5.	To provide an understanding on basics of NoSQL.

Required Knowledge of : Database Management Systems.

Unit – I	**Contact Hours = 8 Hours**
Introduction: Big Data Definition, History of Data Management-Evolution of Big Data, Structuring Big Data, Elements of Big Data, Big Data Analytics, Careers in Big Data, Future of Big Data, Use of Big Data in Social Networking, Use of Big Data in Preventing Fraudulent Activities; Use of Big Data in Retail Industry	

Unit – II	**Contact Hours = 8 Hours**
Hadoop Ecosystem: Understanding Hadoop Ecosystem, Hadoop Distributed File System: HDFS Architecture, Concept of Blocks in HDFS Architecture, NameNodes and Data Nodes, The Command-Line Interface, Using HDFS Files, Hadoop-Specific File System Types, HDFS Commands.	

Unit – III	**Contact Hours = 8 Hours**
Understanding MapReduce: The MapReduce Framework: Exploring the Features of MapReduce, Working of MapReduce, Exploring Map and Reduce Functions. Apache Spark: Introduction to Apache Spark, Apache spark architecture.	

Unit – IV	**Contact Hours = 8 Hours**
Hadoop Related Tools: Pig–Grunt–pig datamodel–PigLatin–developing and testing PigLatin scripts. Hive–data types and file formats–Hive QLdatadefinition–HiveQL datamanipulation– HiveQL queries	

Unit – V	Contact Hours = 8 Hours
NoSQL: Introduction to NoSQL: Why NoSQL, Characteristics of NoSQL, History of NoSQL, Types of NoSQL Data Models: Key-Value Data Model, Column-Oriented Data Model, Document Data Model, Graph Databases, Schemaless Databases, Materialized views, Distribution Models: CAP Theorem, Sharding	

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
II	1	HDFS
III	3	MAPREDUCE
IV	3	HIVE, PIG
V	1	NOSQL

Unit No.	Self-Study Topics
II	The org.apache.hadoop.io package
III	Basics of Scala

Books	
	Text Books:
1.	DT Editorial Services,"Big Data:Black Book ,Comprehensive Problem Solver", Dreamtech Press.2016 Edition.
2.	Paul C. Zikopoulos, Chris Eaton, Dirk deRoos, Thomas Deutsch, George Lapis, Understanding Big Data – Analytics for Enterprise Class Hadoop and Streaming Data, McGraw Hill, 2012.
3.	P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012
	Reference Books:
1.	Seema. Acharya and Subhashini. C, "Big Data and Analytics", 1st Edition, Wiley India, 2015
2.	Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilly, 2012.
3.	EricSammer,"HadoopOperations",O'Reilly,2012
	E-resources (NPTEL/SWAYAM. Any Other)- mention links
1.	Introduction to Big Data with Spark and Hadoop Course by IBM | Coursera
2.	Big Data Computing - Course (nptel.ac.in)

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Lab Test
3.	Flipped Classes	3.	Semester End Examination
4.	Practice session/Demonstrations in Labs		
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.	**Demonstrate** the concept of data collection, processing, analysis, retrieval, mining, visualization, and prediction.	Un	1,2	1
2.	**Analyze** the Big Data framework like Hadoop, Map reduce and NOSQL to efficiently store and process Big Data to generate analytics.	An	1,2,3	1
3.	**Apply** Hadoop tools to solve data intensive problems and to generate analytics.	Ap	2,3,5	1,2
4.	**Analyse** the requirements for a real world problem or a specification and develop a course project as the solution	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**	**Conduction**	**Lab test**	
30 marks	30 marks	10 marks	30 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				
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: 15 marks 5. Viva voce: 10 marks				

Eligibility for SEE:

1. **Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests. Lack of minimum score in IA test will make the student Not Eligible for SEE**
2. **Student should score minimum 40% of 30 marks (i.e. 12 marks) in Lab test & should score 40% of 40 marks (i.e. 16 marks) in Lab component.**
3. Lab test is COMPULSORY
4. **Minimum score in CIE to be eligible for SEE: 40 OUT OF 100.**
5. 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 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (planned)													**CO-PSO Mapping (planned)**		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
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	Hadoop	IT Sector	Big Data Administrator
2	HDFS, PIG, Hive	IT Sector	Big Data developer, Data analyst
3	NoSQL	IT SECTOR	Data Analyst

UNIX SYSTEM AND NETWORK PROGRAMMING

Course Code	22CS72	**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 introduce POSIX and UNIX standards along with basics of working with UNIX Environment.
2.	To develop the ability to work with UNIX Files and UNIX processes
3.	Demonstrate working with Transport layer Protocols using TCP & UDP

Required Knowledge of : C,C++, Computer Networks, Operating System.

Unit – I	**Contact Hours = 8 Hours**
Introduction to UNIX and its Commands: UNIX and ANSI Standards: The ANSI C Standard, The POSIX Standards, UNIX and POSIX APIs: The POSIX APIs, The UNIX and POSIX Development Environment, API Common Characteristics, Basics of working with UNIX Operating system and executing UNIX Genera lcommands like calendar, date etc.	

Unit – II	**Contact Hours = 8 Hours**
UNIX Files: File Types, The UNIX and POSIX File System, The UNIX and POSIX File Attributes, Inodes in UNIX System V, Application Program Interface to Files, UNIX Kernel Support for Files, General File APIs: Open, Read, Write, Close, lseek, fcntl, Stat, chmod, chown, File & Record Locking.	

Unit – III	**Contact Hours = 8 Hours**
UNIX Processes: UNIX Kernel Support for Processes, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, Environment Variables, setjmp and longjmp Functions, getrlimit, setrlimit. Signals: The UNIX Kernel Support for Signals, signal, Signal Mask, sigaction.	

Unit – IV	**Contact Hours = 8 Hours**
Sockets Introduction: Introduction, Socket Address Structures, Value-Result Arguments, Byte Ordering and Manipulation Functions. **Elementary TCP Sockets:** socket, connect, bind, listen, accept, fork and exec, Concurrent Server Design.	

Unit – V	Contact Hours = 8 Hours
Elementary UDP Sockets: recvform and sendto Functions, UDP Echo Client/Server- main, dg_echo and dg_cli Functions. **Ipv4 and IPv6 Interoperability**: IPv4 Client and IPv6 Server, IPV6 Client ad IPv4 Server **Daemon Processes:** syslogd Daemon , syslog Function.	

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
I	2	UNIX environment and UNIX commands, POSIX runtime and compile time Configuration limits
II	2	Hard Link and Symbolic Link, File And Record Locking ,File API's
III	2	Zombie Process & Race Condition
IV	1	Client server communication using socket programming that uses connection-oriented protocol at transport layer
V	1	WIRESHARK tool for Network Analysis for data transfer of UDP & TCP applications.

Unit No.	Self-Study Topics
I	FIPS & X/OPEN STANDARDS, study of latest OS's with their applicability in the industry
II	Device and directory file API'S
III	Exec Functions & Process Accounting
IV	TCP Echo Client/Server Functions.
V	STCP One-to-Many-Style Streaming Echo Client and Server main Functions. IPv6 Address-Testing Macros, Source Code Portability

Books

	Text Books:
1.	Terrence Chan: UNIX System Programming Using C++, Prentice Hall India, 1999 and onwards
2.	W. Richard Stevens, "Advanced Programming in the UNIX Environment" , Pearson Education, 2nd Edition and onwards
3.	W. Richard Stevens, Bill Fenner, Andrew M. Rudoff: "UNIX Network Programming". Volume 1, Third Edition, Pearson 2004 and onwards
4.	Sumitabha Das: "Concepts and applicaions", Tata McGraw Hill, 2012 and onwards
	Reference Books:
1.	Richard Stevens: "UNIX Network Programming". Volume 2, Second Edition 2006 and onwards.
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://onlinecourses.swayam2.ac.in/aic20_sp24/preview
2.	https://elearn.nptel.ac.in/shop/nptel/computer-networks-and-internet-protocol/

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Assignment (OA)/ Lab Project/ Industry assignment/Certification/ Course 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.	Describe the features of POSIX and UNIX standards	Un	1	1
2.	Demonstrate handling of UNIX files, Processes and Signals.	Ap	1,2,3,11	1,2,3
3.	Design and implement programs for inter process communication using UDP & TCP sockets	An	1,2,3,5,11	1,2,3
4.	Apply basics of Unix OS & TCP/UDP to develop basic networking applications	Ap	1,2,3,5,9,11,12	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**	**Conduction**	**Lab test**	
30 marks	30 marks	10 marks	30 marks	100 marks

