GLOBAL ACADEMY OF TECHNOLOGY

(Autonomous Institution Affiliated to VTU, Belagavi)
Accredited by NAAC with 'A' Grade,
NBA Accredited - CSE, ISE, ECE, EEE, ME, CV
Ideal Homes Township, Raja Rajeshwari Nagar, Bengaluru-560098

Scheme and Syllabus of III to VIII Semester

(Autonomous System of 2022 Scheme)

Bachelor of Engineering (B.E)

in

COMPUTER SCIENCE AND ENGINEERING

H.N.Rajashekhar Swamy
Dean Academic
Global Academy of Technology,
Rajarajeshwarinagar, Bengaluru-98

Vision

To achieve academic excellence and strengthen the skills to meet emerging challenges of computer science and engineering.
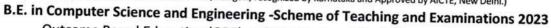
Mission

M1: To impart strong theoretical foundation in the field of Computer Science and Engineering accompanied with extensive practical skills.

M2: To inculcate research and innovation spirit through interaction with industry and carry out projects that address societal needs.

M3: Instill professional ethics and values with a concern for environment.

Sreenamy

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B.E. in Computer Science and Engineering -Scheme of Teaching and Examinations 2023

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

III SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Theory Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	Self-Study (S)	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	BS	22MAT31A	Discrete Mathematics-I	TD: MAT, PSB: MAT	2	2	0		03	50	50	100	3
2	IPCC	22CSE32	Data Structures (Integrated)	TD: CSE, PSB: CSE	3	0	2		03	50	50	100	4
3	IPCC	22CSE33	Digital Design and Computer Organization (Integrated)	TD: CSE, PSB: CSE	3	0	2		03	50	50	100	4
4	PCC	22CSE34	Operating Systems	TD: CSE, PSB: CSE	2	2	0		03	50	50	100	3
6	ETC	22CSE35	Introduction to Web Technology	TD: CSE, PSB: CSE	3	0	0		03	50	50	100	3
7	AEC	22CSE36	Unix and Shell Programming (Integrated)	TD: CSE, PSB: CSE	2	0	2		03	50	50	100	3
			Total							300	300	600	20

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PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L**: Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. **K** : The letter in the course code indicates common to all the stream of engineering. **PROJ**: Project /Mini Project. **PEC**: Professional Elective Course.

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

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

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Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

IV SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
					L	T	P	S					
1	BS	22MAT41A	Discrete Mathematics-II	TD: MAT, PSB: MAT	2	2	0		03	50	50	100	3
2	IPCC	22CSE42	Object Oriented Programming with Java (Integrated)	TD: CSE, PSB: CSE	3	0	2		03	50	50	100	4
3	IPCC	22CSE43	Design and Analysis of Algorithms (Integrated)	TD: CSE, PSB: CSE	3	0	2		03	50	50	100	4
4	PCC	22CSE44	Software Engineering	TD: CSE, PSB: CSE	2	2	0		03	50	50	100	3
6	ETC	22CSE45	Data Visualization (Integrated)	TD: CSE, PSB: CSE	3	0	0		03	50	50	100	3
7	AEC	22CSE46	Full Stack Frameworks -Frontend (Integrated)	TD: CSE, PSB: CSE	2	0	2		03	50	50	100	3
Total										300	300	600	20

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

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V SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	HSMS	22CSE51	Management, Economics and Finance for IT Engineers	TD: CSE PSB: CSE	3	0	0		03	50	50	100	3
2	IPCC	22CSE52	Database Management Systems	TD: CSE PSB: CSE	2	2	2		03	50	50	100	4
3	PCC	22CSE53	Computer Networks	TD: CSE PSB: CSE	3	2	0		03	50	50	100	4
4	PCCL	22CSE54	Full Stack Framework (Back End)	TD: CSE PSB: CSE	0	0	2		03	50	50	100	1
5	PEC	22CSE55x	Professional Elective - I	TD: CSE PSB: CSE	3	0	0		03	50	50	100	3
6	PROJ	22CSEP56	Mini Project	TD: CSE PSB: CSE	0	0	4		03	100		100	2
7	AEC	22RMIK57	Research Methodology and IPR	Any Department	2	2	0		03	50	50	100	3
8	MC	22CIVK58	Environmental Studies	TD: CV/Env/Chem PSB:CV	2	0	0		02	50	50	100	2
9	MC	22NSK59	National Service Scheme (NSS)	NSS coordinator	0	0	2			100		100	0
		22PEK59	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		22YOK59	Yoga	Yoga Teacher									
			Total							550	350	900	22

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Professional Elective Course - I			
22CSE55A	Computer Graphics	22CSE55C	Theory of Computation
22CSE55B	Robotic Process Automation	22CSE55D	Distributed Systems

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

CIE procedure for Mini-project:

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

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

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

No SEE component for Mini-Project.

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

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(Effective from the academic year 2023-24)

VI SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	22CSE61	Cloud Computing	TD: CSE PSB: CSE	2	2	2		03	50	50	100	4
2	PCC	22CSE62	Machine Learning	TD: CSE PSB: CSE	3	2	0		03	50	50	100	4
3	PEC	22CSE63x	Professional Elective - II	TD: CSE PSB: CSE	3	0	0		03	50	50	100	3
4	OEC	22CSE64x	Open Elective - I	TD: CSE PSB: CSE	3	0	0		03	50	50	100	3
5	PROJ	22CSEP65	Major Project Phase - I	TD: CSE PSB: CSE	0	0	4		03	100	--	100	2
6	PCCL	22CSEL66	Machine Learning Lab	TD: CSE PSB: CSE	0	0	2		03	50	50	100	1
7	AEC/ SDC	22CSE67x	Ability Enhancement Course/ Skill Development Course - III	TD & PSB: Concerned Department	If the course is offered as a Theory				01	50	50	100	1
					1	0	0						
					If course is offered as a practical								
					0	0	2						
8	MC	22NSK68	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	0
		22PEK68	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		22YOK68	Yoga	Yoga Teacher									
9	IKS	22IKSK69	Indian Knowledge System	Any Department	1	0	0		01	50	50	100	0
10	MC	22UHV69	Universal Human Values	Any Department	1	0	0		01	50	50	100	0
									Total	600	400	1000	18

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	Professional Elective Course		
22CSE63A	Blockchain Technology	22CSE63B	Compiler Design
22CSE63C	Computer Vision	22CSE63D	Advanced Java
	Open Elective Course		
22CSE64A	Introduction to Data Structures	22CSE64B	Fundamentals of Operating Systems
22CSE64C	Mobile Application Development	22CSE64D	Introduction to AI
	Ability Enhancement Course / Skill Enhancement Course - III		
22CSE67A	Android App Development	22CSE67B	MongoDB
22CSE67C	Selenium Testing	22CSE67D	DevOps

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

Open Elective Courses:

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

Project Phase-I : Students have to discuss with the mentor /guide and with their help he/she has to complete the literature survey and prepare the report and finally define the problem statement for the project work.

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Scheme A- VII SEMESTER (Swappable VII and VIII SEMESTER)

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	22CSE71	Deep Learning	TD: CSE PSB: CSE	3	0	2		03	50	50	100	4
2	IPCC	22CSE72	Cryptography & Network Security	TD: CSE PSB: CSE	3	0	2		03	50	50	100	4
3	PCC	22CSE73	Internet of Things	TD: CSE PSB: CSE	3	2	0		03	50	50	100	4
4	PEC	22CSE74x	Professional Elective-III	TD: CSE PSB: CSE	3	0	0		03	50	50	100	3
5	OEC	22CSE75x	Open Elective- II	TD: PSB:	3	0	0		01	50	50	100	3
6	PROJ	22CSEP76	Major Project Phase-II	---	0	0	12		03	100	100	200	6
									Total	400	300	700	24

Professional Elective Course

22CSE74A	Data Warehousing Techniques	22CSE74C	Augmented Reality and Virtual Reality
22CSE74B	Natural Language Processing	22CSE74D	Big Data Analytics

Open Elective Course

22CSE75A	Introduction to DBMS	22CSE75C	Software Engineering
22CSE75B	Introduction to Algorithms	22CSE75D	Introduction to Networks

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

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

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

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

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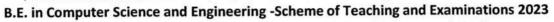
PROJECT WORK (21MEP75): The objective of the Project work is

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

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

(iii) To impart flexibility and adaptability.

(iv) To inspire team working.

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

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

(vii) To install responsibilities to oneself and others.

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

CIE procedure for Project Work:

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

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

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

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

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Scheme A- VIII SEMESTER (Swappable VII and VIII SEMESTER)

Sl. No	Course and Course Code		Course Title	Teaching Department (TD)and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				
					Theory	Tutorial	Practical / Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PEC	22CSE81x	Professional Elective -IV (Online Courses)	TD: CSE PSB: CSE	3	0	0		03	50	50	100	3
2	OEC	22CSE82x	Open Elective - III (Online Courses)	TD: CSE PSB: CSE	3	0	0		03	50	50	100	3
3	INT	22CSEI83	Internship (Industry/Research) (14 - 20 weeks)	---	0	0	12		03	100	100	200	10
								Total		200	200	400	16

Professional Elective Course (Online courses)

22CSE81A	BOS will publish courses based on the availability	22CSE81C	BOS will publish courses based on the availability
22CSE81B	BOS will publish courses based on the availability	22CSE81D	BOS will publish courses based on the availability

Open Elective Courses (Online Courses)

22CSE82A	BOS will publish courses based on the availability	22CSE82C	BOS will publish courses based on the availability
22CSE82B	BOS will publish courses based on the availability	22CSE82D	BOS will publish courses based on the availability

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

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

Swapping Facility

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

Elucidation:

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

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

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

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

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

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

The faculty coordinator or mentor has to monitor the student's internship progress and interact with them to guide for the successful completion of the internship. The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of the internship.

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

Professional Elective /Open Elective Course: These are ONLINE courses suggested by the respective Board of Studies. Details of these courses shall be made available for students on the VTU web portal.

Global Academy of Technology

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B.E. in Computer Science and Engineering Scheme of Teaching and Examinations 2023
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2023-24)

Scheme B-VI SEMESTER for the candidates who seek a two-semester internship with project work /Start-up

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Theory Lecture (L)	Tutorial (T)	Practical/ Drawing (P)	Self-Study (S)	Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
1	IPCC	22CSE61	Cloud Computing	TD: CSE PSB: CSE	3	0	2		03	50	50	100	3
2	PCC	22CSE62	Machine Learning	TD: CSE PSB: CSE	3	0	0		03	50	50	100	4
3	PEC	22CSE63x	Professional Elective - II	TD: CSE PSB: CSE	4	0	0		03	50	50	100	3
4	OEC	22CSE64x	Open Elective - I	TD: CSE PSB: CSE	3	0	0		03	50	50	100	3
5	PCCL	22CSEL65	Machine Learning Lab	TD: CSE PSB: CSE	0	0	2		01	50	50	100	1
6	AEC	22CSE66X	Ability Enhancement Course/Skill Development Course V	TD: CSE PSB: CSE	If the course is offered as a Theory 2 / If course is offered as a practical 1	0 / 0	0 / 2		03	50	50	100	2
7	MC	NSK23657	National Service Scheme (NSS)	NSS coordinator	0	0	2		03	100	-	100	0
		PEK23657	Physical Education (PE) (Sports and Athletics)	Physical Education Director					03				
		YOK23657	Yoga	Yoga Teacher					03				
8	IKS	IKSK23608	Indian Knowledge System	Any Department	0	0	12		01	100	0	100	0
9	MC	22UHV69	Universal Human Values	Any Department	1	0	0		03	50	50	100	0
									01				
				Total						550	350	900	16

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B.E. in Computer Science and Engineering Scheme of Teaching and Examinations 2023

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

Scheme B: VII and VIII semesters for the candidates who seek an internship with project work

Sl. No	Course and Course Code		Course Title	Teaching Department (TD)and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	22CSE71	Deep Learning To be completed in 5th /6th semester	TD: CSE PSB: CSE	3	0	2		03	50	50	100	4
2	IPCC	22CSE72	Cryptography & Network Security To be completed in 5th /6th semester	TD: CSE PSB: CSE	3	0	2		03	50	50	100	4
3	PCC	22CSE73	Internet of Things To be completed in 6th semester	TD: CSE PSB: CSE	4	0	0		03	50	50	100	4
4	PEC	22CSE74x	Professional Elective Course (MOOC Courses)	TD: CSE PSB: CSE	3	0	0		03	50	50	100	3
5	OEC	22CSE75x	Open Elective Courses (MOOC courses)	TD: CSE PSB: CSE	3	0	0		01	50	50	100	3
1	PEC	22CSE81x	Professional Elective -IV (Online Courses)	TD: CSE PSB: CSE	3	0	0		03	50	50	100	3
2	OEC	22CSE82x	Open Elective - III (Online Courses)	TD: CSE PSB: CSE	3	0	0		01	50	50	100	3
3	PROJ	22CSEP83	Project – Outcome of Training	TD: CSE PSB: CSE	0	0	12		03	100	100	200	8
4	INT	22CSEI84	Internship (Industry/Research) (02 semesters)	TD: CSE	0	0	12		03	100	100	200	10
								Total		650	650	1300	42

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SYLLABUS

III SEMESTER

Head of Department
Computer Science Engineering
Global Academy of Technology
Bangalore 98

SUBJECT: DATA STRUCTURES (Integrated)

Subject Code	22CSE32	CIE Marks	50
Hours/Week (L: T: P)	3:0:2	SEE Marks	50
Total Hours	40	Examination Hours	3
No. of Credits: 04			

Course Learning Objectives:

The course will enable students to:

CLO1	Discuss the classification of data structures, arrays, pointers, dynamic memory allocation
CLO2	Explain the working of Stacks, Queues and their operations
CLO3	Apply the concepts of singly linked lists, doubly linked lists, circular linked lists to solve a given problem
CLO4	Apply the concepts of different non-linear tree data structure to practical problems

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Introduction:** Data Structures, Classifications of Data Structures, Data structure Operations, Review of Arrays, type of Structures, Self-Referential Structures, and Unions. Review of Pointers, Dynamic Memory Allocation Functions, Dynamically allocated arrays **Array Operations:** Traversing, inserting, deleting, searching, and sorting, Selection Sort, Insertion Sort, Multidimensional arrays, Sparse matrices, and transpose of sparse matrices **Text Book: T1 Chapter: 2 Text Book: T2 Chapters:1, 4**	08 L3
MODULE 2 **Stacks:** Definition, Stack Operations, Array Representation of Stacks, Polish notation **Applications of stack:** Infix to postfix conversion, evaluation of postfix expression, Recursion- Fibonacci Sequence, Tower of Hanoi, Ackermann Functions **Queues:** Definition, Queue Operations, Array Representation of Queues, Circular Queues and operations, Priority Queue **Text Book: T1 Chapter: 3 Text Book: T2 Chapter: 6**	08 L3
MODULE 3 **Linked Lists:** Definition, Representation of linked lists in Memory, Linked list operations: Traversing, Searching, Insertion, and Deletion. Stack operation using linked list and queue operation using linked list. Doubly Linked lists, Circular linked lists, and header linked lists, Applications of Linked lists –Polynomial Representation and Addition of Polynomial **Text Book: T1 Chapter: 4 Text Book: T2 Chapter: 5**	08 L3
MODULE 4 **Trees:** Terminology, Binary Trees, Properties of Binary Trees, Array and Linked representation of Binary Trees, Types of Binary tree, Construction of Binary Tree, Binary Tree Traversals - Inorder, Postorder, Preorder **Binary Search Trees:** Definition, Construction of Binary Search Tree, Insertion, Deletion, Traversal and Searching **Text Book: T1 Chapter: 5 Text Book: T2 Chapters: 7**	08 L3

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MODULE 5	
Construction and Evaluation of Expression Trees, Threaded binary trees **Hashing:** Hash functions, collision resolution-separate chaining, open addressing-linear probing, quadratic probing, double hashing **Sorting:** Radix sort, Address Calculation Sort **Text Book: T1 Chapter: 5 Text Book: T2 Chapter:9**	08 L3

Laboratory Component
List of Experiments

Implement the following programs using C in Ubuntu

1. Design, Develop and Implement a menu driven Program for the following Array operations
    a. Creating an Array of N Integer Elements
    b. Display of Array Elements with suitable headings
    c. Inserting an element (ELEM) at a given valid position (POS)
    d. Deleting an element at a given valid position (POS)
    e. Exit
    Support the program with functions for each of the above operations.
2. Design, Develop and Implement a program to sort the given list of 'n' integers in increasing/decreasing order using Insertion sort algorithm
3. Design, Develop and Implement a menu driven Program for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX)
    a. Push an Element on to Stack
    b. Pop an Element from Stack
    c. Demonstrate Overflow and Underflow situations on Stack
    d. Display the status of Stack
    e. Exit
    Support the program with appropriate functions for each of the above operations
4. Design, Develop and Implement a Program for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, %(Remainder), ^(Power) and alphanumeric operands.
5. Design, Develop and Implement a Program for evaluation of Stack Suffix expression with single digit operands and operators: +, -, *, /, %, ^
6. Design, Develop and Implement a menu driven Program for the following operations on Ordinary QUEUE of Characters (Array Implementation of Queue with maximum size MAX)
    a. Insert an Element on to Ordinary QUEUE
    b. Delete an Element from Ordinary QUEUE
    c. Demonstrate Overflow and Underflow situations on Ordinary QUEUE
    d. Display the status of Ordinary QUEUE
    e. Exit
    Support the program with appropriate functions for each of the above operations.
7. Design, Develop and Implement a menu driven Program for the following operations on Circular QUEUE of Characters (Array Implementation of Queue with maximum size MAX)
    a. Insert an Element on to Circular QUEUE
    b. Delete an Element from Circular QUEUE
    c. Demonstrate Overflow and Underflow situations on Circular QUEUE
    d. Display the status of Circular QUEUE
    e. Exit
    Support the program with appropriate functions for each of the above operations.

8. Design, Develop and Implement a menu driven Program for the following operations on Singly Linked List (SLL) of Student Data with the fields: USN, Name, Branch, Sem, PhNo
    a. Create a SLL of N Students Data by using front insertion.
    b. Display the status of SLL and count the number of nodes in it
    c. Perform Insertion / Deletion at End of SLL
    d. Exit
9. Design, Develop and Implement a menu driven Program for the following operations on Doubly Linked List (DLL) of Employee Data with the fields: emp_id, Name, Dept, Designation, Sal.
    a. Create a DLL of N Employees Data by using end insertion.
    b. Display the status of DLL and count the number of nodes in it
    c. Perform Insertion and Deletion at Front of DLL
    d. Demonstrate how this DLL can be used as Double Ended Queue
    e. Exit
10. Develop a C program for performing the following operations on Binary Search Tree (BST) of Integers
    a. Create a BST of N Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2
    b. Traverse the BST in Inorder, Preorder and Post Order
    c. Search the BST for a given element (KEY) and report the appropriate message.
    d. Exit

Course Outcomes:

Upon successful completion of this course, student will be able to

CO32.1	Apply array concepts to sort the elements, transpose the sparse matrix
CO32.2	Develop programs on operations of stack and its applications, recursion, queue operations
CO32.3	Apply the concepts of singly linked lists, doubly linked lists, circular linked lists into different applications
CO32.4	Illustrate the construction of binary trees, binary search tress, and its traversal techniques
CO32.5	Write algorithms related to expression tree, hashing and hashing-based sorting techniques

Text Books:

1. Ellis Horowitz, Sartaz Sahni, Anderson, Freed, "Fundamentals of Data Structures in C", 2nd Edition, University Press, 2008, Reprinted 2016.
2. Lipschutz, Schaum's Outlines, "Data Structures using C", Seymour McGraw Hill Special Indian Edition, 13th Reprint 2015.

Reference Books:

1. Yedidyah Langsam, Moshe J Augenstein and Aaron M Tanenbaum, "Data Structures using C & C++", 2nd Edition, Pearson, 10th Impression 2020.
2. Richard F. Gilberg and Behrouz A. Forouzan, "Data Structures - A Pseudo code approach with C", 2nd Edition, Cengage Learning, Sixth Indian Reprint 2016.

E-Books / Web References:

1. https://www.freebookcentre.net/ComputerScience-Books-Download/Data-Structures-and-Algorithms.html
2. http://www.uoitc.edu.iq/images/documents/informatics-institute/Competitive_exam/DataStructures.pdf
3. https://people.cs.vt.edu/shaffer/Book/Java3e20110103.pdf

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MOOCs:

1. https://www.edx.org/course/introduction-to-data-structures
2. https://nptel.ac.in/courses/106/102/106102064/

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO32.1	3	3	2	-	-	-	-	-	1	1	-	2	3	-
CO32.2	3	3	2	-	-	-	-	-	1	1	-	2	3	-
CO32.3	3	3	2	-	-	-	-	-	1	1	-	2	3	-
CO32.4	3	3	2	-	-	-	-	-	1	1	-	2	3	-
CO32.5	3	3	2	-	-	-	-	-	1	1	-	2	3	-
Average	3	3	2	-	-	-	-	-	1	1	-	2	3	-

Low-1: Medium-2: High-3

SUBJECT: DIGITAL DESIGN AND COMPUTER ORGANIZATION (Integrated)

Subject Code	22CSE33	CIE Marks	50
Hours/Week (L: T: P)	3:0:2	SEE Marks	50
Total Hours	40	Examination Hours	3
No. of Credits: 04			

Course Learning Objectives:
The course will enable students to:

CLO1	Understand the basic digital principles and working of various logic gates, and different techniques for simplification of Boolean function
CLO2	Design combinational logic circuits and describe their applications
CLO3	Understand the working of Flip-Flops and Counters
CLO4	Understand the basic sub systems of a computer, their organization, structure and operation
CLO5	Learn arithmetic and logical operations with integer and floating-point operands

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Combinational Logic Circuits:** Boolean functions, The Map Method: Two, Three, Four Variable Maps, Map Manipulation, Product-of-Sums, Sum-of-Products Optimization, Don't Care Conditions, The Tabulation Method, Determination of Prime Implicants **Text Book: T1 Chapters: 4, 5, 6**	08 L3
MODULE 2 **Data Processing Circuits:** Adders, Subtractors, Code Converters, Magnitude Comparators, Multiplexers, Demultiplexers, Encoders, Decoders, Programmable Array Logic, Programmable Logic Arrays **Text Book:T1 Chapters: 9**	08 L3
MODULE 3 **Sequential Logic:** Introduction to Flip-Flops, Types of Flip flops, Various Representation of Flip-Flops, JK Master-Slave Flip-Flop, Flip-Flop Turning, Switch Contact Bounce Circuits **Registers:** Types of Registers. Serial In - Serial Out, Serial In - Parallel out, Parallel ln - Serial Out, Parallel ln - Parallel Out, Applications of Shift Registers **Counters:** Asynchronous Counters, Synchronous Counters, Counter Design as a Synthesis problem **Text Book:T1 Chapter: 11,12**	08 L3
MODULE 4 **Machine Instructions and Programs:** Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language **Input/Output Organization:** Basic Input and Output Operations, Accessing IO Devices, Interrupts - Interrupt Hardware, Enabling and Disabling Interrupts, Direct Memory Access, Buses **Text Book: T2 Chapters: 2, 4**	08 L2
MODULE 5 **Arithmetic:** Numbers, Arithmetic Operations and Characters, Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed	08 L3

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| Operand Multiplication, Fast Multiplication- Bit-pair recoding of multipliers, Integer Division, Floating-point Numbers and Operations
Text Book: T2 Chapter: 6 | |

Laboratory Component

Hardware experiments to be conducted using logic trainer kits and simulation experiments to be conducted using open-source software like Logisim.

List of Experiments

1. a. Study and verify the truth tables of AND, OR, NOT, NOR, NAND and XOR Logic Gates.
    b. Simplify the given Boolean expression and realize it using Basic gates and Universal Gates.
2. Design and implement Half Adder, Full Adder, Half Subtractor, Full Subtractor using Logic Gates. Also simulate their working.
3. Given a 4-variable logic expression, simplify it using appropriate technique and realize the simplified logic expression using 8:1 multiplexer IC.
4. Design and implement 4-bit Parity checker.
5. Design and implement Code converter i) Binary to Gray ii) Gray to Binary Code using Logic gates.
6. Realize a J-K Master Slave flip-flop using NAND gates and verify its truth table.
7. Design and implement 4-bit Ring and Johnson Counters. Also simulate their working.
8. Design and implement mod-n (n<8) synchronous up counter using JK flip-flop ICs and demonstrate its working.
9. Design and implement an asynchronous counter using decade counter IC to count up from 0 to n (n<=9).
10. Design and implement a pseudo-random sequence generator using shift register IC7495.

Demonstration using of virtual lab
https://www.vlab.co.in/
*   Representation of Integers and their Arithmetic
*   Floating Point Numbers Representation

Course Outcomes:
Upon successful completion of this course, student will be able to

CO33.1	Illustrate the minimization of combinational logic expressions using K-map and Quine McCuskey methods
CO33.2	Interpret different combinational logic circuits like Adders, Subtractors, Multiplexers, Decoders and programmable Logic Arrays
CO33.3	Implement the Flip Flops, Registers and Counters
CO33.4	Explain the basic structure of computers, machine instructions & addressing modes
CO33.5	Solve Arithmetic operations on binary numbers

Text Books:
1. Charles H. Roth, Jr. and Larry L Kinney, "Fundamentals of Logic Design", 6th Edition, Thomson, 2010.
2. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, "Computer Organization", McGraw Hill Education India, 5th Edition, 2011.

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Reference Books:

1. Neal S Widmer, Greg Moss and Ronald J Tocci, "Digital Systems Principles and Applications", 12th Edition, 2022, Pearson.
2. William Stallings, "Computer Organization & Architecture", 9th Edition, Pearson. 2015.

