

KARNATAK LAW SOCIETY'S
GOGTE INSTITUTE OF TECHNOLOGY

UDYAMBAG, BELAGAVI-590008

(An Autonomous Institution under Visvesvaraya Technological University, Belagavi)
(APPROVED BY AICTE, NEW DELHI)



Department of Computer Science and Engineering

B.E. (Computer Science and Engineering)
Scheme 1st to 8th Semester
and Detailed Syllabi of 5th to 8th Semester
(2021 Scheme)

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
B.E. in (Computer Science and Engineering)
Draft Scheme of Teaching and Examination 2021-22 as per NEP 2020
Outcome-Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2021-22)

Total credits for B.E. Program: 160

As per the guidelines of UGC CBCS the courses can be classified into:

Abbreviations used:

BSC - Basic Science Course, **PCC**- Professional Core Course, **HSMC** - Humanity and Social Science & Management Courses, **PEC**- Professional Elective Course, **OEC** – Open Elective Course, **AEC** – Ability Enhancement Courses. **INT** – Internships, **UHV** –Universal Human Values, **MP** - Mini Project.
L–Lecture, **T**–Tutorial, **P**- Practical/Drawing, **S**–Self Study Component, **CIE** –Continuous Internal Evaluation, **SEE** –Semester End Examination

Foundation Courses: The Foundation Courses are of two kinds:

These courses are the courses based upon the content that leads to Knowledge enhancement. These courses provide opportunities to improve technological knowledge before entering industry as well as preparing students for higher degrees in technological subjects. They are mandatory for all disciplines. These courses will have 4 credits per course.

The courses are: **Basic Science Courses (BSC)**, **Engineering Science Courses (ESC)**.

Professional Core Courses (PCC): This is the course which is to be compulsorily studied by a student as a core requirement to complete the requirements of a program in a said discipline of study. These courses will have 4 credits per course.

Universal Human Value Courses (UHV): These are value based courses aimed at man making education.

Humanities and Social Science including Management Studies Courses(HSMS). Humanity and Social Science Courses: The Humanities and Social Sciences are the studies of human behavior and interaction in social, cultural, environmental, economic, and political contexts. The Humanities and Social Sciences have a historical and contemporary focus, from personal to global contexts, and consider challenges for the future. Students will develop the ability to question, think critically, solve problems, communicate effectively, make decisions, and adapt to change. Thinking about and responding to issues requires an understanding of the key historical, geographical, political, economic, and societal factors involved, and how these different factors interrelate. Humanities and Social Science Courses includes-Technical-English, Courses on Regional/State languages (Kannada), etc.

Elective Courses: This is course, which can be chosen from the pool of papers. It may be supportive to the discipline/ providing extended scope/enabling an exposure to some other discipline / domain / nurturing student proficiency skills. These courses will have 3 credits per course.

An elective may be **Discipline Centric Course (PEC)** or may be chosen from other discipline (**Open Elective Course- OEC**).

Ability Enhancement Courses (AEC): The Ability Enhancement (AE) Courses may be of two kinds: Ability Enhancement Compulsory Courses (AECC) and Skill Enhancement Courses (SEC).

“AECC” courses are the courses based upon the content that leads to Knowledge enhancement; Environmental Science, English, Biology for Engineers, Bioinformatics, Music and Vibration, Art and Architecture etc

“SEC” courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.

Mandatory Non-Credit Courses (MNC): These courses are mandatory but do not have any credits and students must successfully complete these courses before the completion of degree.

Credit definition:

Offline Courses	Online Courses
<ul style="list-style-type: none"> • 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
<ul style="list-style-type: none"> • Four-credit courses are to be designed for 50 hours of Teaching-Learning process. • Three credit courses are to be designed for 40 hours of Teaching-Learning process. • Two credit courses are to be designed for 25 hours of Teaching-Learning process. • One credit courses are to be designed for 15 hours of Teaching-Learning process. 	

Semester wise distribution of credits for B.E program

Year	Semester	Credits	Total/Year	Cumulative Credits
1 st	AE, CV, ME (I-P & II-C)	19+21	40	40
	CSE, EC, EE, ISE (I-C & II-P)	18+22		
2 nd	III	20	40	80
	IV	20		
3 rd	V	23	45	125
	VI	22		
4 th	VII	17	35	160
	VIII	18		
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 and Management)	10	8
2	Basic Science courses	23	22
3	Engineering Science courses including workshop, drawing	20	20
4	Professional Core Courses	46	49
5	Professional Elective courses relevant to chosen specialization/branch	9	9
6	Open subjects – Electives from other technical, emerging, arts commerce and	6	9
7	Mini, Project, Major Project work and Seminar	13	9
8	Summer Internship and Research /Industrial Internship	20	20
9	Ability Enhancement Courses, including Research Methodology, NCC/NSS/ Sports/Ex- Curricular, Online Certification Course	11	12
10	Universal Human Values	2	2
	TOTAL	160	160

L-T-P Model for Courses

S.No.	Contact Hours				Credits	
	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 is **no Semester End Examination (SEE) for the practical syllabus** of the course, however, Continuous Internal Evaluation (CIE) will be conducted for the practical topics.

New Scheme of Teaching (Including branch specific additional course)

B.E. in (Computer Science and Engineering)
Draft Scheme of Teaching and Examination 2021-22

		1 st Semester	For AE,CV,ME – Physics Cycle			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	21MAT11	Calculus and Linear Algebra	Mathematics		3	2	0	5	4	100	100	200
2	BSC	21PHY12	Applied Physics	Physics		3	0	0	3	3	100	100	200
3	ESC	21CIV13	Engineering Mechanics	CV		3	0	0	3	3	100	100	200
4	ESC	21EME14	Basics of Mechanical Engg.	ME		3	0	0	3	3	100	100	200
5	ESC	21EGR15	Engineering Graphics	ME		1	0	4	5	3	100	100	200
6	BSC	21PHL16	Applied Physics Lab	Physics		0	0	2	2	1	50	50	100
7	AEC	21IIL17	Idea to Innovation Lab	Engg. Depts		1	0	2	3	1	100	-	100
8	HSMS	21ENG18	Communicative English	English		1	0	0	1	1	50	50	100
										19	700	600	1300

		21AEC29A3	Interpersonal Skills									
10	ESC	21AAE29B	Elements Of Aeronautics	AE	3	0	0	3	3	100	100	200
		21ACV29B	Basics of Civil Engineering	CV								
		21AME29B	Material Science and Engineering	ME								
										21	750	700

S.No.	Course Type	Course Code	1 st Semester For CSE, EC, EE and ISE – Chemistry Cycle	Course Title	Teaching Dept.	Hours/week			Total contact hours/week	Credits	Examination		
						L	T	P			CIE	SEE	Total
1	BSC	21MAT11	Calculus and Linear Algebra	Mathematics	Mathematics	3	2	0	5	4	100	100	200
2	BSC	21CHE12	Applied Chemistry	Chemistry	Chemistry	3	0	0	3	3	100	100	200
3	ESC	21ELE13	Basics of Electrical and Electronics Engg.	E & E	E & E	3	0	0	3	3	100	100	200
4	ESC	21CCP14	Problem Solving using C	CSE & ISE	CSE & ISE	3	0	0	3	3	100	100	200
5	BSC	21CHL15	Chemistry Lab	Chemistry	Chemistry	0	0	2	2	1	50	50	100
6	ESC	21CPL16	C Programming Lab	CSE & ISE	CSE & ISE	0	0	2	2	1	50	50	100
7	ESC	21EEL17	Electrical and Electronics Engg. Lab	E & E	E & E	0	0	2	2	1	50	50	100
8	HSMS	21ENG18	Communicative English	English	English	1	0	0	1	1	50	50	100
9	AEC	21AEC191	Introduction to Innovation and Startup	Any Dept.	Any Dept.	1	0	0	1	1	50	--	50
		21AEC192	Leadership and Public Speaking										
		21AEC193	Interpersonal Skills										
										18	650	600	1250

S.No.	Course Type	Course Code	2 nd Semester For CSE, EC, EE and ISE – Physics Cycle	Course Title	Teaching Dept.	Hours/week			Total contact hours/week	Credits	Examination		
						L	T	P			CIE	SEE	Total
1	BSC	21MAT21	Differential Equations and Laplace Transforms	Mathematics	Mathematics	3	2	0	5	4	100	100	200
2	BSC	21PHY22	Applied Physics	Physics	Physics	3	0	0	3	3	100	100	200
3	ESC	21CIV23	Engineering Mechanics	CV	CV	3	0	0	3	3	100	100	200
4	ESC	21EME24	Basics of Mechanical Engg.	ME	ME	3	0	0	3	3	100	100	200

5	ESC	21EGR25	Engineering Graphics	ME	1	0	4	5	3	100	100	200
6	BSC	21PHL26	Applied Physics Lab	Physics	0	0	2	2	1	50	50	100
7	AEC	21IIL27	Idea to Innovation Lab	All Engg. depts	0	0	2	2	1	100	--	100
8	HSMS	21ENG28	Professional Writing Skills in English	English	1	0	0	1	1	50	50	100
9	ESC	21ACS29	Object Oriented Programming Using C++	CSE	3	0	0	3	3	100	100	200
		21AEC29	Fundamentals of Electronics and Communication Engineering	E & C								
		21AEE29	Fundamentals of DC and AC Systems	E & E								
		21AIS29	Object Oriented Programming Using C++	ISE								
									22	800	700	1500

NOTE: Summer Internship - I: All the students admitted shall have to undergo a mandatory summer internship of **03 weeks** during the vacation of II semesters. Summer Internship shall include Inter / Intra Institutional activities. A Viva-voce examination shall be conducted during III semester and the prescribed credit shall be included in III semesters. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements. **SEE component will be the only seminar/Presentation and question answer session.** (The faculty coordinator or mentor has to monitor the students' internship progress and interact to guide them for the successful completion of the internship.)

The course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs:

1. The **mandatory non – credit courses Additional Mathematics I and II prescribed for III and IV semesters respectively**, to the lateral entry Diploma holders admitted to III semester of BE/B.Tech., programs, shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the **Continuous Internal Evaluation (CIE)**. In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfill the requirements during subsequent semester/s to appear for CIE. These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.
2. All the students admitted under the lateral entry category shall have to undergo a mandatory **SUMMER INTERNSHIP-I of 03 weeks during the intervening vacation of III and IV semesters**. Summer Internship shall include Inter / Intra Institutional activities. A Vivavoce examination shall be conducted during the IV semester and the prescribed credit shall be included in the III semester after students clear this head. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements. (The faculty coordinator or mentor has to monitor the students' internship progress and interact to guide them for the successful completion of the internship.)

3rd Semester				Teaching Dept.	Hours/week				Total contact hours/week	Credits	Examination		
S.No.	Course Type	Course Code	Course Title		L	T	P	S			CIE	SEE	Total
1	BSC	21MATCS31	Discrete Mathematical Structures and Numerical Methods	Maths	3	0	0		3	3	100	100	200
2	PCC	21CS32	Data Structures and Algorithms	CSE	3	0	2		5	4	100	100	200
3	PCC	21CS33	Object Oriented Programming using JAVA	CSE	3	0	2		5	4	100	100	200
4	PCC	21CS34	Web Technologies	CSE	3	0	2		5	4	100	100	200
5	INT	21CS35	Summer Internship -I	CSE						2	50	50	100
6	HSMS	21CS36	Constitution of India	CSE	1	0	0		1	1	50	50	100
7	UHV	21CS37	Social Connect and Responsibility	CSE	1	0	0		1	1	100	-	100
8	AEC	21AECCS381	Design Thinking	CSE	0	0	2		2	1	50	50	100
		21AECCS382	Introduction to Embedded Systems and IoT- A Hands-on Approach										
		21AECCS383	Data Visualization Tools and Techniques										
		21AECCS384	Software Tools and Technologies										
		21AECCS385	Multimedia and Animation										
9	BSC*	21DMATCS31	Bridge Course Mathematics - I	Maths	3	0	0		3	MNC	*100	--	*100
			TOTAL							20	650	550	1200

*Only for Diploma Lateral Entry Students

4 th Semester B.E				Teaching Dept.	Hours/week			Total contact hours/ week	Credits	Examination			
S.No	Course Type	Course Code	Course Title		L	T	P			CIE	SEE	Total	
1	BSC	21MATCS41	Fundamentals of Statistics and Probability for Data Science	Maths	3	0	0	3	3	100	100	200	
2	PCC	21CS42	Database Management Systems	CSE	3	0	2	5	4	100	100	200	
3	PCC	21CS43	Python Programming	CSE	3	0	2	5	4	100	100	200	
4	PCC	21CS44	Software Engineering and Design	CSE	3	0	2	5	4	100	100	200	
5	AEC	21CS45	Health and Wellness	Medical Sciences	2	0	0	2	2	50	50	100	
6	HSMS	21CSS46 21CSB46	Samskrutika Kannada Balake Kannada		1	1	0	1	1	50	50	100	
7	UHV	21CS47	Universal Human Values and Professional Ethics	CSE	1	0	0	1	1	50	50	100	
8	AEC	21AECCS481	Design Thinking	CSE	0	0	2	2	1	50	50	100	
		21AECCS482	Introduction to Embedded Systems and IoT- A Hands-on Approach										
		21AECCS483	Data Visualization Tools and Techniques										
		21AECCS484	Software Tools and Technologies										
		21AECCS485	Multimedia and Animation										
9	BSC*	21DMATCS41	Bridge Course Mathematics - II	Maths	3	0	0	3	MNC	100	--	100	
			TOTAL							20	600	600	1200

*Only for Diploma Lateral Entry Students

Balake Kannada (Kannada for communication) is for non-Kannada speaking, reading, and writing students, and Samskrutika Kannada (Kannada for Administration) is for students who speak, read and write Kannada.

Summer Internship-II: At the End Of **fourth Semester four - weeks Summer Internship** Shall Be Carried Out – Based on Industrial/Govt./NGO/MSME/Rural Internship/Innovation/Entrepreneurship. It will be credited in fifth Semester. All the students admitted shall have to undergo mandatory internship of 04 weeks during the vacation of IV semesters. A Viva-Voce examination shall be conducted during V semester and the prescribed credit shall be included in V semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/complete the internship shall be declared fail and shall have

to complete during subsequent University examination after satisfying the internship requirements. SEE component will be the only seminar/Presentation and question answer session. (The faculty coordinator or mentor has to monitor the students' internship progress and interact to guide them for the successful completion of the internship).

5 th Semester					Hours/week				Total contact hours/week	Credits	Examination		
S.No.	Course Type	Course Code	Course Title	Teaching Dept.	L	T	P	S			CIE	SEE	Total
1	PCC	21CS51	Operating Systems	CSE	3	0	0		3	3	100	100	200
2	IPCC	21CS52	Computer Networks	CSE	3	0	2		5	4	100	100	200
3	IPCC	21CS53	Micro-Controllers and Embedded Systems	CSE	3	0	2		5	4	100	100	200
4	PEC	21CS54X	Professional Elective-1	CSE	3	0	0		3	3	100	100	200
5	OEC	21CS55X	Open Elective -1	Other dept.	3	0	0		3	3	100	100	200
6	INT	21CS56	Summer Internship - II	CSE	0	0	6		6	3	100	-	100
7	AEC	21CS57	Research Methodology & Intellectual property rights	CSE	1	0	0		1	1	50	50	100
8	AEC	21AECCS58	Employability Skills -1	Bizotic	1	0	0		1	1	100	-	100
9	HSMS	21CV59	Environmental Studies	Chem/CV	1	0	0		1	1	50	50	100
10	HSMS	21ENG59	*Communicative English	English	1	0	0	1	1	0	50	-	50
			TOTAL							23	800	600	1400

* Only for Lateral Entry students

Environmental Studies: Paper setting: Civil Engineering Board

Professional Elective: The minimum students' strength for offering professional electives is **05**, if the strength is less than the 05 then the department has to take the permission to offer the course.

Open Elective Courses: All Open Electives are offered to students of all branches in general. However, a student shall choose an open Elective from the list in such a manner that he/she has not studied the same course in any form during the Programme. Students can select any one of the open electives offered by other Departments except those that are offered by the parent Department.

Selection of an open elective shall not be allowed if,

- The candidate has studied the same course during the previous semesters of the programme.
- The syllabus content of open electives is similar to that of the Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the programme.
- Registration to electives shall be documented under the guidance of Programme Coordinator/ Advisor/Mentor.

Courses from Law, Business (MBA), Medicine, Arts, Commerce, may be offered as Open Elective Courses (OEC).

The minimum students' strength for offering professional electives is **05**, if the strength is less than the 05 then departments have to take the permission to offer the course.

6 th Semester					Hours/week				Total contact hours/week	Credits	Examination		
S.No.	Course Type	Course Code	Course Title	Teaching Dept.	L	T	P	S			CIE	SEE	Total
1	HSMS	21CS61	Branch Specific Management Course – Software Testing and Project Management	CSE	3	0	0		3	3	100	100	200
2	PCC	21CS62	Formal Languages and Automata Theory	CSE	3	0	0		3	3	100	100	200
3	IPCC	21CS63	Artificial Intelligence and Machine Learning	CSE	3	0	2		5	4	100	100	200
4	IPCC	21CS64	UNIX System and Network Programming	CSE	3	0	2		5	4	100	100	200
5	PEC	21CS65X	Professional Elective-2	CSE	3	0	0		3	3	100	100	200
6	OEC	21CS66X	Open Elective -2	Other Branch	3	0	0		3	3	100	100	200
7	MP	21CS67	Mini Project		0	0	2		2	1	100	-	100
8	AEC	21AECCS68	Employability Skills -2	Bizotic	1	0	0		1	1	100	-	100
			TOTAL							22	800	600	1400

Mini-project work(Single discipline/Interdisciplinary): 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 a group having not more than 4 students. (or Mini Project is a laboratory-oriented course which will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications)

Research/Industrial Internship - At the End of the sixth / Seventh semester (in two cycles to accommodate all the students of the University) Research/Industrial Internship shall be carried out – Based on industrial/Govt./NGO/MSME/Rural Internship/Innovation/Entrepreneurship. All the students admitted shall have to undergo a mandatory internship of 24 weeks during the vacation of VI/VII semesters. A Viva-Voce examination shall be conducted during VII/VIII semester and the prescribed credit shall be included in VII/VIII semester. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements.

Research internship: Students have to take up research internships at Centers of Excellence (CoE) / Study Centers established in the same institute and /or out of the institute at reputed research organizations / Institutes. A research internship is intended to give you the flavour of current research going on a particular topic/s. The internships serve this purpose. They help students get familiarized with the field, the skill needed the effort amount and kind of effort required for carrying out research in that field.