IA Test:
1. No objective part in IA question paper
2. All questions descriptive

Eligibility for SEE:
1. 40% and above (24 marks and above) in theory component (No change)
2. Student should score minimum 40% of 30 marks (i.e. 12 marks) in Lab test & should score 40% of 40 marks (i.e. 16 marks) in Total.
3. Lab test is COMPULSORY
4. Not eligible in any one of the two components will make the student Not Eligible for SEE

Conduct of Lab:
1. Conducting the experiment and journal: 5 marks
2. Calculations, results, graph, conclusion and Outcome: 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: 15 marks 5. Viva voce: 10 marks
Eligibility for SEE: 1. 40% and above (24 marks and above) in theory component (No change) 2. Student should score minimum 40% of 30 marks (i.e. 12 marks) in Lab test & should score 40% of 40 marks (i.e. 16 marks) in Total. 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 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (planned)													**CO-PSO Mapping (planned)**		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
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	Developing System and Application programs. Application development in open source Operating Systems	IT Computer Networking and Communication Industries	Application Developer System Engineer Network Application developer

DISTRIBUTED AND CLOUD COMPUTING

Course Code	**22CS73**	**Course type**	PCC	**Credits L-T-P**	4 - 0 - 0
Hours/week: L - T- P	4 - 0 – 0			**Total credits**	4
Total Contact Hours	L = 50 Hrs; T = 0 Hrs; P = 20 Hrs Total = 50 Hrs			**CIE Marks**	100
Flipped Classes content	10 Hours			**SEE Marks**	100

Course learning objectives	
1.	To learn basic principles and fundamentals of Distributed Systems.
2.	To know the method of File Sharing and Implementation of Distributed File Systems.
3.	To discuss the aspects of of Cryptanalysis, Access control.
4.	To understand the basic concepts of Cloud Computing.

Pre-requisites: Computer Networks, Operating Systems.

Unit – I	**Contact Hours = 10 Hours**
Characterization of Distributed Systems: Introduction, Examples of Distributed Systems, Challenges: Heterogeneity, Openness, Security, Scalability, Failure Handling. **System Model:** Architectural Models, Fundamental models.	

Unit – II	**Contact Hours = 10 Hours**
Inter Process Communication: Introduction, API for Internet Protocols, External Data Representation and Marshalling, Client – Server Communication. **Distributed Object and Remote Invocation:** Introduction, Communication between Distributed Objects, Remote Procedure Call.	

Unit – III	**Contact Hours = 10 Hours**
Distributed File System: Introduction, File Service architecture. **Security in distributed systems:** Introduction, Overview of security techniques: Cryptography, Certificates, Access control. Cryptographic Algo: Symmetric: Ex Substitution algo. , Asymmetric: RSA.	

Unit – IV	**Contact Hours = 10 Hours**
Introduction to Cloud Computing: Introduction, Network Centric computing and Network Centric Content, Peer to Peer Systems, Cloud Computing: An old idea Whose Time has Come, Cloud Computing: Delivery Models and Services, Ethical Issues in Cloud Computing, Cloud Vulnerabilities, Major Challenges Faced by Cloud Computing. **Case Studies**: Amazon Web Studies.	

Unit – V	Contact Hours = 10 Hours
Cloud service providers & Cloud ecosystem: The Cloud Eco system, Cloud computing delivery models and services, Amazon Web services, The continuing evolution of AWS, Google clouds, Microsoft Windows Azure & Online services.	

Flipped Classroom Details

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

Unit No.	Self-Study Topics
I	Security models
II	HTTP functions
III	Asymmetric: RSA
IV	Amazon Web Studies
V	Microsoft Windows Azure

Books	
	Text Books:
1.	George Coulouris, Jean Dollimore, Tim Kindberg: Distributed Systems Concepts and Design, Pearson Education, Third edition 2003 Onwards
2.	Dan Marinescu : Cloud Computing Theory and Practice, ELSEVIER
	Reference Books:
1.	Kai Hwang, Geofrey C, Fox, Jack J, Dongarra: Distributed and Cloud Computing From Parallel processing to the Internet of Things.
2.	Sunita Mahajan, Seema Shah: Distributing Computing, Published by Oxford University press 2010.
	E-resources (NPTEL/SWAYAM.. Any Other)-
1.	https://onlinecourses.nptel.ac.in/noc23_cs27/preview
2.	https://onlinecourses.nptel.ac.in/noc21_cs87/preview

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Book Tests (OBT)
3.	Flipped Classes	3.	Course Seminar
4.	Online classes	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.	**Explain** the basic concepts of Distributed systems	Un	1	1
2.	**Apply** the various algorithms for Distributed systems	Ap	1,2,3,4	2
3.	**Analyze** the different security mechanisms over distributed applications	An	1,2,3,4	2
4.	**Explain** various concepts related to cloud computing and its Applications	Un	1,5,12	1
5	**Apply** the learnings inculcated throughout the course & present a course seminar or develop a course project or assignments	Ap	1,2,3,4,5,9,10,11,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Two Assignments – (Open /Industry/Certification etc)**	**Course project (CP)/ Case study etc**	**Total Marks**
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

--Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.

-Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests.

-Lack of minimum score in IA test will make the student Not Eligible for SEE

-Minimum score in CIE 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 three parts **A, B and C**. Students have to answer 1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**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 Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Understanding Distributed Technologies	Information Technology (IT) Services	Network and security Analyst
2	Prototype Design	Government and Public Sector	Data Analyst
3	Troubleshooting and Problem Solving	Research and Academia	Network Administrator

CRYPTOGRAPHY AND NETWORK SECURITY

Course Code	22CS741	**Course type**	PEC	**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.	Understand standard algorithms used to provide confidentiality, integrity and authenticity, asymmetric encryption algorithms.
2.	Understand standard asymmetric encryption algorithms.
3.	Demonstrate encryption techniques to secure data in transit across data networks
4.	Apply security applications in the field of Information technology

Pre-requisites: Fundamentals of Computer Networks

Unit – I	**Contact Hours = 8 Hours**
Classical Encryption Techniques Symmetric Cipher Model: Symmetric cipher model, security attacks, security services, security mechanisms, Substitution Techniques, transposition techniques The data encryption standard, Feistal cipher structure, Block cipher design Principles	

Unit – II	**Contact Hours = 8 Hours**
Public-Key Cryptography and RSA: Principles of public-key cryptosystems. Publickey cryptosystems. Applications for public-key cryptosystems, requirements for publickey cryptosystems. Public-key cryptanalysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA.	

Unit – III	**Contact Hours = 8 Hours**
Key management and distribution: Symmetric key distribution using Symmetric encryption, Symmetric key distribution using asymmetric encryption, distribution of public keys, x.509 certificates. Hashing: Hashing concepts**,** Properties, Types of hash function.	

Unit – IV	**Contact Hours = 8 Hours**
Wireless network security and Transport layer security: Wireless security, mobile device security, IEEE 802.11 Wireless LAN overview, Web Security Considerations, Secure Sockets Layer and transport layer security.	

Unit – V	Contact Hours = 8 Hours
Electronic Mail Security: Pretty good privacy, notation, operational; description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality, S/MIME messages, S/MIME certificate processing, enhanced security services, Domain keys identified mail, internet mail architecture, E-Mail threats, DKIM strategy, DKIM functional flow.	

Flipped Classroom Details

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

Unit No.	Self-Study Topics
I.	AES
III.	Kerberos , SHA algorithm**,** Hash Function Application, Digital Signatures

Books	
	Text Book:
1.	William Stallings, Cryptography and Network Security, Pearson 6th edition onwards
	Reference Book:
1.	Atul Kahate: Cryptography and Network Security McGraw-Hill Second edition onwards
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	Cryptography - Course (swayam2.ac.in)
2.	Information Security - Course (swayam2.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 Assignment (OA)/ Certification
4.	Online classes	4.	Course Project
		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		**Level**	**PO(s)**	**PSO(s)**
1.	**Explain** the different Symmetric and Asymmetric encryption techniques.	Un	1,2,3,4	1,3
2.	**Analyze** the given encryption techniques and Apply the security measures on network.	An	1,2,3,4, 5, 9, 10	1,3
3.	**Apply** x.509, IEEE 802.11,S/MIME and DKIM functionalities to provide security to wireless, Transport and Electronic mail systems.	Ap	1,2,3,4,5	1,3
4.	**Analyze** the requirements for a real world problem or a specification and develop a course project as the solution or present a course seminar	An	1,2,3,5,9,10,11,12	1, 2, 3

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Two Assignments – (Open /Industry/Certification etc)**	**Course project (CP)/ Case study etc**	**Total Marks**
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

-Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.
-Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests.
-Lack of minimum score in IA test will make the student Not Eligible for SEE
-Minimum score in CIE 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 three parts **A,B and C**. Students have to answer 1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
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.	Students can apply appropriate security model for wireless network security.	Network Security Surveillance	Security Architect Security Consultant
2	Have a knowledge about Network Security Control and Cloud Security	Software Security Planning for disaster recovery and business continuity Software Development	Chief Information Security Officer Cryptographer Security Analyst
3	Students can apply security applications in the field of Information technology		

BLOCKCHAIN MANAGEMENT

Course Code	22CS742	**Course type**	PEC	**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 basics of Blockchain and Decentralization in Blockchain
2.	To understand the concept of Cryptography in Blockchain
3.	To illustrate the concept of Smart Contracts and Ethereum
4.	To apply the concepts of Blockchain is various Use cases.