E-Books / Web References:

1. Computer Organization & Architecture - William Stallings, http://home.ustc.edu.cnl-louwenqi/reference-books-%20Williarm%20Stallings.pdf

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO33.1	3	2	2	1	-	-	-	-	-	1	-	-	-	1
CO33.2	3	2	2	-	2	-	-	-	-	1	-	-	-	1
CO33.3	3	2	2	-	2	-	-	-	-	1	-	-	-	1
CO33.4	2	1	-	-	-	-	-	-	-	-	-	-	-	1
CO33.5	2	1	2	-	-	-	-	-	-	-	-	-	-	1
Average	2	1	2	1	2	-	-	-	-	1	-	-	-	1

Low-1: Medium-2: High-3

SUBJECT: OPERATING SYSTEMS

Subject Code	22CSE34	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Total Hours	40	Examination Hours	03
No. of Credits: 03			

Course Learning Objectives:

The course will enable students to

CLO1	Understand the fundamentals of an Operating Systems and its structures, concept of processes and threads
CLO2	Understand the implement efficient Process scheduling mechanisms and software solutions for process synchronization
CLO3	Discuss Deadlock handling mechanism
CLO4	Understand Operations in Memory Management
CLO5	Study the Virtual memory and mass storage Concepts

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Introduction to operating System:** What operating system do, Operating System Services, Systems Calls, **Processes:** Process Concepts, Process Scheduling, Inter Process Communication, Thread Overview, Multicore Programming, Multithreading Models **Text Book: T1 Chapters: 1.1, 2.1, 2.3, 3.1, 3.2, 3.4, 4.1, 4.2, 4.3**	08 L2
MODULE 2 **Process Scheduling:** CPU Scheduling - Basic concepts, Scheduling Criteria, Scheduling Algorithms **Process Synchronization:** Background, Critical Section Problem, Peterson's Solution, Mutex Locks, Semaphores. Classic problems of Synchronization **Text Book: T1 Chapters: 5.1, 5.2, 5.3, 6.1, 6.2, 6.3, 6.5, 6.6, 7.1**	10 L2
MODULE 3 **Deadlocks:** System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention. Deadlock Avoidance: Banker's Algorithm, Deadlock Detection and recovery from Deadlock **Text Book: T1 Chapters: 8.1, 8.3, 8.4, 8.5, 8.6, 8.7, 8.8**	07 L2
MODULE 4 **Memory management:** Background, Contiguous memory allocation, paging, Structure of page table, Swapping **Text Book: T1 Chapters: 9.1, 9.2, 9.3, 9.4, 9.5**	08 L2
MODULE 5 **Virtual memory management** Background, Demand Paging, Page Replacement algorithms: FIFO page replacement, Optimal page replacement, LRU page replacement, **Thrashing:** Cause of Thrashing **Secondary Storage Structures** HDD Scheduling, Storage Device Management, RAID Structure-Redundancy, Parallelism, RAID levels, Selecting a RAID Level **Text Book: T1 Chapters: 10.1, 10.2, 10.4.1, 10.4.2, 10.4.3, 10.4.4, 10.6.1, 11.2, 11.5, 11.8.1, 11.8.2, 11.8.3, 11.8.4**	07 L2

Course Outcomes:

Upon successful completion of this course, student will be able to

CO34.1	Discuss the basic concepts of operating systems and concept of processes and threads
CO34.2	Explain the process management, CPU scheduling and synchronization tools
CO34.3	Explain the deadlock handling methods
CO34.4	Describe memory management mechanisms
CO34.5	Illustrate Virtual memory concepts and mass storage structure

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Principles", 10th Edition, Wiley-India, 2018.

Reference Books:

1. Stallings, William, "Operating systems: Internals and design principles", Prentice Hall Press, 2011.
2. Andrew S Tanenbaum and Herbert Bos, "Modern Operating Systems", 4th Edition, Pearson Education, 2014.
3. Thomas Anderson and Michael Dahlin, "Operating Systems: Principles and Practice", Recursive Books, 2014.
4. P.C.P. Bhatt, "An Introduction to Operating Systems: Concepts and Practice", 4th Edition, PHI, 2014.
5. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne. "Operating System Concepts", Wiley India, 10th Edition, 2018.
6. Andrew S. Tanenbaum, "Modern Operating Systems", PHI, 3rd Edition, 2009.

E-Books / Web References:

1. http://edclap.com/mod/resource/view.php?id=1445&forceview=1
2. https://www.cs.uic.edu/~jbell/CourseNotes/OperatingSystems/

MOOCs:

1. http://onlinevideolecture.com/?course=computer-science&subject=operating-systems
2. https://nptel.ac.in/courses/106/106/106106144/
3. http://www.nptel.ac.in/courses/106108101/

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO34.1	3	3	3	-	-	-	-	-	-	-	-	3	1	-
CO34.2	3	3	3	-	-	-	-	-	-	-	-	3	1	-
CO34.3	3	3	3	-	-	-	-	-	-	-	-	3	1	-
CO34.4	3	3	3	-	-	-	-	-	-	-	-	3	1	-
CO34.5	3	3	3	-	-	-	-	-	-	-	-	3	1	-
Average	3	3	3	-	-	-	-	-	-	-	-	3	1	-

Low-1: Medium-2: High-3

SUBJECT: INTRODUCTION TO WEB TECHNOLOGIES (Integrated)

Subject Code	22CSE35	CIE Marks	50
Hours/Week (L: T: P)	2:0:2	SEE Marks	50
Total Hours	40	Examination Hours	03
No. of Credits: 03			

Course Learning Objectives:
The course will enable students to

CLO1	Illustrate the Semantic Structure of HTML and CSS
CLO2	Create forms and tables using HTML and CSS
CLO3	Understand different approaches for creating page layout
CLO4	Understand Responsive Web Design with the help of the Bootstrap framework

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Introduction to HTML:** HTML Syntax, Semantic Markup, Structure of HTML Documents, Quick Tour of HTML Elements, HTML5 Semantic Structure Elements **Text Book: 1, Chapter 1**	08 L2
MODULE 2 **Introduction to CSS:** What is CSS, CSS Syntax, Location of Styles, Selectors, The Cascade: How Styles Interact, The Box Model, CSS Text Styling **Text Book: 1, Chapter 2**	08 L3
MODULE 3 **HTML Tables and Forms:** Introducing Tables, Styling Tables, Introducing Forms, Form Control Elements **Text Book: 1, Chapter 3**	08 L3
MODULE 4 **Advanced CSS:** Layout, Normal Flow, Positioning Elements, Floating Elements, Constructing Multicolumn Layouts **Text Book: 1, Chapter 5**	08 L3
MODULE 5 **Bootstrap:** Introduction, applying Bootstrap for Creating a simple HTML Page and adding basic design to the page using CSS, formatting text elements, buttons, and links, and working with images **Text Book: 2, Chapter 1, 2, 3**	08 L3

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- Student can execute the programs on any browsers by enabling the Javascript option in the browser.
- VSCode editor
- Download Bootstrap to get the compiled CSS and JavaScript, source code.

List of Sample Experiments

1. Design a clean and organized layout for the webpage using HTML.
   a. Include a header section with the event title, date, and location.
   b. Create a navigation bar with links to sections like "About," "Speakers," "Agenda," "Registration," and "Contact."
   c. In the "About" section, provide a brief description of the conference's theme and purpose.
   d. Design a "Speakers" section that lists at least three keynote speakers with their names, titles, and photos.
   Note: Use semantic elements to structure this section.

2. Design a simple webpage layout containing text and an image using CSS selectors
   a. Apply CSS styles to change the font family, size, color, and line height of the text content.
   b. Use selectors to target specific headings and paragraphs.
   c. Select the image using an element selector and apply a border with a defined width and color.
   d. Implement a hover effect that slightly increases the image's size
   e. Use class selectors to adjust the text alignment and spacing within paragraphs.
   f. Apply margin and padding to create a balanced layout.
   g. Apply a background color to the entire layout using an element selector.

3. Develop an HTML table to display the weekly class timetable, spanning Monday through Friday.
   a. Populate the table with precise class information, including course codes
   b. Utilize colspan or rowspan to merge cells horizontally or vertically, creating space for breaks or gaps in the schedule.
   c. Implement distinct background colors for cells to differentiate between different subjects.

4. Design a registration form
   a. Include fields for the attendee's name, email address, organization, radio button for gender and a checkbox for dietary preferences (vegetarian, vegan, etc.).
   b. Include a "Submit" button to process the registration

5. Design a multicolumn layout using CSS positioning and z-index to achieve overlapping columns
   a. Create an HTML structure for the multicolumn layout, including three columns.
   b. Use CSS positioning properties to arrange the columns side by side.
   c. Utilize z-index and CSS positioning to achieve an overlapping effect for the columns.
   d. Ensure that the columns partially overlap each other while maintaining readability.
   e. Populate each column with different content sections, including headings, paragraphs, and images.
   f. Apply background colors or patterns to the columns to enhance the visual separation between them.

6. Design multicolumn layout using float element in HTML
   a. Create an HTML structure that includes a main content area and a sidebar.
   b. Use CSS floats to position the main content on the left and the sidebar on the right.
   c. Populate the main content area with blog articles, including headings, images, and text.
   d. Populate the sidebar with widgets such as recent posts, categories, and social media links.

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e. Apply styling to the widgets to create a cohesive design that complements the layout.

7. Design a portfolio webpage using Bootstrap to showcase your skills and projects
   a. Design a header section with your name or a logo.
   b. Use Bootstrap's navbar component to create a simple navigation bar.
   c. Add a brief introduction about yourself or your work.
   d. Utilize Bootstrap's typography classes for consistent styling.
   e. Create a section to list your skills or areas of expertise.
   f. Use Bootstrap's card component to present each skill.
   g. Display a grid of project cards, each with a project name, image, and brief description

Course Outcomes:
Upon successful completion of this course, student will be able to

CO35.1	Adapt HTML and CSS syntax and semantics to build web pages
CO35.2	Construct and visually format tables and forms using HTML and CSS
CO35.3	Construct complex layouts to build web pages
CO35.4	Develop responsive designs for web pages using Bootstrap

Text Books:
1. Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", 4th Edition, Pearson Education India, 2016.
2. Jake Spurlock, "Bootstrap: responsive web development", O'Reilly Media, Inc., 2013.

Reference Books:
1. Jon Duckett, "HTML and CSS: Design and Build Websites", 1st Edition, Wiley, 2011.
2. David DuRocher, "HTML and CSS Quickstart Guide", Clydebank Media LLC, 2021.
3. Elizabeth Robson and Eric Freeman, "Head First HTML and CSS", Second Edition, O'Reilly, 2012.
4. Istvan Novak, "Unraveling Bootstrap 3.3", Kindle Edition, 2014.

E-Books / Web References:
1. http://www.pearsonglobaleditions.com/connolly
2. https://www.w3schools.com/css/
3. https://www.w3schools.com/jS/default.asp
4. https://www.w3schools.com/bootstrap/default.asp

MOOCs:
1. https://nptel.ac.in/courses/106105084
2. https://www.udemy.com/topic/web-app-development/

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO35.1	2	2	3	-	3	-	-	-	-	-	-	2	1	-
CO35.2	2	2	2	-	3	-	-	-	-	-	-	3	1	-
CO35.3	2	1	2	-	3	-	-	-	-	-	-	3	1	-
CO35.4	2	2	2	-	3	-	-	-	-	-	-	3	1	-
Average	2	1	2	-	3	-	-	-	-	-	-	3	1	-

Low-1: Medium-2: High-3

SUBJECT: UNIX AND SHELL PROGRAMMING

Subject Code	22CSE36	CIE Marks	50
Hours/Week (L: T: P)	2:0:2	SEE Marks	50
Total Hours	28	Examination Hours	03
No. of Credits: 03				

Course Learning Objectives

The course will enable students to

CLO1	Understand the features, architecture of UNIX and its commands.
CLO2	Discuss different UNIX files, attributes and permissions.
CLO3	Discuss filter programs and regular expressions.
CLO4	Understand essential facets of shell programming in order solve the shell script Problems.

CONTENTS	# of Hours / RBT Levels
MODULE 1 UNIX Architecture and Command Usage: Unix Architecture, Features of UNIX, Internal and External Commands General-Purpose Utilities: cal, date, echo, printf, bc, passwd, who, uname, tty, stty. The File System: The Parent-Child Relationship, the HOME variable, pwd, cd, mkdir, rmdir, Absolute Pathnames, Relative Pathnames **Text Book: T1 Chapters: 2.1, 2.2, 2.5, 3.1 to 3.5, 3.9 to 3.13, 4.1 to 4.10**	06 L2
MODULE 2 Handling Ordinary Files: cat, cp, rm, mv, more, file, wc, cmp, comm, diff, Basic File Attributes: ls –l, file ownership, file permissions, chmod, directory permissions, changing file ownership More File Attributes: File Systems and Inodes, Hard Links, Symbolic Links and ln, umask Modification and Access Times **Text Book: T1 Chapters: 5.1 to 5.5, 5.10 to 5.12, 6.1 to 6.7, 11.1 to 11.6**	05 L3
MODULE 3 Simple Filters: The sample database, head, tail, cut, paste, sort, uniq, tr Filters using Regular Expression: grep. egrep **Text Book: T1 Chapters: 12.1, 12.3 to 12.9, 13.1 to 13.3**	05 L3
MODULE 4 Essential Shell Programming Part I: Shell Scripts, read, Using command line arguments, exit and exit status of command, the logical operators && and || - conditional execution **Text Book: T1 Chapters: 14.1 to 14.5**	06 L2
MODULE 5 Essential Shell Programming Part II : the if conditional, using test and [ ] to evaluate expressions, the case conditional, expr, $0, while, for, set and shift **Text Book: T1 Chapters: 14.6 to 14.13**	06 L3

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Laboratory Component
List of Sample Experiments

1   Working on general purpose commands and General-Purpose Utilities
2   Working on general purpose commands and General-Purpose Utilities (contd)
3   Working on Ordinary files and Attributes
4   Working on Ordinary files and Attributes (contd)
5   Working on Filter programs and filters using regular expression
6   Working on Filter programs and filters using regular expression
7   a) Write a shell script which displays a list of all the files in the current directory to which you have read, write and execute permissions.
    b) Write a shell script which will accept a filename and starting and ending line numbers and displays these lines from given file.
    c) Write a shell script which is expected to accept two filenames as its arguments. Check the number of arguments and display the contents of the argument files if the arguments is two, otherwise display an error message an exit.

8   a) Write a shell program that will do the following tasks in order:
    i) clear the screen   ii) print the current directory   iii) display current login users
    iv) list of users   v) list of processes   vi) list of files
    vii) today's date   viii) Quit to UNIX
    b) Write a shell script that reads data from a text file and appends the lines starting with an alphabet from 'a' through 'k' to a file named "ak" and the lines from 'l' through 'r' to a file named "lr" and the lines from 's' through 'z' to a file named "sz". Then display the number of lines in each of the files ak, lr and sz individually.
    c) Write a shell script which will receive login name during execution, obtain information about it from /etc/passwd and display this information on screen in easily understandable format.

9   a) A shell script receives even number of filenames as arguments. Suppose four files are supplied as arguments then the first file should get copied into second, third file into fourth and so on. If odd number of filenames is supplied then no copying should take place and an error message should be displayed.
    b) Write a shell script which will receive any number of filenames as arguments. The shell script should check whether every argument supplied is a file or a directory. If it a directory it should be appropriately reported. If it is a filename then name of the file as well as the number of lines present in it should be reported.

10 a) Write a shell script which expects two parameters, a file name and a number. The script deletes the line with given number from given file.
    b) Write a shell script which accepts any number of arguments and prints them in reverse order.
    Ex : If file name is test then $ sh test A B C should produce C B A.
    c) Write script average which computes the average value (rounded to an integer as computed with expr) of the numeric values given in the parameters and writes the result to standard output. For example average 4 13 112 7 outputs 34.

Course Outcomes: Upon successful completion of this course, student will be able to

CO36.1	Explain the fundamental concepts of UNIX Operating system along with the working of various commands
CO36.2	Illustrate various filters to solve variety of applications
CO36.3	Write Regular Expressions for pattern matching
CO36.4	Write shell scripts

Text Books:

1. Sumitabha Das, "UNIX – Concepts and Applications", 4th Edition, McGraw Hill, 2017.

Reference Books:

1. Behrouz A Forouzan and Richard F Gilberg, "UNIX and SHELL Programming", India Edition, Cengage Learning, Third Reprint 2008
2. Kenneth Rosen et al, "UNIX – The Complete Reference", 2nd Edition, Tata McGraw Hill Fourth Reprint 2008.

E-Books / Web References:

1. http://www.ee.surrey.ac.uk/Teaching/Unix/unixintro.html
2. https://www.tutorialspoint.com/unix/index.htm

MOOCs:

1. https://nptel.ac.in/courses/117106113
2. https://onlinecourses.swayam2.ac.in/aic20_sp05/preview
3. http://elearning.vtu.ac.in/econtent/courses/video/CSE/CS36.htm

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO36.1	3	3	2	-	3	-	-	-	-	-	-	2	-	-
CO36.2	3	3	2	-	3	-	-	-	-	-	-	2	-	-
CO36.3	3	3	2	-	3	-	-	-	-	-	-	2	-	-
CO36.4	3	3	2	-	3	-	-	-	-	-	-	2	-	-
Average	3	3	2	-	3	-	-	-	-	-	-	2	-	-

Low-1: Medium-2: High-3

SUBJECT: OBJECT ORIENTED PROGRAMMING WITH JAVA (Integrated)

Subject Code	22CSE42	CIE Marks	50
Hours/Week (L: T: P)	3:0:2	SEE Marks	50
Total Hours	40	Examination Hours	03
No. of Credits: 04			

Course Learning Objectives:

The course will enable students to

CLO1	Learn fundamental features of Java Programming
CLO2	Setup Java JDK environment to create, debug and run Java Programs
CLO3	Learn Object Oriented concepts using Java programs
CLO4	Apply the concepts of multiprogramming, exception handling, Regular Expressions to develop robust Java programs
CLO5	Apply String handling methods to write Java programs

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Introduction to Object Oriented Concepts:** Member functions and data, objects and functions, Constructors, Destructors. **The History and Evolution of Java:** Java's magic: the Bytecode; The Java Buzzwords **An Overview of Java:** Object-Oriented Programming; A First Simple program, Lexical Issues **Data types, variables and Arrays:** The primitive types, A closer look at Literals, Variables, Type conversion and casting, Automatic type promotion in Expressions, Arrays **Operators:** Arithmetic operators, The Bitwise operators, Relational operators, Boolean Logical operators, Assignment operator, The? operator, Operator precedence **Control Statements:** Java's selection statements, iteration statements, Jump statements **Text Book: 1 Chapters: 1, 2, 3, 4, 5 Text Book: 2 Chapter: 1**	08 L3
MODULE 2 **Introducing Classes:** Classes fundamentals; Declaring objects; Introducing methods, Constructors, this keyword, garbage collection **Inheritance:** Inheritance basics, using super, creating a Multilevel hierarchy, method overriding, Dynamic Method dispatch, Using Abstract classes **Text Book: 1 Chapters: 6, 8**	08 L3
MODULE 3 **Packages and Interfaces:** Packages, Member Access, Importing Packages, Interfaces **Exception handling:** Exception handling fundamentals, Exception Types, Uncaught Exceptions, using try and catch, multiple catch clause, throw, throws, finally **Text Book: 1 Chapters: 9, 10**	08 L3
MODULE 4 **Multithreaded Programming:** The Java Thread Model, The Main Thread, Creating a Thread, creating multiple threads, using isAlive() and join(), Thread priorities, Synchronization	08 L3

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Regular Expressions: Regular Expression processing, Pattern, Matcher, Regular Expression Syntax, Demonstrating Pattern matching, Two-pattern matching options, Exploring Regular Expressions **Text Book: 1 Chapters: 11, 30**		
MODULE 5 **String handling:** The String Constructors, String Length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying a String, Data Conversion Using valueOf( ), Changing the case of characters within a String, Joining Strings, Additional String Methods, StringBuffer, StringBuilder **Text Book: 1 Chapter: 17**	**08** **L3**	

Laboratory Component
List of Experiments

Implement the following programs using Java in Eclipse IDE

1. Implement a Java program to simulate a simple calculator using switch statement. The program must continue executing until the user presses the key 'E'.
2. Implement a Java program to create a class called Student which stores USN, name and marks of a student. Calculate the Grade according to the following criteria. Input N number of student details, find grade and print all the members.

Marks	Grade
90 to 100	O
80 to 89	A+
70 to 79	A
60 to 69	B+
55 to 59	B
50 to 54	C
40 to 49	P
0 to 39	F

3. Implement a Java program to create a super class called Staff with the members - staffID, name, phone and salary of the staff members. Extend this class by creating three sub classes namely Teaching (domain, publications), Technical (skills) and Contract (contract_period). Read and display the details of all the sub classes.
4. Implement a Java program to create a super class called Box with the members - width, height and depth and find the volume of the Box. Extend Box by creating a sub class called BoxWeight to find weight of the Box. Extend BoxWeight by creating a sub class called Shipment to find the cost of the shipment. Create two instances of class Shipment to read and display the data.
5. Implement a Java program that uses the concept of Interface to find the area of Rectangle and Triangle.
6. Implement a Java program that implements a multi-threaded application that has three threads. The first thread generates a random integer every 1 second. The second thread computes the square of the number and prints it. The third thread computes cube of the number and prints it.
7. Implement a Java program to input N no. of strings, count the number of vowels and digits in each string using Regular Expressions.
8. Implement a Java program to validate USN and email ID of N students using Regular Expressions.
9. Implement a Java program to replace all instances of a substring with another within a string.
10. Implement a Java Program to input a string and implement Monoalphabetic Cipher.

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Course Outcomes:

Upon successful completion of this course, student will be able to

CO42.1	Apply the fundamental constructs of Java Programming to create, debug and run programs with modern tools
CO42.2	Illustrate the concepts of Object Oriented Programming using Java Programs
CO42.3	Implement reusable Java programs using Interfaces and Packages
CO42.4	Apply Exception handling mechanism and thread synchronization
CO42.5	Design Java programs using Regular Expressions to validate the input data
CO42.6	Implement Java programs using String handling methods

Text Books:
1. Herbert Schildt, "Java: A beginner's guide", 11th Edition, McGraw-Hill Education, 2022.
2. E Balagurusamy, "Object Oriented Programming with C++", 8th Edition, 2020.

Reference Books:
1. E Balaguruswamy, "Programming with Java", 6th Edition, McGraw-Hill Education, 2019.
2. Surbhi Kakar, "A Textbook of Java Programming", 1st Edition, Dreamtech Press, 2019.
3. R. Nageswara Rao, "Core Java: An Integrated Approach", 1st Edition, Dreamtech Press, 2016.

E-Books / Web References:
1. https://docs.oracle.com/javase/tutorial/essential/index.html
2. http://www.onlinecomputerbooks.com/free-java-books.php

MOOCs:
1. https://www.udemy.com/course/java-programming-tutorial-for-beginners/
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01384793912231526456522_shared/overview

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO42.1	3	3	3	-	3	-	-	-	1	-	-	2	-	2
CO42.2	3	3	3	-	3	-	-	-	1	-	-	2	-	2
CO42.3	3	3	3	-	3	-	-	-	1	-	-	2	-	2
CO42.4	3	3	3	-	3	-	-	-	1	-	-	2	-	2
CO42.5	3	3	3	-	3	-	-	-	1	-	-	2	-	2
CO42.6	3	3	3	-	3	-	-	-	1	-	-	2	-	2
Average	3	3	3	-	3	-	-	-	1	-	-	2	-	2

Low-1: Medium-2: High-3

SUBJECT: DESIGN AND ANALYSIS OF ALGORITHMS (Integrated)

Subject Code	22CSE43	CIE Marks	50
Hours/Week (L: T: P)	3:0:2	SEE Marks	50
Total Hours	40	Examination Hours	3
No. of Credits: 04			

Course Learning Objectives:
The course will enable students to

CLO1	Apply mathematical concepts and notations to define a problem
CLO2	Understand and apply algorithms design techniques
CLO3	Gain ability to solve real life problems using algorithms techniques
CLO4	Understand the limitations of Algorithmic power

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Introduction:** What is an Algorithm?, Fundamentals of Algorithmic Problem Solving, Important Problem Types, Algorithm Specification, Performance Analysis: Space complexity, Time complexity Asymptotic Notations: Big-Oh notation (O), Omega notation (Ω), Theta notation (Θ), Mathematical analysis of Non-Recursive and recursive Algorithms with Examples **Text Book 1: Chapters: 1, 2.1-2.4 Text Book 2: Chapters: 1.2, 1.3**	06 L2
MODULE 2 **Brute Force:** Brute force string matching algorithms **Divide & Conquer:** General method, Recurrence equation for divide and conquer, Binary Search, Merge sort, Quick sort, Strassen's matrix multiplication, Advantages and Disadvantages of divide and conquer **Text Book 1: Chapters: 3.2, 5.1, 5.2, 5.4 Text Book 2 : Chapters: 3.1, 3.3**	08 L3
MODULE 3 **Greedy Method:** Introduction, General method, Knapsack Problem, Job sequencing with deadlines **Minimum cost spanning trees:** Prim's Algorithm, Kruskal's Algorithm, **Single source shortest paths:** Dijkstra's Algorithm, **Optimal Tree problem:** Huffman Trees and Codes **Transform and Conquer Approach:** Heaps and Heap Sort, AVL Tree, 2-3 Tree **Text Book 1: Chapters: 6.3-6.4, 9.1-9.4 Text Book 2 : Chapters: 4.3, 4.5**	10 L3
MODULE 4 **Dynamic Programming:** Introduction, Transitive closure - Warshall's and Floyds algorithm, Knapsack problem & memory functions, Bellman Ford algorithm **Decrease & Conquer:** Introduction – Decrease by constant, decrease by constant factor, variable size decrease, Breadth First search traversal, Depth First search traversal, Topological sorting using DFS and source removal method **Text Book 1: Chapters 3.5, 4.2, 8.2, 8.4 Text Book 2: Chapters 5.4, 5.9**	08 L3
MODULE 5 **Backtracking:** N-Queens problem, Sum of subsets problem, Hamiltonian cycles **Branch & Bound:** Introduction, Travelling Salesman problem, Knapsack problem, Assignment problem	08 L3

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Limitations of Algorithm Power: Decision Trees for sorting and searching Approximation Algorithms for NP-Hard Problems – Traveling Salesperson Problem using Nearest-neighbor algorithms

Text Book 1 : Chapters 11.2-11.3, 12.1-12.2

Laboratory Component
List of Experiments

1. Write a C program to sort a given set of 'n' integer elements using Quick Sort method and compute its time complexity.
2. Write a C program to sort a given set of 'n' integer elements using Merge Sort method and compute its time complexity.
3. Write a C program to find Minimum Cost Spanning Tree of a given connected undirected graph using i) Kruskal's algorithm. ii) Prim's algorithm.
4. Write a C program to find the shortest path using Dijkstra's algorithm.
5. Write a C program to implement All-Pairs Shortest Paths problem using Floyd's algorithm.
6. Write a C program to solve the given instance of 0/1 Knapsack problem using Dynamic Programming
7. Write a C program to print all the nodes reachable from a given starting node in a digraph using BFS method.
8. Write a C program to check whether a given graph is connected or not using DFS method.
9. Write a C program to solve N-Queen's problem using Back Tracking.
10. Write a C program to develop Back Tracking solution for Sum of Subset Problem.

Course Outcomes:

Upon successful completion of this course, student will be able to

CO43.1	Explain the basic techniques of analyzing the algorithms using time & space complexity and asymptotic notations
CO43.2	Devise algorithms using brute force and Divide and Conquer techniques for a given problem.
CO43.3	Demonstrate Graph Algorithms using greedy method, Transform and Conquer Approach to model Engineering Problems.
CO43.4	Employ Dynamic Programming and Decrease & Conquer strategies to solve a given problem
CO43.5	Use Back Tracking, Branch and Bound design techniques for solving Computationally hard problems.

Text Books:

1. Anany Levitin, "Introduction to The Design and Analysis of Algorithms", 3rd Edition, Pearson, Tenth Impression 2020.
2. Ellis Horowitz, Sartaj Sahni & Sanguthevar Rajasekaran, "Computer Algorithms/C++", University Press, 2nd Edition, Reprint 2017.

Reference Books:

1. Cormen, Thomas H., Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, "Introduction to Algorithms", MIT press, 2022.