7 th Semester					Hours/week				Total contact hours/week	Credits	Examination		
S.No.	Course Type	Course Code	Course Title	Teaching Dept.	L	T	P	S			CIE	SEE	Total
1	PCC	21CS71	Cyber Security	CSE	3	0	0		3	3	100	100	200
2	PEC	21CS72X	Professional Elective-3	CSE	3	0	0		3	3	100	100	200
3	OEC	21CS73X	Open Elective - 3	Other dept.	3	0	0		3	3	100	100	200
4	Project	21CS74	Project work		0	0	14		14	7	100	100	200
5	AEC		Sports/Cultural/NSS/NCC/Club activities					1	1	1	100	-	100
TOTAL										17	500	400	900

8 th Semester					Hours/week				Total contact hours/week	Credits	Examination		
S.No.	Course Type	Course Code	Course Title	Teaching Dept.	L	T	P	S			CIE	SEE	Total
1	Seminar	21CS81	Technical Seminar		0	0	1		1	1	100	-	100
2	AEC	21CS82	Certification (Minimum 6 - 8 weeks)		0	0	4		4	2	100	-	100
3	Internship	21CS83	Research/Industry Internship (24 weeks)		0	0	30		30	15	100	100	200
TOTAL										18	300	100	400

Certification (Shall have proctored examination):

- NPTEL/SWAYAM/NASSCOM /Industry-Institute partnered certification.
- List of the courses will be notified by the departments

Internship

4 weeks' internship can be completed after 6th sem, 4 weeks' internship can be completed after 7th sem and 16 weeks' internship can be completed in 8th sem

List of Professional Electives 2021 Scheme

5 th Semester		6 th Semester		7 th Semester	
Course Code	Course Name	Course Code	Course Name	Course Code	Course Name
21CS541	Data Visualization	21CS651	Robotic Process Automation (Industry Supported Elective)	21CS721	Compiler Design
21CS542	Big Data Management	21CS652	Distributed and Cloud Computing	21CS722	Block Chain Management
21CS543	Data Warehousing and Data Mining	21CS653	Information and Network Security	21CS723	Mobile Computing
21CS544	Advanced Java	21CS654	Internet of Things (2 – 0 – 2)	21CS724	Salesforce Lightning (Industry Supported Elective)
21CS545	Agile Software Development	21CS655	Introduction to Salesforce (Industry Supported Elective)		

List of Open Electives 2021 Scheme

5 th Semester		6 th Semester		7 th Semester	
Course Code	Course Name	Course Code	Course Name	Course Code	Course Name
21CS551	Object-Oriented Programming with JAVA	21CS661	Python Programming	21CS731	Machine Learning
21CS552	Data Structures	21CS662	Database Management System	21CS732	Big Data and Hadoop
21CS553	Robotic Process Automation	21CS663	Software Testing	21CS733	Data Mining
21CS554	Web Programming	21CS664	Data Analytics	21CS734	Principles of Cyber Security
21PH551	Introduction to Astronomy (Offered by Physics dept.)	21CH661	Nanoscience and Nanotechnology (Offered by Chemistry dept.)		

Operating Systems

Course Code	21CS51	Course type	PCC	Credits L-T-P	3 – 0 - 0
Hours/week: L - T- P	3 – 0 – 0			Total credits	3
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 0 Hrs Total = 40 Hrs			CIE Marks	100
Flipped Classes content	10 Hours			SEE Marks	100

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

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

Unit – I	Contact Hours = 8 Hours
Introduction to Operating System: System structures: What operating systems do; Operating System operations; Process management; Memory management; Storage management; Protection and security; Distributed system; Operating System Services; System calls; Operating System structure; System boot.	
Introduction to UNIX File System: Inside UNIX, Internal and External Commands, Command structure.	
Case Study: Android Operating System / iOS	

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

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

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

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

Flipped Classroom Details

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

Books	
	Text Books:
1.	Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Principles", Wiley India, 6th edition and onwards.
2.	Sumitabha Das: "YOUR UNIX – The Ultimate Guide" , Tata McGraw Hill, 23rd reprint , 2012 and onwards.
	Reference Books:
1.	Gary Nutt, "Operating System", Pearson Education, 2nd edition and above.
2.	Harvey M Deital, "Operating system", Addison Wesley, 2nd edition and above.
3.	D.M Dhamdhere, "Operating System", "A concept based Approach", Tata McGraw- Hill, 2nd edition and onwards
4.	Behrouz A. Forouzan and Richard F. Gilberg: "UNIX and Shell Programming ", Cengage Learning, 2005 and onwards.
	E-resources (NPTEL/SWAYAM.)/COURSERA
1.	https://onlinecourses.nptel.ac.in/ Tentative Course List (July - Dec 2023) - Google Drive
2.	https://www.coursera.org/specializations/codio-introduction-operating-systems
3.	Lectures on Operating Systems (iitb.ac.in)

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Online Quizzes (Surprise and Scheduled)

3.	Flipped Classes	3.	Open Book Tests (OBT)
4.	Online classes	4.	Course Seminar
		5.	Semester End Examination

Course Outcome (COs)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create		Learning Level	PO(s)	PSO(s)
1.	Explain the computer system resources and the role of an operating system in managing those resources	Un	1	1
2.	Develop applications keeping concurrency and synchronization, semaphores, Monitors shared memory, mutual exclusion, and process scheduling services of general operating systems and do the case study on OSSim Simulation Tool.	Ap	1,2,5	1,2
3.	Describe and analyze memory management, file management, and secondary Memory Management techniques.	Ap	2,5	1,2
4.	Discuss UNIX shell commands for file handling, process control and do the case study on Android Operating System / iOS.	Un	1,2	1,2
5.	Apply the learnings inculcated throughout the course and present a course seminar or develop 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	Online Quiz	Addition of two OBAs/ Course	Course Seminar	Total Marks
Marks	25+25 = 50	4* 5 marks = 20	10+10 =20	10	100
OBA - Open Book Assignment					
Minimum score to be eligible for SEE: 40 OUT OF 100					

Scheme of Semester End Examination (SEE):

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

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

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

Computer Networks

Course Code	21CS52	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.	Elucidate basic computer networking.
2.	Demonstration of application layer protocols.
3.	Discuss transport layer services and understand UDP and TCP protocols.
4.	Explain routers, IP and Routing Algorithms in network layer.
5	Demonstrate the error detection and correction at link layer.

Required Knowledge of : Fundamentals of basic mathematics, Data Structures and algorithms, Computer Organization, Operating systems.

Unit – I	Contact Hours = 8 Hours
Introduction to Computer Networks and the Internet: The Internet, The Network Edge, The Network Core, Delay, Loss, and Throughput in Packet-Switched Networks, Protocol Layers and their Service Models	

Unit – II	Contact Hours = 8 Hours
Application Layer: Principles of Network Applications, The Web and HTTP, File Transfer: FTP Commands and Replies, Electronic Mail in the Internet, The Internet's Directory Service, Peer-to-Peer Applications-Bit Torrent File distribution protocol.	

Unit – III	Contact Hours = 8 Hours
Transport Layer: Introduction and Transport-Layer Services, Multiplexing and Demultiplexing, Connectionless Transport: UDP, Principles of Reliable Data Transfer: Go Back-N and Selective Repeat, Connection-Oriented Transport: TCP.	

Unit – IV	Contact Hours = 8 Hours
The Network layer: Introduction, Virtual Circuit and Datagram Networks, Inside a Router, The Internet Protocol (IP): Forwarding and Addressing in the Internet.	

Unit – V	Contact Hours = 8 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

List of Experiments

Unit No.	No. of Experiments	Topic(s) related to Experiment
1	1	Introduction to computer networks and physical media
2	1	Application Network Security
3	2	UDP-Connection less Transport
		TCP-Connection Oriented Transport
4	2	Distance vector routing algorithm
		Congestion control Algorithm
5	1	Implement any Error detection technique.

Unit No.	Self-Study Topics
1	Network Attacks and Network Security Threats
3	Socket Programming
4	Inter-Autonomous System Routing

Books	
	Text Books:
1.	James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth edition, Pearson,2017 .
2.	Larry L Peterson and Bruce S Davie, Computer Networks, fifth edition, ELSEVIER
	Reference Books:
1.	Behrouz A Forouzan, Data and Communications and Networking, Fifth Edition, McGraw Hill, Indian Edition
2.	Andew S Tanenbaum and David Wetherall, Computer Networks, Fifth Edition Pearson
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://nptel.ac.in/courses/106105081/ 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 Book Assignments (OBA)/ Lab Project
3.	Flipped Classes	3.	Lab Test
4.	Practice session/Demonstrations in Labs	4.	Semester End Examination
5.	Virtual Labs (if present)		

Course Outcome (COs)					
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create					
At the end of the course, the student will be able to			Learning Level	PO(s)	PSO(s)
1.	Explain the structure and different components of Internet.	Un	1,2	1	
2.	Explain the principles of application layer protocols.	Un	1	1	
3.	Recognize the transport layer services and infer the different protocols.	Ap	1,5	1,2	
4.	Differentiate between the different types of Services and the application of routing algorithms	An	1,2,12	1,3	
5.	Perform error detection and correction at link layer.	Ap	1,2	1	

Scheme of Continuous Internal Evaluation (CIE):

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

THEORY (60 marks)			LAB (40 marks)		Total
IA test 1	IA test 2	Assignment (OBA/Lab Project/Industry assignment)	Conduction	Lab test	
25 marks	25 marks	10 marks	15 marks	25 marks	100 marks
IA Test:					
1. No objective part in IA question paper 2. All questions descriptive					
Conduct of Lab:					
1. Conducting the experiment and journal: 5 marks 2. Calculations, results, graph, conclusion and Outcome: 5 marks 3. Viva voce: 5 marks					
Lab test: (Batchwise with 15 students/batch)					
1. Test will be conducted at the end of the semester 2. Timetable, Batch details and examiners will be declared by Exam section 3. Conducting the experiment and writing report: 5 marks 4. Calculations, results, graph and conclusion: 10 marks 5. Viva voce: 10 marks					
Eligibility for SEE:					
1. 40% and above (24 marks and above) in theory component 2. 40% and above (16 marks and above) in lab component 3. Lab test is COMPULSORY 4. Not eligible in any one of the two components will make the student Not Eligible for SEE					

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	Minimum marks required in SEE to pass: 40 out of 100

3. Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

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

SI 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	Software Engineer	Network administrator
2	Programming skills	Software Developer	Network architect

Micro-Controllers and Embedded Systems

Course Code	21CS53	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 gain a comprehensive understanding of the ARM architecture, including its instruction set, memory organization, and pipeline structure.
2.	To develop and analyze ARM assembly language programs, including instruction syntax, addressing modes, program flow control, debugging and optimizing ARM-based systems .
3.	To learn about the components of embedded systems, including microcontrollers, sensors, actuators, and communication interfaces.
4.	To acquire knowledge about the embedded system's real-time operating system, IDEs and its application in IoT.

Required Knowledge of : Digital Electronics, Computer Organization.

Unit – I	Contact Hours = 8 Hours
Microprocessors versus Microcontrollers, ARM Embedded Systems: The RISC design philosophy, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software. ARM Processor Fundamentals: Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts, and the Vector Table, Core Extensions.	

Unit – II	Contact Hours = 8 Hours
Introduction to the ARM Instruction Set: Data Processing Instructions, Branch Instructions, Software Interrupt Instructions, Program Status Register Instructions, Coprocessor Instructions, Loading Constants. C Compilers and Optimization: Basic C Data Types, C Looping Structures, Register Allocation, Function Calls, Pointer Aliasing.	

Unit – III	Contact Hours = 8 Hours
C Compilers and Optimization: Structure Arrangement, Bit-fields, Unaligned Data and Endianness, Division, Floating Point, Inline Functions and Inline Assembly, Portability Issues. ARM programming using Assembly language: Writing Assembly code, Profiling and cycle counting, instruction scheduling, Register Allocation, Conditional Execution, Looping Constructs.	

Unit – IV	Contact Hours = 8 Hours
Embedded System Components: Embedded Vs General computing system, History of embedded systems, Classification of Embedded systems, Major applications areas of embedded systems, purpose of embedded systems. Core of an Embedded System including all types of processor/controller, Memory, Sensors, Actuators, LED, 7 segment LED display, stepper motor, Keyboard, Push button switch, Communication Interface (onboard and external types), Embedded firmware, Other system components.	

Unit – V	Contact Hours = 8 Hours
RTOS and IDE for Embedded System Design: Operating System basics, Types of operating systems, Task, process and threads (Only POSIX Threads with an example program), Thread preemption, Multiprocessing and Multitasking, Task Communication (without any program), Task synchronization issues – Racing and Deadlock, Concept of Binary and counting semaphores (Mutex example without any program), How to choose an RTOS, Integration and testing of Embedded hardware and firmware, Embedded system Development Environment – Block diagram (excluding Keil), Disassembler/decompiler, simulator, emulator and debugging techniques, target hardware debugging, boundary scan.	

Flipped Classroom Details

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

List of Experiments

Unit No.	No. of Experiments	Topic(s) related to Experiment
1	1	Observe the various registers, dump, and CPSR.
2	5	Simple arithmetic and logical operations.
3	3	Sorting, memory operations and UART.
4	5	Interfacing Stepper motor, DAC, DC Motor, ADC, External interrupt and 7-segment display.
5	1	Demonstration of IoT applications by using Arduino and Raspberry Pi.

Unit No.	Self-Study Topics
1	Core Extensions.
2	Portability Issues.
3	Looping Constructs.
4	Purpose of embedded systems.
5	Embedded system Development Environment.

Books	
	Text Books:
1.	Andrew N Sloss, Dominic Symes and Chris Wright, ARM system developers guide, Elsevier, Morgan Kaufman publishers, 2008.
2.	Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education, Private Limited, 2nd Edition.
	Reference Books:
1.	Raghunandan. G.H, Microcontroller (ARM) and Embedded System, Cengage learning Publication,2019.
2.	The Insider's Guide to the ARM7 Based Microcontrollers, Hitex Ltd.,1st edition, 2005.
3.	Steve Furber, ARM System-on-Chip Architecture, Second Edition, Pearson, 2015.
4.	Raj Kamal, Embedded System, Tata McGraw-Hill Publishers, 2nd Edition, 2008.
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://nptel.ac.in/courses/106105193
2.	https://nptel.ac.in/courses/106105172

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

Course Outcome (COs)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create				
At the end of the course, the student will be able to			Learning Level	PO(s)
1.	Demonstrate an understanding of ARM architecture, including its instruction set, memory organization, and pipeline structure.	Un	1,2,5	1,2
2.	Develop proficiency in writing and analyzing ARM assembly language programs, including understanding instruction syntax, addressing modes, program flow control, debugging and optimizing ARM-based systems.	Ap, An	2,3,5	1,2
3.	Understand the process of integrating hardware and software components in embedded systems, including interfacing with peripherals, managing memory, and handling interrupts.	Ap	2,3,5	1,2
4.	Demonstrate the need for a real-time operating system for embedded system applications.	Ap	2,3,5	1,2
5.	Apply the learnings inculcated throughout the course and develop a course project.	An	1,2,3,5, 9,10,11,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE):

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

THEORY (60 marks)			LAB (40 marks)		Total
IA test 1	IA test 2	Assignment (OBA/Lab Project/ Industry assignment)/ Course project	Conduction	Lab test	
25 marks	25 marks	10 marks	15 marks	25 marks	100 marks
IA Test:					
1. No objective part in IA question paper 2. All questions descriptive					
Conduct of Lab:					
1. Conducting the experiment and journal: 5 marks 2. Calculations, results, graph, conclusion and Outcome: 5 marks 3. Viva voce: 5 marks					
Lab test: (Batchwise with 15 students/batch)					
1. Test will be conducted at the end of the semester 2. Timetable, Batch details and examiners will be declared by Exam section 3. Conducting the experiment and writing report: 5 marks 4. Calculations, results, graph and conclusion: 10 marks 5. Viva voce: 10 marks					
Eligibility for SEE:					
1. 40% and above (24 marks and above) in theory component 2. 40% and above (16 marks and above) in lab component 3. Lab test is COMPULSORY 4. Not eligible in any one of the two components will make the student Not Eligible for SEE					

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

CO-PO Mapping (planned)														CO-PSO Mapping (planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	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 ARM 7 for simple I/O operations, sensor interfacing and actuators.	Embedded System and IoT Application.	Embedded Engineers
2	Choosing appropriate Real Time Operating Systems for IoT applications.	Embedded System and IoT Application.	Embedded- IoT- Firmware Design Engineer
3	Programming Arduino UNO / Raspberry Pi for simple I/O, sensor/ actuator interfacing and ending/receiving data to/from cloud.	Embedded System and IoT Application.	Embedded- IoT- Firmware Design Engineer

Data Visualization

Course Code	21CS541	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 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: Introduction to Python	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: Data Visualization with Leather	Contact Hours = 8 Hours
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: Numpy , Pandas and Matplotlib	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
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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 Book:
	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.	Online Quizzes (Surprise and Scheduled)	
3.	Flipped Classes	3.	Open Book Tests (OBT)	
4.	Online classes	4.	Course Seminar	
		5.	Semester End Examination	

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

1.	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
5.	Demonstrate the skills to visualize the given data with proper story framing	Ap	1,2,3,5, 9,10,11 12	1,2,3

Scheme of Continuous Internal Evaluation (CIE):

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

Scheme of Semester End Examination (SEE):

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

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

Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
Data visualization techniques using Python and Julia	Finance, Health care, banking etc	Data Scientist, Data science Engineer, Visualization Specialist

Big Data Management

Course Code	21CS542	Course type	PEC	Credits L-T-P	3 – 0 - 0
Hours/week: L - T- P	3 – 0 – 0			Total credits	3
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 0 Hrs Total = 40 Hrs			CIE Marks	100
Flipped Classes content	10 Hours			SEE Marks	100

Course learning objectives	
1.	To understand Big data dimensions, its applications and analyze business case studies in Big Data Analytics
2.	To Explore Hadoop Framework and Architecture
3.	To Understand the importance of MapReduce Framework.
4.	To Understand basics of NoSQL and Hadoop Components

Pre-requisites :Database Management System, Unix Shell Programming

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

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

Unit – III	Contact Hours = 8 Hours
Understanding MapReduce: The MapReduce Framework: Exploring the Features of MapReduce, Working of MapReduce, Exploring Map and Reduce Functions, Uses of MapReduce. YARN Architecture: Background; Advantages of YARN; YARN Architecture	

Unit – IV	Contact Hours = 8 Hours
Big Data Analytics: base, role of Hbase in Big data processing, Characteristics of Hbase, Installation of Hbase. Cassandra: key features of Apache Cassandra Structure of Cassandra system Contextual query Language,	

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

Flipped Classroom Details

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

Books	
	Text Books:
1.	DT Editorial Services, "Big Data: Black Book, Comprehensive Problem Solver", Dreamtech Press. 2016 Edition
	Reference Books:
1.	Paul C. Zikopoulos, Chris Eaton, Dirk deRoos, Thomas Deutsch, George Lapis, Understanding Big Data – Analytics for Enterprise Class Hadoop and Streaming Data, McGraw Hill, 2012
2.	P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
3.	TomWhite, "Hadoop: TheDefinitiveGuide", ThirdEdition,O'Reilly,2012.
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://www.coursera.org/specializations/big-data
2	Best Online Resources to Learn Big Data in 2023 (Courses, Books, Podcasts, and More) (shiksha.com)

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

Course Outcome (COs)				
At the end of the course, the student will be able to (Highlight the action verb representing the learning level.)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create			Learning Level	PO(s)
1.	Explain and understand the concepts of Big Data.	Un	1,2	1
2.	Apply Map-Reduce analytics using Hadoop.	Ap	3,4	1,2
3.	Make Use of Hadoop related tools such as HBase, Cassandra, for big data analytics and Infer the need for NoSQL databases and different types of NoSQL database	Ap	1,2,3,5	1,2
4.	Apply the learnings inculcated throughout the course and present a course seminar	Ap	9,10,12	3

Scheme of Continuous Internal Evaluation (CIE):

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

Scheme of Semester End Examination (SEE):

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

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

Tick mark the CO, PO and PSO mapping

SI No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Hadoop	IT Sector	Big Data Administrator
2	Cassandra	IT SECTOR	Big data Developer
3	No SQL ,HBase	IT SECTOR	Data Analyst

Data Warehousing and Data Mining

Course Code	21CS543	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 develop the skills using recent data mining software for solving practical problems.
3.	To assess the strengths and weaknesses of various data mining methods and algorithms.