Pre-requisites : Operating System, Computer Networks

Unit – I	**Contact Hours = 8 Hours**
Blockchain basics: From Bitcoin to blockchain, What is a blockchain? Blockchain programming, Motivating scenarios, Retrospective. Grasping Blockchain Fundamentals: Revolutionizing the Traditional Business Network, Exploring a Blockchain Application. Taking a Look at How Blockchain Works: What Makes a Blockchain Suitable for Business?, Identifying Participants and Their Roles.	

Unit – II	**Contact Hours = 8 Hours**
Propelling Business with Blockchains: Recognizing Types of Market Friction and Moving Closer to Friction-Free Business Networks. Decentralization: Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Blockchain and full ecosystem decentralization, Pertinent terminology and Platforms for decentralization.	

Unit – III	**Contact Hours = 8 Hours**
Smart contracts: Introduction, The concept of a smart contract, Design of a smart contract, What makes a blockchain contract smart?, Decentralized airline system use case, Airlines smart contract. Techniques for trust and integrity: Essentials of trust and integrity and Digital democracy problem. From smart contracts to Dapps: Introduction.	

Unit – IV	Contact Hours = 8 Hours
Ethereum 101: Ethereum – an overview, Ethereum – a user's perspective, The Ethereum network, Components of the Ethereum ecosystem, Ether cryptocurrency/tokens (ETC and ETH), The Ethereum Virtual Machine (EVM) Further Ethereum: Blocks and blockchain, Gas, Fee schedule, Wallets and client software, Light clients and Nodes and miners.	

Unit – V	Contact Hours = 8 Hours
Blockchain in Action: Use Cases: Financial Services, Insurance, Government, Supply Chain Management, Healthcare and The Internet of Things (IoT). Hyperledger, a Linux Foundation Project; Ten Steps to Your First Blockchain application.	

Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	1	2	2	2	3

Unit No.	Self-Study Topics
1	The emergence of bitcoin.
2	Innovative trends.
3	Block ciphers, Mathematics in Public Key Cryptography.
4	Development of a smart contract code and Deploying and testing the smart contract.
5	Microsoft Azure‟s.

Books	
	Text Books:
1.	Bina Ramamurthy, “Blockchain in Action”, Special Sales Department Manning Publications Co., 2020 onwards
2.	Imran Bashir, “Mastering Blockchain: A deep dive into distributed ledgers, consensus protocols, smart contracts, DApps, cryptocurrencies, Ethereum, and more”, Third Edition/ 2022 onwards
3.	Manav Gupta, “Blockchain For Dummies®, IBM Limited Edition”, Published by John Wiley & Sons, Inc. 2017 onwards.
	Reference Books:
1.	Tiana Laurence, “Blockchain For Dummies”, 3rd Edition John Wiley & Sons, Inc. 2023 onwards
2.	Mansoor Ahmed-Rengers, Marta Piekarska-Geater, Permissioned Blockchain in Action, Manning, 1st Edition, 2021
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://onlinecourses.nptel.ac.in/noc22_cs44/preview
2.	https://onlinecourses.swayam2.ac.in/aic21_ge01/preview

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 Assignment (OA)/ Certification
4.	Online classes	4.	Course Project
		5.	Semester End Examination
		6.	MOOC course

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.	Compare and contrast blockchain with other distributed systems	Un	1,2	1,2
2.	Illustrate the use of Decentralization and use of Cryptography in Blockchain	Un	1,2,3, 4	1,2
3.	Build Smart contract with Ethereum for Blockchain	Ap	1,2,3, 4	1,2
4.	Identify the various domains where blockchain, smart Contract and Ethereum can be applied	Ap	1,2,3, 4, 12	1,2

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Two Assignments – (Open /Industry/Certification etc)**	**Course project (CP)/ Case study etc**	**Total Marks**
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

-Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.

-Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests.

-Lack of minimum score in IA test will make the student Not Eligible for SEE

-Minimum score in CIE 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 ≥ 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 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
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	Blockchain basics	Defense, Banking, Insurance, Healthcare, etc.	Blockchain developer
2	Ethereum		Ethereum Developer
3	Solidity, Truffle		Solidity Developer

BUSINESS INTELLIGENCE AND ANALYTICS

Course Code:	22CS743	**Course type**	PEC	**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 understand the introduction of Business Intelligence, data mining and data warehousing basic concepts .
2.	To understand the various technologies for data mining and data warehouse systems
3.	To apply various data warehousing and data mining techniques for dimensionality reduction
4.	To make use of various techniques for analyzing the predictive models .

Pre-requisites: Engineering Mathematics, Knowledge of Programming.

Unit – I	**Contact Hours = 8 Hours**
Introduction to Business Intelligence rational and Decision Support System, Data-Information-Knowledge-Decision Making-Action cycle. Basic definitions- Business Intelligence; Data warehousing, Business Intelligence architecture, Use and benefits of Business Intelligence. Knowledge Discovery in Databases: KDD process model, Data Pre-processing: Cleaning: Missing Values; Noisy Values; Inconsistent values; redundant values. Outliers, Integration, transformation, reduction, Discretization: Equal Width Binning; Equal Depth Binning, Normalization, Smoothing.	

Unit – II	**Contact Hours = 8 Hours**
Introduction to Business Data Warehouse Definition of Data warehouse, Logical architecture of Data Warehouse, Data Warehouse model- Enterprise warehouse; Data Marts; Virtual warehouse. Populating business Data Warehousing: data integration and extract, transform, load (ETL).	

Unit – III	**Contact Hours = 8 Hours**
Designing Business Data Warehouse OLTP and OLAP systems, Designing business information warehouse: Principles of dimensional modeling, Data cubes, Data cube operations, data cube schemas.	

Unit – IV	**Contact Hours = 8 Hours**
Introduction to Data Mining Data mining definitions and process: business and data understanding. Association Analysis: Definition of association rule, General issues: Support; Confidence; Lift; Conviction, Frequent Item sets: APriori Algorithm; Issues with APriori Algorithm, Data structures: Hash tree and FP tree..	

Unit – V	Contact Hours = 8 Hours
Cheat Sheet and Project on Descriptive Analytics: Cheat Sheet of Descriptive Analytics, Project on Descriptive Analytics. Regression: Predictive Performance Estimation, Finding the Parameters of the Model, Technique and Model Selection	

Flipped Classroom Details

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

Unit No.	Self-Study Topics
I	Basics of Analytics
II	Data Marts; Virtual warehouse.
III	Data cube operations
IV	Hash tree and FP tree..
V	Predictive Performance Estimation

Books	
	Text Books:
1.	Efraim Turban, Ramesh Sharda, Dursun Delen, David King,, Business Intelligence (2nd Edition), Pearson 2nd edition 2013 onwards
2.	Inmon: Building the Data Warehouse Wiley (1993). •
3.	João Mendes ,A General Introduction to Data Analytics et al Wiley 2019
4.	Data Mining: Practical Machine Learning Tools and Techniques, Second Edition, Witten, Ian and Eibe Frank, Morgan Kaufmann (2011)
	Reference Books:
1.	Witten, Ian and Eibe Frank, Morgan Kaufmann Data Mining Practical Machine Learning Tools and Techniques, Second Edition: (2011)
2.	Dunham, Margaret H ,Data Mining: Introductory and Advanced Topics, Prentice Hall (2006)
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://onlinecourses.nptel.ac.in/noc24_cs65/preview
2.	https://www.coursera.org/learn/business-intelligence-data-analytics

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Assignment (OA)/ Certification
3.	Flipped Classes	3.	Course Project
4.	Online classes	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.	**Explain** the fundamental concepts of Business Intelligence data mining and data warehousing.	Un	1,2	1
2.	**Demonstrate and analyze** the various Data mining and data warehousing and Preprocessing methods .	An	1,2,3,4	1,2
3.	**Apply** various data mining and data analysis techniques for a building a model .	Ap	1,2,3,4,5	1,2
4.	**Apply** descriptive analytics for predicting a model	Ap	1,2,3,4,5	1,2
5.	**Apply** the learnings inculcated throughout the course and develop a course project or present a course seminar.	Ap	1,2,3,4,5,9,10,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Two Assignments – (Open /Industry/Certification etc)**	**Course project (CP)/ Case study etc**	**Total Marks**
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

-Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.
-Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests.
-Lack of minimum score in IA test will make the student Not Eligible for SEE
-Minimum score in CIE 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 three parts **A,B and C**. Students have to answer 1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**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 Industry Sectors & domains**	**Job roles students can take up after undergoing the course**
1	Understanding Data Analytics	IT Services	Data Analyst
2	Understanding the visualization	Private Sector	Data Scientist
3	Developing the projects for Business	IT or Academia	Business Intelligence Analyst

CYBER SECURITY

Course Code	22CS744	**Course type**	PEC	**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 understand the basics of cybersecurity and get familiar with cybersecurity analysis tools.
2.	To learn about security threats and countermeasures
3.	To acquire knowledge regarding necessity, and types of attacks
4.	To illustrate knowledge about firewalls and security analysis protocols

Pre-requisites: Basic understanding of internet, Computer Networks, Information and Network Security

Unit – I	**Contact Hours = 8 Hours**
Introduction to Cyber Security Introduction to Information Security and its policies: CIA Triad-3 pillars of information security architecture, CIA components and its importance, Cyber security threats and best practices, Access controls and its types, Discretionary access control, Mandatory access control, Role based access control, Arbitrary based access control, Active Reconnaissance.	

Unit – II	**Contact Hours = 8 Hours**
Ethical Hacking Methodologies Reconnaissance and Footprinting, Scanning and Enumeration, Gaining Access Maintaining Access Types of Cyber Attack, Vulnerability Assessment and its features, Concept and types of Scanning methodology.	

Unit – III	**Contact Hours = 8 Hours**
Network Security Threats and countermeasures Network Security Devices, Types of Network Securities, Network Access Control, Characteristics of Network Access Control, Application Security, Application Security Tools, Virtual private network, Tunneling protocol and types, IDS vs. IPS, IDS, IPS and their Types, Introduction to Web Application Vulnerabilities.	

Unit – IV	**Contact Hours = 8 Hours**
Web Server & Application Security: Common Cyberattacks on Web Applications, Mobile Application Vulnerabilities, Mobile Security Threats, Mobile Application Security.	

Concept and overview of 3 tier Architecture: Web Application Basics, Working of DNS (Domain Name System), Working of DNS and its vulnerabilities, Web Server Vulnerabilities, Web Application Security, Technology Stack for Web Development, Web Application Attacks, Working of HTTP, Configuring Chrome to work with Burp, HTTP Request Methods, HTTP Crash Course & Exploration, HTTP Status Messages, HTTP – Responses.

Unit – V	**Contact Hours = 8 Hours**
Types of Firewalls and its benefits, Packet Filtering Firewall, Circuit-Level Gateway, Application Firewall, Inspection Techniques, Stateful and Stateless Application, Stateful vs. Stateless Filtering Firewall **Cryptography:** Introduction to cryptography, Overview of cryptography, Cryptography and Cryptanalysis, Types of cryptography, Symmetric encryption, Asymmetric encryption, Hash Cryptography, Understanding digital certificates and signatures	

Flipped Classroom Details

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

Unit No.	**Self-Study Topics**
I	Cyber Security Case Studies
II	Mobile Device Management, Cloud Computing Threats and Solutions.
III	Network Analyzers, Wireshark and its use cases.
IV	HTTP Basics &Functionality
V	Cryptographic Attacks

Books	
	Text Books:
1.	Michael Gregg, Omar Santos, Certified Ethical Hacker (CEH) Version 10 Cert Guide,Pearson IT Certification, 3rd Edition, 2019
2.	Ric Messier, CEH v10 Certified Ethical Hacker Study Guide, Sybex, 2019
3.	William Stallings, Cryptography and Network Security, Pearson 7th edition & 2017 Onwards
	Reference Books:
1.	Atul Kahate: Cryptography and Network Security McGraw-Hill Second edition
2.	Matt Walker, CEH Certified Ethical Hacker All-in-One Exam Guide, Fourth Edition,McGraw-Hill, 4th Edition, 2019
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://onlinecourses.swayam2.ac.in/cec20_cs15/preview
2.	https://onlinecourses.nptel.ac.in/noc23_cs127/preview

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Assignment (OA)/ Certification
3.	Flipped Classes	3.	Course Project
4.	Online classes	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 - A**nalysis**; Ev - **Evaluate**; Cr - **Create**		**Learning Level**	**PO(s)**	**PSO(s)**
1.	**Demonstrate** the need of cybersecurity in various web applications	Un	1,2	1
2.	**Make use of** countermeasure tools for various types of attacks and evaluate the performance	Ap	2,3,5,6,12	1,2,3
3.	**Identify** the vulnerabilities at different parts of the networks and types of services	Ap	1,2,3	1,2
4.	**Understand** and **Apply** various types of firewalls and Cryptographic techniques	Ap	5,6,12	1,2,3
5.	**Analyze** the requirements for a real world problem or a specification and develop a course project as the solution.	Ap	1,2,3,5, 9,10,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Two Assignments – (Open /Industry/Certification etc)**	**Course project (CP)/ Case study etc**	**Total Marks**
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

-Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.
-Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests.
-Lack of minimum score in IA test will make the student Not Eligible for SEE
-Minimum score in CIE 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 three parts **A,B and C**. Students have to answer 1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**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 Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Ethical Hacking and Penetration Testing, Threat Awareness, Security Infrastructure and Incident Response	Information Technology (IT) and Software Development, Financial Services, Healthcare, Government and Defense, Retail and E-commerce and Transportation and Logistics	Web Penetration Tester SOC Analyst Cyber Security Engineer (Cryptography Specialist)

SALESFORCE LIGHTNING (PROJECT BASED)

Course Code	22CS745	**Course type**	PEC	**Credits L-T-P**	2-0-1
Hours/week: L - T- P	2 - 0 – 2			**Total credits**	3
Total Contact Hours	L = 30 Hrs; T = Hrs; P = 20 Hrs Total = 50 Hrs			**CIE Marks**	100
Flipped Classes content	10 Hours			**SEE Marks**	100

Course learning objectives	
1.	To introduce Salesforce Lightning interface, its various features and tools to improve user experience.
2.	To provide an understanding of the Salesforce Lightning components, pages, and applications to align with organizational needs and branding requirements.
3.	To design, develop, and deploy Lightning Components using the Lightning Component Framework to extend Salesforce functionality based on the demands by users.
4.	To provide a solution to real world problems with the help of lightning tools and extensions using reusable components.

Required Knowledge of: Web Programming, Object-Oriented Programming, Introduction to Salesforce

Unit – I	**Contact Hours = 10 Hours**
Introduction to Lightning Experience: CRM for Lightning Experience, User Management, Data Management, Chatter Administration for Lightning Experience, Reports & Dashboards for Lightning Experience, Lightning Experience Customization, Lightning Experience Rollout, Lightning Experience Basics, Knowledge Basics for Lightning Experience, Lightning Experience for Salesforce Classic Users.	

Unit – II	**Contact Hours = 10 Hours**
Develop for Lightning Experience: Lightning Experience Basics, Lightning Experience Development, Visualforce & Lightning Experience, Aura Components Basics, Lightning Data Service Basics for Aura Components, Build Flexible Apps with Lightning Components, Build a Lightning Component to Override a Standard Action	

Unit – III	**Contact Hours = 10 Hours**
Lightning Experience Specialist: Lightning Web Components Basics, Lightning Experience Development, Visualforce & Lightning Experience, Lightning Experience Reports & Dashboards Specialist, Quick Start: Lightning App Builder, Lightning Design System for Developers, Lightning App Builder, Quick Start: Aura Components.	

Unit – IV	Contact Hours = 10 Hours
JavaScript Skills for Salesforce Developers: Lightning Data Service Basics for Aura Components, Field Service Lightning Basics, Build Reusable Lightning Components, Aura Components Tips & Gotchas, Aura Components Skills & Tools, Aura Components Core Concepts.	

Unit – V	Contact Hours = 10 Hours
Lightning Alternatives to JavaScript Buttons: Build Flexible Apps with Lightning Components, Build a Lightning Component to Override a Standard Action, Aura Components Specialist, Lightning Experience Features, Build a Suggestion Box App.	

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
I	2	Chatter Integration and Engagement, Dynamic Reporting and Dash boarding
II	2	Optimizing Lightning Experience Development Workflow, Aura Components
III	2	Lightning Web Components, Custom Dashboard Development
IV	1	Aura Components
V	1	JavaScript Button Replacement

Unit No.	Self-Study Topics
I	Lightning Experience
II	Aura Components
III	Lightning Apps
IV	Security for Lightning Components
V	Lightning Experience Rollout Specialist.