E-Books / Web References:
1. http://www.facweb.iitkgp.ac.in/~sourav/daa.html
2. https://freevideolectures.com/course/2281/design-and-analysis-of-algorithms

MOOCs:
1. https://nptel.ac.in/courses/106101060/
2. https://www.coursera.org/specializations/algorithms

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO43.1	3	3	3	-	3	-	-	-	-	-	-	2	3	-
CO43.2	3	3	3	-	3	-	-	-	-	-	-	2	3	-
CO43.3	3	3	3	-	3	-	-	-	-	-	-	2	3	-
CO43.4	3	3	3	-	3	-	-	-	-	-	-	2	3	-
CO43.5	3	3	3	-	3	-	-	-	-	-	-	2	3	-
Average	3	3	3	-	3	-	-	-	-	-	-	2	3	-

Low-1: Medium-2: High-3

SUBJECT: SOFTWARE ENGINEERING

Subject Code	22CSE44	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Total Hours	40	Examination Hours	3
No. of Credits: 03			

Course Learning Objectives:

The course will enable students to

CLO1	Outline Software Engineering principles and activities involved in building large software programs
CLO2	Introduce Software design using UML tools and various system models
CLO3	Introduce Agile Software development and Agile methods – SCRU
CLO4	Introduce Software Testing and Software Evolution processes in detail
CLO5	Explain project planning, Cost estimation techniques and Software quality, standards and metrics

CONTENTS	# of Hours / RBT Levels

MODULE 1
Introduction: Professional Software Development - Software Engineering, Case Studies. **Software Processes:** Software process models - Waterfall Model, Incremental Model, and Spiral Model, Software Process Activities.
Requirement Engineering: Requirements Specification, Requirement elicitation and analysis, Requirements Validation, Requirements change, Functional Specification, and Non-Functional Requirements, The software requirements document
Case Study: Create a SRS document for the following software projects
    1. Online Ticket Reservation System
    2. Stock Maintenance
    3. Student's Marks Analyzing System
    4. Stock Maintenance
Text Book:1 Chapters: 1.1-1.3, 2.1-2.2, 4.1-4.6
	08
	L2

MODULE 2 **System Models:** Context models. Interaction models. Structural models. Behavioral models. Model-driven engineering **Software Design and Planning:** Object-oriented design concepts using UML tool: Star UML application, Design patterns, Implementation issues, Open-Source Development **Text Book:1 Chapters: 5.1-5.5, 7.1-7.4**	08 L2
MODULE 3 **Agile Software Development:** Agile methods, Plan-driven and agile development, Extreme programming, Agile project management, Scaling agile methods. SCRUM Methodology, SCRUM **Text Book:1 & 3 Chapters: 3.1-3.4**	08 L2
MODULE 4 **Software testing strategies:** A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for Conventional software, Test Strategies for Object-Oriented Software, Test Strategies for web apps, Validation Testing, and System Testing	08 L2

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Testing Conventional Applications: Software Testing Fundamentals, Internal and External views of Testing, White-Box Testing, Basic path Testing, Control structure Testing, and Black-box Testing
Case study:
   1. Design the test case for finding the roots of the quadratic equation
   2. Design the test case for the e-commerce application
Text Book:2 Chapters: 17.1-17.7, 18.1-18.6	

MODULE 5 **Project planning:** Software pricing, Plan-driven development, Project scheduling, Agile planning, and Estimation techniques **Quality management:** Software quality, Software standards, Reviews and inspections, Software measurement, and metrics **Text Book:1 Chapters: 23.1-23.5, 24.1-24.3 & 24.5**	**08** **L2**

Course Outcomes:

Upon successful completion of this course, student will be able to

CO44.1	Understand the fundamentals of Software Engineering, Software process models, and Requirements Engineering
CO44.2	Understand the different types of System Models, Software Design and Planning by using UML tool
CO44.3	Understand Agile Software Development and Agile Methods – SCRUM
CO44.4	Describe Software testing methods and Conventional Applications
CO44.5	Discuss the project planning process, Cost estimation models, Software Quality standards, and metrics

Text Books:
1. Ian Sommerville, "Software Engineering", 10th Edition, Pearson Education, 2016.
2. Roger S Pressman, "Software Engineering: A Practitioner's Approach", 7th Edition, Tata McGraw-Hill, 2014.
3. The SCRUM Primer, Ver 2.0, http://www.goodagile.com/scrumprimer/scrumprimer20.pdf

Reference Books:
1. Pankaj Jalote, "An integrated approach to Software Engineering", Springer US, 3rd Edition, 2005.
2. Michael Blaha, James Rumbaugh, "Object Oriented Modelling and Design with UM", Pearson Education, 2nd Edition, 2005.
3. Rajib Mall, "Fundamentals of Software Engineering", 4th Edition, PHI Learning Private Limited, 2014.
4. Tom Pender, "UML Bible", Wiley Publishing, 2003.

E-Books / Web References:
1. https://www.softwaretestingmaterial.com/category/agile/
2. https://www.atlassian.com/agile/kanban

MOOCs:
1. https://www.coursera.org/learn/introduction-to-software-engineering
2. www.vtu.ac.in

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO44.1	3	-	-	-	-	1	1	1	-	3	-	2	3	3
CO44.2	3	-	3	-	-	1	1	1	-	3	-	2	3	3
CO44.3	3	-	3	-	-	1	1	1	-	3	-	2	3	3
CO44.4	3	3	3	3	-	3	-	-	3	3	3	3	3	3
CO44.5	3	1	-	-	-	1	1	1	-	3	2	2	3	3
Average	3	2	3	3	-	2	1	1	3	3	3	3	3	3

Low-1: Medium-2: High-3

SUBJECT: DATA VISUALIZATION (Integrated)

Subject Code	22CSE45	CIE Marks	50
Hours/Week (L: T: P)	2:0:2	SEE Marks	50
Total Hours	28	Examination Hours	3
No. of Credits: 03			

Course Learning Objectives:
The course will enable students to:

CLO1	Demonstrate understanding of Data Visualization and key terms
CLO2	Design effective data visualization for visual mapping using Matplotlib
CLO3	Demonstrate skills on understanding relationship between variables
CLO4	Demonstrate skills on understanding Bivariate analysis
CLO5	Create dashboard and visualization report for Time Series analysis data

CONTENTS	Hours / RBT Levels
MODULE 1 **Exploratory Data Analysis:** EDA fundamentals, Understanding data science, Significance of EDA, Making sense of data, Comparing EDA with classical and Bayesian analysis, Software tools for EDA, Visual Aids for EDA, Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques, Grouping Datasets, data aggregation, Pivot tables and cross-tabulations **Text Book: 1 Chapter: 1**	06 L2
MODULE 2 **Visualizing Using Matplotlib:** Importing Matplotlib, Simple line plots, Simple scatter plots, visualizing errors, density and contour plots, Histograms, legends, colors, subplots, text and annotation, customization, three dimensional plotting, Geographic Data with Basemap, Visualization with Seaborn **Text Book: 2 Chapter: 4**	06 L3
MODULE 3 **Univariate Analysis:** Introduction to Single variable: Distributions and Variables, Numerical Summaries of Level and Spread, Scaling and Standardizing, Inequality, Smoothing Time Series **Text Book: 3 Chapter: 1**	06 L3
MODULE 4 **Bivariate Analysis:** Relationships between Two Variables, Percentage Tables, Analyzing Contingency Tables, Handling Several Batches, Scatterplots and Resistant Lines, Transformations **Multivariate And Time Series Analysis:** Introducing a Third Variable, Causal Explanations, Three-Variable Contingency Tables and Beyond, Longitudinal Data **Text Book: 3 Chapters: 2, 3**	05 L3
MODULE 5 **Working with Data in Tableau:** A simple example, connecting to data, Tableau File types, filtering data, Basic Charts, Telling a Data Story with Dashboards, Analytics **Text Book: 4 Chapter: 2, 7**	05 L3

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Laboratory Component
List of Sample Experiments

Considering suitable dataset

1. Develop a program to read a dataset and perform exploratory data analysis on the dataset
2. Develop a program to implement various types of plots using seaborn
3. Develop a program to implement various types of plots using matplotlib
4. Develop a program to visualize different types of correlation between features of the dataset
5. Develop a program to implement univariate analysis
6. Develop a program to implement bivariate analysis
7. Develop a program to implement multivariate analysis
8. Develop a program to implement various data distribution methods
9. Develop a program to implement various data preprocessing methods
10. Demonstrate and implement a dashboard using Tableau

Course Outcomes:
Upon successful completion of this course, students will be able to

CO45.1	Understand the fundamentals of exploratory data analysis
CO45.2	Implement the data visualization using Matplotlib
CO45.3	Perform univariate data exploration and analysis
CO45.4	Apply bivariate data exploration and analysis
CO45.5	Use Data exploration and visualization techniques for multivariate and time series data

Text Books:
1. Mukhiya, Suresh Kumar, Usman Ahmed, "Hands-On Exploratory Data Analysis with Python: Perform EDA techniques to understand, summarize, and investigate your data", Packt Publishing Ltd, 2020.
2. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", Oreilly, 1st Edition, 2016
3. Catherine Marsh, Jane Elliott, "Exploring Data: An Introduction to Data Analysis for Social scientists", Wiley Publications, 2nd Edition, 2008.
4. Joshua N. Milligan, "Learning Tableau", Packt Publishing Limited, 3rd Edition, 2019.

Reference Books:
1. Eric Pimpler, "Data Visualization and Exploration with R", GeoSpatial Training service, 2017
2. Claus O. Wilke, "Fundamentals of Data Visualization", O'reilly publications, 2019.
3. Matthew O. Ward, Georges Grinstein, Daniel Keim, "Interactive Data Visualization: Foundations, Techniques, and Applications", 2nd Edition, CRC press, 2015.

E-Books / Web References:
1. https://www.perlego.com/book/3815910/data-visualization-exploring-and-explaining-with-data-pdf

MOOCs:
1. https://www.coursera.org/specializations/data-analysis-visualization-foundation
2. https://www.coursera.org/learn/datavisualization

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO45.1	3	3	-	-	3	-	-	3	-	-	-	-	3	-
CO45.2	3	3	-	-	3	-	-	3	-	-	-	-	3	-
CO45.3	3	3	-	-	3	-	-	3	-	-	-	-	3	-
CO45.4	3	3	-	-	3	-	-	3	-	-	-	-	3	-
CO45.5	3	3	-	-	3	-	-	3	-	-	-	-	3	-
Average	3	3	-	-	3	-	-	3	-	-	-	-	3	-

Low-1: Medium-2: High-3

SUBJECT: FULL STACK FRAMEWORK -FRONTEND (Integrated)

Subject Code	22CSE46	CIE Marks	50
Hours/Week (L: T: P)	2:0:2	SEE Marks	50
Total Hours	28	Examination Hours	3
No. of Credits: 03			

Course Learning Objectives:
The course will enable students to

CLO1	Illustrate the basics of JavaScript, its importance, and embed in a web page
CLO2	Build dynamic web pages using JavaScript
CLO3	Facilitate the usage of objects and events in web pages using JavaScript
CLO4	Understand the programming model provided by the React framework and Define React components
CLO5	Build applications using ReactJS

CONTENTS	# of Hours / RBT Levels
MODULE 1 **Basics of JavaScript:** Overview of JavaScript, Object orientation and JavaScript, Syntactic characteristics, Primitives, operations, and expressions, Screen output and keyboard input, Control statements, Object creation and modification, Arrays, Functions, Constructors, Examples **Text Book:1 Chapter: 4**	08 L3
MODULE 2 **JavaScript and HTML Documents:** The JavScript execution environment, 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. The DOM 2 event model, The navigator object, DOM tree traversal and modification **Text Book:1 Chapter: 5**	08 L3
MODULE 3 **Dynamic Documents with JavaScript:** Introduction to dynamic documents, Positioning elements, Moving elements, Element visibility, Changing colors and fonts. Examples Dynamic content, Locating the mouse cursor, Reacting to a mouse click, Slow movement of elements, Dragging and dropping elements, Examples **Text Book:1 Chapter: 6**	08 L3
MODULE 4 React Library: Fundamentals of React: Hello React, Requirements, setting up a React Project, Meet the React Component, React JSX, Lists in React, Meet another React Component, React Component Instantiation, React DOM, React state. **Text Book: 2 Topics: Fundamentals of React: till React Dom and React State**	08 L3
MODULE 5 React Fragments, Forms in React, Styling in React, CSS in React, React Class Components. **Text Book: 2 Topics: React Fragments, React Legacy, Styling in React, and Forms**	08 L3

Laboratory Component

- Student can execute the programs on any browser by enabling the JavaScript option in the browser.
- Go through the installation procedure for ReactJS: https://react.dev/learn/installation

List of Sample Experiments

1. Implement a JavaScript function to design a simple calculator to perform the following operations: sum, product, difference and quotient.
2. Develop JavaScript code that displays text "TEXT-GROWING" with increasing font size in the interval of 100ms in RED COLOR, when the font size reaches 50pt it displays "TEXT-SHRINKING" in BLUE color. Then the font size decreases to 5pt.
3. Develop and demonstrate a HTML5 file that includes JavaScript script that uses functions to find the position of the left-most vowel in the given string.
4. Develop and demonstrate a HTML5 file that includes JavaScript script that uses functions to display the number with its digits in the reverse order.
5. Develop a program to fade the removal of a DOM Element using CSS and JavaScript
6. Implement a program to display a list of books using ReactJS
7. Create a simple login form with name, password, email, contact number, date of birth and submit using ReactJS.
8. Develop a program to build todo list app using reactJS
9. Build a simple search filter functionality to display a filtered list based on the search query entered by the user using ReactJS
10. Design and develop a program to create a BMI calculator using ReactJS
11. Develop a program to build counter app using ReactJS

Course Outcomes:
Upon successful completion of this course, student will be able to

CO46.1	Apply the concepts of JavaScript and pre-defined objects, properties and methods to design web pages
CO46.2	Develop applications using event handling in JavaScript
CO46.3	Analyze the dynamic documents with JavaScript
CO46.4	Apply the fundamentals of ReactJS to design webpages
CO46.5	Implement single-page applications in React with the help of React library and various React features including components and forms

Text Books:
1. Robert W. Sebesta, "Programming the World Wide Web", 7th Edition, Pearson publication, 2012.
2. Robin Wieruch, "The Road to React", 1st Edition, Zaccheus Entertainment, 2018.

Reference Books:
1. Kogent Learning Solutions Inc., "Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black book", 1st Edition, Dream Tech, 2009.
2. Wang, Paul S., and Sanda Katila. "An introduction to Web design and programming", 1st Edition, Cengage Learning, 2004.
3. Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", 4th Edition, Pearson Education India, 2016.

E-Books / Web References:
1. https://www.w3schools.com/js/
2. https://www.w3schools.com/react/default.asp
3. https://www.goodreads.com/work/editions/198800-programming-the-world-wide-web
4. https://vdocuments.mx/world-wide-web-sebesta-robert-w.html?page=1

MOOCs:
1. https://www.udemy.com/course/full-stack-website-development-technologies/
2. https://www.edx.org/learn/web-development/harvard-university-cs50-s-web-programming-with-python-and-javascript?hs_analytics_source=referrals&utm_source=%20%20%20mooc.org&utm_medium=referral&utm_campaign=mooc.org-course-list

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO46.1	2	3	3	-	3	-	-	-	3	-	-	-	2	-
CO46.2	2	3	3	-	3	-	-	-	3	-	-	-	2	-
CO46.3	2	3	3	3	3	-	-	-	3	-	-	-	2	-
CO46.4	2	3	3	3	3	-	-	-	3	-	-	-	2	-
CO46.5	2	3	3	3	3	-	-	-	3	-	-	-	2	-
Average	2	3	3	3	3	-	-	-	3	-	-	-	2	-

Low-1: Medium-2: High-3

SYLLABUS

V SEMESTER

MANAGEMENT, ECONOMICS AND FINANCE FOR IT ENGINEERS

Course Code:	22CSE51	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Total Hours	40	Examination Hours	3
No. of Credits	3		

Course Learning Objectives:

The course will enable students to:

CLO1	To introduce the fundamentals, tools and theories of managerial economics
CLO2	Explain the principles of management, organization and entrepreneur
CLO3	Realize the importance of planning, organizing, staffing, directing and controlling and gain the leadership qualities required to run an enterprise
CLO4	Realize and plan how to launch and make an entrepreneurial career
CLO5	To familiarize the students with basic concepts of financial management and financial system

CONTENTS	# of Hours
MODULE 1	
Nature and Scope of Managerial Economics - Introduction, What is Economics?, What is Managerial Economics? , How Economics Contributes to Managerial Decisions, Application of Economics to Business Decision: An Example, The Scope of Managerial Economics, Some Other Disciplines of Managerial Economics , Managerial Economics Bridges the Gap between Theory & Practice **Objectives of Business Firms** - Introduction, Profit as Business Objective, Alternative Objectives of Business Firms, Baumol's Hypothesis of Sales Revenue Maximization, Marris's Hypothesis of Maximization of Firm's Growth Rate, Williamson's Hypothesis of Maximization of Managerial Utility Function	08
MODULE 2	
Nature and Functions of Management - Importance of Management, Definition of Management, Management Functions or the Process of Management, Levels of Management, Organisational or Business Functions, Roles of a Manager, Managerial Skills Managerial Effectiveness, Management and Administration, Management A Science or an Art? , Management A Profession?, Professional Management vs Family Management, Management of International Business **Planning:** Nature of Planning, Importance of Planning, Types of Plans, Steps in Planning, Difference between Strategic Planning and Tactical Planning, Limitations of Planning, Making Planning Effective, Planning Skills, Strategic Planning in Indian Industry **Organisation:** What is an "Organisation"? Process of Organising, Principles of Organising, Span of Management, Departmentalisation or the Superstructure of an Organisation, Process Departmenatalisation **Staffing:** Importance and need for proper Staffing.	08

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MODULE 3 **Direction and Supervision** - Requirements of Effective Direction, Giving Orders, Motivation, Job Satisfaction, Organisational Commitment, Morale, First-level or Front-line Supervision **Leadership** - Difference between a Lead and a Manager, Characteristics of Leadership, Functions of an Executive Leader, Traditional Approaches to Leadership, Leadership Effectiveness, New Approaches to Top Leadership, Leadership Assessment, Leadership Style in Indian Organisations, Worker Participation in Management in India **Communication** - Importance of Communication, Purposes of Communication, Formal Communication, Forms of Communication, Informal Communication, The Communication Process, Barriers to Communication, Principles of Effective Communication, Communication Channels and Networks, Checks on in-plant Communication, Communication in Indian Industries. **Coordination** - Need for Coordination, Managerial Control- Need for Control System, Benefits of Control.	08
MODULE 4 **Entrepreneurship** - Introduction, Concept of Entrepreneurship, Evolution of the concept, Manager Vs Entrepreneur Functions of Entrepreneur, Characteristics of an Entrepreneur, Types of Entrepreneurs. Intrapreneurs-An emerging class, Stages in Entrepreneurial Process, Role of Entrepreneurs in Economic Development, Entrepreneurship in India Barriers to Entrepreneurship **Preparation of project** - Introduction, Meaning of Project, Project Identification, Project Selection, Report-Need and Significance, Contents of a Project Report Project Formulation, Guidelines by Planning Commission for Project Report, Errors in Project Report, Project Appraisal, Market Feasibility Study, Technical Feasibility Study, Financial Feasibility Study, Social Feasibility Study.	08

MODULE 5
Introduction to Financial Management: Introduction, Evolution of Financial Management, Meaning, Importance Scope and Objectives, Conflicts in Principles of Profit vs. Value Maximization.
Case Studies:
  1. Cashless Aftermath: Effectiveness and Efficiency Worries
  2. Faculty Procedure
  3. Designing an Organisation Structure
  4. Srijan
  5. Ensuring Effective Communication
  6. Getting Effective Leadership and Successful vs Effective Leadership
	08

Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Understand the application of Economic Principles in Management decision making
CO2	Understand the functional areas of management and apply their principles in establishing an enterprise
CO3	Identify the business opportunities and analyze the management skills for the economic growth of the society
CO4	Analyze how the entrepreneur applies the principles of management to meet the personal and societal needs
CO5	Understand the basic financial concepts

Text Books:
1. Dwivedi D. N, "Managerial Economics", Vikas Publishing House 8th Edition, 2018.
2. P.C Tripathi, P.N Reddy, "Principles of Management", Tata McGraw Hill, 6th Edition, 2010.
3. Kaniksha Bedi, "Management and Entrepreneurship", Oxford University Press, 2017.
4. Nishikant Jha, Kuldeep Sharma, Nilesh Ekanath Koli, "Financial Management", Himalaya Publishing House Pvt. Ltd, 1st Edition, 2016.

Reference Books:
1. Geethika, Ghosh & Choudhury, "Managerial Economics", McGraw Hill Education 3rd Edition, 2021.
2. Robert Lussier, Thomson, "Management Fundamentals Concepts", Application, Skill Development - SAGE Publications, Inc, 9th Edition, 2020.

E-Books / Web References:
1. https://www.pdfdrive.com/financial-management-and-analysis-workbook-step-by-step-exercises-and-tests-tohelp-you-master-financial-management-and-analysis-e158595305.html
2. https://www.pdfdrive.com/fundamentals-of-financial-management-concise-sixth-edition-e20229517.html
3. https://www.youtube.com/watch?v=CCQwz_Gwo6o
4. https://www.digimat.in/nptel/courses/video/110107144/L01.html

MOOCs:
1. Introduction to Managerial Economics-
https://www.iimbx.edu.in/courses/coursev1:IIMBx+ES101x+2019BL1/about

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	3	3	3	3	3	2
CO2	-	-	-	-	-	-	-	-	3	3	3	3	3	2
CO3	-	-	-	-	-	3	-	-	3	3	3	3	3	2
CO4	-	3	-	-	-	3	-	-	3	3	3	3	3	2
CO5	-	-	-	-	-	-	-	-	-	-	3	3	3	2
Average	-	3	-	-	-	3	-	-	3	3	3	3	3	2

Low-1: Medium-2: High-3

DATABASE MANAGEMENT SYSTEMS

Course Code:	22CSE52	CIE Marks	50
Hours/Week (L: T: P)	2:2:2	SEE Marks	50
Total Hours	40 hours theory + 8-10 lab slots	Examination Hours	3
No. of Credits	4		

Course Learning Objectives:
The course will enable students to:

CLO1	Outline a strong foundation in database concepts, technology, and practice.
CLO2	Identify a strong foundation on normalization techniques to design a database
CLO3	Demonstrate the use of concurrency and transactions in database
CLO4	Design and build database applications for real world problems

CONTENTS	# of Hours
MODULE 1 **Introduction:** Introduction, An example, Characteristics of Database approach, Advantages of using DBMS approach, Data models, schemas and instances, Three-schema architecture and data independence **Entity-Relationship Model:** An Example Database Application, Entity Types, Entity Sets, Attributes and Keys, Relationship types, Relationship Sets, Roles and Structural Constraints, Weak Entity Types, Sample ER Diagrams.	08
MODULE 2 **Relational Model and Relational Algebra:** Relational Model Concepts, Unary Relational Operations: SELECT and PROJECT, Relational Algebra Operations from Set Theory, Binary Relational Operations: JOIN and DIVISION, Examples of Queries in Relational Algebra. **Mapping Conceptual Design into Logical Design:** Relational Database design using ER to Relational Mapping.	08
MODULE 3 **SQL:** SQL Data Definition and Data Types, Specifying basic constraints in SQL, Retrieval queries in SQL, Insert, Delete, Update statements in SQL. **SQL Advanced Queries:** More complex SQL Queries, Triggers in SQL, Views in SQL. **Database Application Development:** PL/SQL, syntax, examples, create & drop procedure; If and Loops in Procedure; Introduction to Cursor, Cursor within *for* loops, Table within cursors.	08
MODULE 4 **Database Design:** Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms Based on Primary Keys, Second, Third and Boyce Codd Normal Forms. **NoSQL Databases:** What is it ? When to use NOSQL, RDBMS Vs NOSQL: From RDBMS Tables to Collections, Document-Based NOSQL Systems and MongoDB: Querying in NOSQL, CRUD operations, Indexing & Aggregating in MongoDB.	08

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MODULE 5 **Transactions Management:** Introduction to Transaction Processing, Transaction states, Desirable properties of Transactions, Characterizing Schedules based on recoverability, Characterizing Schedules based on Serializability. **Concurrency Control and Recovery System:** Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, ARIES Recovery Algorithm.	**08**

Laboratory Component

Part –A **SQL Programming (Max. Exam Marks: 70)** Design, develop, and implement the specified queries for the following problems using Oracle, MySQL, MS SQL Server, or any other DBMS under Linux/ Windows environment. Construct Schema and inset at least 5 records for each table. Add appropriate database constraints.	
1	Consider the schema for CAR-ACCIDENT Database: PERSON (driver_id, name, address) CAR (reg_num, model, year) ACCIDENT (report_num, accident_date, location) OWNS (driver_id, reg_num) PARTICIPATED (driver_id, reg_num, report_num, damage_amount) Write SQL queries to a. Display the entire CAR relation in the ascending order of manufacturing year. b. Find the number of accidents in which cars belonging to a specific model (example 'Nissan') were involved. c. Find the total number of people who owned cars that involved in accidents in the year 2022. d. Delete the Tuple Whose Damage Amount is below the Average Damage Amount e. Create a list of each person's name and the car models they own, but only for those cars involved in accidents that occurred in the same location as the person's address.
2	Consider the schema for Company Database: EMPLOYEE (SSN, FName, LName, Address, Gender, Salary, DNo) DEPARTMENT (DNo, DName, MgrSSN, MgrStartDate) DLOCATION (DNo,DLoc) PROJECT (PNo, PName, PLocation, DNo) WORKS_ON (SSN, PNo, Hours) Write SQL queries to a. Convert employee name into uppercase whenever an employee record is inserted or updated. *Trigger* to fire before the insert or update. b. Make a list of all project numbers for projects that involve an employee whose last name is 'Scott', either as a worker or as a manager of the department that controls the project. c. Show the resulting salaries if every employee working on the 'IoT' project is given a 10 percent raise.

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		d. Find the sum of the salaries of all employees of the 'Accounts' department, as well as the maximum salary, the minimum salary, and the average salary in this department.

3		The commercial bank wants keep track of the customer's account information. Each customer may have any number of accounts and account can be shared by any number of customers. The system will keep track of the date of last transaction.
		
		We store the following details.
		
		a) Account: unique account-number, type and balance
		
		b) Customer: unique customer-id, name and several addresses composed of street, city and state
		
		Perform the following operations on the database:
		
		    a. Create necessary tables and insert few tuples to all the relations.
		    b. Add 5% interest to the customer who have less than 10000 balance.
		    c. List joint accounts involving more than three customers.
		    d. Find all the customers who have at least two accounts in the Bank.
		    e. Find the customer who has not done any transaction.

4		A college consists of number of employees working in different departments. In this context, create two tables' employee and department.
		
		Employee consists of columns Empno, Empname, Basic, HRA, DA, Deductions, Gross, Net, Date-of-birth. The calculation of HRA, DA are as per the rules of the college. Initially only Empno, Empname, Basic have valid values. Other values are to be computed and updated later. Department contains Deptno, Deptname, and Department Location columns. Deptno is the primary key in department table and referential integrity constraint exists between employee and department tables.
		
		Perform the following operations on the database:
		
		    a. Create the tables employee and department with proper constraints.
		    b. Add constraint that basic should not be less than 5000.
		    c. Calculate HRA, DA, gross and net by using PL/SQL program.

