

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 and Detailed Syllabus of 7st to 8th Semester
(2021 Scheme)**


3/8/24
Head of The Department
Computer Science & Engineering
Gogte Institute of Technology
Belagavi 590 008, India



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.	<u>Communication:</u> 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.	<u>Project management and finance:</u> 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.	<u>Life-long learning:</u> 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.	<u>Problem solving skills:</u> 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.	<u>Project development skills:</u> Ability to apply design principles and demonstrate best practices of software development processes to solve real life problems.
3.	<u>Career advancement:</u> 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

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

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

Integrated courses (Professional Core/Electives): Integrated courses will have Theory Syllabus with Practical Syllabus of the same course. In such a course there 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

		2 nd Semester	For AE, CV, ME – Chemistry Cycle		Hours/week			Total contact hours/week	Credits	Examination		
S.No .	Cours e Type	Course Code	Course Title	Teaching Dept.	L	T	P			CIE	SEE	Total
1	BSC	21MAT21	Differential Equations and Laplace Transforms	Mathematics	3	2	0	5	4	100	100	200
2	BSC	21CHE22	Applied Chemistry	Chemistry	3	0	0	3	3	100	100	200
3	ESC	21ELE23	Basics of Electrical and Electronics Engg.	E & E	3	0	0	3	3	100	100	200
4	ESC	21CCP24	Problem Solving using C	CSE & ISE	3	0	0	3	3	100	100	200
5	BSC	21CHL25	Chemistry Lab	Chemistry	0	0	2	2	1	50	50	100
6	ESC	21CPL26	C Programming Lab	CSE & ISE	0	0	2	2	1	50	50	100
7	ESC	21EEL27	Electrical and Electronics Engg. Lab	E & E	0	0	2	2	1	50	50	100
8	HSMS	21ENG28	Professional Writing Skills in English	English	1	0	0	1	1	50	50	100
9	AEC	21AEC29A1	Introduction to Innovation and Startup	Any Dept.	1	0	0	1	1	50	--	50
		21AEC29A2	Leadership and Public Speaking									

		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	1450

S.No.	Course Type	1 st Semester	For CSE, EC, EE and ISE – Chemistry Cycle		Hours/week			Total contact hours/week	Credits	Examination		
		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	21CHE12	Applied Chemistry	Chemistry	3	0	0	3	3	100	100	200
3	ESC	21ELE13	Basics of Electrical and Electronics Engg.	E & E	3	0	0	3	3	100	100	200
4	ESC	21CCP14	Problem Solving using C	CSE & ISE	3	0	0	3	3	100	100	200
5	BSC	21CHL15	Chemistry Lab	Chemistry	0	0	2	2	1	50	50	100
6	ESC	21CPL16	C Programming Lab	CSE & ISE	0	0	2	2	1	50	50	100
7	ESC	21EEL17	Electrical and Electronics Engg. Lab	E & E	0	0	2	2	1	50	50	100
8	HSMS	21ENG18	Communicative English	English	1	0	0	1	1	50	50	100
9	AEC	21AEC191	Introduction to Innovation and Startup	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	2 nd Semester	For CSE, EC, EE and ISE – Physics Cycle		Hours/week			Total contact hours/week	Credits	Examination		
		Course Code	Course Title	Teaching Dept.	L	T	P			CIE	SEE	Total
1	BSC	21MAT21	Differential Equations and Laplace Transforms	Mathematics	3	2	0	5	4	100	100	200
2	BSC	21PHY22	Applied Physics	Physics	3	0	0	3	3	100	100	200
3	ESC	21CIV23	Engineering Mechanics	CV	3	0	0	3	3	100	100	200
4	ESC	21EME24	Basics of Mechanical Engg.	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.)

3 rd 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	Sanskrutika 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 Sanskrutika 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.)		

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 Security, 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, 1st 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.	Open Book Tests (OBT)
3.	Flipped Classes	3.	Course Seminar
4.	Online classes	4.	Semester End Examination

Course Outcome (COs)				
At the end of the course, the student will be able to (Highlight the action verb representing the learning level.)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create		Learning Level	PO(s)	PSO(s)
1.	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	Two Assignments – (Open /Industry/Certification etc)	Course project (CP)/ Case study etc	Total Marks
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100
-Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks. -Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests. -Lack of minimum score in IA test will make the student Not Eligible for SEE -Minimum score in CIE to be eligible for SEE: 40 OUT OF 100.				