Books	
	Text Books:
1.	Mohit Shrivatsava, Learning Salesforce Lightning Application Development, Packt,2011.
	Reference Books:
1.	Paul Battisson, Learning Salesforce Development with Apex, BPB Publications,2020
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://trailhead.salesforce.com/en/users/00550000007igjNAAQ/trailmixes/lightning-knowledge
2.	https://www.lightningdesignsystem.com/

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 benefits of using Salesforce Lightning over Classic and Interpret the customization options available in Salesforce Lightning.	Un	1,2,3,5	1
2.	Apply integration techniques to connect Salesforce Lightning with external systems.	Ap	1,2,3,4,5,9	1,2,3
3.	Categorize and build the solutions with suitable mode of representation for the domain requirements using the lightning trends.	An	1,2,3,4,5,9,10,11,12	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.

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.

-Submission of 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 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. f. Viva-voce	10 marks 30 marks 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	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
1	✓	✓	✓		✓								✓		
2	✓	✓	✓	✓	✓				✓				✓	✓	✓
3	✓	✓	✓	✓		✓			✓	✓		✓	✓	✓	✓
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	Students can apply appropriate Components of salesforce to provide service to the customers.	Service based Industry	Salesforce Administrator Salesforce Business Analyst Salesforce Developer Salesforce Functional Consultant Salesforce Platform Manager Salesforce Solution Architect Salesforce Technical Architect
2	Have a knowledge about Aura Components and Lightning terminologies.		
3	Students can solve real world problems.		

DISASTER MANAGEMENT

Course Code	22CS751	Credits	03
Course type	PE	CIE Marks	110
Hours/week: L-T-P	3-0-0	SEE Marks	100
Total Hours:	40	SEE Duration	03 Hours for 100 Marks

Course Learning Objectives (CLO's)	
1	Describe Different types of disaster
2	Describe the framework for Disaster Management
3	Explain the approaches for Disaster Preparedness and Response.

Pre-requisites:

1	Environmental Studies

UNIT I	8 Hours
INTRODUCTION ON DISASTER: **Different Types of Disaster:** Natural Disaster: Flood, Cyclone, Earthquakes, Landslides etc Man-made Disaster: Fire, Industrial Pollution, Nuclear Disaster, Biological Disasters, Accidents (Air, Sea, Rail & Road), Structural failures (Building and Bridge), War & Terrorism etc. Causes, effects and practical examples for all disasters.	
Self-Learning Topics: Man Made Disaster (Hiroshima and Nagasaki Nuclear Disaster)	
UNIT II	**8 Hours**
RISK AND VULNERABILITY ANALYSIS: Risk : Its concept and analysis, Risk Reduction, Vulnerability : Its concept and analysis, Strategic Development for Vulnerability Reduction	
Self-Learning Topics: NIL	
UNIT III	**8 Hours**
DISASTER PREPAREDNESS AND RESPONSE **Preparedness:** Disaster Preparedness: Concept and Nature, Disaster Preparedness Plan, Prediction, Early Warnings and Safety Measures of Disaster, Role of Information, Education, Communication and Training, Role of Government, International and NGO Bodies, Role of IT in Disaster Preparedness, Role of Engineers on Disaster Management. **Response:**	

Disaster Response : Introduction, Disaster Response Plan, Communication, Participation, and Activation of Emergency Preparedness Plan, Search, Rescue, Evacuation and Logistic Management, Role of Government, International and NGO Bodies, Psychological Response and Management (Trauma, Stress, Rumor and Panic), Relief and Recovery, Medical Health Response to Different Disasters
Self-Learning Topics: Case Study on Urban Flooding and Mitigation Measures

UNIT IV	**8 Hours**
Reconstruction and Rehabilitation as a Means of Development, Damage Assessment, Post Disaster effects and Remedial Measures, Creation of Long-term Job Opportunities and Livelihood Options, Disaster Resistant House Construction, Sanitation and Hygiene, Education and Awareness, Dealing with Victims' Psychology, Long-term Counter Disaster Planning, Role of Educational Institute.	
Self-Learning Topics: NIL	

UNIT V	**8 Hours**
DISASTER MANAGEMENT IN INDIA: Disaster Profile of India – Mega Disasters of India and Lessons Learnt, Disaster Management Act 2005 – Institutional and Financial Mechanism, National Policy on Disaster Management, National Guidelines and Plans on Disaster Management, Role of Government (local, state and national), Non-Government and Intergovernmental Agencies	

Textbooks:

1.	Tushar Bhattacharya, "**Disaster Science and Management**", McGraw Hill Education (India) Pvt. Ltd-2017
2.	Dr. Mrinalini Pandey, **"Disaster Management"**, Wiley India Pvt. Ltd-2014
3.	J. P. Singhal, "**Disaster Management**", Laxmi Publications-2010

References:

1.	C. K. Rajan, Navale Pandharinath, **"Earth and Atmospheric Disaster Management: Nature and Manmade"**, B S Publication-2017

Course Outcomes (COs)

	At the end of the course, students will be able to:	**Bloom's Level**
1.	**Explain** the types of Disasters and its risk, vulnerability analysis	**L2**
2.	**Identify** the preparedness and response for natural and man-made disaster	**L3**
3.	**Identify** the mitigation measure for disaster	**L3**
4.	**Explain** the disaster management system adopted in India	**L2**

	Program Outcome (POs)	PO No.
1.	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	**PO 6**

	Course delivery methods		Assessment methods
1.	Lecture and Board	1.	Assignments and Open Book Assignments
2.	NPTEL/ Edusat	2.	Quizzes
3.	PowerPoint Presentation	3.	Internal Assessment Tests
4.	Videos	4.	Semester End Examination

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Two Assignments – (Open /Industry/Certification etc)	Course project (CP)/ Case study etc	Total Marks
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

-Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.
-Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests.
-Lack of minimum score in IA test will make the student Not Eligible for SEE
-Minimum score in CIE to be eligible for SEE: 40 OUT OF 100.

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 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, 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	✓	✓	✓								✓		✓		✓
Tick mark the CO, PO and PSO mapping															

DATBASE MANAGEMENT SYSTEMS

Course Code	22CS752	**Course type**	OEC	**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 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 transactions.
4.	To understand the application of different query languages and query optimizations.

Pre-requisites : Basics of Programming Language, SET Theory

Unit – I	**Contact Hours = 8 Hours**
Introduction: Introduction to database, Characteristics of Database approach, Advantages of using DBMS approach, Difference between File System and DBMS, When not to use a DBMS; Actors on the scene, Workers behind the scene; Three-schema architecture and data independence.	

Unit – II	**Contact Hours = 8 Hours**
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	

Unit – III	**Contact Hours = 8 Hours**
Relational Model and Relational Algebra: 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 – IV	**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 **Transactions:** Introduction to transactions, ACID properties	

Unit – V	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. Insert, Delete and Update statements in SQL. SQL vs NoSQL: Critical Differences	

Flipped Classroom Details

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

Unit No.	Self-Study Topics
I	Traditional File system
II	ER diagrams of different scenarios.
III	Schema diagrams of different applications.

Books	
	Text Books:
1.	Elmasri and Navathe: Fundamentals of Database Systems, Addison-Wesley, 3rd edition and onwards.
2.	Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, McGraw-Hill, 2nd edition and onwards.
	Reference Books:
1.	Silberschatz, Korth and Sudharshan: Data base System Concepts, Mc-GrawHill, 3rd edition and onwards.
2.	C.J. Date, A. Kannan, S. Swamynatham: A Introduction to Database Systems, Pearson education, 5th edition and onwards.
	E-resources (NPTEL/SWAYAM. Any Other)- mention links
1.	https://onlinecourses.nptel.ac.in/noc22_cs91/preview

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Assignment (OA)/ Certification
3.	Flipped Classes	3.	Course Project
4.	Online classes	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.	**Analyze** the given database applications using E-R diagrams and apply the normalization to produce schema diagrams and relations.	An	1,2,3,4, 5	1,2
2.	**Explain** the relational operators , SQL concepts and transaction processing.	Re	1,2,3	1
3.	**Apply** ER,SQL , SQL concepts to design different Database applications.	Ap	1,2,3,4, 5	1,2
4.	**Understand** the learnings inculcated throughout the course and present a course seminar or **develop** a course project or assignments.	An	1,2,3,4, 5,9,10, 11,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Two Assignments – (Open /Industry/Certification etc)**	**Course project (CP)/ Case study etc**	**Total Marks**
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

-Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.
-Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests.
-Lack of minimum score in IA test will make the student Not Eligible for SEE
-Minimum score in CIE 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 three parts **A,B and C**. Students have to answer 1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
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	Analyzing and Designing Databases	Software Industry	Database Developers
2	Administration of Databases	Software Industry	Database Administrators

OBJECT-ORIENTED PROGRAMMING USING JAVA

Course Code	**22CS753**	**Course type**	OEC	**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 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 packages, the data structures to organize data in the program using the collections framework in Java.