Table for question 4c:

BASIC	DA	HRA
15000	12%	8%
12000	10%	6%
9000	7%	4%
OTHERS	5%	200/-

    d.   Write PL/SQL program that whenever salary is updated and its value becomes less than 5000 a trigger has to be raised preventing the operation.

| 5 | | Perform the following DB operations using MongoDB (NOSQL Database).

    a.   Create a collection by name Customers with the following attributes. Customer_id, Account_Balance, Account_Type
    b.   Insert at least 5 values into the table
    c.   Write a query to display those records whose total account balance is greater than 10000 for account type 'Savings' for each Customer_id.
    d.   Determine Minimum and Maximum account balance for each Customer_id.
    e.   Export the created collection into local file system.
    f.   Drop the table.
    g.   Import a given csv dataset from local file system into mongodb collection. |

	PART B **Mini project (Max. Exam Marks:30)** • Use JavaScript, React JS, Java, C#, Python , PHP, or any other similar Front End tool to connect database (such as MySQL, MongoDB, or any similar databases). All applications must be demonstrated on desktop/laptop as a standalone or web based application. (Mobile Apps are not permitted) • For any Problem selected, Draw the ER Diagram, Apply the mapping rules, normalize the relations. • Make sure the application has five or more tables, with all the concepts covered in the syllabus.

Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Construct ER models to represent simple database applications
CO2	Develop Relational Algebraic expressions for complex Relational Algebra operations
CO3	Develop SQL/PL/SQL programs for queries using Relational Model Concepts
CO4	Design relational database model for an application by normalizing the database schema and understanding the transition from SQL to NOSQL databases
CO5	Demonstrate the use of concurrency control and transactions in database

Text Books:

1. Fundamentals of Database Systems, Elmasri and Navathe, 7th Edition, Pearson Education, 2016.
2. Learning Oracle SQL and PL/SQL: A Simplified Guide, PHI Publication, ISBN: 9788120345423, 2012.

Reference Books:

1. Database Management Systems, Raghurama Krishnan, Johannes Gehrke, 3rd Edition, Tata McGraw Hill, New Delhi, India.
2. Database System Concepts, Silberschatz, Korth and Sudharshan, 6th Edition, Mc-GrawHill, 2010.
3. An Introduction to Database Systems, C.J. Date, A. Kannan, S. Swamynatham, 8th Edition, Pearson Education, 2006.
4. Professional NoSQL, Shashank Tiwari, John Wiley and Sons, 2011

E-Books / Web References

1. https://amirsmvt.github.io/Database/Static_files/Fundamental_of_Database_Systems.pdf
2. https://www.edureka.co/blog/procedures-in-sql/
3. https://www.mongodb.com/resources/basics/databases/nosql-explained
4. https://www.mongodb.com/resources/basics/databases/nosql-explained/nosql-vs-sql

MOOCs

1. https://archive.nptel.ac.in/courses/106/105/106105175
2. https://www.udemy.com/course/introduction-to-database-management-systems-dbms/

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	3	-	-	-	2	-	-	2	-	3
CO2	3	3	3	-	3	-	-	-	2	-	-	2	-	3
CO3	3	3	3	-	3	-	-	-	2	-	-	2	-	3
CO4	3	3	3	-	3	-	-	-	2	-	-	2	-	3
CO5	3	3	3	-	3	-	-	-	2	-	-	2	-	3
Average	3	3	3	-	3	-	-	-	2	-	-	2	-	3

Low-1: Medium-2: High-3

COMPUTER NETWORKS

Course Code:	22CSE53	CIE Marks	50
Hours/Week (L: T: P)	3:2:0	SEE Marks	50
Total Hours	40	Examination Hours	3
No. of Credits	4		

Course Learning Objectives:
The course will enable students to:

CLO1	Demonstration of application layer protocols
CLO2	Discuss transport layer services and understand UDP and TCP protocols
CLO3	Explain routers, IP and Routing Algorithms in network layer
CLO4	Understand the different Network Security Concepts
CLO5	Discuss Wireless networks and Mobile Networks concepts

CONTENTS	# of Hours
MODULE 1 **Application Layer:** Principles of Network Applications: Network Application Architectures, Transport Services Available to Applications, Transport Services Provided by the Internet, Application-Layer Protocols. The Web and HTTP: Overview of HTTP, Non-persistent and Persistent Connections, HTTP Message Format, User-Server Interaction: Cookies, Web Caching, The Conditional GET, File Transfer: FTP Commands & Replies, Electronic Mail in the Internet: SMTP, Comparison with HTTP, Mail Message Format, Mail Access Protocols, DNS; The Internet's Directory Service: Services Provided by DNS, Overview of How DNS Works, DNS Records and Messages	08
MODULE 2 **Transport Layer:** Introduction and Transport-Layer Services: Overview of the Transport Layer in the Internet: Connectionless Transport: UDP, UDP Segment Structure, UDP Checksum, Principles of Reliable Data Transfer: Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go-Back-N, Selective repeat, Connection-Oriented Transport TCP: The TCP Connection, TCP Segment Structure, Reliable Data Transfer, Flow Control, TCP Connection Management, Principles of Congestion Control: The Causes and the Costs of Congestion, Approaches to Congestion Control, TCP Congestion Control: Fairness.	09
MODULE 3 **The Network layer:** What's Inside a Router?: Input Processing, Switching, Output Processing. The Internet Protocol: datagram format, IPv4 addressing, ICMP, IPv6, Routing Algorithms: The Link-State (LS) Routing Algorithm, The Distance-Vector (DV)Routing Algorithm.	07
MODULE 4 **Network Security:** Overview of Network Security: Elements of Network Security, Classification of Network Attacks, Security Methods, Symmetric-Key Cryptography: Data Encryption Standard (DES), Advanced Encryption Standard (AES), Public-Key Cryptography: RSA Algorithm, Diffie-Hellman Key-Exchange Protocol, Authentication:	08

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Hash Function, Secure Hash Algorithm (SHA), Digital Signatures, Firewalls and Packet Filtering, Packet Filtering, Proxy Server.	
MODULE 5 **Wireless and Mobile Networks:** Cellular Internet Access: An Overview of Cellular Network Architecture, 3G Cellular Data Networks: Extending the Internet to Cellular subscribers, On to 4G: LTE, Mobility management: Principles, Addressing, Routing to a mobile node, Mobile IP, Managing mobility in cellular Networks, Routing calls to a Mobile user, Handoffs in GSM.	**08**

Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Understand principles of application layer protocols
CO2	Explain transport layer UDP and TCP protocols services
CO3	Summarize Internet Protocol and network layer routing algorithms
CO4	Understand different network security algorithms
CO5	Discuss the wireless and mobile network covering IEEE 802.11 standard

Text Books:

1. James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth edition, Pearson, 2017.
2. Computer-Networks- Andrew S. Tanenbaum and David J. Wetherall, Pearson Education, 5th Edition.

Reference Books:

1. Behrouz A Forouzan, Data and Communications and Networking, Fifth Edition, McGraw Hill, Indian Edition
2. Larry L Peterson and Brusce S Davie, Computer Networks, fifth edition, ELSEVIER
3. Andrew S Tanenbaum, Computer Networks, fifth edition, Pearson
4. Mayank Dave, Computer Networks, Second edition, Cengage Learning

E-Books / Web References:

1. https://eclass.teicrete.gr/modules/document/file.php/TP326/%CE%98%CE%B5%CF%89%CF%81%CE%AF%CE%B1%20(Lectures)/Computer_Networking_A_Top-Down_Approach.pdf
2. http://eti2506.elimu.net/Introduction/Books/Data%20Communications%20and%20Networking%20By%20Behrouz%20A.Forouzan.pdf

MOOCs:

1. https://www.my-mooc.com/en/mooc/computer-networking--ud436/
2. https://www.udacity.com/course/computer-networking--ud436
3. https://onlinecourses.swayam2.ac.in/cec19_cs07/preview

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	-	1	1	-	-	1	1	-	3	1	-
CO2	1	-	-	-	2	1	-	-	1	1	-	3	1	-
CO3	1	2	1	1	2	1	-	-	1	1	-	3	1	1
CO4	1	-	-	-	-	1	-	-	1	1	-	3	1	-
CO5	1	-	-	-	-	1	-	-	1	1	-	3	1	-
Average	1	2	1	1	2	1	-	-	1	1	-	3	1	1

Low-1: Medium-2: High-3

FULL STACK FRAMEWORK (BACK END)

Course Code:	22CSE54	CIE Marks	50
Hours/Week (L: T: P)	0:0:2	SEE Marks	50
Total Hours	25	Examination Hours	3
No. of Credits	1		

Course Learning Objectives:

The course will enable students to:

CLO1	Demonstrate the ability to install and configure Node.js and Visual Studio Code, and understand the basic concepts and benefits of using Node.js in modern web development
CLO2	Design and implement an Express server that can serve static assets, HTML, and JSON, and understand the principles of routing and middleware in Express applications.
CLO3	Set up a MongoDB database, create Mongoose models, and develop RESTful API endpoints for creating, reading, updating, and deleting resources, with appropriate data validation and sanitization.
CLO4	Apply best practices for securely storing passwords, use JSON Web Tokens (JWT) for authentication, and protect API endpoints with middleware to ensure data security and user privacy
CLO5	Apply techniques for sorting, filtering, and paginating data to manage large datasets effectively and ensure efficient data retrieval in web applications.

Laboratory Component
List of Programs

1. Create a Node.js application using Express to demonstrate basic server functionality, including serving HTML, JSON, and static assets.

Instructions:

1. **Setup and Initialization**:
   o Install Node.js on your machine. Verify the installation by checking the versions of Node.js and npm (node -v and npm -v).
   o Create a new directory for your project and initialize it with npm init -y to generate a package.json file.
   o Install Express using npm.
2. **Create Your First Node.js Script**:
   o Create a file named hello.js that prints "Hello, Node.js!" to the console.
   o Run the script using node hello.js.
3. **Set Up an Express Server**:
   o Create a file named app.js that sets up an Express server listening on port 3000.
   o Implement a route that responds with "Hello, Express!" when accessing the root URL (/).
4. **Serving HTML and JSON**:
   o **HTML**:
     ▪ Create a public directory.

- Inside the public directory, create an index.html file with a basic HTML structure and a welcome message.
  - o **JSON:**
    - Add a route to your Express server that handles GET requests to /api/data and responds with a JSON object containing a sample message.
5. **Serving Static Assets:**
   - o Inside the public directory, create the following subdirectories:
     - css for your CSS file.
     - js for your JavaScript file.
     - images for an image file.
   - o Create the following files:
     - A CSS file in the css directory.
     - A JavaScript file in the js directory.
     - An image file in the images directory (you may use any placeholder image or create a simple one).
   - o Configure your Express server to serve static files from the public directory.

2. Create a Node.js application using Express and Mongoose to build a REST API that performs basic CRUD operations with data validation and sanitization.

Instructions:
1. **Setup Mongoose:**
   - o Initialize a new Node.js project and install express, mongoose, and body-parser.
   - o Create a file named app.js and set up an Express server that connects to a MongoDB database using Mongoose. Ensure your MongoDB instance is running locally.
2. **Create a Mongoose Model:**
   - o Define a Mongoose model named Item with fields such as name, category, and price. Implement validation for these fields:
     - name should be a non-empty string.
     - category should be a valid string from a predefined set of categories.
     - price should be a positive number.
3. **Data Validation and Sanitization:**
   - o Implement data validation and sanitization for the Item model. For example:
     - Ensure price is a positive number.
     - Sanitize input to prevent any malicious data from being stored.
4. **Structuring the REST API:**
   - o **Resource Creation Endpoints:**
     - Create a POST endpoint (/api/items) to create a new item. This endpoint should validate and save the item data to the database.
   - o **Resource Reading Endpoints:**
     - Create a GET endpoint (/api/items) to retrieve all items.
     - Create a GET endpoint (/api/items/:id) to retrieve a specific item by its ObjectID.
   - o **Resource Updating Endpoints:**

- Create a PUT endpoint (/api/items/:id) to update an existing item. This should allow updating fields like name, category, and price.
  - o **Resource Deleting Endpoints**:
    - Create a DELETE endpoint (/api/items/:id) to delete a specific item by its ObjectID.
5. **Testing with Postman**:
   - o Install Postman and use it to test all your API endpoints. Ensure that you can create, read, update, and delete items using the endpoints you've created.

3. Create a Node.js application with Express that demonstrates secure API authentication and user management with the following features:
   1. **Basic Setup**:
      - o **Server Configuration**:
        - Set up an Express server that listens on port 3000.
      - o **Mongoose Setup**:
        - Install and configure Mongoose to connect to a MongoDB database.
   2. **Securely Storing Passwords**:
      - o **Password Hashing**:
        - Implement password hashing using a library like bcrypt to securely store user passwords in your MongoDB database.
      - o **User Model**:
        - Define a Mongoose model for users with fields such as username, email, and password. Ensure that passwords are hashed before saving to the database.

   3. **User Authentication**:
      - o **User Registration**:
        - Create an endpoint (/api/register) that allows users to register by providing a username, email, and password. Hash the password before saving it to the database.
      - o **User Login**:
        - Create an endpoint (/api/login) that allows users to log in by providing their username and password. Generate a JSON Web Token (JWT) upon successful authentication.
   4. **JWT Authentication**:
      - o **Generating and Accepting Tokens**:
        - Use a library like jsonwebtoken to generate JWTs upon login.
        - Implement middleware to authenticate requests using JWTs. This middleware should validate the token and attach user information to the request object.
      - o **Token Management**:
        - Create an endpoint (/api/logout) that invalidates the JWT or allows for token revocation (e.g., by maintaining a blacklist of tokens).
   5. **Securing Endpoints**:
      - o **Private Data**:
        - Create endpoints that require authentication to access. For example, an endpoint (/api/profile) that returns user details only if the request is authenticated with a valid JWT.
        - Implement middleware to hide sensitive user data in responses.

4. Create a Node.js application with Express and Mongoose that demonstrates sorting, pagination, and filtering of data with the following features:

1. **Basic Setup**:
   - **Server Configuration**:
     - Set up an Express server that listens on port 3000.
   - **Mongoose Setup**:
     - Install and configure Mongoose to connect to a MongoDB database.
     - Define a Mongoose model named Item with fields such as name, category, price, and createdAt.

2. **Handling Timestamps**:
   - Ensure that each Item document has a createdAt field that stores the timestamp when the document is created. Use Mongoose's timestamps option in the schema definition to automatically manage this.

3. **Filtering Data**:
   - Create an endpoint (/api/items) that handles GET requests with query parameters to filter the data. For example:
     - **Category Filter**: ?category=electronics
     - **Price Range Filter**: ?minPrice=10&maxPrice=100
   - Implement logic to apply these filters to the query and return the matching items.

4. **Paginating Data**:
   - Extend the /api/items endpoint to support pagination using query parameters:
     - **Page Number**: ?page=2
     - **Items Per Page**: ?limit=10
   - Implement pagination logic to return a subset of items based on the page number and limit.

5. **Sorting Data**:
   - Enhance the /api/items endpoint to support sorting by different fields. For example:
     - **Sort by Price (Ascending)**: ?sort=price
     - **Sort by Created Date (Descending)**: ?sort=-createdAt
   - Implement sorting logic to sort the filtered and paginated data based on the provided sort parameter.

6. **Combining Filters, Pagination, and Sorting**:
   - Ensure that your endpoint can handle combinations of filtering, pagination, and sorting. For example, a request like /api/items?category=books&minPrice=5&maxPrice=50&page=1&limit=10&sort=-createdAt should filter items by category and price range, paginate the results, and sort them by creation date in descending order.

Course Outcomes:
Upon successful completion of this course, student will be able to

CO1	Install Node.js and Visual Studio Code, understand the role of Node.js in web development, and write and execute basic Node.js scripts
CO2	Set up an Express server, serve static files, and handle HTTP requests for different content types, including HTML, JSON, CSS, JS, and images
CO3	Install MongoDB, setting up Mongoose, and performing CRUD operations using a RESTful API with proper data validation and sanitization

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CO4	Securely handle user authentication, including password management, JWT generation and validation, and implementing middleware for protecting API routes.
CO5	Implement effective data management strategies, including sorting, filtering, and paginating data to enhance application performance and user experience.

Text Books:
1. The Complete Node.js Developer Course (3rd Edition) by Andrew Mead, Rob Percival, Released March 2019, Publisher(s): Packt Publishing, ISBN: 9781789955071

Reference Books:
1. Beginning Node.js by Basarat Ali Syed, Apress
2. Node.JS Web Development by David Herron, Packt Publishing
3. Node.js Design Patterns by Mario Casciaro, Packt Publishing

E-Books / Web References:
1. https://www.anuragkapur.com/assets/blog/programming/node/PDF-Guide-Node-Andrew-Mead-v3.pdf

MOOCs:
https://www.udemy.com/course/the-complete-nodejs-developer-course-2/?couponCode=ST10MT8624

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	3	-	-	-	1	-	-	2	-	3
CO2	3	3	3	-	3	-	-	-	1	-	-	2	-	3
CO3	3	3	3	-	3	-	-	-	1	-	-	2	-	3
CO4	3	3	3	-	3	-	-	-	1	-	-	2	-	3
CO5	3	3	3	-	3	-	-	-	1	-	-	2	-	3
Average	3	3	3	-	3	-	-	-	1	-	-	2	-	3

Low-1: Medium-2: High-3

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COMPUTER GRAPHICS

Course Code:	22CSE55A	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Total Hours	40	Examination Hours	3
No. of Credits	3		

Course Learning Objectives:
The course will enable students to:

CLO1	Overview of Computer Graphics along with its applications.
CLO2	Exploring 2D graphics mathematics along with OpenGL API's
CLO3	Exploring 3D graphics mathematics along with OpenGL API's
CLO4	To understand and analyze various interactive input methods and GUIs
CLO5	To design different types of animations

CONTENTS	# of Hours
MODULE 1	
Computer Graphics hardware and software and OpenGL: Computer Graphics: Video DisplayDevices, Raster-Scan Systems Basics of computer graphics, Application of Computer Graphics. OpenGL: Introduction to OpenGL, coordinate reference frames, specifying two-dimensional world coordinate reference frames in OpenGL, OpenGL point functions, OpenGL line functions, point attributes, line attributes, curve attributes, OpenGL point attribute functions, OpenGL line attribute functions.	08
MODULE 2	
Line drawing algorithms (DDA, Brenham's).2D graphics with OpenGL: 2D Geometric Transformations: Basic 2D Geometric Transformations, matrix representations and homogeneous coordinates, 2D Composite transformations, other 2D transformations, raster methods for geometric transformations, OpenGL raster transformations, OpenGL geometric transformations function.	08
MODULE 3	
3D Geometric Transformations: Translation, rotation, scaling, composite 3D transformations, other 3D transformations, OpenGL geometric transformations functions.	08
MODULE 4	
Interactive Input Methods and Graphical User Interfaces: Graphical Input Data, Logical Classification of Input Devices, Input Functions for Graphical Data, Interactive Picture-Construction Techniques, Virtual-Reality Environments, OpenGL Interactive Input-Device Functions, OpenGL Menu Functions, Designing a Graphical User Interface.	08
MODULE 5	
Computer Animation: Design of Animation Sequences, Traditional Animation Techniques, General Computer-Animation Functions, Computer-Animation Languages, Character Animation, Periodic Motions, OpenGL Animation Procedures.	08

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Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Design geometric objects using Computer Graphics principles and OpenGL APIs
CO2	Use OpenGL APIs and related mathematics for 2D geometric Operations on the objects
CO3	Use OpenGL APIs and related mathematics for 3D geometric Operations on the objects
CO4	Understand and analyze various interactive input methods and GUIs
CO5	Design different types of animations

Text Books:

1. Donald D Hearn, M Pauline Baker and WarrenCarithers: Computer Graphics with OpenGL, 4th Edition, Pearson, 2014

Reference Books:

1. Edward Angel: Interactive Computer Graphics- A Top Down approach with OpenGL, 5th Edition, Pearson Education, 2008.
2. James D Foley, Andries Van Dam, Steven K Feiner, John F Huges Computer graphics with OpenGL: Pearson Education.

E-Books / Web References:

https://medium.com/analytics-vidhya/introduction-to-computer-vision-opencv-in-python-fb722e805e8b

MOOCs:

1. https://nptel.ac.in/courses/106/106/106106090/
2. https://nptel.ac.in/courses/106/102/106102063/
3. https://nptel.ac.in/courses/106/103/106103224/
4. https://nptel.ac.in/courses/106/102/106102065/
5. https://www.tutorialspoint.com/opencv/ (Tutorial, Types of Images, Drawing Functions)

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	-	-	2	-	-	-	-	-	2	-	2
CO2	2	2	2	-	-	2	-	-	-	-	-	2	-	2
CO3	3	3	3	-	-	2	-	-	-	-	-	2	-	2
CO4	3	3	3	-	-	2	-	-	-	-	-	2	-	2
CO5	3	3	3	-	-	2	-	-	-	-	-	2	-	2
Average	3	3	3	-	-	2	-	-	-	-	-	2	-	2

Low-1: Medium-2: High-3

ROBOTIC PROCESS AUTOMATION

Course Code:	22CSE55B	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Total Hours	40	Examination Hours	3
No. of Credits	3		

Course Learning Objectives:
The course will enable students to:

CLO1	To understand basic concepts of RPA
CLO2	To Describe IIPA, where it can be applied and how it implemented
CLO3	To Describe the different types of variables, Control Flow and data manipulation techniques
CLO4	To Understand Image, Text and data Tables Automation
CLO5	To Describe various types of Exceptions and strategies to handle

CONTENTS	# of Hours
MODULE 1 **RPA Foundations:** What is RPA - Flavors of RPA- history of RPA- The Benefits of RPA- The downsides of RPA- RPA Compared to BPO, BPM and BPA - Consumer Willingness for Automation- The Workforce of the Future- RPA Skills-On-Premise Vs. the Cloud- Web Technology- Programming Languages and Low Code- 0CR-Databases-APls- Al-Cognitive Automation-Agile, Scrum, Kanban and Waterfall0 Devops-Flowcharts.	08
MODULE 2 **RPA Platforms**: Components of RPA- RPA Platforms-About Ui Path- About UiPath - The future of automation - Record and Play - Downloading and installing UiPath Studio -Learning Ui Path Studio- - Task recorder - Step-by step examples using the recorder.	08
MODULE 3 **Sequence, Flowchart, and Control Flow**: Sequencing the workflow- Activities-Control flow, various types of loops, and decision making-Step-by step example using Sequence and Flowchart-Step-by-step example using Sequence and Control flow-Data Manipulation-Variables and Scope Collections-Arguments - Purpose and use-Data table usage with examples Clipboard management-File operation with step-by-step example-CSV/Excel to data table and vice versa (with a step-by-step example).	08
MODULE 4 **Taking Control of the Controls:** Finding and attaching windows- Finding the control-Techniques for waiting for a control- Act on controls - mouse and keyboard activities-Working with UiExplorer- Handling events- Revisit recorder- Screen Scraping- When to use OCR- Types of 0CR available- How to use 0CR- Avoiding typical failure points.	08
MODULE 5 **Exception handling, Debugging, and Logging**: Exception handling- Common exceptions and ways to handle them- Logging and taking screenshots Debugging techniques- Collecting crash dumps- Error reporting- Future of RPA.	08

Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	To Understand the basic concepts of RPA
CO2	To Describe various components and platforms of RPA
CO3	To Describe the different types of variables, control flow and data manipulation techniques
CO4	To Understand various control techniques and OCR in RPA
CO5	To Describe various types and strategies to handle exceptions

Text Books:

1. Tom I'aulli, The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems,2020,lSBN-13 (electronic):978-7-4842-5729-6, Publisher : A press
2. Alok Mani Tripathi, Learning Robotic Process Automation, Publisher: Packt Publishing Release Date: March 2018 ISBN: 9787788470940

Reference Books:

1. Frank Casale, Rebecca Dilla, Iieidi Jaynes,Lauren Livingston,"Introduction to Robotic Process Automation: a Primer", Institute of Robotic Process Automation.
2. Richard Murdoch, I{obotic Process Automation: Guide'Io Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant
3. Srikanth Merianda, Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	2	-	-	-	-	-	2	-	2
CO2	2	2	-	-	-	2	-	-	-	-	-	2	-	2
CO3	3	3	-	-	-	2	-	-	-	-	-	2	-	2
CO4	3	3	-	-	-	2	-	-	-	-	-	2	-	2
CO5	3	3	-	-	-	2	-	-	-	-	-	2	-	2
Average	3	3	-	-	-	2	-	-	-	-	-	2	-	2

Low-1: Medium-2: High-3

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THEORY OF COMPUTATION

Course Code	22CSE55C	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Total Hours	40	Examination Hours	3 Hours
No. of Credits	3		

Course Objectives:
The course will enable students to:

CLO1	Introduce core concepts in Automata and Theory of Computation.
CLO2	Identify different Formal Language Classes and their Relationships.
CLO3	Learn concepts of Grammars and Recognizers for different formal languages.
CLO4	Prove or disprove theorems in automata theory using their properties.
CLO5	Determine the decidability and intractability of Computational problems

CONTENTS	# of Hours
MODULE 1 **Finite Automata:** Introduction, Basic Mathematical Notation and techniques, Finite State systems, Basic Definition, Regular Grammars, Finite Automaton, DFA & NDFA, Finite Automaton with ε-moves, Equivalence of NFA and DFA, Equivalence of NDFA's with and without ε-moves, Minimization of DFA.	12
MODULE 2 **Regular Expressions:** Writing Regular Expressions, Regular Languages, Properties of Regular Languages, Pumping Lemma for Regular Languages, Equivalence of Finite Automaton and Regular Expressions.	08
MODULE 3 **Grammars:** Introduction, Types of Grammar, Context Free Grammars and Languages, Derivations and Languages, Ambiguity, Relationship between derivation and derivation trees, Simplification of CFG, Elimination of Useless Symbols, Unit productions, Null productions, Chomsky Normal Form.	10
MODULE 4 **Pushdown Automata:** Definition, Moves, Instantaneous Descriptions, Deterministic Pushdown Automata, Equivalence of Pushdown Automata and CFL, Pumping Lemma for CFL, problems based on Pumping Lemma.	05
MODULE 5 **Turing Machine:** Introduction, Formal definition of Turing Machine, Instantaneous Descriptions, Turing Machine as Acceptors, Turing Machine as Transducers, Computable Languages and functions, Turing Machine constructions, Modifications of Turing Machines, Variants of Turing Machines.	05

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Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Derive the proofs for the closure properties of Regular Languages and Context free Languages using Induction Method
CO2	Construct the abstract machines including Finite Automata, Pushdown Automata from their associated languages and grammar
CO3	Write Grammars for Regular and Context Free Languages
CO4	Write Context Free Grammar in their normalized forms
CO5	Explain the usage of Turing Machines in computability solution

Text Books:

1. John E Hopcroft, Rajeev Motwani, Jeffrey D Ullman, Introduction to Automata Theory, Languages and Computation, 3rd Edition, Pearson Education, 2013.

Reference Books:

1. Elaine Rich, Automata, Computability and Complexity, Pearson Education, 1st Edition, 2013.
2. An Introduction to Formal Languages and Automata, Peter Linz, Jones & Bartlett Learning, 2001.