Pre-requisites: Database Management System.

Unit – I	Contact Hours = 8 Hours
Introduction and Data Preprocessing :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 Preprocessing: An overview, Data cleaning, Data integration, Data reduction, Data transformation and data discretization.	

Unit – II	Contact Hours = 8 Hours
What is a Data Warehouse? A Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, Data cube Technology, 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	1	2	2	1

Books	
	Text Books:
1.	Jiawei Han, Micheline Kamber , Jian Pei: Data Mining - Concepts and Techniques , 3rd Edition, Morgan Kaufmann Publishers, 2011.
	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

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

Course Outcome (COs)				
At the end of the course, the student will be able to (Highlight the action verb representing the learning level.)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create	Learning Level	PO(s)	PSO(s)	
1. Demonstrate storing voluminous data for online processing and preprocess the data for mining applications.	Ap	1,2,3,4	1	

2.	Design and deploy appropriate classification techniques.	An	2,3,4,5	2
3.	Apply clustering the high dimensional data for better organization of the data.	Ap	2,3,4,5	2
4.	Apply data mining techniques and methods to large data sets.	Ap	1,2,3	1,2
5.	Apply the learnings inculcated throughout the course and develop a course project or present a course seminar.	Ap	1,2,3,4,5,9,10,11,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE): Theory course

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

Scheme of Semester End Examination (SEE):

1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	Minimum marks required in SEE to pass: 40 out of 100
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

CO-PO Mapping (Planned)													CO-PSO Mapping(Planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
1	✓	✓	✓	✓									✓		
2		✓	✓	✓	✓									✓	
3		✓	✓	✓	✓									✓	
4	✓	✓	✓										✓	✓	
5	✓	✓	✓	✓	✓				✓	✓	✓	✓	✓	✓	✓
Tick mark the CO, PO and PSO mapping															

SI 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 Data warehouse Engineer Database Administrator

Advanced Java (Integrated)

Course Code	21CS544	Course type	PEC Integrated Project based	Credits L-T-P	2-0-1
Hours/week: L - T- P	2 - 0 – 2			Total credits	3
Total Contact Hours	L = 20Hrs; T = 0Hrs; P = 20 Hrs Total = 40Hrs			CIE Marks	100
Flipped Classes content	5 Hours			SEE Marks	100

Course learning objectives	
1.	Understand the different ways of handling I/O in Java, including file I/O.
2.	Demonstrate the multithreading concepts and develop multithreaded applications.
3.	Build Java applications using Java Data Base Connectivity (JDBC) to interact with databases
4.	Understand the different ways of handling I/O in Java, including file I/O.
5.	To understand the concept of RMI using Java.

Pre-requisites : Basics of Java Programming

Unit – I	08 Hours
Java I/O: Byte streams and Character streams, The Byte Stream classes, The Character Stream classes, Predefined streams, Using Byte Streams, Using Java's Type Wrappers to Convert Numeric Strings	
Unit – II	08 Hours
File I/O: Reading and Writing Files using Byte Streams, Automatically closing a file, Reading and Writing Binary data, Random-Access Files, Using Java's Character-based Streams, File I/O using Character Streams.	

Unit – III	08 Hours
Multithreaded Programming: Multithreading Fundamentals, The Thread class and Runnable interface, Creating a thread, Creating multiple threads, Determining when a thread ends, Thread Priorities, Synchronization, Using Synchronized Methods, The synchronized statement, Thread communication using notify(), wait() and notifyall(), Suspending, Resuming and Stopping threads.	

Unit – IV	08 Hours
JDBC: The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet; Transaction Processing - commit(), rollback(), SavePoint.	
Unit – V	08 Hours
Networking: Networking basics, Java and the Net, Inet address, TCP/IP client sockets, URL connection, TCP/IP server sockets, Datagrams. RMI (Remote Method Invocation) Defining the	

remote interface, Implementing the remote interface, Define the client, Compile and execute the server and the client

Flipped Classroom Details

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

List of experiments	
1.	Write a menu driven Java program to work with files
2.	Write a Java Program to demonstrate the implementation of stream classes in Java
3.	Write a Java Program to demonstrate the implementation of reading and writing binary data in Java.
4.	Write a menu-driven Java Program to work with ArrayLists
5.	Write a multithreaded Java program to work with numbers.
6.	Write a Java program to demonstrate how the standard operations on a bank account can be synchronized.
7.	Write a multithreaded Java program to demonstrate the Producer-Consumer problem
8.	Write a Java program to search and display details of book(s) authored by a particular author from a “BOOKS” table. Assume an appropriate structure and attributes for the table.
9.	Program to demonstrate transaction processing. Assume an appropriate database/table.
10.	Write a program to demonstrate RMI.

PART B

Each student needs to formulate a problem definition in consultation with the guide for the Project component and work towards completion after approval. Project report has to be submitted by each student individually.

Books	
1.	Herbert Schildt and Dale Skrien, “Java Fundamentals A Comprehensive Introduction”, TMH. Special Indian edition.
2.	Jim Keogh, J2EE: The Complete Reference, TMH Edition 2002 onwards
3.	Elliotte Rusty Harold, “ Java Network Programming”, O'Reilly publishers, 2000
4.	Patrick Naughton, “COMPLETE REFERENCE: JAVA2”, Tata McGraw-Hill, 2003
5	Y. Daniel Liang: Introduction to JAVA Programming, 7th Edition, Pearson Education, 2007.
E-Resources	
1.	https://www.w3schools.com/java
2.	https://freecodecamp.org

3	https://www.tutorialspoint.com/java8
4	https://www.javatpoint.com
5.	https://swayam.gov.in/NPTEL

Course delivery methods		Assessment methods		
1.	Chalk & Talk	1.	IA test	
2.	IA Test	2.	Journal writing	
3.	Mini Project	3.	Lab project/ Open ended experiment	
4.	Periodic Journal Evaluation	4.	Lab Test	
5.	Practice session/Demonstrations in Labs	5.	Semester End Examination	

Course Outcome (COs)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create				
At the end of the course, the student will be able to			Learning Level	PO(s)
1.	Illustrate the different ways of handling I/O and file I/O and demonstrate in Java	Ap	1,3	1,3
2.	Develop Java programs to understand multithreading concepts and make use of different packages.	Ap	1,2,3,5, 9,10,12	1,2,3
3.	Apply Java Data Base Connectivity (JDBC) concepts to write applications that interact with databases	Ap	1,2,3,5, 9,10,12	1,2,3
4.	Make use of the type hierarchy in the Collections Framework and Lambda expressions.	Ap	1,3	1,3
5.	Experiment with the concept of packages and interfaces.	Ap	1,3,9,10,12	1,3

Scheme of Continuous Internal Evaluation (CIE):

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

THEORY (40 marks)		PROJECT (60 marks)			Total
IA test (Theory)	IA test (Lab)	Project Phase 1	Project Phase 2	Project report	
25 marks	15 marks	25 marks	25 marks	10 marks	100 marks
Theory IA test should be of one-hour duration. Lab IA test should be of two/three-hour duration. Project batch will ideally consist of 2 students (maximum of 3). Project Phase 1 presentation will be conducted after 6 weeks and Project Phase 2 presentation will be conducted after 13 weeks from the start of the semester. Submitting Project report is compulsory.					
Eligibility for SEE: 1. 40% and above (16 marks and above) in theory component					

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

Semester End Examination (SEE):

1.	It will be conducted for 100 marks having 3 hours duration.		
	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	
2.	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	100 marks
3.	Minimum marks required in SEE to pass: Score should be $\geq 35\%$, however overall score of CIE + SEE should be $\geq 40\%$.		
4.	SEE will be conducted in project batches by Internal & External examiners together.		

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

Agile Software Development

Course Code	21CS545	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	7 Hours			SEE Marks	100

Course learning objectives	
1.	To bring the importance/need for Agile Software Development.
2.	To apply the principles and practices of agile software development on a project of interest and relevance to the student.
3.	To learn about user stories and agile estimation and planning techniques.

Pre-requisites: Software Engineering

Unit – I	Contact Hours = 8 Hours
Introduction: Understanding Success, Beyond Deadlines, The Importance of Organizational Success, Enter Agility: Organizational Success, Technical Success, Personal Success, Agile Methods: Don't Make Your Own Method, Manifesto, Agile principles, The Road to Mastery, Find a Mentor, Traditional lifecycles, The XP Lifecycle, The XP Team. Self-Study: XP Concepts.	

Unit – II	Contact Hours = 8 Hours
Thinking: Pair Programming: Why Pair? How to Pair, Driving and Navigating, Pairing Stations, Challenges, Questions, Results, Contraindications, Alternatives, Root-Cause Analysis: How to Find the Root Cause, how to Fix the Root Cause, When Not to Fix the Root Cause, Questions, Results, Contraindications, Alternatives, Retrospectives: Types, how to Conduct it.	

Unit – III	Contact Hours = 8 Hours
Collaborating: Trust, Strategies for generating trust, Impressions: Organizational Strategy, Sit Together: Accommodating Poor Communication, A Better Way, Secrets of Sitting Together: Making Room, Designing Your Workspace, Sample Workspaces, a small workspace, adopting an Open Workspace, Real Customer Involvement: In-House Custom Development, Outsourced Custom Development, Vertical-Market Software, Horizontal-Market Software, Stand-Up Meetings: How to Hold a Daily Stand-Up Meeting, Be Brief. Releasing: Version Control: Terminologies, Concurrent Editing, Ten-Minute Build: Documentation. Self-Study: Reporting.	

Unit – IV	Contact Hours = 8 Hours
Planning: Vision, Release Planning: How to Release Frequently, how to Create a Release Plan, planning at the Last Responsible Moment, Adaptive Planning and Organizational Culture, The Planning Game: How to Play, overcoming disagreements, how to Win, Iteration Planning: The Iteration Time box and Schedule, Slack, Stories.	

Unit – V	Contact Hours = 8 Hours

Developing: Incremental Requirements: The Living Requirements Document, Work Incrementally Test-Driven Development: Why TDD Works, how to Use TDD, Example, Testing Tools, Unit Tests, Focused Integration Tests, End-to-End Tests, TDD and Legacy Code, Refactoring, Spike Solutions, Performance Optimization, Exploratory Testing.

Flipped Classroom Details

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

Books	
	Text Books:
1.	James Shore and Shane Warden, The Art of Agile Development, O'Reilly, 2007 first edition onwards
	Reference Books:
1.	Robert C. Martin , "Agile Software Development" , Principles, Patterns, and Practices, Pearson, 2014
2.	Mike Cohn, "Succeeding with Agile: Software Development Using Scrum" , Pearson, 2010
	E-resources (NPTEL/SWAYAM. Any Other)- mention links
1.	Agile Model: https://www.youtube.com/watch?v=x90kIAFGYKE
2.	Agile Development: https://www.youtube.com/watch?v=jRs-aFETAXY

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

Course Outcome (COs)				
At the end of the course, the student will be able to (Highlight the action verb representing the learning level.)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create				Learning Level
1.	Compare and contrast the differences between Agile and other project management methodologies.	Un	1,2,3	1.2
2.	Develop an appropriate adaptation model to the existing practices or processes depending upon analysis of typical problems.	Ap	5,11	1.2
3.	Apply various principles, phases and activities of the Agile methodology.	Ap	5,8,11	1.2
4.	Apply the learnings inculcated throughout the course	Cr	1,2,3,5 9,10,11,12	1.2,3

Scheme of Continuous Internal Evaluation (CIE):

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

OBA - Open Book Assignment

Minimum score to be eligible for SEE: 40 OUT OF 100

Scheme of Semester End Examination (SEE):

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

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
1	v	v	v										v	v	
2			v		v						v		v	v	
3					v			v			v		v	v	
4	v	v	v		v				v	v	v	v	v	v	v
Tick mark the CO, PO and PSO mapping															

SI No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Quickly visualize, plan and manage all your projects with an easy tool.	Any software development especially Aviation companies	Professional Agile Leaders, Scrum Master
2	Deliver Iterative & Incremental solutions as fast as possible.	And Finance sector	
3	Improved Flexibility; Continuous Improvement.		

Object-Oriented Programming with JAVA

Course Code	21CS551	Course type	OEC	Credits L-T-P	3 – 0 - 0
Hours/week: L - T - P	3 – 0 – 0			Total credits	3
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 0 Hrs Total = 40 Hrs			CIE Marks	100
Flipped Classes content	10 Hours			SEE Marks	100

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

Pre-requisites : C, C++ programming languages

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

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

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

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

Unit – V	Contact Hours = 8 Hours
Packages: Package fundamentals, packages and member access, importing packages, static import. The Java Collections Framework: overview, the collections interfaces, the collections classes, accessing a collection via an Iterator.	

Flipped Classroom Details

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

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

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

Course Outcome (COs)

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

Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create			Learning Level	PO(s)	PSO(s)
1.	Explain classes, objects, members of a class and relationships among them needed for a specific problem.		Un	1,2,3	1
2.	Apply OOP principles (encapsulation, inheritance, polymorphism etc.) and proper program structure to write application programs.		Ap	1,2,3,5	1,2
3.	Develop skills in writing programs using exception handling techniques.		Ap	1,2,3,5	1,2
4.	Make use of the type hierarchy in the Collections Framework and the concept of packages and interfaces.		AP	1,3	1,2
5.	Apply the learning inculcated throughout the course by developing the course project or by presenting a course seminar		Cr	1,2,3,5,9,10,11,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE):

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

Scheme of Semester End Examination (SEE):

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

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

3	✓	✓	✓		✓								✓	✓	
4	✓			✓									✓	✓	
5	✓	✓	✓		✓				✓						
Tick mark the CO, PO and PSO mapping															

SI No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Well versed with Basics of Java Programming	Software/ Software Development/ Application	Software Developer

Data Structures

Course Code	21CS552	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: 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 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.	

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.	Data Structures: A Pseudocode Approach with C by Richard.F.Gilberg, Behrouz.A.Forouzan, 2nd edition 2007 and onwards.
	Reference Books:
1.	Yedidyah, Augenstein, Tannenbaum: Data Structures Using C and C++, 2nd Edition, Pearson Education, 2003 and onwards.
2.	Debasis Samanta: Classic Data Structures, 2nd Edition, PHI, 2009 and onwards
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	NPTELcourse link : https://nptel.ac.in/courses/106102064/
2.	SWAYAM course link: https://swayam.gov.in/course/1407-programming-and-data-structures
3.	edx course link: https://www.edx.org/course/data-structures-fundamentals

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

Course Outcome (COs)				
At the end of the course, the student will be able to (Highlight the action verb representing the learning level.)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create		Learning Level	PO(s)	PSO(s)
1.	Identify the appropriate and optimal data structure for a specified application.	UN	1, 2	1
2.	Choose dynamic and static data structures implementations	AP	1,2,3	1
3.	Make use of different non-linear data structures and their applications.	AP	1,2,3	1
4.	Apply techniques like hashing, trees in a variety of applications	AP	1,2,3	1
5.	Develop programming skills to solve real life problems using appropriate data structures and build projects	AP	1,2,3,5,9,10,11,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE):

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

Scheme of Semester End Examination (SEE):

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

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

Course Code	21CS553	Course type	PEC Integrated Project based	Credits L-T-P	2 – 0 - 1
Hours/week: L - T- P	2-0-2			Total credits	3
Total Contact Hours	L = 20 Hrs; T = 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 different types of variables, Control Flow and data manipulation techniques
4.	To Understand Image, Text and Data Tables Automation
5.	To Describe automation to Email and various types of Exceptions and strategies to handle

Required Knowledge of : Unix system Programming and Computer Networks

Unit – I	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	8 Hours
RPA CONCEPTS	
RPA Basics - History of Automation - What is RPA - RPA vs Automation - Processes & Flowcharts - Programming Constructs in RPA - What Processes can be Automated - Types of Bots - Workloads which can be automated - RPA Advanced Concepts - Standardization of processes - RPA Developemt methodologies - Difference from SDLC - Robotic control flow architecture - RPA business case - RPA Team - Proccess Design Document/Solution Design Document - Industries best suited for RPA - Risks & Challenges with RPA - RPA and emerging ecosystem.	

Unit – III	8 Hours
RPA TOOL INTRODUCTION & BASICS	

Introduction to RPA Tool - The User Interface - Variables - Managing Variables - Naming Best Practices - The Variables Panel - Generic Value Variables - Text Variables - True or False Variables - Number Variables - Array Variables - Date and Time Variables - Data Table Variables - Managing Arguments - Naming Best Practices - The Arguments Panel - Using Arguments - About Imported Namespaces - Importing New Namespaces- Control Flow - Control Flow Introduction - If Else Statements - Loops - Advanced Control Flow - Sequences - Flowcharts - About Control Flow - Control Flow Activities - The Assign Activity - The Delay Activity - The Do While Activity - The If Activity - The Switch Activity - The While Activity - The For Each Activity - The Break Activity - Data Manipulation - Data Manipulation Introduction - Scalar variables, collections and Tables - Text Manipulation - Data Manipulation - Gathering and Assembling Data

Unit – IV	8 Hours
ADVANCED AUTOMATION CONCEPTS AND TECHNIQUES	
Recording and Advanced UI Interaction - Recording Introduction - Basic and Desktop Recording - Web Recording - Input/Output Methods - Screen Scraping - Data Scraping - Scraping advanced techniques - Selectors - Selectors - Defining and Assessing Selectors - Customization - Debugging - Dynamic Selectors - Partial Selectors - RPA Challenge - Image, Text & Advanced Citrix Automation - Introduction to Image & Text Automation - Image based automation - Keyboard based automation - Information Retrieval - Advanced Citrix Automation challenges - Best Practices - Using tab for Images - Starting Apps - Excel Data Tables & PDF - Data Tables in RPA - Excel and Data Table basics - Data Manipulation in excel - Extracting Data from PDF - Extracting a single piece of data - Anchors - Using anchors in PDF.	

Unit – V	8 Hours
EMAIL AUTOMATION & EXCEPTIONAL HANDLING	
Email Automation - Email Automation - Incoming Email automation - Sending Email automation - Debugging and Exception Handling - Debugging Tools - Strategies for solving issues - Catching errors.	

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	3	Basic automation Example
2	2	Web automation and Conditional Statements
3	2	Data Table and Data manipulation
4	2	Screen Scraping , Data Scraping and PDF automation
5	1	Email Automation

Books	
	Text Book
1.	Alok Mani Tripathi, Learning Robotic Process Automation, Publisher: Packt Publishing Release Date: March 2018 ISBN: 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 Merienda, Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation
4.	https://www.uipath.com/rpa/robotic-process-automation

Course Outcome (COs)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create		Learning Level	PO(s)	PSO(s)
1.	Apply and Implement RPA.	Ap	1,3	1
2.	Explain Image, Text and Data Tables Automation	Un	1	1
3.	Explain automation to Email and various types of Exceptions and strategies to handle.	Un	1	1
4.	Apply the learnings inculcated throughout the course and develop a course project.	Ap	1,2,3, 5,9,10,11,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE):

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

THEORY (40 marks)		PROJECT (60 marks)			Total
IA test (Theory)	IA test (Lab)	Project Phase 1	Project Phase 2	Project report	
25 marks	15 marks	25 marks	25 marks	10 marks	100 marks
Theory IA test should be of one-hour duration. Lab IA test should be of two/three-hour duration. Project batch will ideally consist of 2 students (maximum of 3). Project Phase 1 presentation will be conducted after 6 weeks and Project Phase 2 presentation will be conducted after 13 weeks from the start of the semester. Submitting Project report is compulsory.					
Eligibility for SEE:					

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

Semester End Examination (SEE):

1.	It will be conducted for 100 marks having 3 hours duration.		
	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	
2.	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	100 marks
3.	Minimum marks required in SEE to pass: Score should be $\geq 35\%$, however overall score of CIE + SEE should be $\geq 40\%$.		
4.	SEE will be conducted in project batches by Internal & External examiners together.		