Pre-requisites : C, Object Oriented Programming Language

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 I: 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	

Unit – III	**Contact Hours = 8 Hours**
Methods and classes II: Method overloading. **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.	

Unit – IV	Contact Hours = 8 Hours
Interfaces: Interface fundamentals, creating, implementing, and using interfaces, implementing multiple interfaces. **Exception handling:** the exception hierarchy, exception handling fundamentals, exception types, uncaught exceptions, using try and catch, multiple catch clauses, catching subclass exceptions, throw, finally, Java's built-in exceptions, creating your own exception subclasses.	

Unit – V	Contact Hours = 8 Hours
Lambda Expressions: Functional interface, Types of lambda expressions and examples **The Java Collections Framework**: overview, the collections interfaces, the collections classes, accessing a collection via an Iterator.	

Flipped Classroom Details

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

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 (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://onlinecourses.nptel.ac.in/noc22_cs47/preview
2.	https://www.w3schools.com/java
3.	https://freecodecamp.org

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Assignment (OA)/ Certification
3.	Flipped Classes	3.	Course Project
4.	Online classes	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 - **Remembe**r; Un **- Understand**; Ap - **Apply**; An **- Analysis**; Ev - **Evaluate**; Cr **– Create**		**Learning Level**	**PO(s)**	**PSO(s)**
1.	Explain and apply classes, objects, members of a class, OOP principles, and proper program structure to write application programs.	Ap	1,2,3,5	1,2
2.	Develop 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 the concept of packages and interfaces	Ap	1,3	1,2
4.	Apply the learning inculcated throughout the course by developing the course project	Cr	1,2,3,5,9,10,11,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Two Assignments – (Open /Industry/Certification etc)**	**Course project (CP)/ Case study etc**	**Total Marks**
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

-Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.
-Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests.
-Lack of minimum score in IA test will make the student Not Eligible for SEE
-Minimum score in CIE 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 three parts **A,B and C**. Students have to answer 1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
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	Software Developer Well versed with Basics of Java Programming	Software/ Software Development/ Application	Software Developer Well versed with Basics of Java Programming

MACHINE LEARNING

Course Code	22CS754	**Course type**	OEC	**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 understand the basic concepts of Machine learning
2.	To understand and apply neural networks and genetic algorithms for real world problems
3.	To apply Bayesian techniques to solve probabilistic problems
4.	To explore Reinforcement Learning that trains algorithms to explore their environments on their own.

Pre-requisites : Algorithms, Probability theory

Unit – I	**Contact Hours = 8 Hours**
Introduction to Machine Learning I: Introduction, Training, Rote Learning, Issues in Machine Learning, Learning Concepts, Find-S algorithm, Decision Tree Induction, The Problem of Overfitting, The Nearest Neighbor Algorithm, Supervised Learning, Support Vector Machine, Linear Regression	

Unit – II	**Contact Hours = 8 Hours**
Neural Networks: Introduction, Neurons, Perceptrons, Multilayer Neural Networks-Backpropagation, Recurrent Networks, Unsupervised learning networks- Hebbian learning	

Unit – III	**Contact Hours = 8 Hours**
Unsupervised Learning: Clustering-K-means clustering **Probabilistic Reasoning and Bayesian Belief Networks:** Introduction, Probabilistic Reasoning, Bayes' Theorem, Simple Bayesian Concept Learning, Bayesian Belief Networks, The Naïve Bayes Classifier.	

Unit – IV	**Contact Hours = 8 Hours**
Genetic Algorithms: Introduction, Representations, The Algorithm, Fitness, Crossover, Mutation, Termination Criteria, Why Genetic Algorithms Work, Prisoner's Dilemma, Diversity, Evolving Pictures, Predators and Coevolution	

Unit – V	**Contact Hours = 8 Hours**
Reinforcement Learning: What is Reinforcement Learning? Components of Reinforcement Learning. Key features and elements of Reinforcement Learning. Approaches to implementing Reinforcement	

Learning. Working of Reinforcement Learning. Types of Reinforcement Learning. Reinforcement Learning Algorithm. Applications of Reinforcement Learning.

Flipped Classroom Details

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

Unit No.	Self-Study Topics
I	Candidate elimination algorithm
II	KSOM self-learning networks
III	Joint Probability distribution, Collaborative filtering

Books	
	Text Books:
1.	Ben Coppin, "Artificial Intelligence Illuminated", Jones and Bartlet Publishers, 1st Edition, 2004.
2.	Jiawei Han, Micheline Kamber, Jian Pe, "Data Mining Concepts and Techniques", 3rd Edition, 2011
	Reference Books:
1.	Ethem Alpaydin, "Introduction to Machine Learning", 2nd Edition, PHI Learning Pvt. Ltd., 2013
	E-resourses (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://nptel.ac.in/courses/106106139
2.	https://www.javatpoint.com/reinforcement-learning

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Assignment (OA)/ Certification
3.	Flipped Classes	3.	Course Project
4.	Online classes	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.	**Choose** the appropriate learning skills for various application of classification	Ap	1,2,3,12	1,3
2.	**Apply** effectively neural networks and genetic algorithms for appropriate applications.	Ap	1,2,3	1
3.	**Apply** Bayesian techniques and derive effectively learning rules.	Ap	1,2,3	1

4.	**Understand** the need for Reinforcement Learning	Un	1,12	1,3
5.	**Apply** the learnings inculcated throughout the course and **develop** a course project and present a seminar	Ap	1,2,3,5,9,10,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Two Assignments – (Open /Industry/Certification etc)	Course project (CP)/ Case study etc	Total Marks
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

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-Minimum score in CIE 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 three parts **A,B and C**. Students have to answer 1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (Planned)													**CO-PSO Mapping (Planned)**		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**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 Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Creating intelligent models	Healthcare Sector	Data Engineer
2	Reinforcement learning	Social Media	Machine Learning Engineer
3	Data models and evaluation	Agriculture	Business Intelligence Developer

INTRODUCTION TO CYBER SECURITY

Course Code	22CS755	**Course type**	OEC	**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	5 Hours			**SEE Marks**	100

Course learning objectives	
1.	To understand the basics of cybersecurity and key issues.
2.	To learn about security threats and countermeasures.
3.	To expose students to responsible use of online social media networks
4.	To explore different cybersecurity tools

Pre-requisites : Basic understanding of internet, Computer Networks

Unit – I	**Contact Hours = 8 Hours**
Introduction to Cyber Security Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cybersecurity.	

Unit – II	**Contact Hours = 8 Hours**
Cyber-crime and Cyber law Classification of cyber-crimes, Common cyber-crimes- cyber-crime targeting computers and mobiles, cyber-crime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Cybercriminals modus-operandi ,Reporting of cyber-crimes, Remedial and mitigation measures, Legal perspective of cyber-crime, IT Act 2000 and its amendments, Cyber-crime and offences, Organizations dealing with Cyber-crime and Cyber security in India, Case studies.	

Unit – III	**Contact Hours = 8 Hours**
Social Media Overview and Security Introduction to Social networks. Types of Social media, Social media platforms, Social media monitoring, Hashtag, Viral content, Social media marketing, Social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Flagging and reporting of inappropriate content, Laws regarding posting of inappropriate content, Best practices for the use of Social media, Case studies.	

Unit – IV	Contact Hours = 8 Hours
E - Commerce and Digital Payments Definition of E- Commerce, Main components of E-Commerce, Elements of E-Commerce security, E-Commerce threats, E-Commerce security best practices, Introduction to digital payments, Components of digital payment and stake holders, Modes of digital payments- Banking Cards, Unified Payment Interface (UPI), e-Wallets, Unstructured Supplementary Service Data (USSD), Aadhar enabled payments, Digital payments related common frauds and preventive measures. RBI guidelines on digital payments and customer protection in unauthorized banking transactions. Relevant provisions of Payment Settlement Act,2007	

Unit – V	Contact Hours = 8 Hours
Digital Devices Security, Tools and Technologies for Cyber Security End Point device and Mobile phone security, Password policy, Security patch management, Data backup, Downloading and management of third party software, Device security policy, Cyber Security best practices, Significance of host firewall and Ant-virus, Management of host firewall and Anti-virus, Wi-Fi security, Configuration of basic security policy and permissions.	