E-Books/Web References:

1. https://www.javatpoint.com/theory-of-automata
2. https://www.tutorialspoint.com/automata_theory/pushdown_automata_introduction.htm
3. https://www.jflap.org/

MOOCs:

1. https://www.udemy.com/course/formal-languages-and-automata-theory
2. https://www.classcentral.com/course/edx-automata-theory-376

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO2	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO3	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO4	3	2	2	-	-	-	-	-	-	-	-	1	2	-
CO5	3	2	2	-	-	-	-	-	-	-	-	1	2	-
Average	3	2	2	-	-	-	-	-	-	-	-	1	2	-

Low-1: Medium-2: High-3

DISTRIBUTED SYSTEMS

Course Code:	22CSE55D	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Total Hours	40	Examination Hours	3
No. of Credits	3		

Course Learning Objectives:

The course will enable students to:

CLO1	Understand the goals and challenges of distributed systems
CLO2	Describe the architecture of RPC/RMI, distributed file systems and name services
CLO3	Learn clock synchronization algorithms to monitor and order the events, mutual exclusion, election and consensus algorithms.
CLO4	Study the fundamental concepts and algorithms related to distributed transactions and replication

CONTENTS	# of Hours
MODULE 1	
Characterization Of Distributed Systems: Introduction, Focus on resource sharing, Challenges. **Remote Invocation:** Introduction, Request-reply protocols, Remote procedure call, Introduction to Remote Method Invocation.	10
MODULE 2	
Distributed File Systems: Introduction, File service architecture. **Name Services:** Introduction, Name services and the Domain Name System, Directory services.	08
MODULE 3	
Time And Global States: Introduction, Clocks, events and process states, Synchronizing Physical clocks, Logical time and logical clocks, Global states	08
MODULE 4	
Coordination And Agreement: Introduction, Distributed mutual exclusion, Elections, Coordination and agreement in group communication, Consensus and related problems.	08
MODULE 5	
Distributed Transactions: Introduction, Flat and nested distributed transactions, Atomic commit protocols, Concurrency control in distributed transactions, Distributed deadlocks, Transaction recovery. **Replication:** Introduction.	06

Course Outcomes: Upon successful completion of this course, student will be able to

CO1	Identify the goals and challenges of distributed systems and remote invocation techniques for communication.
CO2	Describe the architecture of distributed file systems and name services
CO3	Apply clock synchronization algorithms to monitor and order the events.
CO4	Analyze the performance of mutual exclusion, election and consensus algorithms.
CO5	Illustrate the fundamental concepts and algorithms related to distributed transactions and replication

Text Books:

1. George Coulouris, Jean Dollimore and Tim Kindberg, "Distributed Systems Concepts and Design", Fifth Edition, Pearson Education, 2012.

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	3	-	-	3	-	-	-	-	3	-
CO2	3	3	-	-	3	-	.	3	-	-	-	-	3	-
CO3	3	3	2	-	3	-	-	3	-	-	-	-	3	-
CO4	3	3	2	-	3	-	-	3	-	-	-	-	3	-
CO5	3	3	2	-	3	-	-	3	-	-	-	-	3	-
Average	3	3	2	-	3	-	-	3	-	-	-	-	3	-

Low-1: Medium-2: High-3

RESEARCH METHODOLOGY AND IPR

Course Code:	22RMIK57	CIE Marks	50
Hours/Week (L: T: P)	2:2:0	SEE Marks	50
Total Hours	40	Examination Hours	3
No. of Credits	3		

Course Learning Objectives:

The course will enable students to:

CLO1	To make the student understand the foundations of Research and problem solution
CLO2	Knowledge in Research design, Qualitative and Quantitative Research
CLO3	Knowledge to formulate and derive equations.
CLO4	To understand the different types of IPR

CONTENTS	# of Hours
MODULE 1	
RESEARCH METHODOLOGY: Introduction, Meaning of Research, Objectives of Research, Types of Research, Research Approaches, Significance of Research, Research and Scientific Method, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India. **DEFINING THE RESEARCH PROBLEM:** Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration	08
MODULE 2	
REVIEWING THE LITERATURE: Place of the literature review in research, bringing clarity and focus to research problem, improving research methodology, broadening knowledge base in research area, enabling contextual findings, Review of the literature, searching the existing literature, reviewing the selected literature, developing a theoretical framework, developing a conceptual framework, writing about the literature reviewed. **RESEARCH DESIGN**: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs	08
MODULE 3	
DESIGN OF SAMPLE SURVEYS: Design of Sampling: Introduction, Sample Design, Sampling and Non-Sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs. **MEASUREMENT AND SCALING:** Qualitative and Quantitative Data, **DATA COLLECTION:** Introduction, Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method.	08
MODULE 4	
TESTING OF HYPOTHESES: Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value	08

MINI PROJECT

Course Code	22CSEP56	CIE Marks	100
Hours/Week (L: T: P)	0:0:4	SEE Marks	-
No. of Credits	2	Examination Hours	03

Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 2 students.

CIE procedure for Mini-Project:

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

(ii) **Interdisciplinary**: Continuous Internal Evaluation shall be group wise at the college level with the participation of all the guides of the college. The CIE marks awarded for the Mini Project, shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

CIE Evaluation		
Components	**Explanation**	
Review 1	Presentation Skills: 25 + Q & A: 25 = 50	50
Review 2	Presentation Skills: 25 + Q & A: 25 = 50	50
Average of Review 1 and Review 2		50
Mini Project Report		50
TOTAL MARKS		100

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and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis. **INTERPRETATION AND REPORT WRITING:** Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.	
MODULE 5 **INTELLECTUAL PROPERTY**: Principles of IPR, Kinds of IPR, Patent- Concepts, Novelty, Utility Inventiveness/Non-obviousness, Procedure for granting and obtaining patents; Copyright- conditions for grant of copyright, Copyright in Literary, Dramatic and Musical ,Works, Sound Recording, Cinematograph Films, Copyright in Computer Programme, Author Special Rights, Right of Broadcasting and performers, Trademark Law and Practices - Procedure of registration of trademark; Emerging Issues and Challenges; Few Future Aspects of Intellectual Property Rights;	08

Course Outcomes: Upon successful completion of this course, student will be able to

CO1	Understand the research problem by literature review to solve problems
CO2	Develop skills in qualitative and quantitative data analysis and presentation.
CO3	Develop advanced critical thinking skills.
CO4	Understand to write the report writing and awareness about IPR

Textbooks:
1. Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition
2. Business Research Methods – Alan Bryman & Emma Bell, Oxford University Press.
3. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. 418p.
4. Lionel Bently., Brad Sherman-Intellectual Property Law, 3rd Edition

Reference books:
1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
2. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications. 2 volumes.
3. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.
4. Wadehra, B.L. 2000. Law relating to patents, trademarks, copyright designs and geographical indications. Universal Law Publishing.

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Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	3	-	-	3	-	-	-	-	3	-
CO2	3	3	-	-	3	-	-	3	-	-	-	-	3	-
CO3	3	3	2	-	3	-	-	3	-	-	-	-	3	-
CO4	3	3	2	-	3	-	-	3	-	-	-	-	3	-
CO5	3	3	2	-	3	-	-	3	-	-	-	-	3	-
Average	3	3	2	-	3	-	-	3	-	-	-	-	3	-

Low-1: Medium-2: High-3

Course: Environmental Studies

Course Code	22CIVK58	CIE Marks	50
Hours/Week (L: T: P)	2:0:0	SEE Marks	50
No. of Credits	2	Examination Hours	3

Prerequisites:

Course Objectives: Students will be taught:

CLO1	To understand ecosystem functions and 17 SDG's for sustainable development
CLO2	To understand advanced energy systems and natural resource management.
CLO3	To understand global environmental issues, related policies and solutions.
CLO4	To understand key environmental legislation related to water, air, waste and environmental protection.
CLO5	To understand e-waste management.

Content	No. of Hours/ RBT levels
Module 1 – Ecosystem and Sustainability Ecosystem: Structure of Ecosystem, Types: Forest, Desert, Wetlands, Riverine, Oceanic ecosystems. Sustainability: 17SDG targets and possible actions. Self-Study **Component (SSC): Components of the environment.**	6 Hours L2
Module 2 - Natural Resource Management Natural Resources: Water resources – Availability & Quality aspects, Energy: Different types of energy, Conventional sources & non-conventional sources of Energy, Solar energy, OTEC Wind Energy, Hydrogen as an alternative energy Self-Study Component (SSC): Alternative Energy sources Disaster Management, Sustainable Mining - case studies and Carbon Trading **Self-Study Component (SSC): Alternative Energy sources.**	6 Hours L2
Module 3 – Environmental Pollution & Waste Management Environmental Pollution: Environmental Pollution (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts, Case-studies): Water Pollution, Water borne diseases & water induced diseases, Noise pollution, Soil Pollution, Air pollution (Sources, Impacts, Preventive measures and Public Health Aspects. Waste Management: Bio-medical Wastes; Solid waste; Hazardous wastes; Industrial and Municipal Sludge Solid Waste Management , types and sources, functional elements of SWM, Biomedical Waste Management - Sources,	6 Hours L2

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Characteristics **Self-Study Component (SSC): Case studies of air pollution episodes.**		
Module 4 - Global Environmental Issues and Environmental Legislation Global Environmental Concerns (Concept, policies and case-studies): Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology **Environmental Legislation** Environmental Legislation: Water Act 1974, Air Act 1981, Environmental Protection Act 1984, Solid Waste Management Rules-2016, E- Waste management Rule - 2022, Biomedical Waste management- 2016 **Self-Study Component (SSC): Case studies on waste management options**	**6 Hours L2**	
Module 5 - E - Waste Management E - Waste Management: Introduction of E- waste; composition and generation. Global context in e- waste; E-waste pollutants, E waste hazardous properties, Effects of pollutant (E- waste) on human health and surrounding environment, domestic e-waste disposal, Basic principles of E waste management, Component of E waste management. E-waste (Management and Handling) Rules, 2011; and E-Waste (Management) Rules, 2022 - Salient Features and its implications. **Self-Study Component (SSC): E-Waste (Management) Amendment Rules, 2023, 2024**	**6 Hours L2**	

COURSE OUTCOMES:
Upon completion of this course, student will be able to:

22CIVK58.1	**Analyze** ecosystem dynamics to formulate strategies for addressing sustainability challenges and implementing the SDGs.
22CIVK58.2	**Evaluate** energy technologies to design effective resource management strategies.
22CIVK58.3	**Evaluate** the impacts of pollution to develop effective waste management strategies.
22CIVK58.4	**Evaluate** global environmental issues to design solutions for sustainable management.
22CIVK58.5	**Interpret** environmental laws and regulations for sustainable management practices.
22CIVK58.6	**Understand** e-waste management in a global scenario.

Suggested Learning Resources:
Textbooks
   1. S M Prakash , "Environmental Studies" 3rd Edition, Elite Publishing House, Mangalore,

2018.
2. Hester R.E., and Harrison R.M, Electronic Waste Management. Science, 2009.

Reference Books:
1. EarchBarucha, "Environmental Studies for UG students", 2004.
2. Benny Joseph (2005), "Environmental Studies", Tata McGraw – Hill Publishing Company Limited.
3. R. Rajagopalan, "Environmental Studies- From Crisis to Cure", 2nd Edition, Oxford university press, New Delhi, 2013.
4. Johri R., E-waste: implications, regulations, and management in India and current global best practices, TERI Press, New Delhi.
5. Raman Sivakumar, "Principles of Environmental Science and Engineering", 2nd edition, Cengage learning Singapur, 2005.
6. G. Tyler Miller Jr., "Environmental Science – working with the Earth", Eleventh Edition, Thomson Brooks /Cole, 2006
7. Dr. Pratiba Singh, Dr.Anoop Singh and Dr. PiyushMalaviya, "Text Book of Environmental and Ecology", Acme Learning Pvt. Ltd. New Delhi.

Web Reference:

➤ https://www.hzu.edu.in/bed/E%20V%20S.pdf

➤ https://onlinecourses.nptel.ac.in/noc23_hs155/preview

➤ https://onlinecourses.swayam2.ac.in/cec19_bt03/preview

➤ https://sdgs.un.org/goals

➤ https://kspcb.karnataka.gov.in/waste-management/biomedical-waste E Waste (Management) Rules, 2022.

➤ https://kspcb.karnataka.gov.in/sites/default/files/inlinefiles/E%20Waste%20%28Management%29%20Rules%2C%202022.pdf

Scheme of Examination:

Semester End Examination (SEE):
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of three sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 40 marks each. Average of three test marks will be added to test component. CIE is executed by way of two quizzes/Alternate Assessment Tools(AAT's), some

possible AAT's: Seminar/ assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses

	Component	Marks	Total Marks
CIE	CIE Test-1	40	**50**
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
SEE	**Semester End Examination**	**100**	**50**
	Grand Total		**100**

Understand e-waste management in a global scenario.

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
22CIVK58.1	2					1	1	1				2			3
22CIVK58.2	2	2	2			1	3	1				1			3
22CIVK58.3		2	2	2		1	3	1							2
22CIVK58.4		2	2	2		1	3	1				1			2
22CIVK58.5	1	2	2	2		1	2	1						1	2
22CIVK58.6	2	2	1			2	2	1				1			2
Average	1.75	2	1.8	2		1.16	2.3	1				1.25		1	2.33

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SYLLABUS

VI SEMESTER

CLOUD COMPUTING

Subject Code	22CSE61	CIE Marks	50
Hours/Week (L: T: P)	2:2:2	SEE Marks	50
Total Hours	40 hours theory + 8-10 lab slots	Examination Hours	03
No. of Credits: 4			

Course Learning Objectives:
The course will enable students to:

CLO1	Illustrate the core concepts of the cloud computing paradigm and reference models
CLO2	Discuss system virtualization and outline its role in enabling the cloud computing system model
CLO3	Understand the Cloud management and Cloud Security
CLO4	Analyze the different applications of Cloud Computing

CONTENTS	# of Hours
MODULE 1	
Introduction: Defining Cloud Computing, Cloud Types, Examining the Characteristics of Cloud Computing Historical Developments, Building Cloud Computing Environments Computing Platform and Technologies. Principles of Parallel and Distributed Computing: Eras of Computing, Parallel vs Distributed Computing, Elements of Parallel Computing, Elements of Distributed Computing, Technologies for Distributed Computing.	08
MODULE 2	
Virtualization: Introduction, Characteristics of Virtualized Environments, Taxonomy of Virtualization Techniques, Pros and Cons of Virtualization, Technology Examples: VMware: Full Virtualization **Microservices, Dockers and Containers:** An introduction to Microservices, Modular Architecture, Advantages and Disadvantages of Microservices. Dockers Containers, Dockers architecture and Components, The Power of Docker: A Simple Example.	08
MODULE 3	
Cloud Computing Architecture: Introduction, Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges.	08
MODULE 4	
Managing the Cloud: Administrating the Clouds, Cloud Management Products, Emerging Cloud Management Standards Understanding Cloud Security: Securing the Cloud, Securing Data, Establishing Identity and Presence.	08
MODULE 5	
Case Study on Open Source & Commercial Clouds: Working with AWS cloud platform- EC2, S3, Understanding Amazon Database Services, Microsoft Azure, Azure Core Concepts, Microsoft Azure using Amazon Web Services, CRM and ERP.	08

Laboratory Component

1. Install Virtualbox/VMware Workstation with different flavours of Linux or windows OS on top of windows 10 or 11
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs.
3. install Google App Engine. Create hello world app and other simple web applications using python/java.
4. Use GAE launcher to launch the web applications.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not presentin CloudSim.
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
8. Install Hadoop single node cluster and run simple applications like wordcount.

Course Outcomes:
Upon successful completion of this course, students will be able to

CO1	Explain the concepts and terminologies of cloud computing
CO2	Understand the concepts of Virtualization
CO3	Identify and analyze the reference models for Cloud Computing
CO4	Examine the Cloud Environment & Cloud Security
CO5	Interpret the use of AWS, Azure and Google cloud platform to develop applications

Text Books:
1. Rajkumar Buyya, Christian Vecchiola, S Thamarai Selvi, "Mastering Cloud Computing", Tata McGraw Hill Education Private Limited, 2013.
2. Parminder Singh Kocher, "Microservices and Containers", Addison Wesley, 2018
3. Barrie Sosinsky, "Cloud Computing Bible", Wiley Publishing, Inc, 2011.

Reference Books:
1. Dinkar Sitaram, Geetha Manjunath, "Moving to the Cloud", Elsevier Publications, 2011.
2. Dr. Kumar Saurabh, "Cloud Computing", Wiley India, 2011.

MOOCs:
1. NPTEL Course - Cloud Computing, By Prof. Soumya Kanti Ghosh, IIT Kharagpur
   https://onlinecourses.nptel.ac.in/noc23_cs89/preview

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	2	-	-	-	-	-	-	2	2	-
CO2	3	2	1	1	2	-	-	-	-	-	-	2	2	-
CO3	3	2	1	1	2	-	-	-	-	-	-	2	2	-
CO4	3	2	1	1	2	-	-	-	-	-	-	2	2	-
CO5	3	2	1	1	2	-	-	-	-	-	-	2	2	-
Average	3	2	1	1	2	-	-	-	-	-	-	2	2	-

Low-1: Medium-2: High-3

MACHINE LEARNING

Subject Code	22CSE62	CIE Marks	50
Hours/Week (L: T: P)	3:2:0	SEE Marks	50
Total Hours	40	Examination Hours	3
No. of Credits: 4			

Course Learning Objectives:
The course will enable students to

CLO1	Define AI, machine learning and application of machine learning in real world
CLO2	Differentiate between supervised and unsupervised learning and their usage
CLO3	Apply neural networks, Bayesian classifier and k nearest neighbor for solving problems in machine learning
CLO4	Perform statistical analysis of machine learning techniques

CONTENTS	# of Hours
MODULE 1 **Introduction**: What is artificial intelligence? A brief introduction to machine learning, Intersection of AI, ML and DL, Supervised vs Unsupervised Learning, Examples of Machine learning Applications. **Dimensionality Reduction**: Subset Selection, Principal Components Analysis, Linear Discriminant Analysis, Isomap, Applications.	08
MODULE 2 **Regression**: Linear Models for Regression, Linear Basis Function Models, The Bias-Variance Decomposition. **Classification**: Linear Models for Classification, Discriminant Functions-Two classes, Multiple classes, Least squares for classification. Logistic Regression, Decision tree representation, Basic decision tree learning algorithm, Issues in decision tree learning, Random Forest, Bagging and Boosting.	08
MODULE 3 **Sparse Kernel Machines**: Maximum Margin Classifiers, Overlapping class distributions, Multiclass SVMs, SVMs for regression **K-nearest neighbour**: Introduction, advantage, and applications. **Artificial Neural Networks**: Introduction, Neural Network representation, Appropriate problems, Perceptron, Back propagation algorithm, Derivation of backpropagation algorithm, Convergence to local minima.	08
MODULE 4 **Bayesian Learning**: Mathematical foundation, Conditional probability, Bayes theorem, ML for predicting probabilities, Naive Bayes classifier. **Clustering**: Introduction, Mixture Densities, k-Means Clustering, Expectation-Maximization Algorithm, Hierarchical Clustering, Choosing the Number of Clusters.	08
MODULE 5 **Evaluating Hypothesis**: Estimating hypothesis accuracy, Basics of sampling theorem, General approach for deriving confidence intervals, Difference in error of two hypotheses, **Reinforcement Learning**: Introduction, Elements of Reinforcement Learning, Model-Based Learning, Temporal Difference Learning, Generalization.	08

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Course Outcomes:
Upon successful completion of this course, student will be able to

CO1	Understand the fundamental of machine learning algorithm
CO2	Illustrate Regression Techniques and classification Algorithm
CO3	Apply SVM, ANN and KNN algorithm to solve appropriate problems
CO4	Apply Bayesian Techniques and derive effective learning rules
CO5	Illustrate performance of ML algorithms using evaluation techniques and understand reinforcement learning

Text Books:
1. Tom M. Mitchell, "Machine Learning", McGraw Hill Education, India Edition 2013.
2. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Paperback, 2016.
3. Khan, Shahzad, "Introduction to Machine Learning" (Adaptive Computation and Machine Learning Series), The MIT Press, 2004, Natural Language Engineering 14, No. 1, 2008.

Reference Books:
1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Springer series in statistics, 2nd Edition.
2. Dipanjan Sarkar, Raghav Bali, Tushar Sharma, "Practical Machine Learning with Python-A Problem-Solver's Guide to Building Real-World Intelligent Systems", APress, 2018.
3. Kevin P. Murphy, Francis Bach, "Machine Learning: A Probabilistic Perspective (Adaptive Computation and Machine Learning) 1st Edition, Massachusets Institute of Technology, 2012.
4. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, "Introduction to Data Mining", Pearson, First Impression, 2014.

E-Books/Web References:
1. https://www.cs.huji.ac.il/~shais/UnderstandingMachineLearning/understanding-machine-learning-theory-algorithms.pdf
2. https://medium.com/@prithvilee22/ai-ml-case-study-55d34e308c92
3. https://d3.harvard.edu/platform-digit/submission/robo-banking-artificial-intelligence-at-jpmorgan-chase/
4. https://towardsdatascience.com/a-machine-learning-approach-building-a-hotel-recommendation-engine-6812bfd53f50
5. https://www.udemy.com/topic/artificial-intelligence

MOOCs:
1. https://onlinecourses.nptel.ac.in/noc20_cs29/preview
2. https://www.simplilearn.com/pgp-ai-machine-learning-certification-training-course
3. https://www.udemy.com/course/machinelearning/
4. https://www.coursera.org/learn/machine-learning

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	3	-	-	-	-	-	-	2	-	2
CO2	3	3	2	-	3	-	-	-	-	1	-	2	-	2
CO3	3	3	2	-	3	-	-	-	-	1	-	2	-	3
CO4	3	3	2	-	3	-	-	-	-	1	-	2	-	3
CO5	3	3	2	-	3	-	-	-	-	1	-	2	-	3
Average	3	3	2	-	3	-	-	-	-	1	-	2	-	3

Low-1: Medium-2: High-3

BLOCKCHAIN TECHNOLOGY

Subject Code	22CSE63A	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Total Hours	40	Examination Hours	3
No. of Credits: 3			

Course Learning Objectives:

The course will enable students to

CLO1	Understand the basic terminologies of cryptography and Hash functions.
CLO2	Understand how Block chain systems such as Bitcoin and Ethereum work.
CLO3	Explain the role of Consensus mechanisms & Smart contracts in Block Chain.
CLO4	Understand various applications of Block chain.

CONTENTS	# of Hours
MODULE 1 **Basics of Block Chain**: Defining Block Chain, Generic elements of a Block chain, How Block chain works, Features of Block chain, Types of Block chain, CAP theorem and Block chain. Distributed Ledger Technologies, Forks in Block Chain. **Decentralization:** Decentralization using Block Chain, Requirements of a DecentralizedApplications (DApps), DApp examples, Platforms for Decentralization.	08
MODULE 2 **Cryptography and Technical Foundations:** Cryptographic services & primitives, Symmetric cryptography: Stream and Block Ciphers, Elliptic Curve Cryptography. **Hash Functions:** Basics, Message Authentication Code & its properties, Design of SHA-256, SHA-3(Keccak) algorithms, Merkle & Petricia trees, Distributed Hash Tables, Digital Signatures: RSA Digital Signature Algorithm, Elliptic Curve Digital Signature Algorithm.	08
MODULE 3 **Bitcoin:** Bitcoin, Digital keys and addresses, Private and Public keys in Bitcoin, Addresses in Bitcoin, Transactions, Block Chain: Structure of Block, Bitcoin Network, Bitcoin Wallets, Bitcoin Installation & Programming, Bitcoin limitations. **Consensus Algorithms:** Mining: Tasks of Miners, Mining Algorithm, Nakamoto Consensus, Proof of Work, Proof of Stake, Proof of Burn.	08
MODULE 4 **Ethreum:** Introduction, EVM, Working of Ethereum, Components of Ethreum Ecosystem, Ether cryptocurrency, EVM, Smart Contracts: Basics, Recardian Contracts **Development tools and Frameworks:** Remix, MetaMask, Ganache, Solidity language.	08
MODULE 5 **Alternative Blockchains:** Kadena, Ripple, Stellar, Quorum **Blockchain-Outside of Currencies:** Internet of Things, Government, Health, Financial Crime Prevention.	08

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Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Explain the terminologies and types of Block Chain.
CO2	Describe various cryptographic algorithms and Hash concepts in Block Chain.
CO3	Explain the Bitcoin features and the importance of Consensus in Block chain.
CO4	Explain Ethereum Block Chain using Smart Contracts, various tools and frameworks learnt.
CO5	Discuss about alternative block chains available and various applications of Block Chain outside the currencies..

Text Books:

1. Mastering Blockchain - Distributed ledgers, decentralization and smart contracts explained, Author-Imran Bashir, Packt Publishing Ltd, Second Edition, 2018.

Reference Books:

1. Blockchain Technology Concepts and Applications, Kumar Saurabh,Ashuthosh Saxena,Wiley emerging technology series,2020.
2. Bitcoin and Cryptocurrency Technologies, Author- Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, Princeton University, 2016 Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
3. DR. Gavin Wood, ``ETHEREUM: A Secure Decentralized Transaction Ledger, "Yellow paper.2014.
4. Arshdeep Bahga, Vijay Madisetti, "Blockchain Applications: A Hands-On Approach", VPT, 2017

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	1	-	1	-	-	1	-	-	-	1	1	-
CO2	2	2	3	-	1	-	-	1	-	-	-	1	1	-
CO3	-	-	3	2	3	-	-	1	-	-	-	1	1	-
CO4	2	2	3	2	3	-	-	1	-	-	-	1	1	-
CO5	-	-	2	2	1	-	-	1	-	-	-	1	1	-
Average	2	2	3	2	1	-	-	1	-	-	-	1	1	-

Low-1: Medium-2: High-3

COMPILER DESIGN

Subject Code	22CSE63B	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Total Hours	40	Examination Hours	3
No. of Credits: 3			

Course Learning Objectives:
The course will enable students to

CLO1	Study the features and design aspects of assemblers, Macro, loaders and linkers.
CLO2	Learn the design principles of a Compiler.
CLO3	Learn the various parsing techniques and different levels of translation.
CLO4	Learn how to optimize and effectively generate machine codes.

CONTENTS	# of Hours
MODULE 1	
Introduction: Introduction to System Software, Machine Architecture of SIC and SIC/XE **Assemblers**: Basic assembler functions, machine dependent assembler features, machine independent assembler features, assembler design options.	08
MODULE 2	
Introduction: Language Processors, The structure of a compiler. **Lexical Analysis**: The role of lexical analyzer, Input buffering, Specifications of token, recognition of tokens.	06
MODULE 3	
Syntax Analysis: Introduction, Context Free Grammars, Writing a grammar, Top Down Parsers, Bottom-Up Parsers.	10
MODULE 4	
Lex and YACC: The Simplest Lex Program, Grammars, Parser-Lexer Communication, A YACC Parser, The Rules Section, Running LEX and YACC, A Word Counting Program, Using YACC – Grammars, A YACC Parser - The Definition Section, The Rules Section, The LEXER, Compiling and Running a Simple Parser.	06
MODULE 5	
SDT: Syntax Directed Translation, Intermediate code generation, Code generation.	10

Course Outcomes:
Upon successful completion of this course, student will be able to

CO1	Discuss the features of assemblers and loaders.
CO2	Describe the functionality of Lexical Analysis using Lex Tool.
CO3	Explain Top –Down, Bottom- Up Parsers using YACC tool.
CO4	Utilize Lex and YACC tools for implementing different concepts of system software
CO5	Describe the importance of Syntax Directed Translation, Intermediate code generation, Code generation.