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

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	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(1) Grammars, Non-recursive Predictive Parsing, Error Recovery in Predictive Parsing	

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

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

Unit – V	Contact Hours = 8 Hours
Intermediate Code Generation and Code Generation: Variants of Syntax Trees: Directed Acyclic Graphs for Expressions, The Value-Number Method for Constructing DAG's; Three-Address Code: Addresses and Instructions, Quadruples, Triples, Static Single-Assignment Form; Translation of Expressions: Operations Within Expressions Control Flow: 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. Dhamdhare, “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.	Open Book Tests (OBT)
3.	Flipped Classes	3.	Course Seminar
4.	Online classes	4.	Semester End Examination

Course Outcome (COs)				
At the end of the course, the student will be able to (Highlight the action verb representing the learning level.)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create		Learning Level	PO(s)	PSO(s)
1.	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	Two Assignments – (Open /Industry/Certification etc)	Course project (CP)/ Case study etc	Total Marks
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100
-Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks. -Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests. -Lack of minimum score in IA test will make the student Not Eligible for SEE -Minimum score in CIE to be eligible for SEE: 40 OUT OF 100.				

Scheme of Semester End Examination (SEE):

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

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

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

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

Scheme of Semester End Examination (SEE):

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

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	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	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 UAProf & 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.	Open Book Tests (OBT)
3.	Flipped Classes	3.	Course Seminar
4.	Online classes	4.	Semester End Examination

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

Scheme of Semester End Examination (SEE):

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

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	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 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 of :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 Componenets
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-resourses (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)	PSO(s)
1.	Explain basic concepts and principles of Salesforce Lightning	Un	1,2	1
2.	Apply design principles for interactive applications.	Ap	2,3,5	1,2
3.	Design and develop Solutions for real world problems.	An,Ev	5,9,10,11,12	2,3

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.**

<p>Theory IA test should be of one-hour duration.</p> <p>Lab IA test should be of two/three-hour duration.</p> <p>Project batch will ideally consist of 2 students (maximum of 3).</p> <p>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.</p> <p>Submitting Project report is compulsory.</p>
<p>Eligibility for SEE:</p> <ol style="list-style-type: none"> 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

1.	It will be conducted for 100 marks having 3 hours duration.		
2.	Lab Open ended program/problem/experiment		100 marks
	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	10 marks	
	b. Hardware project: Exhibiting and demonstration of working of project.		
	Software project: Demonstration of the programming capabilities by writing flowchart, algorithm and codes related to a section of the project.	30 marks	
	c. Viva-voce	10 marks	
3.	Minimum marks required in SEE to pass: Score should be $\geq 35\%$, however overall score of CIE + SEE should be $\geq 40\%$.		
4.	SEE will be conducted in project batches by Internal & External examiners together.		

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															

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

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

Course Outcome (COs)				
At the end of the course, the student will be able to (Highlight the action verb representing the learning level.)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create		Learning Level	PO(s)	PSO(s)
1.	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	Two Assignments – (Open /Industry/Certification etc)	Course project (CP)/ Case study etc	Total Marks
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100
-Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks. -Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests. -Lack of minimum score in IA test will make the student Not Eligible for SEE -Minimum score in CIE to be eligible for SEE: 40 OUT OF 100.				

Scheme of Semester End Examination (SEE):

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

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	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	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 Map Reduce 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, Name Nodes 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 Map Reduce: The Map Reduce Framework: Exploring the Features of Map Reduce, Working of Map Reduce, Exploring Map and Reduce Functions, Uses of Map Reduce. YARN Architecture: Background; Advantages of YARN; YARN Architecture	

Unit – IV	Contact Hours = 8 Hours
Hadoop Related Tools Pig–Grunt–pig data model–Pig Latin–developing and testing Pig Latin scripts. Hive–data types and file formats–Hive QL data definition–Hive QL data manipulation– Hive QL queries Introduction to Apache Spark, Apache Kafka Apache Zoo Keeper.	

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.	Open Book Tests (OBT)
3.	Flipped Classes	3.	Course Seminar
4.	Online classes	4.	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	1,2
4.	Identify suitable types of NoSQL databases to solve complex engineering problems.	Un	1,2,4	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):

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

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

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

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

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

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

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

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

Scheme of Semester End Examination (SEE):

1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	Minimum marks required in SEE to pass: 40 out of 100
3.	Question paper contains 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.	Open Book Tests (OBT)
3.	Flipped Classes	3.	Course Seminar
4.	Online classes	4.	Semester End Examination

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

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

Scheme of Semester End Examination (SEE):

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

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	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