Flipped Classroom Details

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

Unit No.	Self-Study Topics
I	Installation and working with Kali linux
II	whois Query for IP address, Mirroring sites with httrack
III	Metasploit
IV	Nmap

Books	
	Text Books:
1.	Cyber Crime Impact in the New Millennium, by R. C Mishra, Auther Press. Edition 2010
2.	Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. (First Edition, 2011)
3.	Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform. (Pearson, 13th November, 2001)
	Reference Books:
1.	Electronic Commerce by Elias M. Awad, Prentice Hall of India Pvt Ltd.
2	Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers.
3.	Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition, Wiley India Pvt. Ltd.
	E-resources
1.	https://nptel.ac.in/courses/106106248

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 Assignment (OA)/ Certification
4.	Online classes	4.	Course Project
		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	Conduct vulnerability **analysis** to pinpoint security gaps in the organization's network, communication setup, and end systems and Issues and challenges of cybersecurity	4	1,2,5	1
2	Gain comprehensive **understanding** of Cyber Crimes, cyber-crime targeting computers and mobiles, cyber-crime against women and children and associated tools.	2	6,8,12	1,2
3	**Apply** the application of cryptographic algorithms to ensure secure message transmission.	3	5	3
4	**Analyse** the requirements for a real world problem or a specification and develop a course project as the solution	4	1,2,3,5,9,10,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Two Aassignments – (Open /Industry/Certification etc.)**	**Course project (CP)/ Case study etc.**	**Total Marks**
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

-Certification earned by passing the standard Online MOOCs course (1 course of at least 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.

-Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests.

-Lack of minimum score in IA test will make the student Not Eligible for SEE

-Minimum score in CIE 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 ≥ 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 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (Planned)													**CO-PSO Mapping (Planned)**		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
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	Understanding of Cyber Threat Landscape Fundamental Technical Skills Security Principles and Best Practices Risk Assessment and Management Compliance and Regulatory Knowledge Incident Detection and Response Secure Software Development Practices Security Awareness and Training Continuous Learning and Adaptability	Information Technology Finance and Banking Health Care Government and Defense Retail and e Commerce Education Transportation and Logistics Telecommunication	- Network Security Analyst - Web Security Specialist - Endpoint Security Engineer - Incident Response Coordinator - Forensic Analyst - Cryptography Specialist - Penetration Tester - Social Engineering Expert
2	Cloud Security	Software Developer	IT auditor

OPTIMIZATION TECHNIQUES

Course Code	22MAT751	Course type	OEC	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 understand the methodology of OR problem solving and formulate linear programming problem. Solve linear programming problems using simplex method
2.	Develop formulation skills in transportation models and finding solutions. Understand the basics of Assignment Problems.
3.	Analyze dynamic games and understand queuing theory models and applications.
4.	To know how project management techniques help in planning and scheduling a project.

Pre-requisites : Basic algebra, Matrix theory, Probability

Unit – I : Introduction to OR and Linear Programming Problem	Contact Hours = 8 Hours
Evolution of OR, definition of OR, steps (phases) in OR study, characteristics and limitations of OR, models used in OR,Linear Programming Problem, Convexity and Basic Feasible Solutions. Formulation and examples, Graphical Solution, Convex and polyhedral sets, Extreme points, Basic solutions, Basic feasible solutions, Correspondence between basic feasible solutions and extreme points.	

Unit – II : Simplex method and Duality	Contact Hours = 8 Hours
Simplex method, Canonical and Standard form of LP problem, Optimality criterion, slack and surplus variables, Solutions to LPP by Simplex method. Formulation of the dual problem, Unbounded and infeasible solutions in the primal, Solving the primal problem using duality theory.	

Unit – III : Transportation and Assignment Problem	Contact Hours = 8 Hours
Formulation of transportation problems, Methods of finding initial basic feasible solutions: North-west corner rule, Least-cost method, Vogel approximation method, Algorithm for obtaining optimal solution using MODI method. Formulation of assignment problems, Hungarian method.	

Unit – IV : Game Theory and Queuing Theory	Contact Hours = 8 Hours
Formulation of two-person zero-sum games, Games with mixed strategies, Graphical method for solving matrix game, Dominance principle, Solution of game problem. Queuing systems and their characteristics, Pure-birth and Pure-death models (only equations), Kendall & Lee's notation of Queuing, empirical queuing models – Numerical on M/M/1 and M/M/C Queuing models.	

Unit – V : Network Analysis	Contact Hours = 8 Hours
Network Scheduling by CPM-PERT: Rules of Network construction, Numbering of events (Fulkerson's rule), Construction of network, Time analysis: Forward Pass computation, Backward Pass computation, Determination of Floats and Slack times, Critical Path Method (CPM), Program Evaluation Review Technique (PERT). Cost analysis in networks - Problem	

Flipped Classroom Details

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

Unit No.	Self-Study Topics
I	Scope of OR, application areas of OR
II	Solving LPP by Generalized simplex method, Degeneracy in LPP
III	Travelling sales man problem
IV	Linear programming method to solve without saddle point
V	Crashing of networks

Books	
	Text Books:
1.	Operations Research, An Introduction, Seventh Edition, Hamdy A. Taha, PHI Private Limited, 2006.
2.	Operations Research, S D Sharma Kedarnath, Ramnath & Company.
3.	Operations Research, Theory and Applications, Sixth Edition, J K Sharma, Trinity Press, Laxmi Publications Pvt. Ltd. 2016
4.	Operations Research, Anand Sharma, Himalaya Publishing House.
	Reference Books:
1.	Introduction to Operations Research, Hillier and Lieberman, 8th Ed., McGraw Hill.
2.	Hamdy A. Taha (2017). Operations Research: An Introduction to Linear Programming and Game Theory (3rd edition)
	E- resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	http://www.class-central.com/subject/math(MOOCs)
2.	http://academicearth.org/

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Assignment- Open/Industry/Certification
3.	Flipped Classes	3.	Course Project
4.	Online classes	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.	Understand linear programming problems using appropriate techniques and optimization solvers, interpret the results obtained.	Un	1	1
2.	Analyse the transportation models' solutions and infer solutions to the real-world problems recognize and solve assignment problems.	An	1	1
3.	Apply theory of pure and mixed strategy games and queuing theory models.	Ap	1	1
4.	Apply Network models for service and manufacturing systems, and apply operations research techniques and algorithms to solve these Network problems.	Ap	1	1

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Two Assignments– (Open/Industry/Certification etc)**	**Course project(CP)/ Case study etc**	**Total Marks**
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

-Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.
-Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests.
-Lack of minimum score in IA test will make the student Not Eligible for SEE
-Minimum score in CIE 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 three parts **A,B and C**. Students have to answer 1. From Part A answer any 5 out of 7questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosingany one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
1	✓												✓		
2	✓												✓		
3	✓												✓		
4	✓												✓		
Tick mark the CO, PO and PSO mapping															

COMPLEX ANALYSIS AND SPECIAL FUNCTIONS

Course Code	22MAT752	**Course type**	OEC	**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.	Understand complex valued functions.
2.	Apply conformal mapping to find the image of region.
3.	Apply various integral formulae for dealing with complex integration
4.	Understand the importance of special functions.

Pre-requisites :Basic knowledge of complex numbers, algebra and series solution	
Unit – I	**Contact Hours = 8 Hours**
Complex Analysis-I Functions of complex variables, Analytic functions, CR equations- Cartesian and Polar form(with proof), Properties of analytic functions, Applications to flow problems-velocity potential, complex potential, stream functions and stream lines. Harmonic functions	

Unit – II	**Contact Hours = 8 Hours**
Conformal Transformation, Condition for conformality, Mappings : $w = Z^n$ $w = Z^2$, $w = e^z$, $w = z + (a^2/z)$. Bilinear transformation. Cross ratio Fixed points. Numerical based on different regions.	

Unit – III	**Contact Hours = 8 Hours**
Line integral in complex plane, Cauchy's theorem and consequences, Cauchy's integral formula and residue theorem, Singularities and residues. Laurent's series. Region of convergence. Numerical on all above.	

Unit – IV	**Contact Hours = 8 Hours**
Bessel function: Bessel equation and its origin, solution, Bessel function of first kind, $J_0(x)$, $J_1(x)$, $J_{0.5}(x)$, $J_{-0.5}(x)$ Recurrence relations, More J values. Generating function, orthogonality. Numerical on above	

Unit – V	**Contact Hours = 8 Hours**
Legendre function: Legendre equation and its origin, solution, Legendre polynomial, Rodrigues formula Recurrence relations, Generating function, orthogonality. Numericals on above	

Flipped Classroom Details

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

Unit No.	Self-Study Topics
I	Proof of C R equations.
II	Trigonometric transformations: sin z, cos z, tan z.
III	Taylor's and Maclaurin's series.
IV	Graphs of various Bessel function.
V	Rodrigues formula derivation.