Text Books:

1. Leland. L. Beck, D Manjula, "System Software", 3rd Edition, 2012.
2. Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, "Compilers-Principles, Techniques and Tools", Pearson, 2nd Edition, 2007
3. Doug Brown, John Levine, Tony Mason, "Lex & YACC", O'Reilly Media, October 2012.

Reference Books:

1. Srimanta Pal, "Systems programming", Oxford university press, 2016
2. K C Louden, "System programming and Compiler Design", Cengage Learning
3. K Muneeswaran, "Compiler Design", Oxford University Press 2013.

E-Books / Web References:

1. https://www.freebookcentre.net/CompuScience/Free-Compiler-Design-Books-Download.html
2. https://learnengineering.in/pdf-compilers-principles-techniques-tools-by-aho-free-download/

MOOCs:

1. https://online.stanford.edu/courses/soe-ycscs1-compilers
2. https://www.udacity.com/course/compilers-theory-and-practice--ud168

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	1	-	1	3	-
CO2	3	2	-	-	2	-	-	-	-	1	-	1	3	-
CO3	3	3	2	1	2	-	-	-	-	1	-	1	3	-
CO4	3	3	-	-	-	-	-	-	-	1	-	1	3	-
CO5	3	3	1	1	1	-	-	-	-	1	-	1	3	-
Average	3	3	2	1	2	-	-	-	-	1	-	1	3	-

Low-1: Medium-2: High-3

COMPUTER VISION

Subject Code	22CSE63C	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Total Hours	40	Examination Hours	3
No. of Credits: 3			

Course Learning Objectives:

The course will enable students to

CLO1	Review image processing techniques for computer vision
CLO2	Explain shape and region analysis
CLO3	Illustrate Hough Transform and its applications to detect lines, circles, ellipses
CLO4	Contrast three-dimensional image analysis techniques, motion analysis and applications of computer vision algorithms

CONTENTS	# of Hours
MODULE 1	
Cameras: Pinhole Cameras, Radiometry – Measuring Light: Light in Space, Light Surfaces, Important Special Cases, Sources, Shadows, And Shading: Qualitative Radiometry, Sources and Their Effects, Local Shading Models, Application: Photometric Stereo, Interreflections: Global Shading Models, Color: The Physics of Color, Human Color Perception, Representing Color, A Model for Image Color, Surface Color from Image Color.	08
MODULE 2	
Linear Filters: Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Edge Detection: Noise, Estimating Derivatives, Detecting Edges, Texture: Representing Texture, Analysis (and Synthesis) Using Oriented Pyramids, Application: Synthesis by Sampling Local Models, Shape from Texture.	08
MODULE 3	
The Geometry of Multiple Views: Two Views, Stereopsis: Reconstruction, Human Stereposis, Binocular Fusion, Using More Cameras, Segmentation by Clustering: What Is Segmentation?, Human Vision: Grouping and Getstalt, Applications: Shot Boundary Detection and Background Subtraction, Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering	08
MODULE 4	
Segmentation by Fitting a Model: The Hough Transform, Fitting Lines, Fitting Curves, Fitting as a Probabilistic Inference Problem, Robustness, Segmentation and Fitting Using Probabilistic Methods: Missing Data Problems, Fitting, and Segmentation, The EM Algorithm in Practice, Tracking With Linear Dynamic Models: Tracking as an Abstract Inference Problem, Linear Dynamic Models, Kalman Filtering, Data Association, Applications and Examples.	08
MODULE 5	
Geometric Camera Models: Elements of Analytical Euclidean Geometry, Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations, Geometric Camera Calibration: Least-Squares Parameter Estimation, A Linear	08

Approach to Camera Calibration, Taking Radial Distortion into Account, Analytical Photogrammetry, An Application: Mobile Robot Localization, Model- Based Vision: Initial Assumptions, Obtaining Hypotheses by Pose Consistency, Obtaining Hypotheses by pose Clustering, Obtaining Hypotheses Using Invariants, Verification, Application: Registration In Medical Imaging Systems, Curved Surfaces and Alignment	

Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Implement fundamental image processing techniques required for computer vision
CO2	Implement boundary tracking techniques
CO3	Apply chain codes and other region descriptors, Hough Transform for line, circle, and ellipse detections, 3D vision techniques
CO4	Implement motion related techniques.
CO5	Develop applications using computer vision techniques.

Text Books:

1. David A. Forsyth and Jean Ponce: Computer Vision – A Modern Approach, PHI Learning (Indian Edition), 2009.

Reference Books:

1. E. R. Davies: Computer and Machine Vision – Theory, Algorithms and Practicalities, Elsevier (Academic Press), 4th edition, 2013.

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	1	2	-
CO2	3	3	2	-	-	-	-	-	-	-	-	1	2	-
CO3	3	3	2	-	-	-	-	-	-	-	-	1	2	-
CO4	3	3	2	-	-	-	-	-	-	-	-	1	2	-
CO5	3	3	2	-	-	-	-	-	-	-	-	1	2	-
Average	3	3	2	-	-	-	-	-	-	-	-	1	2	-

Low-1: Medium-2: High-3

Sreenaray

ADVANCED JAVA

Subject Code	22CSE63D	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Total Hours	40	Examination Hours	03
No. of Credits: 3			

Course Learning Objectives:

The course will enable students to:

CLO1	Identify the need for advanced Java concepts like Enumerations, Auto boxing/Unboxing and Annotations
CLO2	Understand hierarchy of Interfaces and Classes for managing groups of objects
CLO3	Adapt Servlets and JSP to build Server-Side Programs
CLO4	Learn front end design using Java Swing
CLO5	Discuss the use of JDBC and Spring boot to access database through Java Programs

Content	# of Hours
MODULE 1 **Enumerations, Autoboxing:** Enumerations, Enumeration fundamentals, the values() and valueOf() Methods, Java Enumerations are class types, Enumerations Inherits Enum, example, Type Wrappers, Autoboxing, Autoboxing and Methods, Autoboxing/Unboxing occurs in Expressions, Autoboxing/Unboxing, Boolean and character values, Autoboxing/Unboxing helps prevent errors. **Annotations:** Annotations, Annotation basics, specifying a Retention Policy, Obtaining Annotations at Run Time by use of Reflection, Annotated element Interface, Using Default values, Marker Annotations, Single Member Annotations, The Built-In annotations.	08
MODULE 2 **The Collections Framework:** Collections Overview, The Collection Interfaces, The Collection Interface, The List Interface, The Set Interface, The SortedSet Interface, The NavigableSet Interface, The Queue Interface, The Deque Interface; The Collection Classes, The ArrayList Class, The LinkedList Class, The HashSet Class, The LinkedHashSet Class, The TreeSet Class, The PriorityQueue Class, The ArrayDeque Class, The EnumSet Class, Accessing a Collection via an Iterator, Using an Iterator, The For-Each Alternative to Iterators.	08
MODULE 3 **Introducing Servlets:** Background, The Life Cycle of a Servlet, Using Tomcat, ASimple Servlet, The Servlet API, Reading Servlet Parameter; The Javax.servlet.http Package, The HttpServletRequest Interface, The HttpServletResponse Interface, The HttpSession Interface, The Cookie Interface, The HttpServlet Class, Handling HTTP Requests and Responses, Handling HTTP GET Requests, Handling HTTP POST Requests, Using Cookies, Session Tracking. **Java Server Pages (JSP):** JSP Tags, Variables and Objects, Methods, Control statements, Loops, Tomcat, Request String, User Sessions, Cookies, Session Objects.	08

MODULE 4	
JDBC Objects: 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, Data types, Exceptions.	**08**
MODULE 5	
Introducing Spring Boot: What is Spring Boot, Features, Architecture, Spring Initializr, Generating a Project, Creating a spring Boot Project, connecting Spring Boot with database. **Introducing Swing:** Two key Swing features, Swing components are lightweight, Swing supports a pluggable look and feel, Components and Containers, A simple Swing Application, Jlabel and ImageIcon, JTextField, The Swing Buttons, JComboBox, JTable.	**08**

Course Outcomes:
Upon successful completion of this course, student will be able to

CO1	Use Enumerations, Auto-boxing/Unboxing and Annotations in developing modular and efficient Java programs
CO2	Illustrate the concepts of Collection framework for developing Java applications
CO3	Implement Servlets and JSP in Server-side Java Programming
CO4	Use JDBC API to connect Java Application with Database
CO5	Design simple GUI interfaces using Swing to interact with users

Text Books:
1. Herbert Schildt, "Java the Complete Reference", 11ᵗʰ Edition, McGraw-Hill Education, 2019.
2. Jim Keogh, "J2EE: The Complete Reference", 1ˢᵗ Edition, McGraw Hill Education.

Reference Books:
1. Y Daniel Liang, "Introduction to Java Programming and Data Structures", Comprehensive Version, Addison Wesley; 12ᵗʰ Edition.
2. Stephanie Bodoff, Eric Armstrong, Jennifer Ball, Debbie Bode Carson, Ian Evans, Dale Green, Kim Haase, Eric Jendrock, "The J2EE Tutorial", 2ⁿᵈ Edition, Pearson Education.

E-Books / Web References:
1. http://java.sun.com/docs/books/tutorial/
2. http://www.onlinecomputerbooks.com/free-java-books.php

MOOCs:
1. https://www.udemy.com/course/complete-jdbc-programming-part-1/
2. https://www.coursera.org/learn/java-database-connectivity-introduction

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	3	-	-	-	2	-	-	2	-	2
CO2	3	3	3	-	3	-	-	-	2	-	-	2	-	2
CO3	3	3	3	-	3	-	-	-	2	-	-	2	-	2
CO4	3	3	3	-	3	-	-	-	2	-	-	2	-	2
CO5	3	3	3	-	3	-	-	-	2	-	-	2	-	2
Average	3	3	3	-	3	-	-	-	2	-	-	2	-	2

Low-1: Medium-2: High-3

MACHINE LEARNING LABORATORY

Subject Code	22CSEL66	CIE Marks	50
Hours/Week (L: T: P)	0:0:2	SEE Marks	50
Total Hours	24	Examination Hours	03
No. of Credits: 1			

Course Learning Objectives:

The course will enable students to:

CLO1	Implement supervised and unsupervised learning and their usage
CLO2	Demonstrate classification and regression problems
CLO3	Apply neural networks, Bayesian classifier and k nearest neighbor for solving problems in machine learning
CLO4	Demonstrate required performance matrices

Implement following list of all problem statement using Python Programming.

1	Implement different outlier detection algorithm considering a suitable dataset.
2	Develop a program to demonstrate linear and polynomial regression using appropriate dataset.
3	Develop a program to demonstrate logistic regression using appropriate dataset.
4	Develop a program to demonstrate the working of the decision tree algorithm. Use an appropriate data set for building the decision tree.
5	Develop a program to implement the random forest Classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6	Develop a program to construct Support Vector Machine considering a Sample dataset.
7	Develop a program to implement K-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions.
8	Build an Artificial Neural Network using the Back-propagation algorithm and test the same using appropriate data sets.
9	Develop a program to implement the naïve Bayesian Classifier model. Calculate the accuracy, precision, and recall, ROC curve for your dataset.
10	Implement K Means algorithm and GMM using appropriate datasets

Course Outcomes: Upon successful completion of this course, student will be able to

CO1	Illustrate Regression Techniques and classification for the given dataset.
CO2	Implement neural networks, Bayesian classifier and k nearest neighbor for solving problems in machine learning
CO3	Apply performance matrices to check for the model based on given dataset.

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	2	-	-	2	2	2	-	2	3	-
CO2	3	3	3	-	2	-	-	2	2	2	-	2	3	--
CO3	3	3	3	-	2	-	-	2	2	2	-	2	3	-

Low-1: Medium-2: High-3

OPEN ELECTIVES

VI SEMESTER

Skswamy

INTRODUCTION TO DATA STRUCTURES

Subject Code	22CSE64A	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Total Hours	40	Examination Hours	03
No. of Credits: 3			

Course Learning Objectives:
The course will enable students to:

CLO1	To provide the knowledge of basic data structures and their implementations
CLO2	To develop skills to apply appropriate data structures in problem solving
CLO3	To efficiently implement the different data structures and solutions for specific problems
CLO4	Create and use appropriate data structures in C programs for solving real life problems

CONTENTS	# of Hours
MODULE 1	
Introduction: Introduction to Data Structures, Review of Arrays, Types of Data Structures, Linear & non-linear Data Structures. **Stacks: Stack** definitions & concepts, Representing stacks in C, Operations on stacks, Applications of Stacks: Infix to Postfix, Infix to Prefix, Postfix expression evaluation, **Recursion:** Sample Programs.	08
MODULE 2	
Queues: Representation of queue, operations, circular queues. Application of Queues, Priority Queues. **Dynamic Memory allocation:** malloc(), calloc(),free(), realloc(). **Linked Lists:** Definition and terminology, Singly Linked List (SLL), Various operations on SLL: insertion, deletion and display, Programming Examples Such as Polynomials and others., Header Node.	08
MODULE 3	
Circular Singly Linked List (CSLL): Definition, Various operations, Application. **Doubly Linked List (DLL)** Definition, Various operations Applications: Sparse matrix and others. **Trees:** Definition, Terminology, Binary Trees (BT), Binary Search Trees (BST): Insertion, Deletion and Traversals : Preorder, Post order and In order.	08
MODULE 4	
Expression Trees (ET): Definition and Construction of Expression Tree. **Threaded Binary Tree:** Types and application. **Heap:** Definition, Construction, Applications of Heap: Priority Queue.	08
MODULE 5	
Balanced tree: AVL trees, B tree, B+ tree, Splay. **Graphs:** Introduction, Matrix and List Representation. **Hashing:** Open Hashing, Closed Hashing, Collision and Collision Resolution Strategies.	08

Sleewamy

Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Apply the knowledge of computing to various data structures and its operations
CO2	Analyze a problem and identify suitable data structure to provide solution
CO3	Design solution using modern tools and suitable data structure
CO4	Implement programs with suitable data structure based on the requirements of the application

Text Books:
1. Data Structures using C and C++, Yedidyah Langsam Moshe J. Augenstein and Aaron M. Tenenbaum, 2nd Edition, 2009, PHI/Pearson.
2. Data Structures and Algorithm Analysis in C++, Mark Allen Weiss, 4th Revised Edition, 2013, Addison-Wesley, ISBN-13: 9780132847377

Reference Books:
1. Data Structures Using C, Reema Thareja, 1st Edition, 2011, Oxford Higher Education
2. Fundamentals of Data Structures, Ellis Horowitz, Sartaj Sahni, Illustrated Edition, Computer Science Press.

E-Books / Web References:
1. https://ds1-iiith.vlabs.ac.in/List%20of%20experiments.html
2. https://ds2-iiith.vlabs.ac.in/List%20of%20experiments.html

MOOCs:
https://archive.nptel.ac.in/courses/106/102/106102064/

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	2	-	-	-	-	-	-	2	2	-
CO2	3	3	3	-	2	-	-	-	-	-	-	2	2	-
CO3	3	3	3	-	2	-	-	-	-	-	-	2	2	-
CO4	3	3	3	-	2	-	-	-	-	-	-	2	2	-
Average	3	3	3	-	2	-	-	-	-	-	-	2	2	-

Low-1: Medium-2: High-3

FUNDAMENTALS OF OPERATING SYSTEMS

Subject Code	22CSE64B	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Total Hours	40	Examination Hours	03
No. of Credits: 3			

Course Learning Objectives:
The course will enable students to:

CLO1	Understand the fundamentals of an Operating Systems and its structures, concept of processes and threads
CLO2	Understand the implement efficient Process scheduling mechanisms and software solutions for process synchronization
CLO3	Discuss Deadlock handling mechanism
CLO4	Understand Operations in Memory Management
CLO5	Study the Virtual memory and mass storage Concepts

CONTENTS	# of Hours
MODULE 1 **Introduction to operating System:** What operating system do, Operating System Services, Systems Calls. **Processes:** Process Concepts, Process Scheduling, Inter Process Communication, Thread Overview, Multicore Programming, Multithreading Models.	08
MODULE 2 **Process Scheduling:** CPU Scheduling - Basic concepts, Scheduling Criteria, Scheduling Algorithms. **Process Synchronization:** Background, Critical Section Problem, Peterson's Solution, Mutex Locks, Semaphores. Classic problems of Synchronization.	08
MODULE 3 **Deadlocks:** System Model, Deadlock Characterization, Methods for Handling. Deadlocks, Deadlock Prevention. Deadlock Avoidance: Banker's Algorithm, Deadlock Detection and recovery from Deadlock.	08
MODULE 4 **Memory management:** Background, Contiguous memory allocation, paging, Structure of page table, Swapping.	08
MODULE 5 **Virtual memory management:** Background, Demand Paging, Page Replacement algorithms: FIFO page replacement, Optimal page replacement, LRU page replacement. **Thrashing:** Cause of Thrashing. **Secondary Storage Structures:** HDD Scheduling, Storage Device Management, RAID Structure-Redundancy, Parallelism, RAID levels, Selecting a RAID Level.	08

Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Discuss the basic concepts of operating systems and concept of processes and threads
CO2	Explain the process management, CPU scheduling and synchronization tools
CO3	Explain the deadlock handling methods
CO4	Describe memory management mechanisms
CO5	Illustrate Virtual memory concepts and mass storage structure

Text Books:

Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Principles", 10th Edition, Wiley-India, 2018.

Reference Books:

1. Stallings, William, "Operating systems: Internals and design principles", Prentice Hall Press, 2011.
2. Andrew S Tanenbaum and Herbert Bos, "Modern Operating Systems", 4th Edition, Pearson Education, 2014.
3. Thomas Anderson and Michael Dahlin, "Operating Systems: Principles and Practice", Recursive Books, 2014.
4. P.C.P. Bhatt, "An Introduction to Operating Systems: Concepts and Practice", 4th Edition, PHI, 2014.
5. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne. "Operating System Concepts", Wiley India, 10th Edition, 2018.

E-Books / Web References:

1. http://edclap.com/mod/resource/view.php?id=1445&forceview=1
2. https://www.cs.uic.edu/~jbell/CourseNotes/OperatingSystems/

MOOCs:

1. http://onlinevideolecture.com/?course=computer-science&subject=operating- systems
2. https://nptel.ac.in/courses/106/106/106106144/
3. http://www.nptel.ac.in/courses/106108101/

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	-	3	1	-
CO2	3	3	3	-	-	-	-	-	-	-	-	3	1	-
CO3	3	3	3	-	-	-	-	-	-	-	-	3	1	-
CO4	3	3	3	-	-	-	-	-	-	-	-	3	1	-
CO5	3	3	3	-	-	-	-	-	-	-	-	3	1	-
Average	3	3	3	-	-	-	-	-	-	-	-	3	1	-

Low-1: Medium-2: High-3

Skeswary

MOBILE APPLICATION DEVELOPMENT

Subject Code	22CSE64C	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Total Hours	40	Examination Hours	03
No. of Credits: 3			

Course Learning Objectives:
The course will enable students to

CLO1	Learn to setup Android application development environment
CLO2	Illustrate user interfaces for interacting with apps and triggering actions
CLO3	Interpret tasks used in handling multiple activities
CLO4	Identify options to save persistent application data
CLO5	Appraise the role of security and performance in Android applications

CONTENTS	# of Hours
MODULE 1 Get started, Build your first app, Activities, Testing, debugging and using support libraries	08
MODULE 2 User Interaction, Delightful user experience, Testing your UI	08
MODULE 3 Background Tasks, Triggering, scheduling and optimizing background tasks	08
MODULE 4 All about data, Preferences and Settings, Storing data using SQLite, Sharing data with content providers, Loading data using Loaders	08
MODULE 5 Permissions, Performance and Security, Firebase and AdMob, Publish	08

Course Outcomes:
Upon successful completion of this course, student will be able to

CO1	Create, test and debug Android application by setting up Android development environment
CO2	Implement adaptive, responsive user interfaces that work across a wide range of devices.
CO3	Infer long running tasks and background work in Android applications
CO4	Demonstrate methods in storing, sharing and retrieving data in Android applications
CO5	Analyze performance of android applications and understand the role of permissions and security

Text Books:

1. Google Developer Training, "Android Developer Fundamentals Course – Concept Reference", Google Developer Training Team, 2017. https://www.gitbook.com/book/google-developer-training/android-developerfundamentals-course-concepts/details (Download pdf file from the above link)

Reference Books:

1. Erik Hellman, "Android Programming – Pushing the Limits", 1st Edition, Wiley India Pvt Ltd, 2014.
2. Dawn Griffiths and David Griffiths, "Head First Android Development", 1st Edition, O'Reilly SPD Publishers, 2015.
3. J F DiMarzio, "Beginning Android Programming with Android Studio", 4th Edition, Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126565580
4. Anubhav Pradhan, Anil V Deshpande, "Composing Mobile Apps" using Android, Wiley 2014, ISBN: 978-81-265-4660-2

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	3	-	-	1	-	1	-	1	2	-
CO2	3	3	3	-	3	-	-	1	-	1	-	1	2	-
CO3	3	3	3	-	3	-	-	1	-	1	-	1	2	-
CO4	3	3	3	-	3	-	-	1	-	1	-	1	2	-
CO5	3	3	3	-	3	-	-	1	-	1	-	1	2	-
Average	3	3	3	-	3	-	-	1	-	1	-	1	2	-

Low-1: Medium-2: High-3

INTRODUCTION TO AI

Subject Code	22CSE64D	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Total Hours	40	Examination Hours	03
No. of Credits: 3			

Course Learning Objectives:
The course will enable students to

CLO1	To interpret various concepts like agents, environment in applications to AI.
CLO2	To understand and compare the various search strategies used by the agents.
CLO3	To relate and contrast different learning paradigms and understand the data.
CLO4	To understand the applications of AI in the development of Expert System.

CONTENTS	# of Hours
MODULE 1 **Introduction to AI**: What is AI? History of AI, Agents and Environments, Structure of Agents, Types of Agents: Simple reflex agents, Model-based reflex agent, Goal-based agents, Utility-based agents, Learning agents.	08
MODULE 2 **Search Algorithms**: Search strategies, Best First Search, A*, AO*, Hill Climbing, Generate & Test, AlphaBeta pruning, Min-max search.	08
MODULE 3 **Data preprocessing**: Types of Data: Structured and Unstructured Data, Quantitative and Qualitative Data, Four Levels of data (Nominal, Ordinal, Interval, Ratio Level). Data Transformation: Handling imbalanced data, Handling time series data, Function, Power and Quantile transformers.	08
MODULE 4 **Feature Engineering and Learning Feature Engineering:** Processes, Techniques Forms of Learning: Introduction to Supervised, Unsupervised, Semi Supervised, SelfSupervised, Weakly Supervised and Reinforcement Learning. Use cases.	08
MODULE 5 **Expert Systems**: What an expert system is; how it works and how it is built, basic components of an expert system, Expert System Architectures, Examples of Expert Systems. Rule-based Expert systems: Structure of rule based expert system, Conflict resolution, Uncertainty Management, Advantages & disadvantages of rule-based.Fuzzy based expert System (Mamdani and Sugeno Fuzzy Inference Systems)	08

Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Elucidate the reasons behind AI for being an important field of study, and understand the types of agents, environments, and their relationships.
CO2	Describe the Informed search algorithms that make up the fundamental building blocks of AI.
CO3	Understand the importance of preprocessing, types of data, and data transformation.
CO4	Understand different forms of learning and the importance of the structure of the data used by the agent.
CO5	Explore the application of AI ideas in the development of expert systems.

Text Books:

1. Artificial Intelligence – A Modern Approachl, by Stuart J. Russell and Peter Norvig, 3rd EditionPearson 2015.
2. Artificial Intelligence - E. Rich and Knight, 3rd Edition, McGraw Hill International, 2016.
3. Data preprocessing in Data Mining - Salvador García, JuliánLuengo Francisco Herrera, Springer.

Reference Books:

1. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, CliffordStein, 3rd Edition, PHI.

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	2	-	-	-	-	-	-	2	3	-
CO2	3	3	3	-	2	-	-	-	-	-	-	2	3	-
CO3	3	3	3	-	2	-	-	-	-	-	-	2	3	-
CO4	3	3	3	-	2	-	-	-	-	-	-	2	3	-
CO5	3	3	3	-	2	-	-	-	-	-	-	2	3	-
Average	3	3	3	-	2	-	-	-	-	-	-	2	3	-

Low-1: Medium-2: High-3

Ability / Skill Enhancement Course

VI SEMESTER

ANDROID APP DEVELOPMENT

Subject Code	22CSE67A	CIE Marks	50
Hours/Week (L: T: P)	0:0:2	SEE Marks	50
Total Hours	15	Examination Hours	03
No. of Credits: 2			

Course Learning Objectives:

The course will enable students to

CLO1	Learn to setup Android application development environment
CLO2	Illustrate user interfaces for interacting with apps and triggering actions
CLO3	Interpret tasks used in handling multiple activities
CLO4	Identify options to save persistent application data
CLO5	Appraise the role of security and performance in Android applications

List of Programs

1	Create an application to design a Visiting Card. The Visiting card should have a company logo at the top right corner. The company name should be displayed in Capital letters, aligned to the center. Information like the name of the employee, job title, phone number, address, email, fax and the website address is to be displayed. Insert a horizontal line between the job title and the phone number.
2	Develop an Android application using controls like Button, Text View, Edit Text for designing a calculator having basic functionality like Addition, Subtraction, Multiplication, and Division.
3	Create a SIGN Upton activity with Username and Password. Validation of password should happen
4	Develop an application to set an image as wallpaper. On click of a button, the wallpaper image should start to change randomly every 30 seconds
5	Write a program to create an activity with two buttons START and STOP. On pressing of the START button, the activity must start the counter by displaying the numbers from One and the counter must keep on counting until the STOP button is pressed. Display the counter
6	Create two files of XML and JSON type with values for City Name, Latitude, Longitude, Temperature, and Humidity. Develop an application to create an activity with two buttons to parse the XML and JSON files which when clicked should display the data in their respective layouts side by side.
7	Develop a simple application with one Edit Text so that the user can write some text in it. Create a button called "Convert Text to Speech" that converts the user input text into voice
8	Create an activity like a phone dialer with CALL and SAVE buttons. On pressing the CALL button, it must call the phone number and on pressing the SAVE button it must save the number to the phone contacts.

Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Create, test and debug Android application by setting up Android development environment
CO2	Implement adaptive, responsive user interfaces that work across a wide range of devices.