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

Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
Robotic Process Automation with UiPath	HealthCare, Finance, Banking, Education etc	RPA solution architect, RPA developer, RPA Evangelist, RPA Subject Matter Expert etc

Web Programming

Course Code	21CS554	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 = 40Hrs; T = 0Hrs; P = 0Hrs Total = 40Hrs			CIE Marks	100
Flipped Classes content	10 Hours			SEE Marks	100

Course learning objectives	
1.	To understand HTML,XHTML and create web pages
2.	To design web pages with CSS
3.	To utilize JavaScript for interactive pages on the client side
4.	To understand server side programming and that can be deployed on any device

Pre-requisites :Computer Concepts and C Programming, Database Management Systems

Unit – I	Contact Hours = 8 Hours
Fundamentals of Web, XHTML – 1: Internet, WWW, Web Browsers and Web Servers, URLs, MIME, HTTP, Security, The Web Programmers Toolbox. XHTML: Basic syntax, Standard structure, Basic text markup, Images, Hypertext Links. Self-learning topics: Built-In Directives	

Unit – II	Contact Hours = 8 Hours
CSS: XHTML (continued): Lists, Tables, Forms, Frames along with examples. CSS: Introduction, Levels of style sheets, Style specification formats, Selector forms, Font properties, List properties, Color, Alignment of text, The box model, Background images,The and <div> tags, Conflict resolution with programming scripts. Self-learning topics: Built-In Directives	

Unit – III	Contact Hours = 8 Hours
Introduction to Javascript: Overview of Javascript, Object orientation and Javascript, Syntactic characteristics,Primitives, operations, and expressions, Screen output and keyboard input, Control statements, Objectcreation and modification, Arrays, Functions, Constructors, Pattern matching using regularexpressions, Errors in scripts, Examples.	

Unit – IV	Contact Hours = 8 Hours
Javascript and HTML Documents, Dynamic Documents with Javascript: The Javascript executionenvironment, The Document Object Model, Element access in Javascript, Events and event handling,Handling events from the Body elements, Button elements, Text box and Password elements, TheDOM 2 event model, The navigator object, DOM tree traversal and modification. Introduction todynamic documents, Positioning elements, Moving elements, Element visibility.	

Unit –V	Contact Hours = 8 Hours
PHP: Origins and uses of PHP, Overview of PHP, General syntactic characteristics, Primitives, operations and expressions, Output, Control statements, Arrays, Functions, Pattern matching, Formhandling, Files, Cookies, Database access with PHP and MySQL.	

Flipped Classroom Details

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

Books	
	Text Books:
1.	Robert W. Sebesta: Programming the World Wide Web, Pearson education, 7th Edition .
2.	Simon Holmes, Getting MEAN: Mongo, Express, Angular, Node, Dreamtech press, 2015, 1 st Edition and onwards
	Reference Books:
1.	M. Deitel, P.J. Deitel, A. B. Goldberg: Internet & World Wide Web How to Program, Pearson education, 4 th Edition
2.	Chris Bates: Web Programming Building Internet Applications, Wiley India, 3rd Edition 2006
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	HTML Tutorial (w3schools.com)

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

Course Outcome (COs)				
At the end of the course, the student will be able to (Highlight the action verb representing the learning level.)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create			Learning Level	PO(s)
1.	Explain and acknowledge basic concepts of Web programming.	Un	1	1
2.	Describe and liberate usage of XHTML and CSS, for real time representation.	Un	1,2	1
3.	Implement simple applications with HTML, CSS ,Javascript and phpfor various real time applications.	Ap	1,2,3,5	1,2
4.	Apply the learnings inculcated throughout the course and develop a course project and present a seminar.	Ap	1,2,3,5,9,10 ,11,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE):

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

OBA- Open Book Assignment

Minimum score to be eligible for SEE: 40 OUT OF 100

Scheme of Semester End Examination (SEE):

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

CO-PO Mapping (Planned)														CO-PSO Mapping(Planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO 11	PO 12	PSO 1	PSO 2	PSO 3	
1	✓												✓			
2	✓	✓											✓			
3	✓	✓	✓		✓								✓	✓		
4	✓	✓	✓		✓				✓	✓	✓	✓	✓	✓	✓	
Tick mark the CO, PO and PSO mapping																

Sl No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Creating Dynamic Web Pages	Product Based	Front End Developer
2	Designing a website	Social Media	Web Designer

Introduction to Astronomy

Course Code	21PH551	Course type	Open elective	Credits L-T-P	3 – 0 - 0
Hours/week: L - T- P	3 – 0 – 0			Total credits	3
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 0 Hrs Total = 40 Hrs			CIE Marks	100
Flipped Classes content	10 Hours			SEE Marks	100

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

Pre-requisites : None

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

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

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

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

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

Flipped Classroom Details

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

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

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

Course Outcome (COs)				
At the end of the course, the student will be able to:				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create				Learning Level
1.	Apply nuclear physics, statistical physics to understand working and end states of stars.	Ap	1	1

2.	Understand classification of stars and binary systems.	Un	1	1
3.	Understand structure of galaxy and expansion of the universe	Un	1	1
4.	Apply general relativity to understand cosmology	Ap	1	1

Scheme of Continuous Internal Evaluation (CIE):

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

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

Scheme of Semester End Examination (SEE):

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

Rubrics:Levels	Target
1 (Low)	60% of the students score Less than 50 % of the total marks.
2 (Medium)	60% of the students score 50 – 70 % of the total marks.
3 (High)	60% of the students score More than 70 % of the total marks.

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

Tick mark the CO, PO and PSO mapping

Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
Understanding of various types, motion of celestial objects and its observation techniques	Research in astronomy, space science	Engineer at research institutes in the field of astronomy, engineers at ISRO.

Research Methodology & Intellectual property rights

Course Code	21CS57	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 = 15 Hrs; T = 0 Hrs; P = 0 Hrs Total = 15 Hrs			CIE Marks	50
Flipped Classes content	3 Hours			SEE Marks	50

Course learning Objectives

- | | |
|----|---|
| 1. | Understand the basic concepts of research and its methodologies |
| 2. | Identify and select the appropriate research/sampling design methods. |
| 3. | Create the awareness about Intellectual Property Rights for the protection of inventions. |

Required Knowledge of : Probability & Statistics.

Unit-I	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.	
Research Problem: Defining a research problem, Selecting a research problem, necessity and techniques involved in defining the research problem.	

Unit-II	5 Hours
Data Collection Methods: Collection of Primary Data, Observation Method, Interview Method, Questionnaires, Schedules, Other Methods of Data Collection, Collection of Secondary Data, Case study method.	
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, Simple regression analysis	

Unit-III	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.	

Flipped Classroom Details

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

Self-Study Topics	
Unit No.	Topic description
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.
	Reference Books:
1.	Panneer Selvam, Research Methodology, PHI Learning Pvt. Ltd., 2007.
2.	Dr. B.L. Wadhera -Intellectual Property Rights, Universal Law Publishing Co. Ltd.. 2002
	William G Zikmund, Business Research Methods, Indian edition, South western Publishers, 8th Indian Reprint – 2009.
	E-resources (NPTEL/SWAYAM. Any Other)- mention links
1.	https://onlinecourses.swayam2.ac.in/cec20_ge37 (Research Methodology)

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Research Activity
3.	Flipped Classes	3.	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.	Discuss the significance of Intellectual Property Rights & report writing	Ap	1,2,3,9,10	1,2,3

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Research Activity	Total Marks
Marks	20+20=40	10	50

IAS and Assignments: Minimum score to be eligible for SEE: 20 OUT OF 50

The weightage of Continuous Internal Evaluation (CIE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50).

Scheme of Semester End Examination (SEE):	
1.	The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is 01 hour .
2.	SEE paper shall be set for 50 questions, each of the 01 mark .
3.	The weightage for Semester End Exam (SEE) is 50%. The minimum passing mark for the SEE is 35% of the maximum marks (18 marks out of 50).
4.	A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to the subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

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

Employability Skills I

Course Code	21AECCS58	Course type	AEC	Credits L-T-P	1–0 - 0
Hours/week: L - T - P	1 – 0 – 0			Total credits	1
Total Contact Hours	L = 20 Hrs; T = 0 Hrs; P = 0 Hrs Total = 20 Hrs			CIE Marks	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

Unit – I	Contact Hours = 4 Hours
General Aptitude 1.1: Understanding Quantitative Aptitude : Number System, Averages, Ratio and Proportion Partnership	

Unit – II	Contact Hours = 4 Hours
General Aptitude 1.2: Understanding Quantitative Aptitude : Percentages, Profit and Loss , Time and Work, Ages	

Unit – III	Contact Hours = 4 Hours
General Aptitude 1.3: Understanding Quantitative Aptitude : Number and Letter Series, Coding and Decoding and DST, Analogy and Blood Relations	

Unit – IV	Contact Hours = 4 Hours
General Aptitude 1.4: Understanding Quantitative Aptitude : Reading Comprehension, Sentence Correction, Ordering of Sentences	

Unit – V	Contact Hours = 4 Hours
Improve Sense of Belongingness: Body Language, Grooming and Etiquette, Group Discussions	

Books
Text Books:
The Aptitude Triad , BIZOTIC
Reference Books:
Name of the author(s), Title of the Book, Publisher, Edition/Year _____ and onwards

Course delivery methods		Assessment methods		
1.	Chalk and Talk	1.	IA tests	
2.	PPT and Videos	2.	Online Quizzes (Surprise and Scheduled)	
		3	Internal Assessments	

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				
1.	Clear the Aptitude round of recruiters during placements	L2	10	3
2.	Perform confidently during the Interview process	L2	12	3
3.	Develop Resumes that are grammatically correct	L2	10	3
4.	Develop behaviors that are appropriate for a professional	L2	12	3

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Online Quiz	Addition of two OAs/ Course project	Course Seminar	Total Marks
Marks	25+25 = 50	10	15+15 =30	10	100
> Writing 2 IA tests is compulsory > Minimum score to be eligible for SEE: 40 OUT OF 100					

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

SI 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

Name & Signature of Faculty members involved in designing the syllabus

Name & Signature of Faculty members verifying/approving the syllabus

Environmental Studies

Course Code	21CV59	Course type	HSMS	Credits L-T-P	1–0 - 0
Hours/week: L - T- P	1 – 0 – 0			Total credits	1
Total Contact Hours	L = 1Hrs; T = 0 Hrs; P =0 Hrs Total = 20 Hrs			CIE Marks	50
Flipped Classes content	10 Hours			SEE Marks	50

Course learning objectives

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

Pre-requisites:--

Unit – I	Contact Hours = 4 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 = 4 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 =4 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 = 4 Hours
Disaster Management: International strategy for disaster reduction. Concept of disaster management and national disaster management framework	

Unit – V	Contact Hours = 4 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	2	2	2	2	2

Books	
	Text Books:
1.	Benny Joseph, " Environmental Studies ", Tata McGraw - Hill Publishing Company Limited (2005).
2.	Ranjit Daniels R.J. and Jagdish Kirshnaswamy, " Environmental Studies ", Wiley India Private Ltd., New Delhi (2009).
3.	Sanjay K. Sharma, " Environment Engineering and Disaster Management ", USP (2011).
4.	Harsh K. Gupta, " Disaster Management ", Universities Press (India) Pvt. Ltd (2003).
	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)- mention links
1.	–

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

Course Outcomes (COs)				
At the end of the course, the student will be able to:			Learning Level	PO(s)
1.	Explain the importance of the Environment		Un	1,6,7
2.	Evaluate Environmental disasters caused by human activities		Un	1,6,7
3.	Outline the water problems and energy crisis in the present era		Un	1,6,7
4.	Explain and classify the Renewable and Non-Renewable sources of energy		Un	1,6,7
5.	Summarize the various Legislations related to Environment		Un	1,6,7

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Addition of two Assignments	Total Marks
Marks	15+15 = 30	10+10 =20	50

Writing the IA test is Compulsory

Minimum marks required to be eligible for SEE: 20 out of 50

Scheme of Semester End Examination (SEE):

- | | |
|----|--|
| 1. | It will be conducted for 50 marks of 1 hour duration. |
| 2. | Minimum marks required in SEE to pass: 20 out of 50 |
| 3. | Question paper contains multiple choice questions. |

CO-PO Mapping (Planned) [tick mark relevant ones]															CO-PSO Mapping (Planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3		
1	✓					✓	✓							✓			
2	✓					✓	✓							✓			
3	✓					✓	✓							✓			
4	✓					✓	✓							✓			

Communicative English

Course Code:	21ENG59	Course type	MNC	Credits L-T-P	1–0 - 0
Hours/week: L - T- P	1 – 0 – 0			Total credits	1
Total Contact Hours	L = 15 Hrs, T = 0 Hrs P = 0 Hrs Total = 15 Hrs			CIE Marks	50
Flipped Classes content	3 Hours			SEE Marks	Nil

Course learning objectives	
1.	Enhance pronunciation and fluency for better communication skills.
2.	Augment English vocabulary and grammar for better communication skills.
3.	Impart basic language skills [LSRW].
4.	Achieve better writing skills for employment.
5.	Understand the importance of Non-verbal communication

Pre-requisites: Conversant with basic English Grammar and able to understand spoken English.

Unit – I Introduction to Listening Skills	Contact Hours = 2 Hours
Content of the Unit: Introduction to Listening Comprehension, Hearing and Listening, Listening Process, Types of Listening, Barriers of Listening, Effective and Passive Listening, Reasons and Disadvantages of Poor Listening.	

Unit – II Introduction to Speaking Skills	Contact Hours = 3 Hours
Content of the Unit: Introduction to Phonetics of English Vowel and Consonant sounds, Phonetic Transcription [IPA/RP], English Syllables, Rules for Word Accent -Stress Shift, Intonation, Silent and Non-silent Letters.	

Unit – III Introduction to Reading Skills	Contact Hours = 2 Hours
Content of the Unit: Reading Meaning and Stages, Importance of Reading, Types of Reading, Characteristics of Reading, Process of Reading, Approaches and Factors Influencing Reading, Techniques or Strategies of Reading.	

Unit – IV Introduction to Writing Skills	Contact Hours = 3 Hours
Content of the Unit: Introduction Writing Paragraphs, Parts of the paragraph, Importance of Proper Punctuation, Creating Coherence and Cohesion in Writing, Precise writing, Importance of Summarizing and Paraphrasing. Types of Writing,	

Unit – V Introduction to Non- Verbal communication	Contact Hours = 2 Hours
Content of the Unit: Introduction to Nonverbal Communication, Importance of NVC, Types of NVC-Gestures, Postures, Haptics, Proxemics, Chronemics and Paralanguage.	

Flipped Classroom Details

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

Books	
	Text Books:
1.	A Textbook of English Language Communication Skills, Infinite Learning Solutions–(Revised Edition) 2021.
	Reference Books:
1.	Communication Skills by Sanjay Kumar and Pushp Lata, Oxford University Press - 2019.
2.	English for Engineers by N.P.Sudharshana and C.Savitha, Cambridge University Press – 2018.
	E-resources (NPTEL/SWAYAM. Any Other)- mention links
1.	Technical English for Engineers course Swayam/ NPTEL https://onlinecourses.nptel.ac.in/noc22_hs34/preview
2.	ESOL Courses: Listening & Grammar free online video lesson https://www.esolcourses.com/

Course delivery methods		Assessment methods		
1.	Chalk and Talk	1.	CIE assignments	
2.	PPT and Videos	2.	Online Quizzes (Surprise and Scheduled)	
3.	Flipped Classes	3.	Course seminar	
4.	Online classes, if required.	4.		

Course Outcome (COs)				
At the end of the course, the student will be able to (Highlight the action verb representing the learning level.)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create		Learning Level	PO(s)	PSO(s)
1.	To understand and identify the Common Errors in Writing and Speaking.	Re	10	3
2.	To Achieve better technical writing and Presentation skills.	Un	10	3
3.	To read technical proposals properly and make them Write good technical reports.	Ap	10	3
4.	4. Acquire Employment and Workplace communication skills.	An	10	3

Scheme of Continuous Internal Evaluation (CIE):

Components	Assignments	Course Seminar	Quizzes	Total Marks
Marks	10+10 = 20	10	10x2=20	50

Scheme of Semester End Examination (SEE): No SEE component

1.	NA
2.	Minimum marks required in SEE : NA
3.	The weightage of Continuous Internal Evaluation (CIE) is 100%

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

Software Testing and Project Management

Course Code	21CS61	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 introduce the terminology, testing, test-case, pseudo-codes algorithms /flowcharts of Triangle, Next Date & Commission programs.
2.	To develop the skill of analyzing the Triangle, Next Date & Commission programs, with the perspective of Boundary Value Analysis, Equivalence Class Testing paradigms.
3.	To introduce quality parameters to measure project performance accomplishing specified requirements.
4.	To develop software quality standards based on industry perspectives and relevant versions.

Pre-requisites : Software Engineering, Graph Theory, C Programming

Unit – I	Contact Hours = 8 Hours
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, The currency convertor, Saturn Windshield Wiper Controller.	

Unit – II	Contact Hours = 8 Hours
Boundary Value Testing Boundary Value Analysis, Robustness Testing, Worst Case Testing, Special Value Testing, Examples, Random Testing, Guidelines for Boundary Value Testing. Case Study: Analysis of Banking application using Boundary Value Analysis	

Unit – III	Contact Hours = 8 Hours
Equivalence Class Testing: Equivalence classes, Equivalence Class Test Cases for the Triangle Problem, Equivalence Class Test Cases for the NextDate Function, Equivalence Class Test Cases for the Commission Problem, Guidelines and Observations. Case Study: Analysis of Amazon E-Commerce application by using Equivalence class testing.	

-Unit – IV	Contact Hours = 8 Hours
Project management: Risk management, Managing people, Teamwork	
Configuration management: Change management, Version management, System building, Release management	
Case study: GitHub	

Unit – V	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. The COCOMO II Model. Project Duration and Staffing.	