Books	
	Text Books:
1.	B.S. Grewal – Higher Engineering Mathematics, Khanna Publishers, 42nd Edition, 2012.
2.	B. V. Ramana- Higher Engineering Mathematics,Tata McGraw-Hill Publishing Company Ltd. Tenth reprint 2010 and onwards.
	Reference Books:
1.	P.N.Wartikar & J.N.Wartikar– Applied Mathematics (Volume I and II) Pune Vidyarthi Griha Prakashan, 7th Edition 1994 onwards.
2.	Functions of One Complex Variable" by John B. Conway, 2004 edition onwards.
3.	Special Functions & Their Applications, by N.N.Lebedev, 2004 edition onwards.
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://www.shiksha.com/online-courses/numerical-methods-for-engineers-course-courl3484
2.	https://www.coursera.org/learn/complex-analysis

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Assignment- Open/Industry/Certification
3.	Flipped Classes	3.	Course Project
4.	Online classes	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.	To Understand the complex function as generalisation.	Un	1	1
2.	To Apply conformal mapping for image processing.	Ap	1	1
3.	To Understand complex integration and its properties	Un	1	1
4.	To Understand the role of special functions in applications.	Un	1	1

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Two Assignments – (Open /Industry/Certification etc)	Course project (CP)/ Case study etc	Total Marks
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

-Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.

-Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests.

-Lack of minimum score in IA test will make the student Not Eligible for SEE

-Minimum score in CIE 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 three parts **A,B and C**. Students have to answer 1. From Part A answer any 5 out of 7questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosingany one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (Planned)													**CO-PSO Mapping (Planned)**		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
1	✓												✓		
2	✓												✓		
3	✓												✓		
4	✓												✓		
Tick mark the CO, PO and PSO mapping															

INTRODUCTION TO ASTRONOMY

Course Code	22PH751	**Course type**	OEC	**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 review concepts in physics required in astronomy.
2.	To understand energy generation, transport in stars and end states of a star.
3.	To comprehend HR diagram, evolution of stars and binary systems.
4.	To understand the structure of galaxies, milky way and the expansion of the universe. To study cosmology and the big bang model.

Pre-requisites : None

Unit – I	**Contact Hours = 8 Hours**
The universal law of Gravitation, Conservation of energy, Electric force, Relative strength of electric and gravitational forces, Electromagnetism, Nuclear Forces, Quantum mechanical behaviour of light and matter, Hydrogen atom spectrum, orbital angular momentum, spin angular momentum, quantum statistics, atomic spectroscopy, special theory of relativity, time dilation, Length contraction, Relativistic Doppler effect, Relativistic mass, Mass-energy equivalence, thermodynamics , statistical mechanics, perfect gas, Thermodynamic behaviour of radiation, Introduction to reflective and refractive telescope.	

Unit – II	**Contact Hours = 8 Hours**
The source of energy in the sun, the stability of the sun, the principles of stellar structure, the radiative and convection zone of the sun, The atmosphere of the sun –Radiative transfer in the sun, the chromospheres and corona of the sun, magnetic activity in the sun, Matter and four forces, The strong and weak nuclear forces, Atomic nuclei, Binding energy of atomic nuclei, Thermonuclear reactions, The end states of a star- White dwarfs, Neutron star and Black hole.	

Unit – III	**Contact Hours = 8 Hours**
Evolution of stars-Theoretical H-R diagram, Evolution of low mass stars, Evolution of high mass stars, Observational H-R diagram, The H-R diagram of nearby stars, The H-R diagram of nearby star clusters, Classification and formation of binary stars, examples of close binary stars.	

Unit – IV	Contact Hours = 8 Hours
Interstellar dust and gas, Gaseous Nebulae, Cosmic rays and interstellar magnetic field, stars and interstellar medium, Milky way, stellar population, Differential rotation of galaxy, spiral structure, interacting binary galaxies, mergers, the expansion of the universe.	

Unit – V	Contact Hours = 8 Hours
Newtonian cosmology, General relativity and cosmology, Large scale geometry of space and time, The Big bang vs. steady state, The hot big bang, The creation of material world.	

Flipped Classroom Details

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

Unit No.	Self-Study Topics
I	Relativistic Doppler effect
II	Radiative transfer in the sun
III	H-R diagram of nearby by stars
IV	Stellar population in Milky way
V	Geometry of space and time in flat spacetime

Books	
	Text Books:
1.	Frank H. Shu, The Physical Universe- An introduction to Astronomy, University Science books, 1st edition and onwards
	Reference Books:
1.	M.Harwit , Astrophysical Concepts , Springer, 4th edition and onwards
2.	M. Stix, The Sun : An Introduction, Springer, 2nd edition and onwards
3.	K.D. Abhyankar, Astronomical Physics : Stars and Galaxies, University press, 1st edition and onwards
4.	Karttunen, Fundamental astronomy, Springer, 4th edition and onwards

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Assignment- Open/Industry/Certification
3.	Flipped Classes	3.	Course Project
4.	Online classes	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.	Apply nuclear physics, statistical physics to understand working and end states of stars.	Ap	1	1
2.	Understand classification of stars and binary systems.	Un	1	1
3.	Understand structure of galaxy and expansion of the universe	Un	1	1
4.	Apply general relativity to understand cosmology	Ap	1	1

Scheme of Continuous Internal Evaluation (CIE):

Components	**Addition of two IA tests**	**Two Assignments – (Open /Industry/Certification etc)**	**Course project (CP)/ Case study etc**	**Total Marks**
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100
-Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks. **-Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests.** **-Lack of minimum score in IA test will make the student Not Eligible for SEE** **-Minimum score in CIE to be eligible for SEE: 40 OUT OF 100.**				

Scheme of Semester End Examination (SEE):
It will be conducted for 100 marks of 3 hours duration.
Minimum marks required in SEE to pass: Score should be $\geq$ 35%, however overall score of CIE + SEE should be $\geq$ 40%.
Question paper contains three parts **A, B and C**. Students have to answer 1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (Planned)													**CO-PSO Mapping (Planned)**		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
1	✓												✓		
2	✓												✓		
3	✓												✓		
4	✓												✓		
Tick mark the CO, PO and PSO mapping															

INDIAN KNOWLEDGE SYSTEM

Course Code	22AECCS77	**Course type**	HSMS	**Credits L-T-P**	1– 0 – 0
Hours/week: L – T- P	1 – 0 – 0			**Total credits**	1
Total Contact Hours	L = 15Hrs; T = 0 Hrs; P =0 Hrs Total = 15 Hrs			**CIE Marks**	100
Flipped Classes content	03 Hours			**SEE Marks**	--

Course learning objectives	
1.	To understand the importance of ancient knowledge to a society and familiarize with vedas and vedangas
2.	To understand the concepts of science and technology in ancient India

Pre-requisites: Nil

Unit – I	**Contact Hours = 5 Hours**
Importance of ancient knowledge and IKS. IKS corpus – a classification framework, history and unique aspects of IKS. Introduction to vedas and vedangas, vedic life. Indian philosophical systems – development and unique features, vedic schools of philosophy. Panchatantra – puranas and itihasa as a source of wisdom.	

Unit – II	**Contact Hours = 5 Hours**
Foundational concepts for science and technology – importance & role of Sanskrit in Natural language processing, stages of speech in Sanskrit vocabulary, number system in India, salient features of numerical system- measurement for time, distance & weight.	

Unit – III	**Contact Hours = 5 Hours**
Science, Engineering and Technology in IKS – unique aspects of Indian Mathematics and astronomy, functions in Mathematics, historical development of astronomy, elements of Indian calendar. The rise and fall of great Indian technology, mining, metal working, alloys in India Irrigation practices and architecture in India	

Flipped Classroom Details

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

Books	
	Text Books:
1.	B. Mahadevan, V. R. Bhat and R. N. Nagendra Pavana, “Introduction to Indian Knowledge system - Concepts and Applications”, PHI, 2023

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 Assignments (OA)
4.	Online classes	4.	

Course Outcomes (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** the importance of ancient knowledge to a society and familiarize with vedas and vedangas	Un	6,7	3
2.	**Understand** the fundamental concepts of science and technology in ancient India	Un	6,7	3

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Addition of two Assignments	Case study/Activity	Total Marks
Marks	30+30 = 60	10+10 =20	20	100

- Writing 2 IA tests are compulsory.

-Student should score minimum 40% of 100 marks to pass the course.

CO-PO Mapping (Planned) [tick mark relevant ones]													CO-PSO Mapping (Planned)		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
1						✓	✓								✓
2						✓	✓								✓