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CO3	Infer long running tasks and background work in Android applications
CO4	Demonstrate methods in storing, sharing and retrieving data in Android applications
CO5	Analyze performance of android applications and understand the role of permissions and security

Text Books:
1. Google Developer Training, "Android Developer Fundamentals Course – Concept Reference", Google Developer Training Team, 2017. https://www.gitbook.com/book/google-developer-training/android-developerfundamentals-course-concepts/details (Download pdf file from the above link)

Reference Books:
1. Erik Hellman, "Android Programming – Pushing the Limits", 1st Edition, Wiley India Pvt Ltd, 2014.
2. Dawn Griffiths and David Griffiths, "Head First Android Development", 1st Edition, O'Reilly SPD Publishers, 2015.
3. J F DiMarzio, "Beginning Android Programming with Android Studio", 4th Edition, Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126565580
4. Anubhav Pradhan, Anil V Deshpande, "Composing Mobile Apps" using Android, Wiley 2014, ISBN: 978-81-265-4660-2

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	3	-	-	1	-	1	-	1	2	-
CO2	3	3	3	-	3	-	-	1	-	1	-	1	2	-
CO3	3	3	3	-	3	-	-	1	-	1	-	1	2	-
CO4	3	3	3	-	3	-	-	1	-	1	-	1	2	-
CO5	3	3	3	-	3	-	-	1	-	1	-	1	2	-
Average	3	3	3	-	3	-	-	1	-	1	-	1	2	-

Low-1: Medium-2: High-3

MONGODB

Subject Code	22CSE67B	CIE Marks	50
Hours/Week (L: T: P)	0:0:2	SEE Marks	50
Total Hours	15	Examination Hours	03
No. of Credits: 1			

Course Learning Objectives:
The course will enable students to

CLO1	Understand basic MongoDB functions, operators and types of operations in MongoDB.
CLO2	Demonstrate the use of Indexing, Advanced Indexing in MongoDB.
CLO3	Apply the aggregation and Map Reduction in MongoDB.
CLO4	Demonstrate text searching on collections in MongoDB.

List of Programs

1	a. Illustration of Where Clause, AND,OR operations in MongoDB. b. Execute the Commands of MongoDB and operations in MongoDB : Insert, Query, Update, Delete and Projection. (Note: use any collection)
2	a. Develop a MongoDB query to select certain fields and ignore some fields of the documents from any collection. b. Develop a MongoDB query to display the first 5 documents from the results obtained in a. [use of limit and find]
3	a. Execute query selectors (comparison selectors, logical selectors) and list out the results on any collection b. Execute query selectors (Geospatial selectors, Bitwise selectors) and list out the results on any collection
4	Create and demonstrate how projection operators ($, $elematch and $slice) would be used in the MondoDB.
5	Execute Aggregation operations ($avg, $min,$max, $push, $addToSet etc.).
6	Execute Aggregation Pipeline and its operations (pipeline must contain $match, $group, $sort, $project, $skip etc.
7	a. Find all listings with listing_url, name, address, host_picture_url in the listings And Reviews collection that have a host with a picture url b. Using E-commerce collection write a query to display reviews summary.
8	a.Demonstrate creation of different types of indexes on collection (unique, sparse, compound and multikey indexes) b. Demonstrate optimization of queries using indexes
9	a. Develop a query to demonstrate Text search using catalog data collection for a given word b. Develop queries to illustrate excluding documents with certain words and phrases
10	Develop an aggregation pipeline to illustrate Text search on Catalog data collection

Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Make use of MangoDB commands and queries.
CO2	Illustrate the role of aggregate pipelines to extract data.
CO3	Demonstrate optimization of queries by creating indexes.
CO4	Develop aggregate pipelines for text search in collections

Text Books:

1. Kristina Chodorow, Mongodb: The Definitive Guide,, 2nd Ed ,O'REILLY, 2013.
2. KYLE BANKER ,*Mongodb In Action*. 2nd Ed, Manning Publication, 2016
3. Manu Sharma ,Mongodb Complete Guide, 1st Ed, Bpb Publication, 2023.

E-Books/Web References:

1. https://www.manning.com/downloads/529
2. MongoDB Exercise URL: https://www.w3resource.com/mongodb-exercises/

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	-	-	1	-	1	-	1	-	1	2	-
CO2	2	2	2	-	-	1	-	1	-	1	-	1	2	-
CO3	2	2	2	-	-	1	-	1	-	1	-	1	2	-
CO4	2	2	2	-	-	1	-	1	-	1	-	'1	2	-
Average	2	2	2	-	-	1	-	1	-	1	-	1	2	-

Low-1: Medium-2: High-3

SELENIUM TESTING

Subject Code	22CSE67C	CIE Marks	50
Hours/Week (L: T: P)	0:0:2	SEE Marks	50
Total Hours	15	Examination Hours	03
No. of Credits: 1			

Course Learning Objectives:
The course will enable students to

CLO1	Understand the components of Selenium
CLO2	Understand Selenium WebDriver 2.0 and 3.0
CLO3	Learn TestNG Annotations

List of Programs

1	Understand The Automation Testing Approach (Theory Concept), Introducing Selenium Commands
2	Installing the IDE, Running Test Cases
3	Using Selenium IDE, Write a test suite containing minimum 4 test cases
4	Conduct a test suite for two web sites.
5	Create a Selenium script that automates the process of logging into an educational portal, updating personal details, modifying career preferences, and navigating various sections of the portal
6	Write a Selenium script to automate the complete process of searching for flights, selecting a flight, entering passenger details, proceeding with payment, and confirming the booking on a flight reservation platform
7	Develop a Selenium script to automate the key functions of an e-commerce platform, including user sign-up, login, searching for products, adding items to the cart, and completing the purchase process
8	Use Selenium and the Robot class to automate the file upload or download functionality, simulating real-user interactions with file dialogs in a web application
9	Create a Selenium script to automate the filling of a Google Form by identifying input fields, dropdowns, radio buttons, and submitting the form

Course Outcomes:
Upon successful completion of this course, student will be able to

CO1	Understand the need for automation testing
CO2	Demonstrate Selenium IDE installation
CO3	Use Selenium API commands to illustrate Web Driver Applications
CO4	Use TestNG Framework for Automated testing

Text Books:
1. Selenium Testing Tools Cookbook (Second Edition) by Unmesh Gundecha

E-Books / Web References:
1. https://www.udemy.com/course/learn-selenium-with-java-live- project

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	3	-	-	1	-	2	-	1	1	1
CO2	3	3	3	-	3	-	-	1	-	2	-	1	1	1
CO3	3	3	3	-	3	-	-	1	-	2	-	1	1	1
CO4	3	3	3	-	3	-	-	1	-	2	-	1	1	1
Average	3	3	3	-	3	-	-	1	-	2	-	1	1	1

Low-1: Medium-2: High-3

DEVOPS

Subject Code	22CSE67D	CIE Marks	50
Hours/Week (L: T: P)	2:0:2	SEE Marks	50
Total Hours	25	Examination Hours	03
No. of Credits: 2			

Course Learning Objectives:

The course will enable students to

CLO1	Define and discuss the key concepts and principles of DevOps.
CLO2	Describe the Service Delivery process using Cloud
CLO3	Explain the concepts of test automation, infrastructure automation, and build and deployment automation
CLO4	Apply agile principles to a range of decision possibilities
CLO5	Explain the concepts of Docker Containerization

List of Programs

1	Create Amazon AWS EC2 Linux instance with conceptual understanding of SSH client software protocol and keys
2	Create Amazon AWS EC2 Windows server instance with conceptual understanding of RDP (Remote Desktop Protocol).
3	Develop and Deploy an Application with AWS CodeStar
4	Create cloud storage Bucket using Amazon Simple Storage Service (S3). Perform the following operations: A. Create a folder within a S3 Bucket B. Upload content to S3 C. Change permissions to allow public access of contents. D. Set Meta Data on an S3 Bucket E. Delete an S3 Bucket and its contentConduct a test suite for two web sites.
5	Use git hub action to execute simple program
6	Install and configure Docker tool and perform Docker commands for content management
7	Create a Docker image and push Docker image into AWS ECR
8	Create Repositories, Cloning, and Pushing Code Changes using AWS Code Commit.
9	Install and configure Jenkins to build and deploy Java or Web Applications.

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Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Interpret and apply various principles, history of DevOps
CO2	Understand and usage of Cloud on DevOps
CO3	Identify and use GIT tool
CO4	Identify and use various tools using Jenkins
CO5	Understand and implement DevOps principles using Docker

Textbooks:

1. Mikael Krief – Learning DevOps- The complete guide to accelerate collaboration with Jenkins, Kubernetes, Terraform and Azure DevOps, 2019.

2. Stephen Baron, "AWS: The Complete Beginner's Guide", Kindle Edition2020

Reference books:

1. DevOps: Continuous Delivery, Integration, and Deployment with DevOps: Dive -Sricharan Vadapalli, Packt, 2018.
2. DevOps: Puppet, Docker, and Kubernetes -Thomas Uphill, John Arundel, Neependra Khare, Hideto Saito, Hui-Chuan Chloe Lee, Ke-Jou Carol Hsu, Packt, 2017.
3. Agile Project Management: Creating Innovative Products, Second Edition- Jim Highsmith, Addison-Wesley Professional, 2009.
4. Learning Agile: Understanding Scrum, XP, Lean, and Kanban- Andrew Stellman, Jennifer Greene, 2015, O Reilly.
5. More Agile Testing: Learning Journeys for the Whole Team -Janet Gregory, Lisa Crispin, Addison Wesley, 2015.

MOOCs:

1. https://www.coursera.org/specializations/aws-devops
2. https://www.coursera.org/learn/intro-to-devops

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	1	3	2	1	3	-	-	-	3	2	3
CO2	3	3	2	-	3	1	1	2	-	-	-	2	2	3
CO3	3	1	2	1	3	2	-	1	-	-	-	2	2	3
CO4	3	1	3	3	3	2	-	1	-	-	-	3	2	3
CO5	3	2	3	3	3	2	-	1	-	-	-	2	2	3
Average	3	2	3	2	3	2	1	2	-	-	-	2	2	3

Low-1: Medium-2: High-3

INDIAN KNOWLEDGE SYSTEM

Course Code	22IKSK69	CIE Marks	50
Hours/Week (L: T: P)	1:0:0	SEE Marks	50
No. of Credits	0	Examination Hours	01

Course Objectives:

CLO1	To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system
CLO2	To make the students understand the traditional knowledge and analyse it and apply it to their day-to-day life.

Content
Module 1 (05 hours)
Introduction to Indian Knowledge Systems (IKS): Overview, Vedic Corpus, Philosophy, Character scope and importance, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge vs. western knowledge.
Module 2 (05 hours)
Traditional Knowledge in Humanities and Sciences: Lingistics, Number and measurements- Mathematics, Chemistry, Physics, Art, Astronomy, Astrology, Crafts and Trade in India and Engineering and Technology
Module 3 (05 hours)
Traditional Knowledge in Professional domain: Town planning and architecture Construction, Health, wellness and Psychology-Medicine, Agriculture, Governance and public administration, United Nations Sustainable development goals.

Reference Books:
1. Introduction to Indian Knowledge System- concepts and applications, B Mahadevan, Vinayak Rajat Bhat, Nagendra Pavana R N, 2022, PHI Learning Private Ltd, ISBN-978-93- 91818-21-0
2. Traditional Knowledge System in India, Amit Jha, 2009, Atlantic Publishers and Distributors (P) Ltd., ISBN-13: 978-8126912230,
3. Knowledge Traditions and Practices of India, Kapil Kapoor, Avadesh Kumar Singh, Vol. 1, 2005, DK Print World (P) Ltd., ISBN 81-246-0334,

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO 1	Provide an overview of the concept of the Indian Knowledge System and its importance.
CO 2	Appreciate the need and importance of protecting traditional knowledge.
CO 3	Recognize the relevance of Traditional knowledge in different domains.
CO 4	Establish the significance of Indian Knowledge systems in the contemporary world

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	3	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	3	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	3	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	3	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	3	-	-	-	-	-	-	-	-
Average	-	-	-	-	-	3	-	-	-	-	-	-	-	-

Low-1: Medium-2: High-3

UNIVERSAL HUMAN VALUES

Course Code	22UHV69	CIE Marks	50
Hours/Week (L: T: P)	1:0:0	SEE Marks	50
No. of Credits	0	Examination Hours	01

Course Objectives:

CLO1	To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
CLO2	To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
CLO3	To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.
CLO4	To provide a much-needed orientation input in value education to the young enquiring minds.

Content
Module 1 (03 hours)
Introduction to Value Education: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations
Module 2 (03 hours)
Harmony in the Human Being : Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health
Module 3 (03 hours)
Harmony in the Family and Society : Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order
Module 4 (03 hours)
Harmony in the Nature/Existence: Understanding Harmony in the Nature. Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence
Module 5 (03 hours)
Implications of the Holistic Understanding – a Look at Professional Ethics: Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

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Reference Books:

1. The Textbook A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978- 93-87034-47-1
2. The Teacher"s Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G

Course Outcomes:

Upon completion of this course, student would:

CO 1	Become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
CO 2	Have better critical ability
CO 3	Become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
CO 4	Apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	3	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	3	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	3	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	3	-	-	-	-	-	-	-	-
Average	-	-	-	-	-	3	-	-	-	-	-	-	-	-

Low-1: Medium-2: High-3

SYLLABUS

VII SEMESTER

DEEP LEARNING

Subject Code	22CSE71	CIE Marks	50
Hours/Week (L: T: P)	3:0:2	SEE Marks	50
Total Hours	40 hours theory + 8-10 lab slots	Examination Hours	03
No. of Credits: 4			

Course Learning Objectives:

The course will enable students to:

CLO1	Introduce the idea of Artificial Neural Networks and their applications.
CLO2	Study and implement different architectures of Artificial Neural Networks.
CLO3	Study and implement various optimization techniques on Artificial Neural Networks
CLO4	Enable design and deployment of deep learning models for machine learning problems.

CONTENTS	# of Hours
MODULE 1	
Introduction: Artificial Intelligence and Deep Learning-a historical perspective, Artificial neural networks, Shallow neural networks, Deep neural networks, gradient descent, forward and backpropagation, computational graphs, linear and non-linear activation functions.	08
MODULE 2	
Optimization Techniques: Regularization, Dropout, Batch Normalization, Vanishing/Exploding gradients, Mini-batch gradient, Gradient descent with momentum, RMSprop, Adam optimization, Learning rate decay, Local optima, Global optima. Hyperparameter tuning.	08
MODULE 3	
Convolutional Neural Networks: Basic operations: padding, stride, pooling; Classic convolutional models: LeNet-5, AlexNet, VGG, Modern Deep Convolutional models: ResNet, GoogleNet; Inception Network, 1-D convolutions, Object detection and Face Recognition with CNN.	08
MODULE 4	
Recurrent Neural Networks: Sequence modelling, Types of Recurrent Neural Networks, Backpropagation through time, Language modelling and sequence generation, Word Embeddings, vanishing gradients with RNNs, Long-Short Term Memory (LSTM), Gated Recurrent MODULEs (GRU), Bidirectional LSTMs, Sequence-to-Sequence model, Attention Mechanism, Transformer Network.	08
MODULE 5	
Advanced Topics: Deep Reinforcement Learning, Generative Adversarial Networks, Generative vs. Discriminative models, Deep Convolution GANS, Autoencoders, NLP Applications.	08

Laboratory Component
List of exercises for which student should develop programs and execute in theLaboratory

1. Basic image processing operations: Histogram equalization, Thresholding, edge detection, data augmentation, morphological operations
2. Implement SVM/Softmax classifier for CIFAR-10 dataset: (i) using KNN, (ii) using 3 layer neural network
3. Study the effect of batch normalization and dropout in neural network classifier
4. Familiarization of image labelling tools for object detection, segmentation
5. Image segmentation using Mask RCNN, UNet, SegNet
6. Object detection with single-stage and two-stage detectors (Yolo, SSD, FRCNN, etc.)
7. Image Captioning with Vanilla RNNs
8. Image Captioning with LSTMs

Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Understand the functioning of Mathematics and Science in ANN
CO2	Apply the optimization techniques in Parameter tuning of Deep Learning Models
CO3	Apply CNN with its basic building blocks.
CO4	Design and deploy deep learning solutions for real-world applications with popular deep learning tools.

Text Books:

1. Charu C. Aggarwal, "Neural Networks and Deep Learning- A textbook", 2018, Springer.
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning (Adaptive Computation and Machine Learning series", MIT Press.
3. Nikhil Buduma, Nicholas Locascio, "Fundamentals of Deep Learning: Designing Next Generation Machine Intelligence Algorithms", O'Reilly Media.

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	1	3	1	-	-	1	-	-	1	2	-
CO2	3	3	3	1	3	1	-	-	1	-	-	1	2	-
CO3	3	3	3	1	3	1	-	-	1	-	-	1	2	-
CO4	3	3	3	1	3	1	-	-	1	-	-	1	2	-
CO5	3	3	3	1	3	1	-	-	1	-	-	1	2	-
Average	3	3	3	1	3	1	-	-	1	-	-	1	2	-

Low-1: Medium-2: High-3

CRYPTOGRAPHY AND NETWORK SECURITY

Subject Code	22CSE72	CIE Marks	50
Hours/Week (L: T: P)	3:0:2	SEE Marks	50
Total Hours	40	Examination Hours	3
No. of Credits: 04			

Course Learning Objectives:
The course will enable students to:

CLO1	Apply different Classical Encryption Techniques
CLO2	Analyse different Block Ciphers and the Data Encryption Standard
CLO3	Illustrate Public-Key Cryptography algorithms
CLO4	Understand different types of malicious software
CLO5	Understand the concepts of Payload-System and Firewalls

CONTENTS	# of Hours
MODULE 1	
Overview Computer Security Concepts: The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms **Classical Encryption Techniques**: Symmetric Cipher Model, Substitution Techniques, Transposition techniques	08
MODULE 2	
Block Ciphers and the Data Encryption Standard: Traditional block Cipher structure, The data encryption standard, A DES example, The strength of DES, Block cipher design principles	08
MODULE 3	
Public-Key Cryptography and RSA: Principles of public-key cryptosystems, The RSA algorithm, **Other Public-Key Cryptosystems:** Diffie-Hellman key exchange, Elgamal Cryptographic systems	08
MODULE 4	
Malicious Software: Malicious Software: Types of malicious software (malware), Advanced persistent threats, Propagation - Infected Content-Viruses, Propagation-Vulnerability Exploit-Worms, Propagation - Social Engineering, Spam e-mail, Trojans	08
MODULE 5	
Malicious Software: Payload-System corruption, Payload - Attack agent - Zombie, bots, Payload-Information Theft - Key loggers, phishing, spyware, Payload – Steal thing - Backdoors, Rootkits, Countermeasures, Distributed Denial of Service attacks **Firewalls:** The Need for Firewalls, Firewall Characteristics and access policy, Firewall types	08

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Laboratory Component
List of Programs

Programs can be written in C/ Java

1. Implement Caesar Cipher encryption & Decryption technique.
2. Implement data encryption and decryption using Hill Cipher method.
3. Demonstrate the working of Play fair Substitution technique.
4. Demonstrate the working of Vigenere Cipher substitution technique.
5. Write a program to implement Rail fence - Row and column transposition technique.
6. Demonstrate the Data Encryption Standard algorithm using substitution and transposition attributes of cryptography.
7. Execute the program for simple RSA algorithm to encrypt and decrypt the data.
8. Implement Diffie-Hellman Key Exchange algorithm.

Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Implement different Classical Encryption Techniques
CO2	Implement Block Ciphers and the Data Encryption Standard algorithm
CO3	Implement Public-Key Cryptography algorithms
CO4	Explain different types of malicious software
CO5	Explain the concepts of Payload and Firewalls

Text Books:

1. William, Stallings. Cryptography and network security: For VTU. Pearson Education India, 2006.
2. William, Stallings. Network Security Essentials: Applications and Standards (For VTU). Pearson Education India, 2011.

Reference Books:

1. V. K Pachghare: Cryptography and Information Security, PHI 2nd Edition
2. BehrouzA.Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007.

E-Books / Web References:

1. https://www.sanfoundry.com
2. https://www.oreilly.com/library/view/cryptography-and-network/9789332579125/

MOOCs:

1. https://www.coursera.org/learn/cryptography
2. https://onlinecourses.nptel.ac.in/

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	3	1	-	-	-	-	-	2	-	2
CO2	3	3	3	-	3	1	-	-	-	-	-	2	-	2
CO3	3	3	3	-	3	1	-	-	-	-	-	2	-	2
CO4	3	3	1	-	-	1	-	-	-	-	-	2	-	2
CO5	3	3	1	-	-	1	-	-	-	-	-	2	-	2
Average	3	3	2	-	2	1	-	-	-	-	-	2	-	2

Low-1: Medium-2: High-3

INTERNET OF THINGS

Subject Code	22CSE73	CIE Marks	50
Hours/Week (L: T: P)	3:2:0	SEE Marks	50
Total Hours	40	Examination Hours	3
No. of Credits: 04			

Course Learning Objectives:

The course will enable students to:

CLO1	Understand the fundamental basic concepts of IoT
CLO2	Learn the working of Sensors, Transducers, Actuators and their connectivity to the network.
CLO3	Relate different Application protocols for IoT.
CLO4	Familiarize on different Systems on Chips like Arduino, Raspberry Pi and Intel

CONTENTS	# of Hours
MODULE 1 **Introduction to IoT:** Introduction to IoT: What is IoT?, IoT terms and Basic Definitions, Disambiguation of IoT vs IoE vs M2M vs others, Characteristics of IoT ,IoT Ecosystem: What is an IoT Ecosystem? , Enabling Technologies in IoT, Applications of IoT ,IoT Reference model: Level 1 Physical Devices and Controllers, Level 2 Connectivity, Level 3 Edge(Fog) Computing, Level 4 Data Accumulation, Level 5 Data Abstraction, Level 7 Collaboration and Processes, Security in the IoT.	08
MODULE 2 **Transducers, Sensors and Actuators:** Defining Transducers, Sensors and Actuators, Introduction to Transducers, Introduction to sensors, Introduction to Actuators, Interfacing concepts to Embedded systems, Wireless sensor networks and its technologies, Network topologies in wireless sensor networks, Issues and challenges of a wireless sensor network, security in wireless sensor networks, participating wireless sensing technologies, RFID, LoRa.	08
MODULE 3 **IoT Protocols:** Protocol Classification, MQTT, XMPP, DDS, AMQP, COAP, REST, and comparison of the Protocols.	08
MODULE 4 **IoT Physical Devices and Endpoints Arduino UNO:** Introduction to Arduino, Exploring Arduino Uno Learning Board, Installing the Software (Arduino IDE), Fundamentals of Arduino Programming, Introduction to Communications, Example Modules on Arduino-Case studies.	08
MODULE 5 **IoT Physical Devices and Endpoints RaspberryPi:** Introduction to RaspberryPi, Exploring the Raspberry Learning Board, RaspberryPi Operating Systems, Operating system setup on Raspberrypi, RaspberryPi Commands, Programming RaspberryPi with Python, Case studies.	08

Course Outcomes:

Upon successful completion of this course, students will be able to

CO1	Discuss the functional blocks of an IoT system, IoT communication models by enabling different technologies of IoT
CO2	Explain the deployment of Sensors, Transducers, Actuators to connect them to the network
CO3	Discuss the role of IoT protocols for efficient network communication
CO4	Develop programs that run on Arduino UNO board
CO5	Illustrate different sensor technologies for sensing real-world entities and identify the applications of IoT in the Industry using Raspberry Pi

Text Books:
1. Srinivasa K G, Siddesh G. M, Hanumantha Raju R, "Internet of Things", Cengage Leaning India, 017.

Reference Books:
1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1st Edition, Pearson Education (Cisco Press Indian Reprint)
2. Vijay Madisetti and Arshdeep Bahga, "Internet of Things - A Hands on Approach", Orient Blackswan Private Limited, 1st Edition, 2015.
3. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017.

MOOCs:
1. NPTEL Course – Introduction to Internet of Things, By Prof. Sudip Misra, IIT Kharagpur, https://onlinecourses.nptel.ac.in/noc23_cs83/preview

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	1	1	1	1	-	-	1	-	3
CO2	3	-	-	-	1	1	2	1	1	-	-	1	-	3
CO3	3	-	1	-	1	1	2	1	1	-	-	1	-	3
CO4	3	3	3	3	3	3	3	3	3	1	3	1	-	3
CO5	3	3	3	3	3	3	3	3	3	1	3	1	-	3
Average	3	3	3	3	2	2	3	2	2	1	3	1	-	3

Low-1: Medium-2: High-3

DATA WAREHOUSING TECHNIQUES

Subject Code	22CSE74A	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Total Hours	40	Examination Hours	3
No. of Credits: 3			

Course Learning Objectives:
The course will enable students to:

CLO1	Be familiar with mathematical foundations of data mining tools..
CLO2	Understand and implement classical models and algorithms in data warehouses and data mining
CLO3	Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.
CLO4	Master data mining techniques in various applications like social, scientific and environmental context.
CLO5	Develop skill in selecting the appropriate data mining algorithm for solving practical problems.

CONTENTS	# of Hours
MODULE 1 Basic Concepts of Data Warehousing, Introduction, Meaning and characteristics of Data Warehousing, Online Transaction Processing (OLTP), Data Warehousing Models, Data warehouse architecture & Principles of Data Warehousing, Data Mining .	06
MODULE 2 Building a Data Warehouse Project: Structure of the Data warehouse, Data warehousing and Operational Systems, Organizing for building data warehousing, Important considerations – Tighter integration, Empowerment, Willingness Business Considerations: Return on Investment Design Considerations, Technical Consideration, Implementation Consideration, Benefits of Data warehousing Project Management Process, Scope Statement, Work Breakdown Structure and Integration, Initiating a data warehousing project Project Estimation, Analyzing Probability and Risk, Managing Risk: Internal and External, Critical Path Analysis.	10
MODULE 3 Data Mining, What is Data mining (DM)? Definition and description, Relationship and Patterns, KDD vs Data mining, DBMS vs Data mining, Elements and uses of Data Mining, Measuring Data Mining Effectiveness : Accuracy,Speed & Cost Data Information and Knowledge, Data Mining vs. Machine Learning, Data Mining Models. Issues and challenges in DM, DM Applications Areas	08
MODULE 4 Techniques of Data Mining, Various Techniques of Data Mining Nearest Neighbor and Clustering Techniques, Decision Trees, Discovery of Association Rules, Neural Networks, Genetic Algorithm	08

MODULE 5	
OLAP,Need for OLAP, OLAP vs. OLTP Multidimensional Data Model Multidimensional verses Multirelational OLAP Characteristics of OLAP: FASMI Test (Fast, Analysis Share, Multidimensional and Information), Features of OLAP, OLAP Operations Categorization of OLAP Tools: MOLAP, ROLAP,	08

Course Outcomes:

Upon successful completion of this course, students will be able to

CO1	Understand the functionality of the various data mining and data warehousing component
CO2	Understand the strengths and limitations of various data mining and data warehousing models
CO3	Explain the analyzing techniques of various data
CO4	Describe different methodologies used in data mining and data ware housing
CO5	Compare different approaches of data ware housing and data mining with various technologies

Text Books:

1. Data Mining-Concepts and Techniques- Jiawei Han, Micheline Kamber, Morgan Kaufmann Publishers, Elsevier, 2 Edition, 2006.
2. Introduction to Data Mining, Pang-Ning Tan, Vipin Kumar, Michael Steinbanch, Pearson Education.

Reference Books:

1. Data Mining Techniques, Arun K Pujari, 3rd Edition, Universities Press.
2. Data Ware Housing Fundamentals, Pualraj Ponnaiah, Wiley Student Edition.
3. The Data Ware House Life Cycle Toolkit- Ralph Kimball, Wiley Student Edition.
4. Data Mining, Vikaram Pudi, P Radha Krishna, Oxford University.