Flipped Classroom Details

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

Books	
	Text Books:
1.	Paul C. Jorgensen: Software Testing, A Craftsman's approach, 3 rd Edition, Auerbach Publications, 2008.
2.	Ian Sommerville: Software Engineering, Pearson Education, 9 th Edition onwards.
	Reference Books:
1.	Aditya P. Mathur: Foundations of Software Testing, Pearson Education, 2008.
2.	Srinivasan Desikan, Gopalaswamy Ramesh, : Software Testing Principles and Practices, 2 nd Edition, Pearson Education, 2007.
	E-resources (NPTEL/SWAYAM.. Any Other)- https://onlinecourses.nptel.ac.in/
1.	https://onlinecourses.nptel.ac.in/noc19_mg30/preview

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

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

Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create				Learning Level	PO(s)	PSO(s)
1. Define the test case, testing and error taxonomy.				Re	1,3	1
2. Illustrate Test Cases for Triangle, Next Date and Commission Problem for Boundary Value Analysis.				Un	2,3,12	1,3
3. Design Test Cases for Triangle, Next Date and Commission Problem for Equivalence Class Testing.				Ap	3,5,12	1,2,3
4. Prepare Test cards and Project schedule models for the given scenarios.				Ap	3,5,11,12	1,2,3
5. Apply the learnings inculcated throughout the course and present a seminar on that				An	2,9,10, 11,12	1,3

Scheme of Continuous Internal Evaluation (CIE):

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

Scheme of Semester End Examination (SEE):

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

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

Sl No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Understanding Testing Technologies	Information Technology (IT) Services	Test Engineers (DBA)
2	Test-case Design	Govt. Regulatory Services	Project Manager
3	Troubleshooting and Problem Solving	Research and Academia	Business Intelligence (BI) Developer

Formal languages and Automata Theory

Course Code	21CS62	Course type	PCC	Credits L-T-P	3 – 0 - 0
Hours/week: L-T-P	3 – 0 – 0			Total credits	3
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 0 Hrs Total = 40 Hrs			CIE Marks	100
Flipped Classes content	10 Hours			SEE Marks	100

Course learning objectives	
1.	To study abstract computing machines, Language representation techniques, Regular Expressions, Grammar constructions and associated theories and tools to realize formal language.
2.	Employ finite state machines to solve problems in computing.
3.	Discuss the hierarchy of problems arising in the computer science.
4.	Understand the Turing theory and its significance.

Pre-requisites :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. Applications of Automata Theory.	

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 and Ambiguity.	

Flipped Classroom Details

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

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. Eugenexavier "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)- mention links
	https://nptel.ac.in/courses/106105196

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

Course Outcome (COs)				
At the end of the course, the student will be able to (Highlight the action verb representing the learning level.)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr – Create		Learning Level	PO(s)	PSO(s)
1.	Explain the concepts & properties of automata and Design the optimized DFA for the given problem description.	Ap	1, 2, 3, 12	1, 3
2.	Explain the properties of RE and Design the Regular Expressions for the given pattern.	Ap	1, 2, 3, 12	1, 3
3.	Explain the properties of Languages and Write the Grammar for the given language description.	An	1, 2, 3, 12	1, 3
4.	Explain the properties of PDA, Turing Machine & Design PDA, Turing Machine for the given problem description.	An	1, 2, 3, 12	1, 3
5.	Write programs to implement lexical analyzer & parsers using software tools.	Ap	1, 2, 3, 9,10,11,12	1, 2, 3

Scheme of Continuous Internal Evaluation (CIE):

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

Scheme of Semester End Examination (SEE):

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

CO-PO Mapping (Planned)													CO-PSO Mapping(Planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
1	v	v	v								v	v			v
2	v	v	v								v	v			v
3	v	v	v								v	v			v
4	v	v										v			v
5	v	v	v		v							v	v	v	
Tick mark the CO, PO and PSO mapping															

SI 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

Artificial Intelligence and Machine Learning (Integrated)

Course Code	21CS63	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, what is AI, Strong Methods, and Weak Methods, Uses and Limitations	
Knowledge Representation: Need for good representation, Semantic nets, Frames, Search Spaces, Semantics Trees, 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 Search, Forward Checking, Ant Colony Optimization, Genetic Algorithms for search, Bidirectional search, Non-chronological backtracking	

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	

Unit – IV	Contact Hours = 8 Hours
Introduction to Machine Learning-II: The Nearest Neighbor-K nearest neighbor algorithm, Linear regression, Support vector machine, k-means clustering	
Neural Networks: Introduction, Neurons, Perceptrons, Multilayer Neural Networks- Backpropagation algorithms, Recurrent Networks, Unsupervised Learning Networks	

Unit – V	Contact Hours = 8 Hours
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
2.	3	DFID algorithm
		Heuristic search algorithm
		A* algorithm
3.	2	Game trees
		Find-S algorithm
4.	4	Single Layer Perceptrons
		Backpropagation
		Unsupervised learning networks
		Clustering algorithm
5.	1	Naïve Bayes Algorithm

Unit No.	Self-Study Topics
1.	Inheritance, Object oriented programming
2.	Depth First Search, Breadth First Search, Implementing Depth-First and Breadth-First Search, Beam Search
3.	Truth Tables: Not, And, Or, Implies, if, Complex Truth Tables, Tautology, Equivalence, The Deduction Theorem
4.	Supervised Learning, Unsupervised Learning, Hebbian Learning, Linear Regression
5.	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 3 rd edition 2013.

2.	Stuart Russel, Peter Norvig: Artificial Intelligence A Modern Approach, Pearson 3 rd edition 2013.
3.	Ethem Alpaydin, "Introduction to Machine Learning", 2 nd Edition, PHI Learning Pvt. Ltd., 2013.
E-resources (NPTEL/SWAYAM.. Any Other)- mention links	
1.	https://nptel.ac.in/courses/106105077
2.	https://nptel.ac.in/courses/106106139

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

Course Outcome (COs)					
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create					
At the end of the course, the student will be able to			Learning Level	PO(s)	PSO(s)
1.	Apply difficult real-world problems in a state space representation to solve them using AI techniques	Ap	1,2,3,5,12	1,2,3	
2.	Understand the informed and uninformed problem types and apply search strategies to solve them.	Ap	1,2,3,5,12	1,2,3	
3.	Understand the basics of machine learning and neural networks to solve real world problems	An	1,2,3,5,12	1,2,3	
4.	Understand the concepts in Bayesian analysis from probability models and methods	Re	1,2,3,5,12	1,2,3	
5.	Apply the learnings inculcated throughout the course and develop a course project / present a seminar on that	An	1,2,3,5,9,10, 11,12	1,2,3	

Scheme of Continuous Internal Evaluation (CIE):

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

THEORY (60 marks)			LAB (40 marks)		Total
IA test 1	IA test 2	Assignment (OBA/Lab Project/ Industry assignment)/ Course project	Conduction	Lab test	
25 marks	25 marks	10 marks	15 marks	25 marks	100 marks
IA Test:					
1. No objective part in IA question paper 2. All questions descriptive					
Conduct of Lab:					
1. Conducting the experiment and journal: 5 marks					

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

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours' duration.
2.	Minimum marks required in SEE to pass: Score should be ≥ 35 &, however overall score of CIE+SEE should be $\geq 40\%$.
3.	<p>Question paper contains three parts A, B and C. Students have to answer</p> <ol style="list-style-type: none"> 1. From Part A answer any 5 questions each Question Carries 6 Marks. 2. From Part B answer any one full question from each unit and each Question Carries 10 Marks. 3. From Part C answer any one full question and each Question Carries 20 Marks.

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

SI 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

Unix System & Network Programming (Integrated type)

Course Code	21CS64	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	5 Hours			SEE Marks	100

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

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

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

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

Unit – III	Contact Hours = 8 Hours
UNIX Processes: UNIX Kernel Support for Processes, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, Environment Variables, setjmp and longjmp Functions, getrlimit, setrlimit Process Control: Process Id and its applicability , API'S(FORK,VFORK,WAIT & WAIT PID)	

Unit – IV	Contact Hours = 8 Hours
Introduction to Transport Layer: TCP, UDP and SCTP, TCP Connection Establishment and Termination. Sockets Introduction: Introduction, Socket Address Structures, Value-Result Arguments, Byte Ordering and Manipulation Functions. Elementary TCP Sockets: socket, connect, bind, listen, accept, fork and exec, Concurrent Server design, getsockname and getpeername functions	

Unit – V	Contact Hours = 8 Hours
Elementary UDP Sockets: recvform and sendto Functions, UDP Echo Client/Server- main, dg_echo and dg_cli Functions, Lost Datagrams, Verifying received Responses, Server Not Running, connect Function with UDP, Lack of Flow control with UDP, Determining Outgoing Interface with UDP, TCP and UDP Echo Server using select.	

Ipv4 and IPv6 Interoperability: IPv4 Client and IPv6 Server, IPV6 Client ad IPv4 Server,

Flipped Classroom Details

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

List of Experiments

Unit No.	No. of Experiments	Topic(s) related to Experiment
1	2	UNIX environment and UNIX commands, POSIX runtime and compile time limits, UNIX / Linux virtualization
2	2	Basic Unix File Commands, Hard Link and Symbolic File And Record Locking
3	2	Differentiating The Parent & Child Processes Using FORK (The resources that are shared and not shared between parent & child) Race Condition Handling Using Tell & Wait Functions
4	2	Client server communication using socket programming that uses connection oriented protocol at transport layer Simulation of Network Applications using NS2/NS3
5	2	WIRESHARK tool for Network Analysis for data transfer of UDP & TCP applications. Simulation of Network Applications using NS2/NS3

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

Books

	Text Books:
1.	Terrence Chan: UNIX System Programming Using C++, Prentice Hall India, 1999 and onwards
2.	W. Richard Stevens, "Advanced Programming in the UNIX Environment" , Pearson Education, 2nd Edition and onwards
3.	W. Richard Stevens, Bill Fenner, Andrew M. Rudoff: "UNIX Network Programming". Volume 1, Third Edition, Pearson 2004 and onwards
4.	Sumitabha Das: "Concepts and applicaions", Tata McGraw Hill, 2012 and onwards
	Reference Books:
1.	Richard Stevens: "UNIX Network Programming". Volume 2, Second Edition 2006 and onwards.
	E-resources (NPTEL/SWAYAM. Any Other)- mention links
	Following courses have Good Learning Resources as well:
1.	A CERIFICATION Course on Linux Operating System https://onlinecourses.swayam2.ac.in/aic20_sp24/preview

2.	A CERTIFICATION Course on computer-networks-and-internet-protocol https://elearn.nptel.ac.in/shop/nptel/computer-networks-and-internet-protocol/
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Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Lab Project
3.	Flipped Classes	3.	Lab Test
4.	Practice session/Demonstrations in Labs	4.	Semester End Examination

Course Outcome (COs)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create				
At the end of the course, the student will be able to		Learning Level	PO(s)	PSO(s)
1.	Describe the features of POSIX and UNIX standards	Re	1	1
2.	Demonstrate handling of UNIX files and UNIX Processes	Ap	3,5,11	1,2,3
3.	Design and implement programs for inter process communication using UDP & TCP sockets	Ap	3,5,11	1,2,3
4.	Apply basics of Unix OS & TCP/UDP to develop basic networking applications	Ap	1,2,3,5,9,10,11,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE):

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

THEORY (60 marks)			LAB (40 marks)		Total
IA test 1	IA test 2	Assignment (OBA/Lab Project/ Industry assignment)/ Course project	Conduction	Lab test	
25 marks	25 marks	10 marks	15 marks	25 marks	100 marks

IA Test:

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

Conduct of Lab:

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

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

1. Test will be conducted at the end of the semester
2. Timetable, Batch details and examiners will be declared by Exam section
3. Conducting the experiment and writing report: 5 marks
4. Calculations, results, graph and conclusion: 10 marks
5. Viva voce: 10 marks

Eligibility for SEE:

- | |
|--|
| 1. 40% and above (24 marks and above) in theory component |
| 2. 40% and above (16 marks and above) in lab component |
| 3. Lab test is COMPULSORY |
| 4. Not eligible in any one of the two components will make the student Not Eligible for SEE |

Scheme of Semester End Examination (SEE):

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

CO-PO Mapping (planned)													CO-PSO Mapping(planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
1	✓												✓		
2			✓		✓						✓		✓	✓	✓
3			✓		✓						✓		✓	✓	✓
4	✓	✓	✓		✓				✓	✓	✓	✓	✓	✓	✓
Tick mark the CO, PO and PSO mapping															

Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
Network Application development in open source Operating Systems	Computer Networking and Communication Industries	Network application developer

**Robotic Process Automation
(Industry Supported Elective)**

Course Code	21CS651	Course type	OEC Integrated Project based	Credits L-T-P	2 – 0 - 1
Hours/week: L - T- P	2-0-2			Total credits	3
Total Contact Hours	L = 20 Hrs; T = 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 different types of variables, Control Flow and data manipulation techniques
4.	To Understand Image, Text and Data Tables Automation
5.	To Describe automation to Email and various types of Exceptions and strategies to handle

Required Knowledge of : Unix system Programming and Computer Networks

Unit – I	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	8 Hours
RPA CONCEPTS	
RPA Basics - History of Automation - What is RPA - RPA vs Automation - Processes & Flowcharts - Programming Constructs in RPA - What Processes can be Automated - Types of Bots - Workloads which can be automated - RPA Advanced Concepts - Standardization of processes - RPA Developemt methodologies - Difference from SDLC - Robotic control flow architecture - RPA business case - RPA Team - Procces Design Document/Solution Design Document - Industries best suited for RPA - Risks & Challenges with RPA - RPA and emerging ecosystem.	

Unit – III	8 Hours
RPA TOOL INTRODUCTION & BASICS	

Introduction to RPA Tool - The User Interface - Variables - Managing Variables - Naming Best Practices - The Variables Panel - Generic Value Variables - Text Variables - True or False Variables - Number Variables - Array Variables - Date and Time Variables - Data Table Variables - Managing Arguments - Naming Best Practices - The Arguments Panel - Using Arguments - About Imported Namespaces - Importing New Namespaces- Control Flow - Control Flow Introduction - If Else Statements - Loops - Advanced Control Flow - Sequences - Flowcharts - About Control Flow - Control Flow Activities - The Assign Activity - The Delay Activity - The Do While Activity - The If Activity - The Switch Activity - The While Activity - The For Each Activity - The Break Activity - Data Manipulation - Data Manipulation Introduction - Scalar variables, collections and Tables - Text Manipulation - Data Manipulation - Gathering and Assembling Data

Unit – IV	8 Hours
ADVANCED AUTOMATION CONCEPTS AND TECHNIQUES	
Recording and Advanced UI Interaction - Recording Introduction - Basic and Desktop Recording - Web Recording - Input/Output Methods - Screen Scraping - Data Scraping - Scraping advanced techniques - Selectors - Selectors - Defining and Assessing Selectors - Customization - Debugging - Dynamic Selectors - Partial Selectors - RPA Challenge - Image, Text & Advanced Citrix Automation - Introduction to Image & Text Automation - Image based automation - Keyboard based automation - Information Retrieval - Advanced Citrix Automation challenges - Best Practices - Using tab for Images - Starting Apps - Excel Data Tables & PDF - Data Tables in RPA - Excel and Data Table basics - Data Manipulation in excel - Extracting Data from PDF - Extracting a single piece of data - Anchors - Using anchors in PDF.	

Unit – V	8 Hours
EMAIL AUTOMATION & EXCEPTIONAL HANDLING	
Email Automation - Email Automation - Incoming Email automation - Sending Email automation - Debugging and Exception Handling - Debugging Tools - Strategies for solving issues - Catching errors.	

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	3	Basic automation Example
2	2	Web automation and Conditional Statements
3	2	Data Table and Data manipulation
4	2	Screen Scraping , Data Scraping and PDF automation
5	1	Email Automation

Books	
	Text Book
1.	Alok Mani Tripathi, Learning Robotic Process Automation, Publisher: Packt Publishing Release Date: March 2018 ISBN: 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 Merienda, Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation
4.	https://www.uipath.com/rpa/robotic-process-automation

Course Outcome (COs)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create		Learning Level	PO(s)	PSO(s)
1.	Apply and Implement RPA.	Ap	1,3	1
2.	Explain Image, Text and Data Tables Automation	Un	1	1
3.	Explain automation to Email and various types of Exceptions and strategies to handle.	Un	1	1
4.	Apply the learnings inculcated throughout the course and develop a course project.	Ap	1,2,3, 5,9,10,11,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE):

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

THEORY (40 marks)		PROJECT (60 marks)			Total
IA test (Theory)	IA test (Lab)	Project Phase 1	Project Phase 2	Project report	
25 marks	15 marks	25 marks	25 marks	10 marks	100 marks
Theory IA test should be of one-hour duration. Lab IA test should be of two/three-hour duration. Project batch will ideally consist of 2 students (maximum of 3). Project Phase 1 presentation will be conducted after 6 weeks and Project Phase 2 presentation will be conducted after 13 weeks from the start of the semester. Submitting Project report is compulsory.					
Eligibility for SEE:					

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

Semester End Examination (SEE):

1.	It will be conducted for 100 marks having 3 hours duration.		
	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	
2.	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	100 marks
3.	Minimum marks required in SEE to pass: Score should be $\geq 35\%$, however overall score of CIE + SEE should be $\geq 40\%$.		
4.	SEE will be conducted in project batches by Internal & External examiners together.		

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

Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
Robotic Process Automation with UiPath	HealthCare, Finance, Banking, Education etc	RPA solution architect, RPA developer, RPA Evangelist, RPA Subject Matter Expert etc

Distributed and Cloud Computing

Course Code	21CS652	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 learn Basic Concepts of Distributed System.
2.	To understand File Sharing, Implementation of Distributed File Systems.
3.	To understand the concepts of Cryptanalysis, Access control.
4.	To learn Basic concepts of Cloud Computing.

Pre-requisites: Basic Computer Concepts, Operating Systems.

Unit – I	Contact Hours = 8 Hours
Characterization of Distributed Systems: Introduction, Examples of Distributed Systems, Challenges: Heterogeneity, Openness, Security, Scalability, Failure Handling. System Model: Architectural Models, Fundamental models.	

Unit – II	Contact Hours = 8 Hours
Inter Process Communication: Introduction, API for Internet Protocols, External Data Representation and Marshalling, Client – Server Communication. Distributed Object and Remote Invocation: Introduction, Communication between Distributed Objects, Remote Procedure Call.	

Unit – III	Contact Hours = 8 Hours
Distributed File System: Introduction, File Service architecture. Security in distributed systems: Introduction, Overview of security techniques: Cryptography, Certificates, Access control. Cryptographic Algo: Symmetric: Ex Substitution algo. , Asymmetric: RSA.	

Unit – IV	Contact Hours = 8 Hours
Introduction to Cloud Computing: Introduction, Network Centric computing and Network Centric Content, Peer to Peer Systems, Cloud Computing: An old idea Whose Time has Come, Cloud Computing: Delivery Models and Services, Ethical Issues in Cloud Computing, Cloud Vulnerabilities, Major Challenges Faced by Cloud Computing. Case Studies: Amazon Web Studies.	

Unit – V	Contact Hours = 8 Hours
CLOUD SERVICE PROVIDERS AND THE CLOUD ECOSYSTEM: The Cloud Eco system, Cloud computing delivery models and services, AMAZON Web services, The continuing evolution of AWS, Google clouds, MICROSOFT Windows AZURE AND ONLINE SERVICES.	

