KARNATAK LAW SOCIETY'S

GOGTE INSTITUTE OF TECHNOLOGY

UDYAMBAG, BELAGAVI-590008

(An Autonomous Institution under Visvesvaraya Technological University, Belagavi)

(APPROVED BY AICTE, NEW DELHI)

Fifth to Sixth semester B.E.

(2022 Scheme)

COMPUTER SCIENCE AND ENGINEERING

1/10/2024

Head of the Department
Computer Science & Engineering
KLS Gogte Institute of Technology
Udyambag, Belagavi-590 008
Karnataka, India

G.I.T. Udyambag, Belagavi-590 008
Dept. of Comp. Sc. & Engg.

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	22CS381/ 22IS381	National Service Scheme (NSS)	NSS coordinator	0	0	2		0	100	--	100
		22CS382/ 22IS382	Physical Education (PE) (Sports and Athletics) and Yoga	Physical Education dept & Yoga instructor								
		22CS383/ 22IS383	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	04	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 (3 – 0 – 0)	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	MC	22CS56	Environmental Studies		2	0	0	02	2	100	100	200
7	AEC	22CS57	Research Methodology and Intellectual Property Rights	CSE	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 (2-0-2)
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)		
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

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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 https://onlinecourses.nptel.ac.in/noc24_cs85/preview	22CS814	Cloud Computing by Prof. Soumya Kanti Ghosh https://onlinecourses.nptel.ac.in/noc24_cs17/preview
22CS812	Data Structure and Algorithms using Java by Prof. Debasis Samanta https://onlinecourses.nptel.ac.in/noc24_cs96/preview	22CS815	Operating System Fundamentals by Prof. Santanu Chattopadhyay https://onlinecourses.nptel.ac.in/noc24_cs108/preview
22CS813	Introduction to Machine Learning by Prof. Balaraman Ravindran https://onlinecourses.nptel.ac.in/noc24_cs51/preview	22CS816	Advanced Web Technology by Prof. Kannan Moudgalya(swayam) https://onlinecourses.swayam2.ac.in/aic20_sp32/preview
Open Elective Courses (Online Courses)			
22CS821	Advanced Distributed Systems by Prof. Smruti Ranjan Sarangi https://nptel.ac.in/courses/106102237	22CS823	Introduction to Internet of Things by Prof. Sudip Misra https://onlinecourses.nptel.ac.in/noc24_cs35/preview
22CS822	Software Testing by Prof. Meenakshi D'souza https://onlinecourses.nptel.ac.in/noc24_cs91/preview	22CS824	Ethical Hacking by Prof. Indranil Sengupta https://nptel.ac.in/courses/106105217

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.

Detailed 5th Semester Syllabus

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.	Lab Test
3.	Flipped Classes	3.	Semester End Examination
4.	Practice session/Demonstrations in Labs	4.	
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 (of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 15 marks. -Minimum score to be eligible for SEE: 40 OUT OF 100				

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration.
2.	Minimum marks required in SEE to pass: Score should be $\geq$ 35%, however overall score of CIE + SEE should be $\geq$ 40%.
3.	Question paper contains 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 (of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 15 marks. -Minimum score to be eligible for SEE: 40 OUT OF 100				

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration.
2.	**Minimum marks required in SEE to pass:** Score should be $\geq$ 35%, however overall score of CIE + SEE should be $\geq$ 40%.
3.	Question paper contains 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 (Project based)

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 (Industry Supported)

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.

-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	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 (of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 15 marks. **-Minimum score to be eligible for SEE: 40 OUT OF 100**				

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration.
2.	**Minimum marks required in SEE to pass:** Score should be $\geq$ 35%, however overall score of CIE + SEE should be $\geq$ 40%.
3.	Question paper contains 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

Environmental Studies

Course Code	22CS56	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															

Research Methodology and IPR

Course Code	**22CS57**	**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															

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

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

Detailed 6th Semester Syllabus

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.	Lab Test
3.	Flipped Classes	3.	Semester End Examination
4.	Practice session/Demonstrations in Labs		

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	**PO 1**	**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.	Open Assignment (OA)/ Certification
3.	Flipped Classes	3.	Course Semianr/project
		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 (of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 15 marks. -Minimum score to be eligible for SEE: 40 OUT OF 100				

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration.
2.	**Minimum marks required in SEE to pass:** Score should be $\geq$ 35%, however overall score of CIE + SEE should be $\geq$ 40%.
3.	Question paper contains 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.	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.	**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 (of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 15 marks.
-Minimum score to be eligible for SEE: 40 OUT OF 100

Scheme of Semester End Examination (SEE):

1.	It will be conducted for 100 marks of 3 hours duration.
2.	**Minimum marks required in SEE to pass:** Score should be $\geq$ 35%, however overall score of CIE + SEE should be $\geq$ 40%.
3.	Question paper contains 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 (Project based)

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 ≥ 35%, however overall score of CIE + SEE should be ≥ 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(I) Items, Constructing LR(I) Sets of Items, Canonical LR(I) 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.	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.	**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 (of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 15 marks. **-Minimum score to be eligible for SEE: 40 OUT OF 100**				

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration.
2.	**Minimum marks required in SEE to pass:** Score should be $\geq$ 35%, however overall score of CIE + SEE should be $\geq$ 40%.
3.	Question paper contains 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 $\geq$ 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	✓	✓	✓	✓		✓			✓	✓			✓	✓	✓
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.		

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.	Open Book Tests (OBT)
3.	Flipped Classes	3.	Course Seminar/Project
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 learninglevel.)				
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 (of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 15 marks. -Minimum score to be eligible for SEE: 40 OUT OF 100				

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

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	**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 (Project based)

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

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.	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.	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 ≥ 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 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															

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															

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 ≥ 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 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