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	2	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	2
CO3	3	3	2	3	-	-	-	-	-	-	-	-	2	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	2	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	-	-
Average	3	3	2	3	-	-	-	-	-	-	-	-	2	2

Low-1: Medium-2: High-3

Course Outcomes:

Upon successful completion of this course, students will be able to

CO1	Understand natural language processing models
CO2	Apprehend the concepts of word level analysis
CO3	Interpret the concepts of extracting relations from text and mining diagnostic text reports
CO4	Understand evaluating self-explanations in iSTART and contextual signatures
CO5	Apprehend the concepts behind information retrieval models and lexical resources

Text Books:

1. Tanveer Siddiqui, U. S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, Sixth Impression, 2018.
2. Anne Kao, Stephen R Poteet, "Natural Language Processing and Text Mining", Springer-Verlag London Limited 2007.

Reference Books:

1. James Allen, "Natural Language Understanding", 2nd Edition, Pearson Publisher, 1995.
2. Charniack, Eugene, Statistical Language Learning, MIT Press, 1996.
3. Jurafsky, Daniel and Martin, James, "Speech and Language Processing: An introduction to Computational Linguistics and Speech Recognition" Second Impression, Pearson Education, 2009.

E-Books / Web References:

1. https://www.coursera.org/learn/language-processing
2. https://towardsdatascience.com/a-practitioners-guide-to-naturallanguage-processing-part-i-processing-understanding-text-9f4abfd13e72

MOOCs:

1. https://nptel.ac.in/courses/106/105/106105158/
2. https://onlinecourses.nptel.ac.in/noc19_cs56/preview
3. https://nptel.ac.in/courses/106/106/106106211/

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	-	-	-	-	-	-	-	2	-	2
CO2	3	2	2	1	-	-	-	-	-	-	-	2	-	2
CO3	3	2	2	1	-	-	-	-	-	-	-	2	-	2
CO4	3	2	2	1	-	-	-	-	-	-	-	2	-	2
CO5	3	2	2	1	-	-	-	-	-	-	-	2	-	2
Average	3	2	2	1	-	-	-	-	-	-	-	2	-	2

Low-1: Medium-2: High-3

NATURAL LANGUAGE PROCESSING

Subject Code	22CSE74B	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Total Hours	40	Examination Hours	3
No. of Credits: 3			

Course Learning Objectives:
The course will enable students to:

CLO1	To understand natural language processing models
CLO2	To apprehend the concepts of word level analysis
CLO3	To interpret the concepts of extracting relations from text and mining diagnostic text reports
CLO4	To understand evaluating self-explanations in iSTART and contextual signatures
CLO5	To apprehend the concepts behind information retrieval models and lexical resources

CONTENTS	# of Hours
MODULE 1	
Introduction: Natural language processing (NLP), origins of NLP, language and knowledge, challenges of NLP, language and grammar, processing of Indian languages, applications, examples of early NLP systems, information retrieval, language modelling, grammar-based language models, statistical language model	08
MODULE 2	
Word level Analysis: Introduction, regular expressions, finite state automata, morphological parsing, spelling error detection and correction, words and word classes, part of speech tagging, syntactic analysis, context free grammar, constituency, parsing, probabilistic parsing	08
MODULE 3	
Extracting relations from text: Introduction, subsequence kernels for relation extraction, a dependency path kernel for relation extraction, experimental evaluation, mining diagnostic text reports by learning to annotate knowledge roles, frame semantics and semantic role labelling, learning to annotate cases with knowledge roles, Evaluations	08
MODULE 4	
Evaluating Self-Explanations in iSTART: Introduction, iSTART -feedback systems, iSTART-evaluations of feedback systems	
Textual signatures: Introduction, Cohesion, Coh- Metrix, approaches to analysing texts, latent Symantec analysis, predictions	08
Automatic document separation: Introduction, related work, data preparation, document separation as a sequence mapping problem	
MODULE 5	
Information Retrieval: Introduction, design features of information retrieval systems, Information retrieval models, classical, nonclassical, alternative models of information retrieval, Evaluation of the information retrieval systems,	
Lexical Resources: Introduction, WordNet, FrameNet, Stemmers, Part of speech Tagger,	08

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AUGMENTED AND VIRTUAL REALITY

Subject Code	22CSE74C	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Total Hours	40	Examination Hours	3
No. of Credits: 3			

Course Learning Objectives:

The course will enable students to:

CLO1	Explain the Fundamentals of Virtual Reality
CLO2	Discuss the Various Interfaces - Input and output devices
CLO3	Illustrate the Augmented reality methods and mixed reality.
CLO4	Outline and Utilize various modeling techniques.
CLO5	Select simple AR/VR applications using the frameworks.

CONTENTS	# of Hours
MODULE 1	
Introduction: The three I's of virtual reality, commercial VR technology and the five classic components of a VR system. **Virtual Reality and Virtual Environment:** Introduction, Computer graphics, Real time computer graphics, Flight Simulation, Virtual environment requirement, benefits of virtual reality, Historical development of VR, Scientific Landmark.	08
MODULE 2	
Input Devices: (Trackers, Navigation, and Gesture Interfaces): Three-dimensional position trackers, navigation and manipulation, interfaces and gesture interfaces. **Output Devices:** Graphics displays, sound displays & haptic feedback.	08
MODULE 3	
Augmented and Mixed Reality: Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality. wireless displays in educational augmented reality applications, mobile projection interfaces, marker-less tracking for augmented reality, enhancing interactivity in AR environments, evaluating AR systems.	08
MODULE 4	
Modeling: Geometric modeling, kinematics modeling, physical modeling, behavior modeling, model management	08
MODULE 5	
Human Factors: Methodology and terminology, user performance studies, VR health and safety issues. **Applications:** Medical applications, military applications, robotics applications, Engineering, Entertainment, Science, Training.	08

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Course Outcomes: Upon successful completion of this course, student will be able to

CO1	Explain various principles and concepts of virtual reality and its application.
CO2	Discuss input and output interfaces.
CO3	Discuss VR/AR technology differences
CO4	Apply appropriate method of geometric modelling
CO5	Implement Virtual Reality and Augmented Reality applications

Reference Books:

1. Virtual Reality Technology, Gregory C. Burdea& Philippe Coiffet, John, 2nd Edition, 2013 Wiley & Sons, Inc.
2. Grigore C. Burdea, Philippe Coiffet , "Virtual Reality Technology", Wiley Interscience, 2nd Edition, 2006.
3. Alan B. Craig, "Understanding Augmented Reality", Concepts and Applications, Morgan Kaufmann,1st Edition, 2013
4. Oliver Bimber and Ramesh Raskar, Spatial Augmented Reality: Merging Real and Virtual Worlds, 2005.

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	-	-	-	-	-	-	-	2	-	2
CO2	3	2	2	1	-	-	-	-	-	-	-	2	-	2
CO3	3	2	2	1	-	-	-	-	-	-	-	2	-	2
CO4	3	2	2	1	-	-	-	-	-	-	-	2	-	2
CO5	3	2	2	1	-	-	-	-	-	-	-	2	-	2
Average	3	2	2	1	-	-	-	-	-	-	-	2	-	2

Low-1: Medium-2: High-3

BIG DATA ANALYTICS

Subject Code	22CSE74D	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Total Hours	40	Examination Hours	3
No. of Credits: 3			

Course Learning Objectives:

The course will enable students to:

CLO1	Understand the fundamentals of Big Data Analytics
CLO2	Explore the Hadoop framework and Hadoop Distributed File system
CLO3	Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data
CLO4	Employ MapReduce programming model to process the big data

CONTENTS	# of Hours
MODULE 1 **Introduction to Big Data Analytics:** Big Data, Scalability, and Parallel Processing, Designing Data Architecture, Data Sources, Quality, Pre-Processing, and Storing, Data Storage and Analysis, Big Data Analytics Applications, and Case Studies.	08
MODULE 2 **Introduction to Hadoop:** Hadoop Distributed File System Basics, Running Example Programs, and Benchmarks, Hadoop MapReduce Framework, MapReduce Programming, Essential Hadoop Tools, Hadoop YARN Applications, Managing Hadoop with Apache Ambari, Basic Hadoop Administration Procedures	08
MODULE 3 **NoSQL Big Data Management, MongoDB and Cassandra:** Introduction, NoSQL Data Store, NoSQL Data Architecture Patterns, NoSQL to Manage Big Data, Shared-Nothing Architecture for Big Data Tasks, MongoDB, Databases, Cassandra Databases.	08
MODULE 4 **MapReduce, Hive and Pig:** Introduction, MapReduce Map Tasks, Reduce Tasks and MapReduce Execution, Composing MapReduce for Calculations and Algorithms, Hive, HiveQL, Pig.	08
MODULE 5 **Text, Web Content, Link, and Social Network Analytics:** Introduction, Text mining, Web Mining, Web Content and Web Usage Analytics, Page Rank, Structure of Web and analyzing a Web Graph, Social Network as Graphs and Social Network Analytics.	08

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Course Outcomes:

Upon successful completion of this course, students will be able to

CO1	Understand the fundamentals of Big Data analytics.
CO2	Investigate the Hadoop framework and Hadoop Distributed File system.
CO3	Illustrate the concepts of NoSQL using MongoDB and Cassandra for Big Data.
CO4	Demonstrate the MapReduce programming model to process the big data along with Hadoop tools.
CO5	Analyze web content and Social Networks to provide analytics with relevant visualization tools.

Text Books:

1. Raj Kamal and Preeti Saxena, "Big Data Analytics Introduction to Hadoop, Spark, and Machine-Learning", McGraw Hill Education, 2018 ISBN: 9789353164966, 9353164966.
2. Douglas Eadline,"Hadoop 2 Quick-Start Guide: Learn the Essentials of Big Data Computing in the Apache Hadoop 2 Ecosystem", 1stEdition, Pearson Education,2016. ISBN-13: 978-9332570351.

Reference Books:

1. Tom White, "Hadoop: The Definitive Guide", 4th Edition, O"Reilly Media, 2015.ISBN-13: 978-9352130672
2. Boris Lublinsky, Kevin T Smith, Alexey Yakubovich, "Professional Hadoop Solutions", 1 stEdition, Wrox Press, 2014ISBN-13: 978 8126551071
3. Eric Sammer, "Hadoop Operations: A Guide for Developers and Administrators",1 stEdition, O'Reilly Media, 2012.ISBN-13: 978-9350239261

E-Books / Web References :

1. 1.Seema Acharya, Subhashini Chellappan, "Big Data and Analytics", Wiley Publication, 2015.
2. Judith Hurwitz, Alan Nugent, Dr. Fern Halper, Marcia Kaufman, "Big Data for Dummies", John Wiley & Sons, Inc., 2013.

MOOCs

https://www.coursera.org/courses?query=big%20data

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	-	-	2	-	3	-	2	-	2
CO2	3	3	3	-	-	-	-	2	-	3	-	2	-	2
CO3	3	3	3	-	-	-	-	2	-	3	-	2	-	2
CO4	3	-	3	-	1	-	-	-	-	1	-	2	-	2
CO5	-	-	3	-	1	-	-	-	-	1	-	2	-	2
Average	3	3	3	-	1	-	-	-	-	1	-	2	-	2

Low-1: Medium-2: High-3

OPEN ELECTIVES

VII SEMESTER

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INTRODUCTION TO DBMS

Course Code:	22CSE75A	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Total Hours	40	Examination Hours	3
No. of Credits	3		

Course Learning Objectives:

The course will enable students to:

CLO1	Outline a strong foundation in database concepts, technology, and practice.
CLO2	Identify a strong foundation on normalization techniques to design a database
CLO3	Demonstrate the use of concurrency and transactions in database
CLO4	Design and build database applications for real world problems

CONTENTS	# of Hours
MODULE 1	
Introduction: Introduction, An example, Characteristics of Database approach, Advantages of using DBMS approach, Data models, schemas and instances, Three-schema architecture and data independence **Entity-Relationship Model:** An Example Database Application, Entity Types, Entity Sets, Attributes and Keys, Relationship types, Relationship Sets, Roles and Structural Constraints, Weak Entity Types, Sample ER Diagrams.	08
MODULE 2	
Relational Model and Relational Algebra: Relational Model Concepts, Unary Relational Operations: SELECT and PROJECT, Relational Algebra Operations from Set Theory, Binary Relational Operations: JOIN and DIVISION, Examples of Queries in Relational Algebra. **Mapping Conceptual Design into Logical Design:** Relational Database design using ER to Relational Mapping.	08
MODULE 3	
SQL: SQL Data Definition and Data Types, Specifying basic constraints in SQL, Retrieval queries in SQL, Insert, Delete, Update statements in SQL. **SQL Advanced Queries:** More complex SQL Queries, Triggers in SQL, Views in SQL. **Database Application Development:** PL/SQL, syntax, examples, create & drop procedure; If and Loops in Procedure; Introduction to Cursor, Cursor within *for* loops, Table within cursors.	08
MODULE 4	
Database Design: Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms Based on Primary Keys, Second, Third and Boyce Codd Normal Forms. **NoSQL Databases:** What is it ? When to use NOSQL, RDBMS Vs NOSQL: From RDBMS Tables to Collections, Document-Based NOSQL Systems and MongoDB: Querying in NOSQL, CRUD operations, Indexing & Aggregating in MongoDB.	08

	MODULE 5	
	Transactions Management: Introduction to Transaction Processing, Transaction states, Desirable properties of Transactions, Characterizing Schedules based on recoverability, Characterizing Schedules based on Serializability. **Concurrency Control and Recovery System:** Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, ARIES Recovery Algorithm.	08

Course Outcomes:

Upon successful completion of this course, student will be able to

CO1	Construct ER models to represent simple database applications
CO2	Develop Relational Algebraic expressions for complex Relational Algebra operations
CO3	Develop SQL/PL/SQL programs for queries using Relational Model Concepts
CO4	Design relational database model for an application by normalizing the database schema and understanding the transition from SQL to NOSQL databases
CO5	Demonstrate the use of concurrency control and transactions in database

Text Books:

1. Fundamentals of Database Systems, Elmasri and Navathe, 7th Edition, Pearson Education, 2016.
2. Learning Oracle SQL and PL/SQL: A Simplified Guide, PHI Publication, ISBN: 9788120345423, 2012.

Reference Books:

1. Database Management Systems, Raghurama Krishnan, Johannes Gehrke, 3rd Edition, Tata McGraw Hill, New Delhi, India.
2. Database System Concepts, Silberschatz, Korth and Sudharshan, 6th Edition, Mc-GrawHill, 2010.
3. An Introduction to Database Systems, C.J. Date, A. Kannan, S. Swamynatham, 8th Edition, Pearson Education, 2006.
4. Professional NoSQL, Shashank Tiwari, John Wiley and Sons, 2011

E-Books / Web References

1. https://amirsmvt.github.io/Database/Static_files/Fundamental_of_Database_Systems.pdf
2. https://www.edureka.co/blog/procedures-in-sql/
3. https://www.mongodb.com/resources/basics/databases/nosql-explained
4. https://www.mongodb.com/resources/basics/databases/nosql-explained/nosql-vs-sql

MOOCs

1. https://archive.nptel.ac.in/courses/106/105/106105175
2. https://www.udemy.com/course/introduction-to-database-management-systems-dbms/

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	3	-	-	-	2	-	-	2	-	3
CO2	3	3	3	-	3	-	-	-	2	-	-	2	-	3
CO3	3	3	3	-	3	-	-	-	2	-	-	2	-	3
CO4	3	3	3	-	3	-	-	-	2	-	-	2	-	3
CO5	3	3	3	-	3	-	-	-	2	-	-	2	-	3
Average	3	3	3	-	3	-	-	-	2	-	-	2	-	3

Low-1: Medium-2: High-3

INTRODUCTION TO ALGORITHMS

Subject Code	22CSE75B	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Total Hours	40	Examination Hours	3
No. of Credits: 3			

Course Learning Objectives:

The course will enable students to:

CLO1	Apply mathematical concepts and notations to define a problem.
CLO2	Understand and apply algorithms design techniques
CLO3	Gain ability to solve real life problems using algorithms techniques.
CLO4	Understand the limitations of Algorithmic power.

CONTENTS	# of Hours
MODULE 1 **Introduction:** What is an Algorithm?, Fundamentals of Algorithmic Problem Solving, Important Problem Types, Algorithm Specification, Performance Analysis: Space complexity, Time complexity Asymptotic Notations: Big-Oh notation (O), Omega notation (Ω), Theta notation (Θ), Mathematical analysis of Non-Recursive and recursive Algorithms with Examples.	06
MODULE 2 **Brute Force:** Brute force string matching algorithms. **Divide & Conquer:** General method, Recurrence equation for divide and conquer, Binary Search, Merge sort, Quick sort, Strassen's matrix multiplication, Advantages and Disadvantages of divide and conquer.	08
MODULE 3 **Greedy Method:** Introduction, General method, Knapsack Problem, Job sequencing with deadlines. **Minimum cost spanning trees:** Prim's Algorithm, Kruskal's Algorithm **Single source shortest paths:** Dijkstra's Algorithm **Optimal Tree problem:** Huffman Trees and Codes **Transform and Conquer Approach:** Heaps and Heap Sort, AVL Tree, 2-3 Tree	10
MODULE 4 **Dynamic Programming:** Introduction, Transitive closure - Warshall's and Floyds algorithm, Knapsack problem & memory functions, Bellman Ford algorithm. **Decrease & Conquer:** Introduction – Decrease by constant, decrease by constant factor, variable size decrease, Breadth First search traversal, Depth First search traversal, Topological sorting using DFS and source removal method.	08

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MODULE 5	
Backtracking: N-Queens problem, Sum of subsets problem, Hamiltonian cycles **Branch & Bound:** Introduction, Travelling Salesman problem, Knapsack problem, Assignment problem **Limitations of Algorithm Power:** Decision Trees for sorting and searching, Approximation Algorithms for NP-Hard Problems – Traveling Salesperson Problem using Nearest-neighbor algorithms.	**08**

Course Outcomes: Upon successful completion of this course, student will be able to

CO1	Explain the basic techniques of analyzing the algorithms using time & space complexity and asymptotic notations
CO2	Devise algorithms using brute force and Divide and Conquer techniques for a given problem.
CO3	Demonstrate Graph Algorithms using greedy method, Transform and Conquer Approach to model Engineering Problems.
CO4	Employ Dynamic Programming and Decrease & Conquer strategies to solve a given problem
CO5	Use Back Tracking, Branch and Bound design techniques for solving Computationally hard problems.

Textbooks:

1. "Introduction to The Design and Analysis of Algorithms", Anany Levitin, Third Edition, Pearson, Tenth Impression 2020

2. "Computer Algorithms/C++", Ellis Horowitz, Sartaj Sahni & Sanguthevar Rajasekaran", University Press, Second Edition, Reprinted 2017.

Reference Books:

1. "Introduction to Algorithms", Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, MIT Press, Third Edition, PHI Learning Private Limited, 2019

E-Books / Web References

1. http://www.facweb.iitkgp.ac.in/~sourav/daa.html
2. https://freevideolectures.com/course/2281/design-and-analysis-of-algorithms

MOOCs

1. https://nptel.ac.in/courses/106101060/
2. https://www.coursera.org/specializations/algorithms

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Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	-	2	3	-
CO2	3	3	3	-	-	-	-	-	-	-	-	2	3	-
CO3	3	3	3	-	-	-	-	-	-	-	-	2	3	-
CO4	3	3	3	-	-	-	-	-	-	-	-	2	3	-
CO5	3	3	3	-	-	-	-	-	-	-	-	2	3	-
Average	3	3	3	-	-	-	-	-	-	-	-	2	3	-

Low-1: Medium-2: High-3

SOFTWARE ENGINEERING

Subject Code	22CSE75C	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Total Hours	40	Examination Hours	3
No. of Credits: 3			

Course Learning Objectives:

The course will enable students to:

CLO1	Outline software engineering principles and activities involved in building large software programs
CLO2	Introduce Software design using UML tools and various system models
CLO3	Introduce Agile Software development and Agile methods - SCRUM
CLO4	Introduce Software Testing and Software Evolution processes in detail
CLO5	Explain project planning, Cost estimation techniques and Software quality, standards and metrics

CONTENTS	# of Hours
MODULE 1	
Introduction: Professional Software Development - Software Engineering, Case Studies. **Software Processes:** Software process models - Waterfall Model, Incremental Model, and Spiral Model, Software Process Activities. **Requirement Engineering:** Requirements Specification, Requirement elicitation and analysis, Requirements Validation, Requirements change, Functional Specification, and Non-Functional Requirements, The software requirements document. **Case Study:** Create a SRS document for the following software projects. 1. Online Ticket Reservation System 2. Stock Maintenance 3. Student's Marks Analyzing System 4. Stock Maintenance	08
MODULE 2	
System Models: Context models. Interaction models. Structural models. Behavioral models. Model-driven engineering. **Software Design and Planning:** Object-oriented design concepts using UML tool: Star UML application, Design patterns, Implementation issues, Open-Source Development.	08
MODULE 3	
Agile Software Development: Agile methods, Plan-driven and agile development, Extreme programming, Agile project management, Scaling agile methods. SCRUM Methodology, SCRUM.	08

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MODULE 4	

Software testing strategies: A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for Conventional software, Test Strategies for Object-Oriented Software, Test Strategies for web apps, Validation Testing, and System Testing.
 	
Testing Conventional Applications: Software Testing Fundamentals, Internal and External views of Testing, White-Box Testing, Basic path Testing, Control structure Testing, and Black-box Testing.
 	
Case study:
 	
  1. Design the test case for finding the roots of the quadratic equation.
  2. Design the test case for the e-commerce application.
	08

MODULE 5	
Project planning: Software pricing, Plan-driven development, Project scheduling, Agile planning, and Estimation techniques. **Quality management:** Software quality, Software standards, Reviews and inspections, Software measurement, and metrics.	08

Course Outcomes:

Upon successful completion of this course, students will be able to

CO1	Understand the fundamentals of Software Engineering, Software process models, and Requirements Engineering.
CO2	Use UML tool for software design.
CO3	Understand Agile Software Development and Agile Methods - SCRUM
CO4	Describe Software testing methods and Software Evolution processes.
CO5	Discuss the project planning process, Cost estimation models, Software Quality standards, and metrics.

Text Books:

1. Software Engineering, Ian Sommerville, 10th Edition, Pearson Education, 2016. ISBN: 978 - 0133943030
2. Software Engineering: A Practitioner's Approach, Roger S Pressman, 7th Edition, Tata McGraw-Hill, 2014
3. The SCRUM Primer, Ver 2.0, http://www.goodagile.com/scrumprimer/scrumprimer20.pdf

Reference Books:

1. Pankaj Jalote, An integrated approach to software engineering, Springer US, 3rd Edition, 2005.
2. Michael Blaha, James Rumbaugh, Object Oriented Modelling and Design with UML, , Pearson Education, 2nd Edition, 2005.
3. Rajib Mall, Fundamentals of Software Engineering, 4th Edition, PHI Learning Private Limited,2014.
4. Tom Pender, UML Bible, Wiley Publishing,2003.

E-Books / Web References:

1. https://www.softwaretestingmaterial.com/category/agile/
2. https://www.scrum.org/resources/
3. https://www.atlassian.com/agile/kanban

MOOCs :

1. https://nptel.ac.in/noc/courses/106/
2. E-learning: www.vtu.ac.in

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	1	1	1	-	3	-	2	3	3
CO2	3	-	3	-	-	1	1	1	-	3	-	2	3	3
CO3	3	-	3	-	-	1	1	1	-	3	-	2	3	3
CO4	3	3	3	3	-	3	-	-	3	3	3	3	3	3
CO5	3	1	-	-	-	1	1	1	-	3	2	2	3	3
Average	3	2	3	3	-	2	1	1	3	3	3	2	3	3

Low-1: Medium-2: High-3

INTRODUCTION TO NETWORKS

Subject Code	22CSE75D	CIE Marks	50
Hours/Week (L: T: P)	3:0:0	SEE Marks	50
Total Hours	40	Examination Hours	3
No. of Credits: 3			

Course Learning Objectives:

CLO1	Comprehend the transmission technique of digital data between computers and a computer network.
CLO2	Discuss Analog transmission and Digital transmission in Physical layer.
CLO3	Demonstrate Bandwidth, Switching and Error control in Data Link layer.
CLO4	Explain Media Access Control in Data link layer.
CLO5	Disseminate different wireless and wired LANs.

CONTENTS	#. of Hours
MODULE 1 **Introduction:** Data Communications, Networks, Network Types, Internet History, Standards and Administration. **Networks Models:** Protocol Layering, TCP/IP Protocol suite, The OSI model, **Introduction to Physical Layer-1:** Data and Signals, Digital Signals, Transmission Impairment, Data Rate limits, Performance.	08
MODULE 2 **Digital Transmission:** Digital to digital conversion (Only Line coding: Polar, Bipolar and Manchester coding. **Physical Layer-2:** Analog to digital conversion (only PCM), Transmission Modes Analog Transmission: Digital to analog conversion.	08
MODULE 3 **Bandwidth Utilization:** Multiplexing and Spread Spectrum, **Switching:** Introduction, Circuit Switched Networks and Packet switching. **Error Detection and Correction:** Introduction, Block coding, Cyclic codes, Checksum.	08
MODULE 4 **Data link control:** DLC services, Data link layer protocols, HDLC, and Point to Point protocol (Framing, Transition phases only). **Media Access control:** Random Access, Controlled Access, and Channelization.	08
MODULE 5 **Wired LANs Ethernet:** Ethernet Protocol, Standard Ethernet, Fast Ethernet, Gigabit Ethernet and 10 Gigabit Ethernet. **Wireless LANs:** Introduction, IEEE 802.11 Project, and Bluetooth. **Other Wireless Networks:** WiMAX, Cellular Telephony and Satellite Networks	08

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Course Outcomes:

Upon completion of this course, student will be able to:

CO1	Explain data communication, networking with reference to OSI, TCP/IP models and signals.
CO2	Discuss analog to digital conversion techniques, transmission modes, and digital to analog conversion in physical layer.
CO3	Describe Multiplexing, Switching, Error detection and correction.
CO4	Explain the different data link layer protocols and Media Access Control
CO5	Discuss wired LANs and Wireless LANs

Text Books:

1. Behrouz A. Forouzan, Data Communications and Networking, 5th Edition, Tata McGraw-Hill, 2013

Reference books:

1. Alberto Leon-Garcia and Indra Widjaja: Communication Networks - Fundamental Concepts and Key architectures, 2nd Edition Tata McGraw-Hill, 2004.
2. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.
3. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.
4. Nader F. Mir: Computer and Communication Networks, Pearson Education, 2007.

E-Books / Web References:

1. Data Communications and Networking, 5th Edition.
2. https://www.mheducation.com/highered/product/data-communications-networking-forouzan/M9780073376226.html

MOOCs:

1. https://www.classcentral.com/course/data-communication-network-services-9160
2. https://ocw.mit.edu/courses/6-263j-data-communication-networks-fall-2002/
3. https://www.my-mooc.com/en/mooc/data-communications-and-network-services/

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	1	1	1	-	3	-	2	3	3
CO2	3	-	3	-	-	1	1	1	-	3	-	2	3	3
CO3	3	-	3	-	-	1	1	1	-	3	-	2	3	3
CO4	3	3	3	3	-	3	-	-	3	3	3	3	3	3
CO5	3	1	-	-	-	1	1	1	-	3	2	2	3	3
Average	3	2	3	3	-	2	1	1	3	3	3	2	3	3

Low-1: Medium-2: High-3

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