Flipped Classroom Details

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

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

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

Course Outcome (COs)				
At the end of the course, the student will be able to (Highlight the action verb representing the learning level.)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create		Learning Level	PO(s)	PSO(s)
1.	Explain the basic concepts of Distributed systems	Un	1	1
2.	Apply the various algorithms for Distributed systems	Ap	2,3,4	1, 2

3.	Analysis of different security mechanisms over distributed applications.				An	2,3,4	1, 2
4.	Explain Various concepts related to cloud environment and its Applications				Un	1,12,5	1,2,3
5.	Apply the learnings inculcated throughout the course and present a seminar on that				An	2,9,10, 11,12	1,3

Scheme of Continuous Internal Evaluation (CIE):

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

Scheme of Semester End Examination (SEE):

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

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

SI No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Understanding Distributed Technologies	Information Technology (IT) Services	Network and security Analyst
2	Prototype Design	Government and Public Sector	Data Analyst
3	Troubleshooting and Problem Solving	Research and Academia	Network Administrator

Information and Network Security

Course Code	21CS653	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 gain the knowledge of Standard algorithms used to provide confidentiality, integrity and authenticity, asymmetric encryption algorithms.				
2.	To understand the Standard Asymmetric Encryption algorithms.				
3.	To demonstrate the Encryption techniques to secure data in transit across data networks.				
4.	To understand the security applications in the field of Information technology				

Pre-requisites : Engineering Mathematics and Computer Networks

Unit – I Classical Encryption Techniques Symmetric Cipher Model:	Contact Hours = 8 Hours
Symmetric cipher model, security attacks, security services, security mechanisms, Substitution Techniques, transposition techniques The data encryption standard, Feistal cipher structure, Block cipher design Principles	
Unit – II Public-Key Cryptography and RSA	Contact Hours = 8 Hours
Principles of public-key cryptosystems. Public key cryptosystems. Applications for public-key cryptosystems, requirements for public key cryptosystems. Public-key cryptanalysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA, Diffie-hellman key exchange algorithm	
Unit – III Key management and distribution	Contact Hours = 8 Hours
Symmetric key distribution using Symmetric encryption, Symmetric key distribution using asymmetric encryption, distribution of public keys, x.509 certificates.	
Unit – IV Wireless network security and Transport layer security	Contact Hours = 8 Hours
Wireless security, mobile device security, IEEE 802.11 Wireless LAN overview, Web Security Considerations, Secure Sockets Layer and transport layer security, Secure Shell(SSH).	
Unit – V Electronic Mail Security:	Contact Hours = 8 Hours
Pretty good privacy, notation, operational; description, S/MIME, RFC5322, Multipurpose internet mail extensions, S/MIME functionality, S/MIME messages, S/MIME certificate processing, enhanced security services, Domain keys identified mail, internet mail architecture, E-Mail threats, DKIM strategy, DKIM functional flow.	

Flipped Classroom Details

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

Unit No.	Self-Study Topics
4	Security tools: Nmap (Network Mapper)
5	Snort

Books	
	Text Books:
1.	William Stallings, Cryptography and Network Security, Pearson 6th edition onwards
	Reference Books:
1.	Atul Kahate: Cryptography and Network Security McGraw-Hill Second edition onwards.
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://www.coursera.org/learn/cryptography-sscp
2.	https://www.coursera.org/learn/crypto-info-theory

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

Course Outcome (COs)				
At the end of the course, the student will be able to (Highlight the action verb representing the learning level.)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create		Learning Level	PO(s)	PSO(s)
1.	Analyze the given encryption techniques and Apply the security measures on networks.	An	1,2,3,4,5,9,10	1,2,3
2.	Explain the different Symmetric and Asymmetric encryption techniques.	Un	1,2,3,4	1,2
3.	Apply x.509, IEEE 802.11, S/MIME and DKIM functionalities to provide security to wireless, Transport and Electronic mail systems.	Ap	1,2,3,4,5	1,2
4.	Apply the learnings inculcated throughout the course and develop a course project or present a course seminar.	Ap	1,2,3,4,5,9,10,11,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE):

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

Scheme of Semester End Examination (SEE):

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

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

SI No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Students can apply appropriate security model for wireless network security.	Network Security Surveillance	Security Architect Security Consultant
2	Have a knowledge about Network Security Control and Cloud Security	Software Security Planning for disaster recovery and business continuity	Chief Information Security Officer Cryptographer
3	Students can apply security applications in the field of Information technology	Software Development	Security Analyst

Internet of Things

Course Code	21CS654	Course type	PEC Integrated Project based	Credits L-T-P	2 - 0 - 1
Hours/week: L - T- P	2 - 0 - 2			Total credits	03
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 give an insight into Internet of Things, its associated components, IoT Architecture and Protocols.
2.	To have a comprehensive understanding of IoT sensing and actuation, enabling them to design and implement effective IoT systems.
3.	To be able to program Arduino UNO/ Raspberry Pi boards effectively, interface sensors with the board, and develop basic projects that involve reading sensor data and controlling external devices based on the sensor inputs.
4.	To have a comprehensive understanding of IoT case studies in agriculture, transportation, and healthcare domains.

Required Knowledge of: Micro-Controllers and Embedded Systems.

Unit – I	Contact Hours = 8 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 = 8 Hours
IoT Sensing and Actuation: Introduction, sensors, sensor characteristics, sensorial deviations, sensing types, sensing considerations, actuators, actuator types, actuator characteristics.	

Unit – III	Contact Hours = 8 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 = 8 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 = 8 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
1	2	Simple I/O applications using Arduino UNO.
2	2	Interfacing various sensors with Arduino UNO.
3	2	Interfacing various peripheral devices like 7-segment display, LCD, DC motor with Arduino UNO.
4	2	Interfacing various sensors with Raspberry Pi, sending/receiving data to/from cloud.
5	2	Implementing case studies using Arduino UNO and Raspberry Pi.

Unit No.	Self-Study Topics
1	Domain Specific IoTs: Introduction, Home Automation, Environment.
2	Actuator characteristics.
3	Boards.
4	Installation.
5	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	
2.	PPT and Videos	2.	Open Book Assignments (OBA)/ Lab Project	
3.	Flipped Classes	3.	Lab Test	
4.	Practice session/Demonstrations in Labs	4.	Semester End Examination	
5.	Virtual Labs (if present)			

Course Outcome (COs)					
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create					
At the end of the course, the student will be able to			Learning Level	PO(s)	PSO(s)
1.	Illustrate the 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.	Apply the learnings inculcated throughout the course and develop a course project.	An	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. **No SEE for Lab.**

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

Semester End Examination (SEE):

1.	It will be conducted for 100 marks having 3 hours duration.			
	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		
2.	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	100 marks	
3.	Minimum marks required in SEE to pass: Score should be $\geq 35\%$, however overall score of CIE + SEE should be $\geq 40\%$.			
4.	SEE will be conducted in project batches by Internal & External examiners together.			

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

SI 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

Introduction to Salesforce (**Project based**)

Course Code	21CS655	Course type	Integrated Project based	Credits L-T-P	2-0-1
Hours/week: L - T- P	2 - 0 – 2			Total credits	3
Total Contact Hours	L = 20 Hrs; T = 0 Hrs; P = 20 Hrs Total = 40Hrs			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 gain an understanding of 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 = 8 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 = 8 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 = 8 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.	

Object Customizations: Creating Picklist and Picklist Administration, Creating Formula Fields and Validation Rule, Working with Page Layouts, Working with Record Types, Introduction to Business Process, Maintaining Data Quality.

Managing Data: Import Wizards, Export Wizards, Use Data Loader To Export Data, Data Loader To Import.

Unit – IV	Contact Hours = 8 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 = 8 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.	Salesforce CRM - The Definitive Admin Handbook,4th Edition, Paul Goodey, Copyright © 2016 Packt Publishing
	Reference Books:
1.	Basics of salesforce- Salesforce Docs @salesforcedocs 19 Dec 2019
2.	Best Practices for Implementing Salesforce CRM- SalesforceDocs @ salesforcedocs Dec 2019
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://trailhead.salesforce.com

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

Course Outcome (COs)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create				
At the end of the course, the student will be able to		Learning Level	PO(s)	PSO(s)
1.	Understand the Salesforce terminologies to make use for products of different commodity	Re	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	1,2,3,4,5,9	1,2,3
4.	Categorize and build the solutions with suitable mode of representation for the domain requirements using the lightning trends.	An	1,2,3,4,6,9,10	1,2,3

Scheme of Continuous Internal Evaluation (CIE):

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

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

Semester End Examination (SEE):

1.	It will be conducted for 100 marks having 3 hours duration.			
2.	Lab Open ended program/problem/experiment Write-up & execution (1 open ended expt)- (20 marks write-up + 20 marks algorithm/flowchart + 10 marks execution)		50 marks	
	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	100 marks	
	30 marks	10 marks		
3.	Minimum marks required in SEE to pass: Score should be $\geq 35\%$, however overall score of CIE + SEE should be $\geq 40\%$.			
4.	SEE will be conducted in project batches by Internal & External examiners together.			

CO-PO Mapping (planned)													CO-PSO Mapping (planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	v	v												v	
2		v	v		v									v	v
3	v	v	v	v	v				v				v	v	v
4	v	v	v	v		v			v	v					
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.		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.	Service based Industry	
3	Students can solve real world problems.		

Python Programming

Course Code	21CS661	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.	Gain knowledge about basic Python language syntax and semantics to write Python programs using the procedure oriented programming paradigm.
2.	Appreciate the usage of high level data constructs provided by Python and work with file and exception handling mechanisms.
3.	Write Python applications using the object-oriented programming paradigm.
4.	Become acquainted with the development of database and GUI applications and usage of various packages.

Pre-requisites : Any Programming Language

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; 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	

Unit – II	Contact Hours = 8 Hours
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; Strings: Basic skills for working with strings, split and join strings; Dates and times: get started with dates and times	

Unit – III	Contact Hours = 8 Hours
Files, Exception Handling, Database Programming File I/O: An introduction to file I/O, test files, CSV files, binary files; Exception Handling: handle a single exception, handle multiple exceptions, Two more skills; Work with a database: An introduction to relational databases, SQL statements for data manipulation.	

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; Design an object oriented program: Techniques for object-oriented design	

Unit – V	Contact Hours = 8 Hours
Packages: How to build a GUI Program: Create a GUI that handles an event, more skills for working with Components, Python Json, REST API; 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	

Flipped Classroom Details

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

Books	
	Text Books:
1.	Michael Urban and Joel Murach, Python Programming, Shroff/Murach, 2016 onwards
2.	Wes McKinney, Python for Data Analysis, O'Reilly, 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.	Online Quizzes (Surprise and Scheduled)
3.	Flipped Classes	3.	Open Book Tests (OBT)
4.	Online classes	4.	Course Seminar
		5.	Semester End Examination

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

Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create			Learning Level	PO(s)	PSO(s)
1.	Illustrate basic principles of Python programming and Demonstrate programs using the procedure oriented programming paradigm.		Ap	1,3	1
2.	Develop Python programs for file operations, exception handling, GUI, database operations 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	1,2,3,5	1,2
4.	Apply the learning inculcated throughout the course by developing the course project or by presenting a course seminar		Cr	1,2,3,5,9,10,11,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE):

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

OBA - Open Book Assignment

Minimum score to be eligible for SEE: 40 OUT OF 100

Scheme of Semester End Examination (SEE):

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

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

Tick mark the CO, PO and PSO mapping

Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
Well versed with Basics of Python Programming	Software/ Data Science/ Application	Coder, Data Analyst (Novice)

Database Management System

Course Code	21CS662	Course type	OEC	Credits L-T-P	3 – 0 – 0
Hours/week: L - T - P	3 – 0 – 0			Total credits	3
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 0 Hrs Total = 40 Hrs			CIE Marks	100
Flipped Classes content	10 Hours			SEE Marks	100

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

Pre-requisites: Basics of Programming Knowledge & Mathematics.

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

Unit – II	Contact Hours = 8 Hours
Entity-Relationship Model: Using High-Level Conceptual Data Models for Database Design; An Example Database Application; Entity Types, Entity Sets, Attributes and Keys; Relationships, Relationship types, Roles and Structural Constraints; Weak Entity Types; Refining the ED Design for Company Database, ER Diagrams, Naming conventions, and Design issues; ER-Relational mapping.	

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

Unit – IV	Contact Hours = 8 Hours
Database Design: Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms. Transaction Processing Concepts: Introduction to Transaction processing, Transaction and System concepts, Desirable properties of Transactions.	

Unit – V	Contact Hours = 8 Hours
SQL: SQL Data Definition and Data Types; Specifying basic constraints in SQL; Schema change statements in SQL; Basic queries in SQL; More complex SQL Queries. Nested and Correlated Queries, IN, ALL, EXIST operators. Insert, Delete and Update statements in SQL.	

Flipped Classroom Details

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

Books	
	Text Books:
1.	Elmasri and Navathe: Fundamentals of Database Systems, Addison-Wesley, 5th edition and onwards.
2.	Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, McGraw-Hill, 2nd edition and onwards
	Reference Books:
1.	Silberschatz Korth and Sudharshan, Database System Concepts, 6th Edition, Mc-GrawHill, 2013 and onwards
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	Database Management Systems – NPTEL - https://onlinecourses.nptel.ac.in/noc22_cs51/preview
2.	Database Management Courses- https://www.udemy.com/topic/database-management/

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

Course Outcome (COs)				
At the end of the course, the student will be able to (Highlight the action verb representing the learning level.)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create		Learning Level	PO(s)	PSO(s)
1.	Explain the fundamental concepts of Database terminology.	Un	1	1
2.	Analyze the given database applications using E-R diagrams and apply the normalization to produce schema diagrams and relations.	An	1,2,4,5	1, 2

3.	Design and implement effective database models with the consideration of various concepts of relational algebra, design techniques and SQL.	Ap	1,3,5	1, 2
4.	Demonstrate knowledge of relational algebra, normalization and SQL in the form of Creating, Populating, Updating, Querying the database and Database connection and exception handling.	Ev	1,2,3,4,5,10,12	1, 2, 3
5.	Demonstrate skill and knowledge of current information and technological tools and techniques specific to the professional field of study.	Ev	1,2,3,4,5,9, 10,11, 12	1, 2, 3

Scheme of Continuous Internal Evaluation (CIE):

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

Scheme of Semester End Examination (SEE):

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

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

SI No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Understanding Database Technologies	Information Technology (IT) Services	Database Administrator (DBA)
2	Database Design	Government and Public Sector	Data Analyst
3	Troubleshooting and Problem Solving	Research and Academia	Business Intelligence (BI) Developer

Software Testing

Course Code	21CS663	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 introduce the terminology, testing, test-case, pseudo-codes algorithms /flowcharts of Triangle, Next Date & Commission programs
2.	To develop the skill of analyzing the Triangle, Next Date & Commission programs, with the perspective of Boundary Value Analysis, Equivalence Class & Decision Table Testing paradigms
3.	To practice quality assurance related processes/methods / standards

Pre-requisites : Software Engineering, Graph Theory, C Programming

Unit – I	Contact Hours = 8 Hours
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, TheCommission Problem, The SATM (Simple Automatic Teller Machine) system	

Unit – II	Contact Hours = 8 Hours
Boundary Value Testing Boundary Value Analysis, Robustness Testing, Worst Case Testing, Special Value Testing, Examples, Guidelines for Boundary Value Testing. Case Study: Analysis of Vehicle Insurance application using Boundary Value Analysis	

Unit – III	Contact Hours = 8 Hours
Equivalence Class Testing: Equivalence classes, Equivalence Class Test Cases for the Triangle Problem, Equivalence Class Test Cases for the NextDate Function, Equivalence Class Test Cases for the Commission Problem, Guidelines and Observations. Case Study: Analysis of E-Commerce application by using Equivalence class testing .	

Unit – IV	Contact Hours = 8 Hours
Path Testing: DD Paths, Test Coverage Matrix, Basis Path Testing, Guidelines and Observations	

Unit – V	Contact Hours = 8 Hours
Data Flow Testing: Define/use Testing, Slice Based Testing, Guidelines and Observations.	

Flipped Classroom Details

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

Books	
	Text Book:
	Paul C. Jorgensen: Software Testing, A Craftsman's approach, 3 rd 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, 2 nd Edition, Pearson Education, 2007.
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
	https://onlinecourses.nptel.ac.in/noc22_cs61

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

Course Outcome (COs)				
At the end of the course, the student will be able to (Highlight the action verb representing the learning level.)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr – Create		Learning Level	PO(s)	PSO(s)
1. Explain the test case, testing and error taxonomy.	Un	1	1	
2. Apply Test Cases for Triangle, Next Date and Commission Problem for Boundary Value Analysis	Ap	1	1	
3. Design Test Cases for Triangle, Next Date and Commission Problem for Equivalence Class Testing , Decision Table Testing.	Ap	5	2	
4. Analyze the importance of Verification and Validation in	An	2	2	

	improving the process of software development			
5.	Evaluate the testing, verification and validation for an application	Ev	5,9	2, 3
6.	Apply the learnings inculcated in understanding testing techniques	Ap	1,2,3,5,10,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE): Theory course

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

Scheme of Semester End Examination (SEE):

- It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
- Minimum marks required in SEE to pass: 40 out of 100**
- Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

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

SI 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	Software Engineer	Software Testing Engineer
2	Programming skills	Software service	Business Analyst

Data Analytics

Course Code	21CS664	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 explain introductory concepts, a brief methodological description and some descriptive statistics of data.
2.	To explain multivariate descriptive statistics methods of data analytics, methods used in the data preparation phase of the CRISP-DM methodology, concerning data quality issues, converting data to different scales or scale types and reducing data dimensionality.
3.	To explain and demonstrate methods involving various Data Analytics .
4.	To demonstrate projects on descriptive analytics and generalization, analyze the performance measures.
5.	To demonstrate the binary classification problem, performance measures for classification, methods based on probabilities and distance measures.

Pre-requisites :Engineering Mathematics, Knowledge of Programming

Unit – I	Contact Hours = 8 Hours
Wholeness of Data Analytics Business Intelligence, Pattern Recognition Data Processing Chain Data Database Data Warehouse, Data Mining Data Visualization, Introduction to Data, Big Data and Data Science, Big Data Architectures, Small Data, what is Data? A Short Taxonomy of Data Analytics, Examples of Data Use, A Project on Data Analytics. Descriptive Statistics: Scale Types, Descriptive Univariate Analysis, Descriptive Bivariate Analysis.	

Unit – II	Contact Hours = 8 Hours
Data Quality and Preprocessing: Data Quality, converting to a Different Scale Type, Converting to a Different Scale, Data Transformation, Dimensionality Reduction.	

Unit – III	Contact Hours = 8 Hours
Clustering: Distance Measures, Clustering Validation, Clustering Techniques. Frequent Pattern Mining: Frequent Item sets, Association Rules, Behind Support and Confidence, Other Types of Pattern.	

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

Unit – V	Contact Hours = 8 Hours
Classification: Binary Classification, Predictive Performance Measures for Classification, Distance-based Learning Algorithms, Probabilistic Classification Algorithms.	

Flipped Classroom Details

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

Books	
	Text Books:
1.	João Mendes ,A General Introduction to Data Analytics et al Wiley 2019
2.	Dr Anil Maheshwari, Data Analytics Made Accessible,2023
	Reference Books:
1.	Annalyn Ng and Kenneth Soo Numsense! Data Science for the Layman 2017 onwards
2.	Joel Grus Data Science from scratch second edition 2019 onwards
	E-resources (NPTEL/SWAYAM. Any Other)- mention links
	https://onlinecourses.nptel.ac.in/noc21_cs45/preview
	https://www.coursera.org/learn/introduction-to-data-analytics

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

Course Outcome (COs)

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

Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create		Learning Level	PO(s)	PSO(s)
1.	Explain the fundamental concepts of Data Analytics.	Un	1,2	1
2.	Analyze various Data Quality and Preprocessing methods.	An	1,2,3,4	1,2
3.	Design and implement various methods for multivariate analysis data preparation, transformation and reduction.	An	1,2,3,4	1,2
4.	Demonstrate the methods of Predictive analytics ,performance measures for various classification methods.	An	1,2,3,4	1,2
5.	Apply the learnings inculcated throughout the course and develop a course project or 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	Online Quiz	Addition of two OAs/ Course project	Course Seminar	Total Marks
Marks	25+25 = 50	4* 5 marks = 20	10+10 =20	10	100

OBA - Open Book Assignment

Minimum score to be eligible for SEE: 40 OUT OF 100

Scheme of Semester End Examination (SEE):

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

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

Sl No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Understanding Data Analytics	IT Services	Data Analyst
2	Understanding the visualization	Private Sector	Data Scientist
3	Developing the projects for Business	IT or Academia	Business Intelligence Analyst

Nanoscience and Nanotechnology

Course Code	21CH661	Course type	Open Elective	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 : Basics of Chemistry

Unit – I: Introduction to Nanomaterials	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. Top-Down approach- Ball milling technique, Sputtering, Laser Ablation	
LABORATORY ACTIVITIES PLANNED <ol style="list-style-type: none"> 1) Preparation of silver nanoparticles and characterization of particle size by optical spectroscopy 2) Preparation of ZnO nanoparticles by combustion technique 3) Preparation of Al₂O₃ nanoparticles by precipitation method 4) Preparation of Silica nanoparticles by sol-gel method 5) Hydrothermal synthesis of metal oxide nanoparticles 	

Unit – II: Characterization of Nanomaterials	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, numericals on Debye Scherrer equation, Optical Spectroscopy- Instrumentation and application of IR, UV/VIS (Band gap measurement)	

Unit – III : Properties of Nanomaterials	Contact Hours = 8 Hours
<p>Electronic and optoelectronic properties: Explanation of Ballistic transport-comparison with superconductor, Coulomb blockade-property-in quantum dot circuit/single electron transistor, Diffusive transport</p> <p>Dielectric Properties: Polarization, Ferroelectric Behaviour</p> <p>Optical Properties: Photoconductivity, Optical absorption and transmission, Plasmons and Excitons, Luminescence- Phosphorescence and Fluorescence.</p> <p>Magnetic properties: Nanomagnetism, Magnetoresistance, Super Para Magnetism-Neel Relaxation time, blocking temperature etc.</p>	

Unit – IV: Nanotechnology in Energy storage and conversion	Contact Hours = 8 Hours
<p>Solar cells: First generation, Second generation and third generation solar cells: Construction and working of Dye sensitized and Quantum dot sensitized solar cells.</p> <p>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</p> <p>Fuel Cells:Introduction, construction, working of fuel cells and nanotechnology in hydrogen storage and proton exchange membranes.</p>	

Unit –V: Nanoelectronics	Contact Hours = 8 Hours
<p>Switching glasses, Semiconductor devices including LEDs and Photonic crystals (1D, 2D and 3D) and their applications</p> <p>Photo-electronics: Merger of photonics and electronics at nanoscale dimensions.</p> <p>Single electron devices, molecular circuits, Display devices.</p>	

Flipped Classroom Details

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

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.

	Nanotechnology, M. Wildon, K. Kannagara, G. Smith, M. Simmons and B. Raguse, CRC Press Boca Raton 2002.
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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 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			Learning Level	PO(s)
1.	Demonstrate the synthesis of nanoparticles by various techniques.	L2	1	1
2.	Explain working of basic instruments used in characterization of nanoparticles.	L2	4	2
3.	Discuss the applications of nanotechnology to engineering domains	L2	6	2
4.	Classify the nanomaterials based on the dimensions	L3	1	1
5	Assess the suitability of nanomaterials for various device applications	L4	1, 12	1,3

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Lab activities	Addition of two open Book Assignments	Course project	Total Marks
Marks	25+25= 50	10	10+10 =20	20	100

Minimum score to be eligible for SEE: 40 OUT OF 100

Scheme of Semester End Examination (SEE):

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

CO-PO Mapping (Planned)													CO-PSO Mapping(Planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	✓												✓		
2				✓										✓	
3						✓								✓	
4	✓												✓		
5	✓												✓	✓	✓

Tick mark the CO, PO and PSO mapping

SI No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1			
2			
3			

Employability Skills II

Course Code	21AECCS68	Course type	AEC	Credits L-T-P	1 – 0 - 0
Hours/week: L - T- P	1 – 0 – 0			Total credits	1
Total Contact Hours	L = 20 Hrs; T = 0 Hrs; P = 0 Hrs Total = 20 Hrs			CIE Marks	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
General Aptitude 1.1: Understanding Quantitative Aptitude: Time, Speed, and Distance, Trains, Boats, and Streams	

Unit – II	Contact Hours = 4 Hours
General Aptitude 1.2: Understanding Quantitative Aptitude: Permutation and Combination, Probability, Data Interpretation, and Simple and Compound Interest	

Unit – III	Contact Hours = 4 Hours
General Aptitude 1.3: Understanding Quantitative Aptitude: Change of Speech & Voice, Sentence Completion, and Critical Reasoning	

Unit – IV	Contact Hours = 4 Hours
General Aptitude 1.4: Understanding Quantitative Aptitude: Allegation and Mixtures, Syllogisms, Seating Arrangement, Data Arrangement, Clocks & Calendars, and Data Sufficiency	

Unit – V	Contact Hours = 4 Hours
Improve Sense of Belongingness: Interview Skills and Resume Writing	

Books
Text Books:
The Aptitude Triad , BIZOTIC
Reference Books:
How to prepare for Quantitative Aptitude for CAT & other Management Examinations, Arun Sharma, McGraw Hill Education(India) Private Limited, 4 th Edition, 2018.

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Online Quizzes (Surprise and Scheduled)
		3.	Internal Assessments

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				
1.	Clear the Aptitude round of recruiters during placements	L2	10	3
2.	Perform confidently during the Interview process	L2	12	3
3.	Develop Resumes that are grammatically correct	L2	10	3
4.	Develop behaviors that are appropriate for a professional	L2	12	3

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Online Quiz	Assignment	Class Performance	Total Marks
Marks	25+25 = 50	10	15+15 =30	10	100
> Writing 2 IA tests is compulsory					
> Minimum score to be eligible for SEE: 40 OUT OF 100					

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

SI 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

Cyber Security

Course Code	21CS71	Course type	PCC	Credits L-T-P	3 – 0 - 0
Hours/week: L - T- P	3 – 0 – 0			Total credits	3
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 0 Hrs Total = 40 Hrs			CIE Marks	100
Flipped Classes content	5 Hours			SEE Marks	100

Course learning objectives	
1.	To understand the basics of cybersecurity and get familiar with cybersecurity analysis tools.
2.	To learn about security threats and countermeasures
3.	To acquire knowledge regarding necessity, and types of attacks
4.	To learn about firewalls and security analysis protocols
5.	To explore secure coding practices

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

Unit – I	Contact Hours = 8 Hours
Introduction to Cyber Security Introduction to Information Security and its policies: CIA Triad-3 pillars of information security architecture, CIA components and its importance, Cyber security threats and best practices, Access controls and its types, Discretionary access control, Mandatory access control, Role based access control, Arbitrary based access control , Active Reconnaissance, Types of Reconnaissance, Passive Reconnaissance, Types of Cyber Attack, Vulnerability Assessment and its features, Concept and types of Scanning Methodology, Penetration Tests	

Unit – II	Contact Hours = 8 Hours
Network Security Threats and countermeasures Network Security Devices, Types of Network Securities, Network Access Control, Characteristics of Network Access Control, Application Security, Application Security Tools, Firewalls and its types, virtual private network, Tunneling protocol and types, IDS vs. IPS,IDS, IPS and their Types, Introduction to Web Application Vulnerabilities Basic Practices of Web Application Security: Common Cyberattacks on Web Applications, Mobile Application Vulnerabilities, Mobile Security Threats, Mobile Application Security, Fundamentals of Mobile Device Management, Overview of Mobile Device Management, Cloud Computing Threats and Solutions.	

Unit – III	Contact Hours = 8 Hours
Firewall and its types Types of Firewalls and its benefits, Packet Filtering Firewall, Circuit-Level Gateway, Application Firewall, Inspection Techniques, Stateful and Stateless Application, Stateful vs. Stateless Filtering Firewall, Internet protocol, TCP Header, Transmission Control Protocol, User Datagram Protocol, Well-known UDP and TCP Ports, Client Server Model, Internet Control Message Protocol, DNS and DHCP, SSL and TSL, VPN and how it protects your IP address and privacy. Introduction to Network Analyzers , Wireshark and its use cases.	

Unit – IV	Contact Hours = 8 Hours
Cryptography Introduction to cryptography, Overview of cryptography, Cryptography and Cryptanalysis, Types of cryptography, Symmetric encryption, Asymmetric encryption, Hash Cryptography, Understanding digital certificates and signatures, introduction to signatures, introduction to digital certificates, introduction to cryptographic attacks, types of cryptographic attacks, Traditional cryptographic attacks, Counter measures to cryptographic attacks.	

Unit – V	Contact Hours = 8 Hours
Web Server & Application Security Concept and overview of 3 tier Architecture: Web Application Basics, Working of DNS (Domain Name System), Working of DNS and its vulnerabilities, Web Server Vulnerabilities, Web Application Security, Technology Stack for Web Development, Web Application Attacks, Working of HTTP, Configuring Chrome to work with Burp, HTTP Request Methods, HTTP Crash Course & Exploration, HTTP Status Messages, HTTP – Responses.	

Flipped Classroom Details

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

Books	
	Text Books:
1.	William Stallings, Cryptography and Network Security, Pearson 6th edition.
2.	Michael E. and Herbart J.: Principles of Information Security, 2nd Edition 2005
3.	Ric Messier, CEH v10 Certified Ethical Hacker Study Guide, Sybex, 2019
4.	Michael Gregg, Omar Santos, Certified Ethical Hacker (CEH) Version 10 Cert Guide, Pearson IT Certification, 3rd Edition, 2019
5.	Matthew Portony, Visualization Essentials, Sybex, 2016 Edition, ISBN:9781119267720.
6.	Shankar Kambhampaty, Infrastructure Architecture Essentials for Data Center and Cloud, First Indian Reprint 2022, ISBN 979-8786300469
	Reference Books:
1.	Atul Kahate: Cryptography and Network Security McGraw-Hill Second edition

2.	Matt Walker, CEH Certified Ethical Hacker All-in-One Exam Guide, Fourth Edition, McGraw-Hill, 4th Edition, 2019
3.	Angela Orebaugh, Nmap in the Enterprise: Your Guide to Network Scanning, Syngress, 2008, 978-1597492416
4.	Wes Noonan , Firewall-Fundamentals, Cisco-Press, 1 st Edition, 2006, ISBN 978-1587052217 .
E-resources (NPTEL/SWAYAM.. Any Other)- mention links	
1.	SWAYAM Course on Cyber Security https://onlinecourses.swayam2.ac.in/cec20_cs15/preview
2.	NPTEL Course on Cyber Security and Privacy By Prof. Saji K Mathew, IIT Madras https://onlinecourses.nptel.ac.in/noc23_cs127/preview

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

Course Outcome (COs)				
At the end of the course, the student will be able to (Highlight the action verb representing the learning level.)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create			Learning Level	PO(s)
Learning Level	PO(s)	PSO(s)		
1.	Demonstrate the need of cybersecurity in various web applications	Un	1,2	1
2.	Make use of countermeasure tools for various types of attacks and evaluate the performance	Ap	2,3,5	1,2
3.	Identify the vulnerabilities at different parts of the networks and types of services	Ap	1,2,3	1
4.	Choose the factors to ensure secured communication between two authorized users and secured information processing in web and cloud-based services.	Ap	6,8	2,3
5.	Apply the learnings inculcated throughout the course and develop a course project or present a course seminar	Ap	1,2,3,5,9,10,11,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE):

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

OBA - Open Book Assignment

Minimum score to be eligible for SEE: 40 OUT OF 100

Scheme of Semester End Examination (SEE):

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

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

Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
Ethical Hacking and Penetration Testing, Threat Awareness, Security Infrastructure and Incident Response	Information Technology (IT) and Software Development, Financial Services, Healthcare, Government and Defense, Retail and E-commerce and Transportation and Logistics	Web Penetration Tester SOC Analyst Cyber Security Engineer (Cryptography Specialist)

Compiler Design

Course Code	21CS721	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 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 an 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(0) Automaton, The LR-Parsing Algorithm, Constructing SLR-Parsing Tables, Viable Prefixes; More Powerful LR Parsers: Canonical LR(1) Items, Constructing LR(1) Sets of Items, Canonical LR(1) 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: Boolean Expressions, Short-Circuit Code, Flow-of-Control 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/
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Course delivery methods		Assessment methods		
1.	Chalk and Talk	1.	IA tests	
2.	PPT and Videos	2.	Online Quizzes (Surprise and Scheduled)	
3.	Flipped Classes	3.	Open Book Tests (OBT)	
4.	Online classes	4.	Course Seminar	
		5.	Semester End Examination	

Course Outcome (COs)				
At the end of the course, the student will be able to (Highlight the action verb representing the learning level.)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create		Learning Level	PO(s)	PSO(s)
1. Create a lexical analyzer for a given lexical specification		Cr	1,2,3	1
2. Analyze and categorize the given grammar to build suitable parser		An	1,2,3,4	1,2
3. Apply the concept of syntax directed translation to aid intermediate code generation.		Ap	1,2,3,4,5,10,12	1,2,3
4. Develop intermediate code for any high level construct and generate optimized target code.		Ap	1,2,3,4,5,10,12	1,2,3
5. Apply the learnings inculcated throughout the course and develop a course project / present a seminar on that		Ap	1,2,3,4,5,9,10,11,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE): Theory course

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

Scheme of Semester End Examination (SEE):

1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	Minimum marks required in SEE to pass: 40 out of 100

3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.
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CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	√	√	√										√		
2	√	√	√	√									√	√	
3	√	√	√	√	√					√		√	√	√	√
4	√	√	√	√	√				√		√	√	√	√	√
5	√	√	√	√	√				√	√	√	√	√	√	√
Tick mark the CO, PO and PSO mapping															

SI No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Understanding phases of a Compiler	IT Services	Programmer
2	Understanding the Parsers	Private Sector	Compiler Engineer
3	Developing the projects for Business	IT or Academia	Business Intelligence Analyst

Block Chain Management

Course Code	21CS722	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 basics of blockchain
2.	To create Smart contract with Ethereum
3.	To design Web UI for decentralized apps
4.	To implement Identity, privacy and security techniques

Pre-requisites : Distributed Systems, Information and Network Security

Unit – I	Contact Hours = 8 Hours
Grasping Blockchain Fundamentals: Tracing Blockchain Origin; Revolutionizing the Traditional Business Network. Taking a Look at How Blockchain Works: Why it's called Blockchain; What makes a Blockchain Suitable for Business; Identifying Participants and their Roles Propelling Business with Blockchains: Recognizing Types of Market Friction; Moving Closer to Friction-Free Business Networks; Transforming Ecosystems through Increased Visibility. Ten Steps to Your First Blockchain Applications.	

Unit – II	Contact Hours = 8 Hours
Blockchain basics: From Bitcoin to Blockchain; Blockchain programming; Smart contracts: The concept of a smart contract; Design of a smart contract; Development of smart contract code; Deploying and testing the smart contract; Decentralized airline system use case; Airlines smart contract; Motivating decentralized scenarios; Smart contract design considerations.	

Unit – III	Contact Hours = 8 Hours
Techniques for trust and integrity: Essentials of trust and integrity; Implementing trust intermediation; Testing; Establishing trust with modifiers, require(), revert(), and assert(). From smart contracts to Dapps: Preliminary concepts; Dapp development using the Truffle IDE; Installing the Ganache test chain; Smart contract development; Dapp web application development.	

Unit – IV	Contact Hours = 8 Hours
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Security and privacy: Deploying smart contracts on Ropsten; Cryptography basics; Application of public key cryptography; Hashing basics; Application of secure hashing.

On-chain and off-chain data: On-chain data; Blind auction use case; Off-chain data: External data sources; ASK airline system.

Unit – V	Contact Hours = 8 Hours
Web3 and a channel Dapp: web3 API; The Channel Concept; Micropayment Channel. Going public with infura: Nodes and Networks; Infura Blockchain Infrastructure; Going Public with Infura; End-to-end process for public deployment Blockchain business use cases; Hyperledger, a Linuz Foundation Project.	

Flipped Classroom Details

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

Books	
	Text Books:
1.	Bina Ramamurthy, Blockchain in Action, Manning, 1st Edition, 2020
2.	Mansoor Ahmed-Rengers, Marta Piekarska-Geater, Permissioned Blockchain in Action, Manning, 1st Edition, 2021
	Reference Books:
1.	Roberto Infante, Exploring Ethereum Dapps, Manning, 1st Edition, 2019
2.	
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://onlinecourses.swayam2.ac.in/aic21_ge01/preview
2.	https://onlinecourses.nptel.ac.in/noc22_cs44/preview

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

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

1.	Compare and contrast blockchain with other distributed systems	Un	2	1
2.	Build Smart contract with Ethereum and the Solidity language	Ap	2, 3	1
3.	Develop Web UI for decentralized apps	AP	2	1, 2
4.	Apply Identity, privacy and security techniques	Ap	2, 3, 5	2, 3
5.	Understand On-chain and off-chain data storage	Un	2, 3	1

Scheme of Continuous Internal Evaluation (CIE):

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

OBA - Open Book Assignment

Minimum score to be eligible for SEE: 40 OUT OF 100

Scheme of Semester End Examination (SEE):

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

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

Sl No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Blockchain basics	Defense, Banking, Insurance, Healthcare, etc.	Blockchain developer
2	Ethereum		Ethereum Developer
3	Solidity, Truffle		Solidity Developer

Mobile Computing

Course Code	21CS723	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 fundamental concepts of wireless networks and design considerations of mobile computing environment.
2.	To familiarize with the concepts of location management, mobility management and tracking management of Cellular networks.
3.	To introduce security aspects of Mobile computing Environment
4.	To familiarize with SMS, GSM and GPRS Technologies and Smart client Architecture
5.	To explore the advanced technologies in mobile computing.

Pre-requisites : Computer Networks

Unit – I	Contact Hours = 8 Hours
Introduction: PCS Architecture, Cellular Telephony: Advanced Mobile phone service, Global system for mobile communication, Cordless telephone and low tier PCS: Cordless Telephone, 2 nd generation, Digital European Cordless Telephone, Personnel handy phone system, personnel access communication system Mobility management: Handoff, Intersystem handoff, Roaming management.	

Unit – II	Contact Hours = 8 Hours
GSM System: Overview, Architecture: Mobile Station, Base Station System, Network and switching Subsystem, Radio Interface, Location Tracking, Security, Data Services: GPRS, Mobility Management, GSM Location Update, Failure Restoration.	

Unit – III	Contact Hours = 8 Hours
Wireless application Protocol: Wireless application Protocol Model, WAP Protocols, WAP UAPerf & caching, wireless bearers of WAP, WAP Developer Toolkit ,Mobile station execution environment. Case Studies: Demonstration of Mobile code and Mobile Agent related Applications in Internet.	

Unit – IV	Contact Hours = 8 Hours
Wireless Enterprise Networks: Enterprise Telephony, Enterprise Location system, Bluetooth, Bluetooth Usage Models, Enterprise PCS: Office level, Enterprise PCS: Enterprise level.	

Unit – V	Contact Hours = 8 Hours
Security in Mobile Computing: Security threats to wireless networks, IEEE 802.11 security model, security features of wireless networks, Bluetooth security, WAP 2.0 security.	
Design and Programming Projects: Implementation of mobile IP, Comparison between AODV and DSR protocols, Design of a WAP gateway.	
Case study: An IEEE 802.11 LAN for a typical student hostel, Demonstration of Security frameworks in real time Mobile Applications.	

Flipped Classroom Details

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

Books	
	Text Books:
1.	Yi-Bing Lin, Imrich Chlamtac, Wireless and Mobile Architectures, Wiley Computer Publishing, Wiley Student Edition 2005 and onwards
2.	Kumkum Garg, Mobile Computing Theory and Practice, Pearson Edition 2010 onwards.
	Reference Books:
1.	Martyn Mallick, Mobile and Wireless Design Essentials, Wiley Publications- 2016 print and onwards.
2.	Jochen Schiller- Mobile communications, Pearson Education Publications, 2 nd Edition onwards.
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://nptel.ac.in/courses/106106147

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

Course Outcome (COs)				
At the end of the course, the student will be able to :				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create		Learning Level	PO(s)	PSO(s)
1.	Explain the architecture for mobile computing and its design considerations.	Un	1,2,3	1
2.	Describe the working of SMS computing, its service and GPRS network architecture and its operations.	Un	1,2,5	1,2

3.	Compare the different mobile technological concepts learnt to prepare a survey report on their performance analysis parameters.	An	1,2,10	1,3
4.	Analyze the security models for mobile computing environment	An	1,3,5,10	1,2,3
5.	Apply the learnings inculcated in mobile computing	Ap	1,2,12	1,3

Scheme of Continuous Internal Evaluation (CIE):

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

Scheme of Semester End Examination (SEE):

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

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

SI No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Understanding Distributed Technologies	Information Technology (IT) Services	Network and security Analyst
2	Prototype Design	Government and Public Sector	Data Analyst
3	Troubleshooting and Problem Solving	Research and Academia	Network Administrator

Salesforce Lightning (**Project based**)

Course Code	21CS724	Course type	Integrated Project based	Credits L-T-P	2-0-1
Hours/week: L - T- P	2 - 0 – 2			Total credits	3
Total Contact Hours	L = 20 Hrs; T = 0 Hrs; P = 20 Hrs Total = 40 Hrs			CIE Marks	100
Flipped Classes content	10 Hours			SEE Marks	100

Course learning objectives	
1.	To introduce fundamentals of Salesforce Lightning- component based framework for app development.
2.	To develop applications using HTML5,CSS3, Apex, JavaScript and Visualforce.
3.	To solve real world problems with the help of tools and extensions using reusable components.

Required Knowledge :Introduction to Salesforce, Web and Object oriented Programming,

Unit – I	Contact Hours = 8 Hours
Introduction to Lightning Experience: CRM for Lightning Experience, User Management, Data Management, Chatter Administration for Lightning Experience, Reports & Dashboards for Lightning Experience, Lightning Experience Customization, Lightning Experience Rollout, Lightning Experience Basics, Knowledge Basics for Lightning Experience, Lightning Experience for Salesforce Classic Users.	

Unit – II	Contact Hours = 8 Hours
Develop for Lightning Experience: Lightning Experience Basics, Lightning Experience Development, Visualforce & Lightning Experience, Aura Components Basics, Lightning Data Service Basics for Aura Components, Build Flexible Apps with Lightning Components, Build a Lightning Component to Override a Standard Action.	

Unit – III	Contact Hours = 8 Hours
Lightning Experience Specialist: Lightning Web Components Basics, Lightning Experience Development, Visualforce & Lightning Experience, Lightning Experience Reports & Dashboards Specialist, Quick Start: Lightning App Builder, Lightning Design System for Developers, Lightning App Builder, Lightning Apps, Quick Start: Aura Components.	

Unit – IV	Contact Hours = 8 Hours
JavaScript Skills for Salesforce Developers: Lightning Data Service Basics for Aura Components, Field Service Lightning Basics, Build Reusable Lightning Components, Aura Components Tips & Gotchas, Aura Components Skills & Tools, Aura Components Core Concepts, Security for Lightning Components.	

Unit – V	Contact Hours = 8 Hours
Lightning Alternatives to JavaScript Buttons: Build Flexible Apps with Lightning Components, Build a Lightning Component to Override a Standard Action, Aura Components Specialist, Lightning Experience Features, Lightning Experience Rollout, Build a Suggestion Box App, Lightning Experience Rollout Specialist.	

Flipped Classroom Details

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

List of Experiments

Unit No.	No. of Experiments	Topic(s) related to Experiment
1	1	Chatter Administration for Lightning Experience
2	1	Build a Lightning Component to Override a Standard Action.
3	1	Aura Components
4	1	Build Reusable Lightning Components
5	1	Build a Suggestion Box App

Unit No.	Self-Study Topics
3	Web Components
4	JavaScript

Books	
	Text Books:
1.	Salesforce CRM - The Definitive Admin Handbook,4th Edition, Paul Goodey, Copyright © 2016 Packt Publishing
	Reference Books:
1.	Basics of salesforce- Salesforce Docs @salesforcedocs 19 Dec 2019
2.	Best Practices for Implementing Salesforce CRM- SalesforceDocs @ salesforcedocs Dec 2019
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://trailhead.salesforce.com/en/users/00550000007igjNAAQ/trailmixes/lightning-knowledge
2.	help.salesforce.com
3.	https://www.lightningdesignsystem.com/

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

Course Outcome (COs)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create				
At the end of the course, the student will be able to			Learning Level	PO(s)
1.	Explain basic concepts and principles of Salesforce Lightning		Un	1,2
2.	Apply design principles for interactive applications.		Ap	2,3,5
3.	Design and develop Solutions for real world problems.		An,Ev	5,9,10,11,12
				2,3

Scheme of Continuous Internal Evaluation (CIE):

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

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

Semester End Examination (SEE):

1.	It will be conducted for 100 marks having 3 hours duration.			
2.	Lab Open ended program/problem/experiment Write-up & execution (1 open ended expt)- (20 marks write-up + 20 marks algorithm/flowchart + 10 marks execution)		50 marks	
	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	100 marks	
	30 marks	10 marks		
3.	Minimum marks required in SEE to pass: Score should be $\geq 35\%$, however overall score of CIE + SEE should be $\geq 40\%$.			
4.	SEE will be conducted in project batches by Internal & External examiners together.			

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

SI 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
2	Have a knowledge about Interactive applications and salesforce terminologies.		Salesforce Platform Manager Salesforce Solution Architect Salesforce Technical Architect
3	Students can solve real world problems.		

Machine Learning

Course Code	21CS731	Course type	OEC	Credits L-T-P	3 – 0 - 0
Hours/week: L - T- P	3 – 0 – 0			Total credits	3
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 0 Hrs Total = 40 Hrs			CIE Marks	100
Flipped Classes content	10 Hours			SEE Marks	100

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

Pre-requisites : Algorithms, Probability theory

Unit – I	Contact Hours = 8 Hours
Introduction to Machine Learning: Introduction, Training, Rote Learning, Issues in Machine Learning, Learning Concepts, Find-S algorithm, The Problem of Overfitting, The Nearest Neighbor Algorithm, Supervised Learning, Unsupervised Learning	

Unit – II	Contact Hours = 8 Hours
Neural Networks: Introduction, Neurons, Perceptrons, Multilayer Neural Networks, Unsupervised learning networks- Hebbian learning Data Preprocessing: Domain Knowledge, Data Preprocessing: An Overview, Data Cleaning	

Unit – III	Contact Hours = 8 Hours
Probabilistic Reasoning and Bayesian Belief Networks: Introduction, Probabilistic Reasoning, Bayes' Theorem, Simple Bayesian Concept Learning, Bayesian Belief Networks, The Naïve Bayes Classifier.	

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

Unit – V	Contact Hours = 8 Hours

Reinforcement Learning: What is Reinforcement Learning? Components of Reinforcement Learning. Key features and elements of Reinforcement Learning. Approaches to implementing Reinforcement Learning. Working of Reinforcement Learning. Types of Reinforcement Learning. Reinforcement Learning Algorithm. Applications of Reinforcement Learning.

Flipped Classroom Details

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

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

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

Course Outcome (COs)				
At the end of the course, the student will be able to (Highlight the action verb representing the learning level.)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create		Learning Level	PO(s)	PSO(s)
1. Choose the appropriate learning skills for various application of classification	Ap	1,2,3,12	1,3	
2. Apply effectively neural networks and genetic algorithms for appropriate applications.	Ap	1,2,3	1	
3. Apply Bayesian techniques and derive effectively learning rules.	Ap	1,2,3	1	
4. Understand the need for Reinforcement Learning	Un	1,12	1,3	
5. Apply the learnings inculcated throughout the course and develop a course project and present a seminar	Ap	1,2,3,5,9,10, 11, 12	1,2,3	

Scheme of Continuous Internal Evaluation (CIE):

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

Scheme of Semester End Examination (SEE):

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

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

SI No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Creating intelligent models	Healthcare Sector	Data Engineer
2	Reinforcement learning	Social Media	Machine Learning Engineer
3	Data models and evaluation	Agriculture	Business Intelligence Developer

Big Data and Hadoop

Course Code	21CS732	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 Big data dimensions, its applications and analyze business case studies in Big Data Analytics.
2.	To explore Hadoop framework and architecture
3.	To understand the importance of MapReduce framework
4.	To understand the importance of Hive and Pig
5.	To understand basics of NoSQL

Pre-requisites: Database Management System

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

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

Unit – III	Contact Hours = 8 Hours
Understanding MapReduce: The MapReduce Framework: Exploring the Features of MapReduce, Working of MapReduce, Exploring Map and Reduce Functions, Uses of MapReduce. YARN Architecture: Background; Advantages of YARN; YARN Architecture	

Unit – IV	Contact Hours = 8 Hours
Hadoop Related Tools Pig–Grunt–pig datamodel–PigLatin–developing and testing PigLatin scripts.Hive–data types and file formats–Hive QLdefinition–HiveQL datamanipulation–HiveQLqueries Introduction to Apache Spark, Apache Kafka Apache ZooKeeper.	

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

Flipped Classes

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

Books	
	Text Books:
1.	DT Editorial Services,"Big Data:Black Book ,Comprehensive Problem Solver", Dreamtech Press. 2016 Edition.
2.	Paul C. Zikopoulos, Chris Eaton, Dirk deRoos, Thomas Deutsch, George Lapis, Understanding Big Data – Analytics for Enterprise Class Hadoop and Streaming Data, McGraw Hill, 2012.
3.	P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
	Reference Books:
1.	Seema. Acharya and Subhashini. C, "Big Data and Analytics", 1st Edition, Wiley India, 2015
2.	Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilly, 2012.
3.	EricSammer,"HadoopOperations",O'Reilly,2012
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://onlinecourses.nptel.ac.in/noc23_cs112/preview
2.	https://www.coursera.org/learn/introduction-to-big-data-with-spark-hadoop

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

Course Outcomes

Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create		Learning Level	PO(s)	PSO(s)
1.	Analyze the characteristics of digital data and it's challenges in Big data environment.	An	1	1
2.	Explain the ecosystem of Hadoop and Analyze the data using Mapreduce framework.	An	1,2,4	1,2

Scheme of Semester End Examination (SEE):				
1.	It will be conducted for 100 marks of 3 hours duration.			
2.	Minimum marks required in SEE to pass: Score should be $\geq 35\%$, however overall score of CIE + SEE should be $\geq 40\%$.			
3.	Question paper contains 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.			
3.	Apply Hadoop tools on structured data for processing and analyzing.		An	1,2,4,5
4.	Identify suitable types of NoSQL databases to solve complex engineering problems.		Un	1,2,4
5.	Apply the learnings inculcated throughout the course and develop a course project or present a course seminar.		Ap	1,2,3,4,5,9,10,11,12

Scheme of Continuous Internal Evaluation (CIE):

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

OBA - Open Book Assignment

Minimum score to be eligible for SEE: 40 OUT OF 100

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	v												v		
2	v	v		v									v	v	
3	v	v		v	v								v	v	
4	v	v		v									v	v	
5	v	v	v	v	v				v	v	v	v	v	v	v
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	Managing big data	IT industry	Hadoop developer
2	Able to handle the huge amount of data and get the useful meaning out of it	Banking Education Health care Agriculture	Hadoop / Big Data Developer Hadoop Administrator Data Engineer Big Data Architect Machine Learning Engineer Software Development Engineer Big data Engineer Big Data Consultant

Data Mining

Course Code	21CS733	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 introduce the fundamental concepts of data mining and recognize various types of data mining tasks.
2.	To introduce mathematical and statistical models used in data Classification.
3.	To define, understand and interpret association rules.
4.	Discuss the clustering algorithms to solve real-world problems.

Pre-requisites : Data Base Management Systems, Design and analysis of algorithms

Unit – I	Contact Hours = 8 Hours
Data Mining: Introduction, Challenges, Data Mining Tasks, Types of Data, Data Pre-processing, Measures of Similarity and Dissimilarity, Data Mining Applications, Using WEKA Software.	

Unit – II	Contact Hours = 8 Hours
Classification-1: Basics, General approach to solve classification problem, Decision Tree Induction, Rule Based Classifier, Nearest Neighbor Classifier.	

Unit – III	Contact Hours = 8 Hours
Classification-II: Bayesian Classifiers, Artificial Neural Network, Support Vector Machine, Estimating Predictive accuracy of classification methods, Improving accuracy of classification methods, Evaluation criteria for classification methods.	

Unit – IV	Contact Hours = 8 Hours
Association Analysis: Basic Concepts and Algorithms: Frequent Itemset Generation, Rule Generation, Compact Representation of Frequent Itemsets, Alternative Methods for Generating Frequent Itemsets, FP-Growth Algorithm, Evaluation of Association Patterns.	

Unit – V	Contact Hours = 8 Hours
Cluster Analysis: Overview, K-means, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation, Characteristics of Data, Clusters, and Clustering Algorithms.	

Flipped Classroom Details

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

Books	
	Text 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.
	Reference Books:
1.	Jiawei Han, Micheline Kamber , Jian Pei: Data Mining - Concepts and Techniques , 3rd Edition, Morgan Kaufmann Publishers, 2011.
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://nptel.ac.in/courses/106105174

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

Course Outcome (COs)				
At the end of the course, the student will be able to (Highlight the action verb representing the learning level.)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create		Learning Level	PO(s)	PSO(s)
1. Explain the basic steps in data-mining.	Un		1,2	1
2. Evaluate the performance of various Classification algorithms.	Ap		1,2,4,5	1,2
3. Recognize interesting patterns from large amounts of data to analyze and extract patterns to make predictions of outcomes.	Ev		1,2,4,5	2
4. Classify data by applying various clustering algorithms.	Ap		2,3,4,5	2
5. Apply the learnings inculcated throughout the course and develop a course project or present a course seminar.	Ap		1,2,3,4,5,9,10,11,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE): Theory course

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

Scheme of Semester End Examination (SEE):

1. It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2. **Minimum marks required in SEE to pass: 40 out of 100**
3. Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

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

SI 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 algorithms to extract useful information from large data sets.	IT Industry	Software Developer Data Mining Engineer Database Administrator

Principles of Cyber Security

Course Code	21CS734	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	7 Hours		SEE Marks	100	

Course learning objectives	
1.	To understand key issues plaguing the information security world
2.	To understand Social Engineering techniques.
3.	To perform vulnerability analysis to identify security loopholes in the target organization's network
4.	To understand different types of attacks

Pre-requisites: Computer Networks, Information Security, Operating Systems

Unit – I	Contact Hours = 8 Hours
Introduction: Overview of Ethics, Overview of Ethical Hacking, Methodology of Ethical Hacking, Networking	
Foundations: Communications Models, Topologies, Physical Networking, IP, TCP, UDP, Internet Control Message Protocol, Network Architectures, Cloud Computing.	

Unit – II	Contact Hours = 8 Hours
Security Foundations: The Triad, Risk, Policies, Standards, and Procedures, Security Technology, Being Prepared;	
Footprinting and Reconnaissance: Open-Source Intelligence, Domain Name System, Technology Intelligence.	

Unit – III	Contact Hours = 8 Hours
Scanning Networks: Nmap, SuperScan, THC-Amap, Hping, Port Knocking, War Driving, OS Fingerprinting, Active Fingerprinting Tools and Services, Mapping The Network Attack Surface, Evasion Techniques, Remote Method Invocation, Server Message Block, Simple Network Management Protocol Enumeration, Simple Mail Transfer Protocol.	

Unit – IV	Contact Hours = 8 Hours
System Hacking: Technical and Nontechnical Password Attacks, Privilege Escalation and Exploiting Vulnerabilities, Exploiting an Application, Buffer Overflow, Owning the Box, Windows Authentication Types, Cracking Windows Passwords, Linux Authentication and Passwords, Cracking Linux Passwords, Hiding Files and Covering Tracks, Rootkits, File Hiding	

Unit – V	Contact Hours = 8 Hours				
Social Engineering: Social Engineering: Pretexting, Social Engineering Vectors, Physical Social Engineering: Badge Access, Man Traps, Biometrics, Phone Calls, Baiting, Phishing Attacks, Website Attacks: Cloning, Rogue Attacks.					
Cryptography: Basic Encryption, Symmetric Key Cryptography, Asymmetric Key Cryptography, Certificate Authorities and Key Management: Certificate Authority, Trusted Third Party, Self-Signed Certificates, Cryptographic Hashing, PGP and S/MIME					

Flipped Classroom Details

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

Books	
	Text Books:
1 .	Ric Messier, CEH v10 Certified Ethical Hacker Study Guide, Principles, Patterns, and Practices, Pearson, 2014
2 .	Michael Gregg, Omar Santos, Certified Ethical Hacker (CEH) Version 10 Cert Guide, Pearson IT Certification, 3rd Edition, 2019
	Reference Books:
1 .	Matt Walker, CEH Certified Ethical Hacker All-in-One Exam Guide, Fourth Edition, McGraw-Hill, 4th Edition, 2019
	E-resources (NPTEL/SWAYAM. Any Other)- mention links
1 .	Introduction to Ethical Hacking https://www.youtube.com/watch?v=t8nwQ6At0CU&list=PL7AT7LU4byRKMBCEWpeZ4QOd2VWvdIHXU
2 .	Foundations of Cryptography https://www.youtube.com/watch?v=iTVyKbDCJrA&list=PLgMDNELGJ1CbdGLyn7OrVAP-IKg-0q2U2

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

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

1.	Perform vulnerability analysis to identify security loopholes in the target organization's network, communication infrastructure, and end systems.	An	1,2	1
2.	Understand mobile and desktop platform attack vector, android vulnerabilities, mobile security guidelines and tools.	Un	3, 5	1,2
3.	Apply the learning inculcated throughout the course and develop a course project or present a course seminar	Ap	9,10, 12	3

Scheme of Continuous Internal Evaluation (CIE):

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

Scheme of Semester End Examination (SEE):

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

CO-PO Mapping (Planned)														CO-PSO Mapping (Planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	
1	✓	✓	✓											✓	✓	
2			✓		✓									✓	✓	
3									✓	✓			✓			✓
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	Network Security Control		Cyber Crime Analyst
2	Skills set needed by individuals whose activities impact the security of their organization's cyberspace.	Banking and finance. Government. Health care	Risk Analyst, Cyber security Consultant, Cyber security Engineer